BANNER ROAD SHOULDERS:
A Kitsap County Health Impact Assessment

Prepared by Kitsap Public Health District

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ACKNOWLEDGEMENTS

This Health Impact Assessment would not have been possible without the support of our partners: Kitsap Department of Community Development, Kitsap Transit, Kitsap Department of Public Works, South Colby Elementary School, and South Kitsap School District. Additional thanks to Kitsap Public Health Board, Commissioner Garrido, community members of the lower Banner Road area, and our mentor, Jimmy Dills. Finally, a tremendous thank you to the National Association of County and City Health Officials (NACCHO) for this funding opportunity and their ongoing guidance and provision of areas for new growth and information sharing regarding Health Impact Assessments.

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Executive Summary

This summary presents the findings and recommendations of the Banner Road Shoulders Health Impact Assessment (HIA) conducted to inform how a potential shoulder-widening transportation project would impact the community's health. The potential project would take place on a 1.25 mile stretch of road in a rural area of south Kitsap County, along which sits an elementary school, South Colby Elementary. This HIA considered health effects of the project, focusing on two specific health determinants: physical activity and injury risk. Data were collected from a community survey, literature review, stakeholder interviews and a community workshop to determine what the likely health impact of this project would be. The two health determinants were prioritized based on community input and concern, local data availability and larger existing evidence base. Our predictions of impact and likelihood, including magnitude are outlined Table A. We conclude this report with recommendations to enhance health under either the widening or maintenance scenarios. Our recommendations are supported by the existing evidence along with community and stakeholder input.

Key Findings

Injury

- Community members and stakeholders perceive the current design of the stretch of Banner Road between Southworth and Sedgwick to be unsafe.
- Community survey respondents expressed that they would use the stretch of Banner Road between Southworth and Sedgwick more if there were more safety standards in place such as lighting, barriers between cars and pedestrians and increased room.
- While we do not have data specific to lower Banner Road, we know of one motor-vehicle injury-related death in the assessment area (98367) as well as one in a neighboring rural zip code, 98359. The South Kitsap area is in the middle quintile for injury rates in the county (See p. 27).

Physical Activity

- Of community survey respondents, 72% (33 out of 46) said that they would use lower Banner Road more if the road had wider shoulders.
- Of community survey respondents, 25% (14 out of 55) said that they use lower Banner Road to exercise, and 20% (11 out of 55 respondents) said that they use it for recreation.
- Of community survey respondents, 5% (2 out of 53) reported that their kids walk to South Colby Elementary, none of the respondents reported their children bike to school.
- There may be an increase in opportunities for physical activity, both directly on lower Banner Road itself (referenced in Table A as *Direct Physical Activity*), as well as in the areas such as school grounds, parks and trails (referenced in Table A as *Indirect Physical Activity*), which could be made more accessible by changes to lower Banner Road's design.

Priority Recommendations

The above findings were used to develop five main recommendations. These five priority recommendations received highest priority based on potential health impacts and feasibility. While this is a complete list of our priority recommendations, they are not in priority order and are addressed in more detail in the body of the report:

1. Incorporate traffic calming measures, including, but not limited to: fog lines, shading of the areas for pedestrians and bikers (outside of the lines), decreased speed limits, speed beds, and increased enforcement.

2. Establish barriers between pedestrians and road users.

3. Designate spots along road for motorized pull-off and turnaround.

4. Provide ongoing safety and mode-use education and awareness to users of Banner Road and South Colby Elementary School so that residents, parents, staff and commuters are aware of options and hazards.

5. Create a secondary drop off route for South Colby Elementary School so that there can be supervision for drop off at the front *and* back side of the school.

