

Executive Summary: Health Impact Review of SB 5343

Relating to Parking Impact Mitigation from Regional Transit Authority Facility
Construction (2015-2016 legislative sessions)

It is unclear whether SB 5343 has the potential to increase financial stability for individuals who reside in a restricted parking zone near a transit facility. However, if the bill results in improved financial security (as suggested by some community input), evidence indicates the bill has potential to improve health outcomes. It is unclear how the bill would impact health disparities.

BILL INFORMATION

Sponsors: Senators Hasegawa, King, Jayapal, Chase, Rolfes, Keiser, Darneille, Conway

Summary of Bill:

- Requires a regional transit authority to consider the potential impacts of a transportation facility on parking in residential areas and provide appropriate parking impact mitigation for residents nearby.
- Requires a regional transit authority to pay for the cost of parking permits in the vicinity of a transportation facility if a local government implements zoned residential parking as a direct result of the facility.

HEALTH IMPACT REVIEW

Summary of Findings:

This Health Impact Review found the following evidence regarding the provisions in SB 5343:

- The relationship between subsidies for parking mitigation measures, such as residential parking program permits, and financial security has not been well researched.
- Very strong evidence that increased financial security for low-income individuals who reside in a restricted parking zone (RPZ) near a transit facility would likely lead to improved health outcomes.
- Unclear evidence for the bill's impacts on health disparities. Relevant data is explored in further detail in the full Health Impact Review.

For more information contact:
(360)-236-4109 | hir@sboh.wa.gov
or go to sboh.wa.gov

Health Impact Review of SB 5343

**Relating to Parking Impact Mitigation from Regional Transit Authority Facility
Construction**

2015-2016 Legislative Sessions

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Author: Alexandra Montaña, State Board of Health

Contributor: Rad Cunningham, Department of Health

Contributor/Reviewer: Christy Hoff, State Board of Health

Reviewer: Michelle Davis, State Board of Health

Reviewer: Kelie Kahler, State Board of Health

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Introduction and Methods

A Health Impact Review is an analysis of how a proposed legislative or budgetary change will likely impact health and health disparities in Washington state ([RCW 43.20.285](#)). For the purpose of this review ‘health disparities’ have been defined as the differences in disease, death, and other adverse health conditions that exist between populations ([RCW 43.20.270](#)). This document provides summaries of the evidence analyzed by State Board of Health staff during the Health Impact Review of Senate Bill 5343 ([SB 5343](#)) from the 2015-2016 legislative sessions.

Staff analyzed the content of SB 5343 and created a logic model depicting possible pathways leading from the provisions of the bill to health outcomes. We consulted with experts and contacted stakeholders with diverse perspectives on the bill. State Board of Health staff can be contacted for more information on which stakeholders were consulted on this review. We conducted objective reviews of the literature for each pathway using databases including PubMed and Google Scholar.

The following pages provide a detailed analysis of the bill including the logic model, summaries of evidence, and annotated references. The logic model is presented both in text and through a flowchart (Figure 1). The logic model includes information on the strength of the evidence for each relationship.

The strength-of-evidence has been defined using the following criteria:

- **Not well researched:** the literature review yielded few if any studies or only yielded studies that were poorly designed or executed or had high risk of bias.
- **A fair amount of evidence:** the literature review yielded several studies supporting the association, but a large body of evidence was not established; or the review yielded a large body of evidence but findings were inconsistent with only a slightly larger percent of the studies supporting the association; or the research did not incorporate the most robust study designs or execution or had a higher than average risk of bias.
- **Strong evidence:** the literature review yielded a large body of evidence on the relationship (a vast majority of which supported the association) but the body of evidence did contain some contradictory findings or studies that did not incorporate the most robust study designs or execution or had a higher than average risk of bias; or there were too few studies to reach the rigor of ‘very strong evidence’; or some combination of these.
- **Very strong evidence:** the literature review yielded a very large body of robust evidence supporting the association with few if any contradictory findings. The evidence indicates that the scientific community largely accepts the existence of the association.

This review was subject to time constraints, which influenced the scope of work for this review. The annotated references are only a representation of the evidence and provide examples of current research. In some cases only a few review articles or meta-analyses are referenced. One article may cite or provide analysis of dozens of other articles. Therefore the number of references included in the bibliography does not necessarily reflect the strength-of-evidence. In addition, some articles provide evidence for more than one research question so they are referenced multiple times.