Table A: Summary Health Impacts of Shoulder Widening of Banner Road

Health Outcomes	Health Indicator	Strength of Evidence of Impact on Indicator	Local Data Availability	Stakeholder Projections	Based Primarily on Evidence from Literature			
					Expected Change	Expected Health Impact	Magnitude of Impact	Likelihood of Impact
Chronic Disease	Direct Physical Activity	**	**	Increase	Increase	Positive	Med	Possible
	Indirect Physical Activity	**	*	Increase	Increase	Positive	Low	Possible
Injury	Injury Risk	***	**	Decrease	Decrease	Positive	Med	Likely
	Perception of Safety	***	*	Increase	Mixed	Positive	Med	Possible
General Health	Mental Health	*	***	N/A	No change	No effect	Low	Unlikely
	Overall well-being	*	***	Increase	Increase	Positive	Med	Possible

Table Keys:

Rating	Strength of Evidence	Data availability	Can we measure a potential change?
*	Low	Not available	No
**	Medium	Available but not comparable to national literature	Yes, but with limitations
***	High	Available and comparable	Yes, with a strong data source

Category	Criteria
Stakeholder Projections	• Mixed – Stakeholders were divided in their projections. • Increase – Stakeholders expect to see increase. • Decrease – Stakeholders expect to see decrease. • N/A – Stakeholders did not express thoughts on this issue.
Expected Change	• No change – we do not expect this indicator to change based upon literature. • Mixed - There is a lack of consensus regarding impact on indicator. • Increase – there is consensus that this indicator will likely increase. • Decrease - there is consensus that this indicator will likely decrease.
Expected Health Impact	• Positive – changes may improve health. • Negative – changes may worsen health. • No effect – No identified effect on health.
Magnitude of Impact	• Low – Expected to impact little to no persons in the community. • Med – Expected to affect a moderate amount of people in the community. • High – Expected to affect a large amount of people in the community.
Likelihood of Impact	• Likely – Likely that impact will occur as result of project. • Possibly – Possible that impact will occur as a result of project. • Unlikely – Unlikely that impact will occur as a result of this project. • Uncertain – Uncertain that impact will occur as a result of this project.

Key Tables Adapted from Vermont Department of Health and Kansas Health Institute.

Background

Kitsap County

Kitsap County is one of the smallest counties in Washington State by geographic size, but it is the third most densely populated county in the state with an estimated population of 254,000 in 2013 (US Census and WA State Office of Financial Management Population Estimates). It is located in the central Puget Sound region of Washington State and is characterized by large areas of relatively rural land and four incorporated cities, including Port Orchard in South Kitsap. As of 2013, one in ten Kitsap households earned less than the federal poverty level, almost three in four adults age 25 and older did not have a college education, one in five of the population were non-white or Hispanic and one in eight adults under the age of 65 did not have medical insurance. The study area is designated by the red box in Figure 1 below.

Figure 1: Kitsap County

Source: visitkitsap.com.

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What is a Health Impact Assessment?

According to the National Research Council a Health Impact Assessment (HIA) is a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program or project on the health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects through a six step process (Figure 2) (National Research Council, September 2011).

HIA brings a greater understanding to the human health consequences of policy and decision-making. The Kitsap Public Health District (KPHD) is committed to promoting decisions founded on community input and epidemiology in all focus areas. HIAs provide a critical component by which we can fulfill our 2011-2021 Strategic Plan goal to "*decrease chronic diseases and their impacts in our community"* and our 5 year milestone to *"participate in community planning processes in order to promote and support a healthy built environment."*

Figure 2: Six Steps of an HIA

Screening	Scoping	Assessment	Recommendations	Reporting	Monitoring & Evaluating
Determine whether an HIA is needed and useful.	With stakeholder and community input, develop plan for HIA including identification of potential health impacts.	Describe the baseline health of affected communities and assess potential impacts of the decision.	Develop practical solutions that can be implemented, taking into account the feasibility given the project context.	Disseminate findings to stakeholders, elected officials, and community members.	Monitor changes in health or health risk factors, evaluate implemented measures, assess HIA process

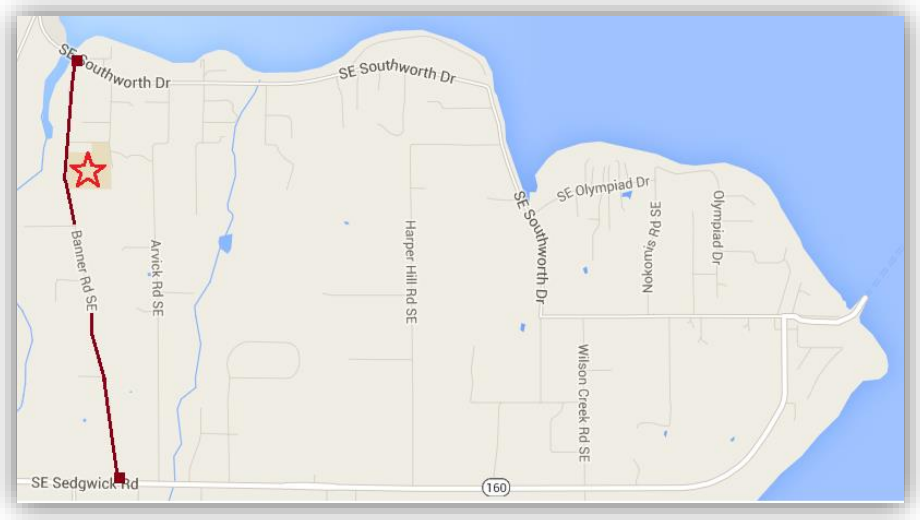
Source: Pew Charitable Trust.

What is the Banner Road Shoulder Project?

The area of focus for this Health Impact Assessment is lower Banner Road in South Kitsap, described by the community as 'lower' despite it being the northern stretch of Banner Road, due to the hill that you travel down to get to the street at its north end, SE Southworth Drive (Figure 3). This section of Banner Road is approximately 1.3 miles, one lane each way with no fog lines. It is a stretch of wooded road in a rural residential area of South Kitsap that runs between Sedgewick and Southworth Drive. South Colby Elementary School is located on the northern part of this stretch (see star in Figure 3.), in between two sharp turns in the road. The speed limit on most of banner road is 35 miles per hour (mph) except for the stretch alongside the school which is reduced to 25mph.

Our HIA was conducted on a potential Kitsap County Transportation Improvement Program (TIP) project titled Banner Road Shoulders. The TIP is used by the technical advisory board, consisting of land use and transportation planners and engineers to update and coordinate the County's future plans for road and transportation improvements. If funded, this project would widen the shoulder on each side of Banner Road, to the north and south of South Colby Elementary School. This project would potentially create more space for non-motorized modes of transportation that already occur, including biking and walking.

Figure 3: Banner Road Area Map



Source: Google Maps.

Screening: Why do an HIA on the Banner Road Shoulder Project?

The Kitsap Public Health District was approached by the Kitsap County Department of Community Development (DCD) to assist with transportation project prioritization by incorporating a health impact component. We were seeking an opportunity to conduct an HIA and considered it an informative way to gather relevant data and methods for creating a tool to integrate health into the larger health in all policies concept that DCD was exploring. We picked the lower Banner Road shoulders project for our first HIA for three reasons. The first reason is that the Banner Road project is currently undecided upon and unfunded, giving us the opportunity to use our research and findings to inform a decision. The second

reason for the focus on Banner Road for our HIA is that there is an elementary school on this stretch of road, resulting in the presence of children, a prioritized and vulnerable population. Additionally, this is a focus area due to robust evidence supporting the creation of safer routes to school. Thirdly, this area of our county is known to have poorer health outcomes than most of the rest of the county. As a main premise and purpose of HIAs is to address health disparities by creating a more holistic approach to health consideration, this is a significant reason we chose this potential project, and this area.