Analysis of SB 5343 and the Scientific Evidence

Summary of relevant background information

- RCW 81.112.030 establishes that two or more adjoining counties, each with a population of 400,000 persons or more, may establish a regional transit authority.
 - Per this definition, there is one regional transit authority in Washington, Sound Transit, which serves most cities within Snohomish, King, and Pierce counties.
- Restricted parking zones (RPZs) are designed to help alleviate parking congestion in residential neighborhoods and require residents to have a vehicle permit to park (Seattle Department of Transportation).
- In some communities, RPZ permits carry no cost and are covered by the local jurisdiction while other communities have established fees. These fees range from \$10 for low-income residents to \$65 every two years for residents in Seattle.

Summary of SB 5343

- Requires a regional transit authority to consider the potential impacts of a transportation facility on parking in residential areas and provide appropriate parking impact mitigation for residents nearby.
- Requires a regional transit authority to pay for the cost of parking permits in the vicinity of a transportation facility if a local government implements zoned residential parking as a direct result of the facility.

Scope of this Health Impact Review

The fiscal note for SB 5343 indicates that there are four communities in the Sound Transit district that currently have fees for permits within RPZs: Edmonds, Mercer Island, Shoreline, and Seattle. This Health Impact Review will focus on only Edmonds, Mercer Island, and Seattle for the following reasons:

- There is only one RPZ in Shoreline and after examining the location it was determined that there was no transit facility in the vicinity and would therefore not be impacted by this bill.
- Additionally, although Tacoma is re-establishing their residential parking permit program, a representative from the city indicated the old program is not currently active and has not been supported for over 5 years. For this reason, Tacoma is excluded from the analysis.
- Remaining communities in the Sound Transit district either do not have residential parking permit programs or cover the full cost of the permits through general revenue.

This Health Impact Review will refer specifically to the only regional transit authority in the state, Sound Transit, but we recognize that this bill will be applicable to future regional transit authorities that may be created. The first provision in SB 5343 provides that Sound Transit must consider the potential impacts of a transportation facility on parking in residential areas and provide appropriate mitigation for residents. A representative from Sound Transit indicated that they are required by state and federal regulations to evaluate the effects of new transit facilities and parking is among the impacts that they evaluate. The findings from their parking studies, and potential mitigation actions, are summarized in their Environmental Impact Statements and the required actions are listed in the Record of Decision from the Federal Transit Authority. With the understanding that Sound Transit already has practices in place for considering parking impacts, this review focuses solely on the provision that requires the authority to pay for the cost of the parking mitigation. Finally, while there are a number of additional parking control measures that may be implemented such as parking meters, passenger load zones, and

restricted parking signage, this Health Impact Review will focus on RPZs given the specific language in the bill, and community input regarding this issue.

Health impact of SB 5343

It is unclear whether SB 5343 has the potential to increase financial stability for individuals who reside in a restricted parking zone near a transit facility. However, if the bill results in improved financial security (as suggested by some community input), evidence indicates the bill has potential to improve health outcomes. It is unclear how the bill would impact health disparities.