Scoping

Scoping is the blueprint for the HIA, during which community members, stakeholders and partners determine the temporal and geographic parameters of the process as well as health impacts to be considered and the overarching assessment goals. This section includes the following focus areas:

HIA Goals

The aim of this HIA was to determine how this potential project might influence the health of the surrounding community and users of Banner Road. We used existing literature, a community survey, expert opinion, and baseline health data to assess the impact of this potential project.

Beyond our HIA we aimed to create a tool to promote the inclusion of health impact into the county's Transportation Improvement Program, including built environment benefits such as walkability, access and connectivity. Historically, this process has focused on aspects such as preservation, capacity, environmental retrofit and safety, but has not incorporated a more holistic concept of health, including the community's perception of health impact.

Developing the Scope

In developing the scope for this HIA, we designated the catchment area of South Colby Elementary as the primary geographical scope, and included those census tracts and zip codes that surrounded it as a secondary geographical scope to include the populations that might travel the stretch of road for purposes such as commuting, running errands, and attending events and activities at South Colby Elementary. Based upon our funding opportunity with the National Association of County and City Health Officials (NACCHO) we had determined our temporal scope to be September 2014 through June 2015. We held an initial meeting of stakeholders and partners to gather input on the process, HIA timeline and to ensure all

parties understood and accepted their respective roles and responsibilities. We met with partners and stakeholders in person or over the phone to talk through concerns and levels of participation. We then created a community survey for the collection of primary data and set up a community workshop for mid-January to inform the community further and to assess the potential pathways of health impact that the prospective road project would have.

Partners & Stakeholders

Our partners in this HIA were the Kitsap County Departments of Community Development and Public Works. Our stakeholders included Kitsap Transit, South Colby Elementary School, the South Kitsap School District Transportation staff, the County Commissioner for the district in which lower Banner Road is situated, community members, and a member of the Parent Teacher Student Organization (PTSO). We met with our partners twice collectively, interviewed each partner and stakeholder group one-on-one, and contacted them all for feedback in early summer of 2015. We plan to report back to all partners and stakeholders in 2016.

Health Effects Considered

For this HIA we reviewed several different connections between the proposed widening of lower Banner Road and health determinants including several health outcomes. Each series of connections we depict are called pathways, which are illustrated in Figure 4 on page 15. This shows the entirety of all the possible connections that community members, partners, stakeholders and health district professionals came up with. Highlighted with arrows and shaded bold boxes are the two focused pathways (Injury and Physical Activity) which we discuss in detail under Methods.

Vulnerable Populations

Based on our scope for this HIA the populations affected by this potential project are those that use Banner Road for commuting, exercise, getting themselves or their children to school, and those that may use it to access public transportation. Within these groups, the most vulnerable populations are the children, elderly, and low-income persons.

Children are particularly vulnerable to pedestrian injury because they are not yet developed enough to judge traffic speeds and dangers and therefore are more likely to misjudge or put themselves in harms away. One study found children aged 6-11 cannot detect cars moving faster than 20mph and don't see them coming. (Wann et. al, 2011). The shoulder widening project has the potential to influence the drop-off and pick-up patterns of children, as well as the various modes by which children travel to school (foot, bus, bike, etc.).

Pedestrians and residents, of all age groups and backgrounds, using the road for exercise and commuting purposes should be considered in the decision-making process. The elderly may not be able to react as quickly, and once hit are more frail and less likely to recover. In addition, the older a person gets the more likely they are to give up their driving, creating a greater need to rely on alternate modes of transportation.

It is important to note that in national data, the elderly, ethnic minorities and children are disproportionately represented in pedestrian deaths. Risk is measured in Pedestrian Danger Index (PDI) which interprets the risk of dying as a pedestrian. While children under 16 have the lowest PDI at 6.6, older pedestrians have the highest risk of 36.6 for those 65 and older and 45.8 for those 75 years and older. (Dangerous by Design, 2014).