Pathways to health impacts

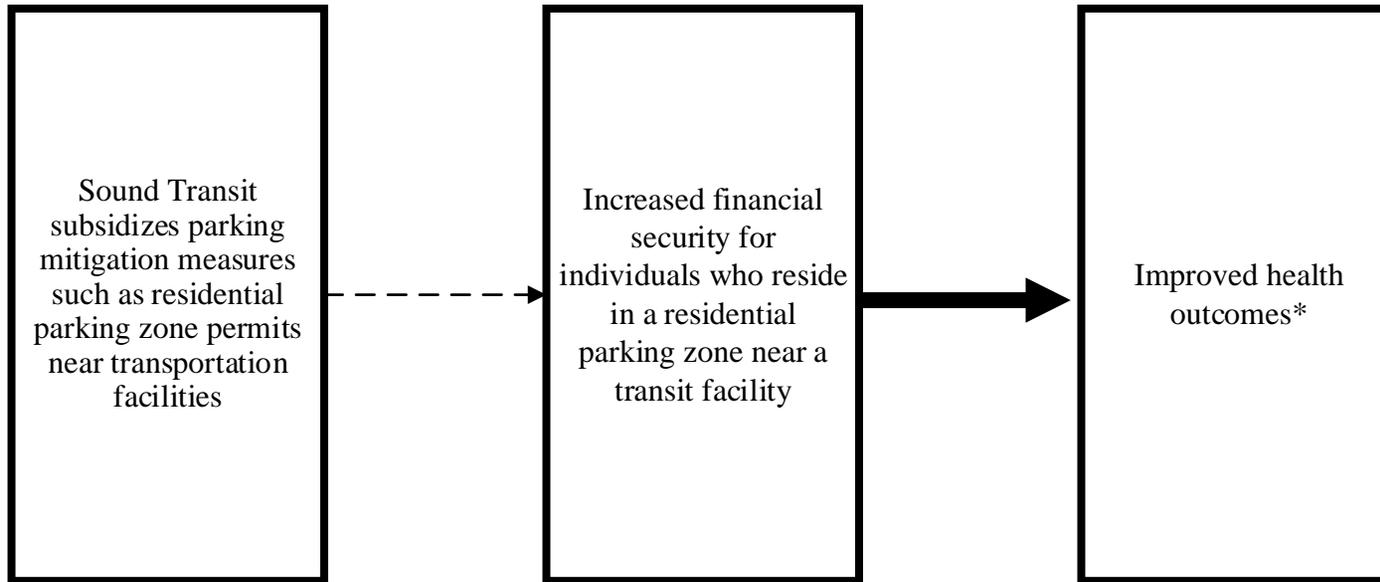
The potential pathways leading from the provisions of SB 5343 to decreased health disparities are depicted in Figure 1. We were unable to find any research on the relationship between subsidies for parking mitigation measures, such as residential parking permits, and financial security. However, some limited community input has suggested that the bill could have a positive impact on financial security by subsidizing parking permits, particularly for low-income individuals. Assuming subsidized parking permits help improve financial stability for some residents in the RPZs, there is very strong evidence that increased financial security would likely improve health outcomes for a number of indicators including overall self-rated health, depression, anxiety, asthma, obesity, and high blood pressure.¹⁻¹² It is unclear from available evidence how the bill would impact health disparities. Data provided by the Department of Health suggests that residents living within RPZs that would be impacted by this bill have similar or better health outcomes than the state average (see Tables 1 and 2). The data also indicate that the residents are more likely to be Black, Asian, in poverty, and to have limited English proficiency (Table 1). Because there is ample evidence that Blacks^{1,3,5,6,12}, people in poverty¹⁻¹², and those with limited English proficiency¹³⁻¹⁵ are more likely to have poorer health, it is difficult to interpret these data, which show residents in these areas tend to have similar or better health outcomes than the state as a whole. Given the limitations to the data, as well as the apparent contradictions between the data and the scientific evidence, it is unclear what impact this bill would likely have on health disparities.

Due to time limitations we only researched the most direct connections between the provisions of the bill and decreased health disparities and did not explore the evidence for all possible pathways. For example, one potential pathway that was not researched was how zoned residential parking programs impact vehicle ownership.

Magnitude of impact

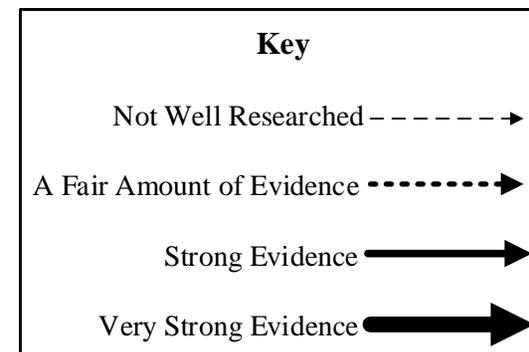
We requested data from Seattle Department of Transportation but were not able to obtain the information regarding the number of parking permits issued in specific RPZs near transit facilities, therefore it is difficult to estimate the number of people who would likely be impacted by this bill. As an alternative, we used data provided by the Department of Health to estimate the number of people who live in RPZs within a quarter mile radius of a Sound Transit facility such as a Link light rail station, Sounder station, or a park and ride facility in Seattle, Edmonds, and Mercer Island. The methods for these data and the subsequent estimates are explained in further detail in the annotated bibliography.¹⁶ Using these data, it is estimated that 66,619 people live in a RPZ within a quarter mile of a Sound Transit facility and would therefore likely be impacted by this bill.¹⁶ However, there is a level of uncertainty with this estimate because it includes only people age 18 and over therefore excluding those aged 16-17 who may also need a permit. In addition, it is also likely that not every person who resides in these RPZs has a car and will need a parking permit. Given these estimates, if the prices of the parking permits were to remain as they are now (i.e. \$10 to \$65 every two years), and if all 66,619 people who live in these RPZs needed a permit, the estimated cost for Sound Transit is between \$666,190 and \$4,330,235 every two years.

Logic Model



*See the full Health Impact Review for a detailed analysis of the likely impacts of SB 5343 on health disparities

Figure 1
Senate Bill 5343
Relating to Parking Impact Mitigation from Regional Transit Authority Facility Construction



Summaries of Findings

Will subsidies for parking mitigation measures paid for by Sound Transit increase financial security for individuals who reside in a RPZ near a transit facility?