It has been determined that low income people suffer disproportionately from health issues related to lack of physical activity. Those with fewer years of education, lower incomes, less accumulated wealth, living in poorer neighborhoods, or substandard housing conditions have worse health outcomes, including diabetes, asthma and obesity (Prevention for the Health of North Carolina: Prevention Action Plan). We know that low income people are at disproportionately higher risk for both road traffic crashes and safety issues (World Health Organization). Furthermore, low income individuals are often more at risk of injury due to their lesser ability to rebound from sickness or injury. While children and the elderly are more susceptible to accidents due to misperception and response rates respectively, low income persons are at a higher risk of not being able to afford care or the things they need to fully recover from such accidents. Additionally, low-income persons face difficult social and environmental barriers to physical activity including lack of meaningful transportation choices, traffic conditions, lack of time, and poor access to parks and recreational centers.

When compared to Kitsap County as a whole, South Kitsap has a higher rate of poverty for both adults and children. The South Kitsap school district has the second highest rate of free or reduced lunch participation of the five school districts in the county. Although South Kitsap poverty figures are worse than the rest of the county, notably they are better than the state (Table B).

Table B: Local and State Poverty Data

	South Kitsap	Kitsap County	Washington State
Population Living Below 100% of the Poverty Level	**13%**	**11%**	**14%**
Children Living Below 100% of the Poverty Level (under 18)	**17%**	**14%**	**19%**
Free or Reduced Lunch (K-12)	**39%**	**36%**	**45%**

Sources: US Census, the American Community Survey 2012, and WA State OSPI 2013.

Banner Community Survey

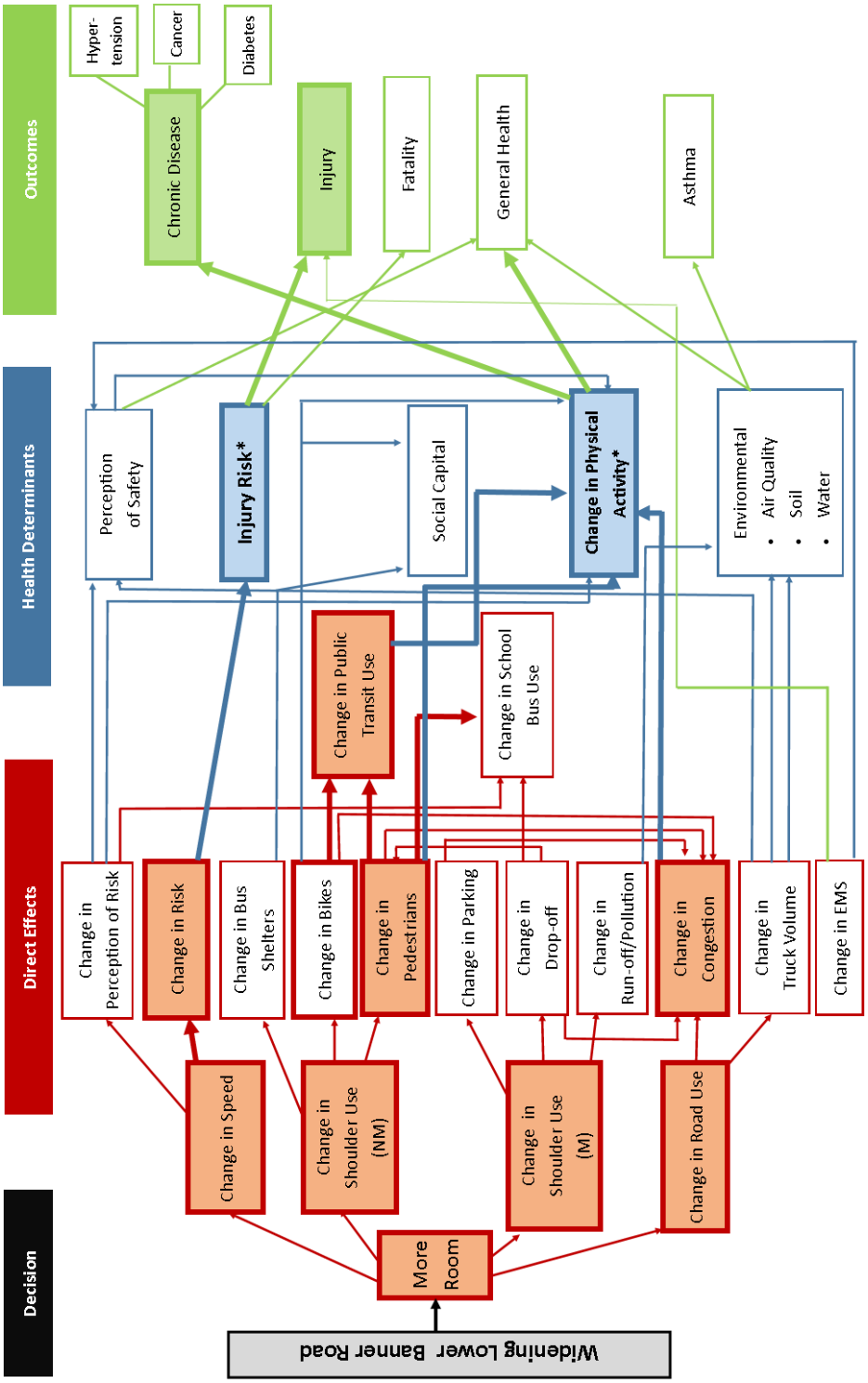
In 2015, we conducted a community survey (Appendix D) from January 5th through January 31st to supplement the community input from our workshop as well as to increase the depth of our local health data. We went through the Washington State Institutional Review Board (WSIRB) screening process, completing the necessary paperwork and received confirmation that review was not required. We developed a web-based survey and disseminated it through the Kitsap Transit ridership list-serve as well