We were unable to find any research studying the relationship between subsidies for residential parking mitigation measures, such as residential parking permits, and financial security. Moreover, there is quite a bit of variance in the cost of permits borne by residents in RPZs. As previously mentioned, many communities either do not have residential parking permit programs or cover the full cost of the permits through general revenue. Parking permits in the communities that have established fees range in price from \$10 per year in Mercer Island, to \$25 per year in Edmonds, \$65 every two years in Seattle, and \$10 every two years for low-income residents in Seattle. Given this range of fees, it is unclear even anecdotally what impact subsidized parking permits would have on an individual's financial security, particularly because these subsidies would be available to all impacted individuals and not just individuals that have a demonstrated need. While some community members have indicated that any amount of savings would likely be beneficial, primarily for low-income families, others shared that concerns about zoned parking are less about the financial impact and have more to do with the stress of applying for permits. Community members also indicated that when individuals are unable to purchase a parking permit, either due to financial constraints or difficulty with the application process, they often receive parking tickets for parking in the RPZ without a permit. These tickets stack up and cause a further financial burden. Therefore, while the impact of parking subsidies has not been well researched in the scientific literature, some limited community input suggests such subsidies may have a positive impact on financial security, particularly for low-income communities.

Will increased financial security for individuals who reside within a RPZ near a transit facility lead to improved health outcomes?

Provided that SB 5343 has a positive impact on an individual's finances, there is very strong evidence that increased financial security would likely lead to improved health outcomes. Financial security can be measured by a number of indicators including household income, socioeconomic position, relative deprivation, poverty rates, and personal indebtedness.^{8,11,12} There is a large body of robust evidence that supports the association between income, or socioeconomic position, and health. Significant correlations exist between lower income and a number of health indicators including worse overall self-reported health, depression, stress, asthma, arthritis, stroke, oral health, tobacco use, women's health indicators, health screening rates, physical activity, and diabetes.^{2-4,8,11} Further, 2015 data indicate that age-adjusted death rates were higher in Washington census tracts with higher poverty rates.⁶ Household income was also the strongest predictor of self-reported health status in Washington in 2016, even after accounting for age, education, and race/ethnicity.⁹ Among children, evidence indicates that low socioeconomic status in the first five years of life has negative health outcomes in later childhood and adolescence including activity-limiting illness, parent-reported poor health status, acute and recurrent infections, increasing body mass index (BMI), dental caries, and higher rates of hospitalization.¹⁰ Finally, financial stress in itself is also associated with adverse outcomes for families such as problem behavior in adolescents, interparental conflict, and parental depression.⁷ Therefore, increasing financial security for individuals who reside within a RPZ near a transit facility, particularly low-income residents, would likely improve mental and physical health outcomes.

Will improved health outcomes for individuals who reside within a RPZ near a transit facility lead to decreased health disparities?

It is unclear from the available evidence how improving health outcomes for individuals who reside within a RPZ near a transit facility would likely impact health disparities. To estimate the demographic characteristics of people that will be impacted by SB 5343 we used data provided by the Department of Health (DOH). Spatial data on RPZs was provided by the Seattle Department of Transportation and staff at DOH manually added RPZs in Mercer Island and Edmonds to this map. Any RPZ that was receiving a full or partial subsidy from another source such as a hospital, university, or private business was excluded from the analysis. As previously mentioned, any RPZ that was not within a quarter mile of a light rail station, sounder station, or park and ride was further excluded. The RPZs that remained after this selection were in Seattle (Beacon Hill, Columbia City, Mount Baker, Othello, Pine and Pike, and Rainier Beach) Edmonds, and Mercer Island. Further details on the methods and potential limitations for these data can be found in the annotated bibliography.¹⁶ One important limitation to these data is that they do not reveal whether differences are statistically significant.

Nonetheless, the data seem to indicate that residents living in RPZs near Sound Transit facilities have, on average, similar or better health outcomes than the state average overall (Table 2). These measures include a lower rate of cancer deaths (155 versus 166 per 100,000 population) and cardiovascular disease (188 versus 197 per 100,000 population), higher life expectancy (81 years versus 80 years), lower percentage of people living with a disability (11% versus 13%), and the same percentage of low birth weight infants as the state average (5%).

The data also indicate that the residents are more likely to be Black, Asian, in poverty, and to have limited English proficiency (Table 1). Because there is ample evidence that Blacks^{1,3,5,6,12}, people in poverty¹⁻¹², and those with limited English proficiency¹³⁻¹⁵ are more likely to have poorer health, it is difficult to interpret these data, which show residents in these areas tend to have similar or better health outcomes than the state as a whole. Given the limitations to the data, as well as the apparent contradictions between the data and the scientific evidence, it is unclear what impact this bill would likely have on health disparities.

Table 1: Demographic Information for Populations Living in a RPZ* within a Quarter Mile Buffer of a Sound Transit Facility

	Within Buffer		Washington State
	N	%	%
Population	66,619	-	-
Over 18	57,767	86.7%	77.5%
White	35,174	52.8%	80.3%
Black	9,417	14.1%	4.1%
American Indian/Alaska Native	766	1.2%	1.5%
Asian	16,507	24.8%	7.2%
Native Hawaiian/Pacific Islander	423	0.6%	0.6%
Multi-Race	3,353	5.0%	4.6%
Hispanic	5,231	7.9%	12.4%
Living in Poverty	5,610	17.0%	12.2%
No High School Diploma	6,405	9.6%	9.8%
No Health Insurance	9,799	9.2%	7.6%
Median Household Income***	\$59,585		\$60, 294

*RPZ's were limited to those with no current subsidies that were within a quarter mile of a light rail, Sounder station or a park and ride. These RPZ's included Beacon Hill, Columbia City, Mt. Baker, Othello, Pike Pine, Rainier Beach, Edmonds, and Mercer Island.

**Calculated using data from the American Community Survey 5-year estimates at the block group level from tables B02001, B03003, B15003, B17017, B19001, B19013, B27010, Modified according to the proportion of the census block group that fell within the buffer.

***Calculated as the average of the median household incomes for block groups that are at least 25% within the buffer.

Table 2: Health Outcomes and Social Determinants of Health for RPZs* Compared to the Washington State Average

	Within the RPZs	State Average
Age-Adjusted Cancer Death Rate	155 per 100,000 population	166 per 100,000 population
Age-Adjusted Cardiovascular Disease Rate	188 per 100,000 population	197 per 100,000 population
Living in Unaffordable Housing	45%	37%
Life Expectancy (years)	81	80
Limited Access to a Private Vehicle	27%	7%
Low Birth Weight	5%	5%
18-64 with No Health Insurance	21%	19%
Limited English Proficiency	20%	8%
65+ Living Alone	46%	29%
Unemployment Rate	8%	9%
Living with a Disability	11%	13%
Children in Poverty	26%	18%
Age-Adjusted Premature Death (years)	3,415 per 100,000 population	3,379 per 100,000 population
Single Parent Households	5%	9%

*RPZ's were limited to those with no current subsidies that were within a quarter mile of a light rail or sounder station or a park and ride. These RPZ's included Beacon Hill, Columbia City, Mt. Baker, Othello, Pike Pine, Rainier Beach, Edmonds, and Mercer Island.

Social Determinants and Health outcome data come from data compiled for the Washington Tracking Network. Washington Tracking Network, Washington State Department of Health. Web. Health Disparities Index. Data obtained from US Census American Community Survey, CHAT, Washington State Cancer Registry, and Washington State Center for Health Statistics, HUD 2013. Published: 1 June 2015.

Other considerations

We pursued a number of other research questions in order to determine if there are alternate pathways leading from the provisions in the bill to positive or negative health impacts. We ultimately did not include these pathways in the logic model on page three of this review either because there is no evidence to support the connection or because the evidence indicates that the connection does not exist. We evaluated the evidence concerning 1) mode of transportation choice, and 2) financial impact to Sound Transit and communities.

Transportation choice

We reviewed the literature to determine if there is an association between residential parking and an individual's choice in mode of transportation. More specifically, we aimed to understand if an association existed between residential on-street parking and use of a personal vehicle instead of, for example, taking the bus or other public transit. If Sound Transit subsidized parking permits for residents, would they be more likely to drive than to use alternative modes of transportation if they believed they would have parking near their residence when they returned? We were not able to identify evidence indicating that such an association exists. A representative from Seattle Department of Transportation also noted that having a residential parking permit does not necessarily guarantee a parking space and in some densely populated neighborhoods in Seattle, there are a far greater number of parking permits issued than parking spots available.

Financial impacts to Sound Transit and communities

The Washington State Department of Licensing indicates that residents who live in urban areas of King, Pierce, and Snohomish counties are often required to pay a Regional Transit Authority (RTA) tax when they renew their car tabs or purchase a new or used vehicle and register it in their name. This tax is collected on behalf of Sound Transit and is used to help fund their local transit-related projects in these counties. Provided that consumers are paying for Sound Transit services through tax dollars, we aimed to explore how this bill may potentially have a financial impact on Sound Transit and whether or not the added expenses from subsidizing parking mitigation would be passed on to consumers in any way. A representative from Sound Transit indicated that an annual expenditure in the range of \$2 to \$5 million would be paid out of the general fund, which is primarily funded by tax revenue. The fiscal note estimate for SB 5343 is close to \$2 million and Sound Transit explained that this would represent between 0.5% and 0.8% of the total operating funds for the agency. Although this would not likely impact any currently ongoing projects or construction, there is still the concern from Sound Transit that this expenditure has a limited scope and benefit compared to the larger population they serve, and any impact on their total budget from something that is not already currently in the budget, nor in their long range plan, would have a substantial impact. It is unclear what this impact could mean for residents down the line and whether it could result in issues such as an increase in the RTA tax, reduced transit routes, or delayed future transit construction.

Annotated References

1. *Health of Washington State: Mental Health.* Washington State Department of Health;2008.

Washington Behavioral Risk Factor Surveillance System (BRFSS) data from 2004-2006 indicate that American Indians and Alaska Natives and non-Hispanic black individuals reported significantly higher rates of poor mental health compared to other groups. These relationships persisted after adjusting for additional factors such as age, income, and education. Washington BRFSS data also show an association between lower annual household income and poor mental health, a relationship that was also shown with education. It is well understood that mental health is also closely related to other areas such as employment opportunities, physical health, substance abuse. This report also highlights a Washington state study from 2002 that reveal that 16% of individuals in the state who were receiving publicly funded mental health services had at least one felony conviction, a rate over twice that of the general population.

2. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Prevalence And Trends Data: Washington-2014. 2014; <http://apps.nccd.cdc.gov/brfss/page.asp?cat=XX&yr=2014&state=WA#XX>. Accessed August 16, 2016.

Behavioral Risk Factor Surveillance System (BRFSS) 2014 data from Washington state show significant correlations between lower income and a number of health indicators including: worse overall self-reported health, depression, asthma, arthritis, stroke, oral health, tobacco use, women's health indicators, health screening rates, physical activity, and diabetes. Data also show that as educational attainment increases income level also increases.

3. Boysun Mike, Wasserman Cathy. *Health of Washington State Report: Tobacco Use.* Washington State Department of Health;2012.

Boysun et al. report Washington state Behavioral Risk Factor Surveillance System (BRFSS) data from 2008-2010, which indicate that adults with lower incomes are significantly more likely to report smoking cigarettes than their counterparts. Further, American Indians and Alaska Natives (AI/AN) and black populations have significantly higher smoking rates than white, Hispanic, and Asian populations. There is also significant geographic variation among counties with southwest and northeast counties in the state reporting higher rates of smoking. These counties are also more likely to have high levels of poverty and lower proportions of the population with college degrees.

4. Ellings Amy. *Health of Washington State Report: Obesity and Overweight.* Washington State Department of Health;2015.

Ellings reports Washington state Behavioral Risk Factor Surveillance System (BRFSS) data from 2002-2014, which shows that obesity rates are the highest among low income families and that as income increase, rates of obesity decrease. Further, individuals that graduated college or attended some college had lower rates of obesity than those who had a high school education or less. Black, American Indian and Alaska Native, and Hispanic Washington residents had higher rates of obesity even after accounting for gender, income, education, and age.

5. Kemple Angela. *Health of Washington State Report: Diabetes*. Washington State Department of Health;2016.

Kemple presents data from Washington regarding diabetes in the state. Washington data from the Behavioral Risk Factor Surveillance System (BRFSS) from 2012-2014 show that among adults, the percentage of persons with diabetes increased as household income decreased. This relationship was also true for education. Further, BRFSS data also show that age-adjusted diabetes prevalence is highest among those who are Hispanic, American Indian/Alaska Native, and black.

6. Poel A. *Health of Washington State Report: Mortality and Life Expectancy. Data Update 2015*. Washington State Department of Health;2015.

Poel presents Washington state data on mortality and life expectancy. The data show that age-adjusted death rates were higher in Washington census tracts with higher poverty rates. The state data also show that American Indian/Alaska Natives, Native Hawaiian/Other Pacific Islanders, and black residents had the highest age-adjusted death rate and shortest life expectancy at birth compared to other groups in the state.

7. Ponnet K. *Financial stress, parent functioning and adolescent problem behavior: an actor-partner interdependence approach to family stress processes in low-, middle-, and high-income families*. *Journal of youth and adolescence*. Oct 2014;43(10):1752-1769.

Ponnet cites extensive evidence on the relationship between financial hardship and emotional problems among youth and adults, family conflict, problem behavior among adolescents, and psychological distress. The author analyzed data from a subsample of two-parent families with children between 11 and 17 years of age from the Relationship between Mothers, Fathers and Children study drawn from the Dutch-speaking part of Belgium (n= 1,596 individuals from 798 families). Analysis showed that parents in low-income groups had significantly more financial stress than those in middle-income and high-income groups. The author found that the association between financial stress and problem behavior in adolescents is mediated by depressive symptoms, interparental conflict, and positive parenting. They also found that financial stress had more detrimental impacts on depressive feelings for mothers with low incomes than for those with higher incomes.

8. Prause J., Dooley D., Huh J. *Income volatility and psychological depression*. *American journal of community psychology*. Mar 2009;43(1-2):57-70.

Prause et al. analyzed a sample (n = 4,493) from the National Longitudinal Survey of Youth. Researchers found that income volatility was significantly associated with depression; and downward volatility (frequent losses in income) was significantly associated with depression even after controlling for baseline depression. High income appeared to act as a buffer, so those with lower incomes were more vulnerable to the adverse effects of downward volatility.

9. Serafin M. *Health of Washington State Report: Self-reported Health Status. Data Update 2016*. Washington State Department of Health;2016.

Serafin presents data from Washington state on self-reported health status. The data show that after accounting for age, education, race and ethnicity, household income was a strong predictor of self-reported health status. Health status varied by race and ethnicity, with close to 35% of Hispanics, 30% of American Indian/Alaska Natives, and 20% of Native Hawaiian/Other Pacific Islander reporting fair or poor health. Washington Behavioral Risk Factor Surveillance System (BRFSS) data from 2012-2014 also show that education was a strong predictor of self-reported fair or poor health after adjusting for age.

10. Spencer N., Thanh T. M., Louise S. Low income/socio-economic status in early childhood and physical health in later childhood/adolescence: a systematic review. *Maternal and child health journal*. Apr 2013;17(3):424-431.

Spencer et al. conducted a meta-analysis of studies examining the relationship between low socioeconomic status in the first five years of life and physical health outcomes in later childhood and adolescence. Nine studies met the researchers' strict inclusion criteria. The studies indicated significant associations between early childhood low-income status and a number of adverse health outcomes including: activity-limiting illness, parent-reported poor health status, acute and recurrent infections, increasing body mass index (BMI), dental caries, and higher rates of hospitalization.

11. Subramanyam M., Kawachi I., Berkman L., et al. Relative deprivation in income and self-rated health in the United States. *Social science & medicine*. Aug 2009;69(3):327-334.

Subramanyam et al. analyzed data from the 2002, 2004, and 2006 Current Population Surveys conducted by the United States Census Bureau. Researchers found that individuals from the lowest income category were over five times more likely to report being in poor health than participants from the highest income category. In addition, they found that relative deprivation (the differences in incomes between an individual and others who have higher incomes than that individual [one measure of income inequality]) appeared to explain a large part of this association.

12. VanEenwyk J. *Health of Washington State Report: Socioeconomic Position in Washington*. Washington State Department of Health;2014.

VanEenwyk presents data about socioeconomic position in Washington State including differences within the state as well as statewide differences compared to national data. Data indicate that compared to the United States as a whole, fewer Washington residents are living in poverty and a higher percentage of residents ages 25 and older have college degrees. However, these economic resources are not evenly distributed among all Washington residents. Females in Washington were more likely to be living in poverty than males and were also more likely to have lower wages. Further, American Indian and Alaska Native, Hispanic, and black residents had higher percentages of living in poverty and lower median household incomes compared to other groups. Data also indicated that counties in eastern Washington were more likely to have high poverty rates and high rates of unemployment than counties in western Washington.

13. **Derose K. P., Escarce J. J., Lurie N. Immigrants and health care: sources of vulnerability. *Health affairs*. Sep-Oct 2007;26(5):1258-1268.**

Derose et al. discuss a host of factors that influence immigrants' vulnerability in obtaining adequate health care including immigration status, limited English proficiency, policies, location, stigma, and socioeconomic background, among others. The authors cite a number of studies that demonstrate associations such as, "...adults with limited English proficiency and their children are much less likely to have insurance and a usual source of care, have fewer physician visits, and receive less preventive care than those who only speak English." They further discuss that differences in experiences and outcomes are even more different when they are broken down by language subgroups such as, for example, differences in Pap test rates among Spanish speakers versus those who speak Cantonese, Mandarin, and Korean. In addition to differences in health outcomes, persons with limited English proficiency also report lower satisfaction with their care and a lower understanding of their medical situation in general. The authors go on to discuss efforts that are aimed to address the effects of limited English proficiency and what these efforts mean under Title VI of the Civil Rights Act of 1964.

14. **Gee Gilbert C., Ponce Ninez. Associations between racial discrimination, limited English proficiency, and health-related quality of life among 6 Asian ethnic groups in California. *American Journal of Public Health*. 2010;100(5):888-895.**

Gee and Ponce analyzed data from the California Health Interview Survey (CHIS) from 2003 and 2005 to examine the association of racial discrimination and limited English proficiency with health-related quality of life. The authors analyzed survey responses from adults who identified as Chinese, Filipino, Japanese, Korean, South Asian, and Vietnamese for a total of 7,723 respondents. Measures drawn from survey data included self-rated health, activity limitation days, and unhealthy days. Experience with language barriers varied greatly with only 3% of South Asians and 5% of Filipinos but 52% of Vietnamese and 47% of Koreans reporting limited English proficiency. The most relevant finding was that individuals reporting limited English proficiency were also more likely to report a decreased health-related quality of life. The authors conclude that although this association was not as strong as association between poor health-related outcomes and discrimination, limited English proficiency still acts as a barrier to health communication and access to services.

15. **Sentell T., Braun K. L. Low health literacy, limited English proficiency, and health status in Asians, Latinos, and other racial/ethnic groups in California. *Journal of health communication*. 2012;17 Suppl 3:82-99.**

Sentell et al. analyzed data from the 2007 California Health Interview Survey (CHIS) to better understand the relationship between low health literacy and limited-English proficiency, alone and in combination, among Latinos, Chinese, Korean, Vietnamese, and Whites. Low health literacy and limited English proficiency have both been demonstrated as barriers to obtaining health care and as being associated with poor health status. CHIS is a random-digit-dial telephone survey and from the 2007 data, the authors included results from 48,427 individuals that met their inclusion criteria. The authors found that, "[o]verall, 44.9% [individuals] with limited English proficiency reported low health literacy, versus 13.8% of English speakers. Among the limited English proficient, Chinese respondents had the highest prevalence of low health literacy (68.3%), followed by Latinos (45.3%), Koreans (35.6%), Vietnamese (29.7%),

and Whites (18.8%). In the full sample, respondents with both limited English proficiency/low health literacy reported the highest prevalence of poor health (45.1%)..." The authors conclude that while low health literacy and limited English proficiency may impact health status to varying degrees among different racial/ethnic subgroups, limited English proficiency on its own may carry a greater health risk and that further research is necessary.

16. ***Demographics of Seattle Residents within a Quarter Mile of a Sound Transit Facility, unpublished data.: Washington State Department of Health;2016.***

The Washington State Department of Health's (DOH) Environmental Epidemiology unit created a geographic information system (GIS) model to estimate the demographics of Washington state residents living in restricted parking zones that were within a quarter mile of a Sound Transit facility. To generate the data for Table 1, staff from DOH drew quarter mile buffers around each RPZ to geographically represent the populations that would be impacted by this policy. They then used the proportion of each census block group that fell within the buffer to estimate the demographics of the populations living within the impacted zones. For example if the population of a block group was 100 and 34% of the block group fell within the buffer, it was estimated that 34 people in that block group lived within the buffer. This method was applied to education, race, and economic indicators. The data for Table 2 were available at the census tract level. For these data, DOH staff included the census tracts that had at least 25% of their area within the RPZ plus quarter mile buffer. The indicators used were pulled from the Washington Tracking Network (WTN), which is a DOH tool for making public health data sets publicly available. WTN developed a health disparities index that includes the measures in Table 2. Data from these measures came from the multiple sources including the U.S. Census Bureau, The Department of Housing and Urban Development, and the Washington State Department of Health Center for Health Statistics, Community Health Assessment Tool, and the Washington State Cancer Registry. It is important to note that there are limitations to these data. The methods used assume an even distribution of indicator measures (population, race, disease rates, etc.) across block groups and census tracts. In block groups or census tracts where there is not an even distribution, the accuracy of the estimate is likely to be influenced. However, if the variations are random they are not likely to have a large impact but if they are systematic, it could cause the method to produce an inaccurate estimate. For example, if the population was slightly more dense in the area covered by the buffer zone in some tracts and slightly less dense in others, the estimate would still be relatively accurate. If the population is systematically more or less dense in the portions of the census tract or block group though, the estimates could be inaccurate.