as to all the families with children attending or participating in activities at South Colby Elementary. Additionally we mailed postcards to all residents living on the Banner road segment (lower Banner Road) between Southworth and Sedgwick inviting them to take the survey. It is important to note that due to the methods of survey dissemination that there is the possibility that we did not reach all affected persons and that the results of the survey may not be representative. We received survey responses from 57 residents.

Community Workshop

As part of our Scoping process we conducted a Community Workshop. Recruitment for the workshop included the development and dissemination of a flyer, postcard and email messages. During this workshop we gave stakeholders and community members an overview of a HIA including the purpose, and went through the specific elements of the lower Banner Road HIA. We then split into groups to formulate pathways of impact. The purpose of these pathways was to assess the relationship between the decision to widen lower Banner Road and potential health outcomes. The decision was placed on the left side of poster sheets with the health outcomes of Chronic Disease, Injury, Fatality, Asthma and General Health on the right. Community members, stakeholders, public health professionals and partners participated in connecting the decision to direct effects, to health determinants, to the existing health outcomes. This exercise produced Figure 4.

Figure 4: All Possible Pathways (Workshop end-product)



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As a result of the pathways determined by the workshop we looked at the connections that were most important to the community, perceived as most relevant and impactful by partners and stakeholders, and with enough local data to be assessed and monitored. This resulted in three major pathways; Injury, Chronic Disease and General Health. The health determinants connected to these outcomes are injury risk and physical activity, respectively.

Pathway Development

The Injury pathway (Figure 5), starts with the widening of Banner Road and the room it would create, connecting the associations to potential changes in speed, shoulder and road use. Thinking through the impact of these direct effects, aspects such as truck volume, transit use, and change in risk and congestion shifts were considered. All of these considerations may lead to a change in safety ultimately impacting outcomes in injury.

The Physical Activity pathway (Figure 6), consists of two outcomes: chronic disease and general health. Similar to the injury pathway, it begins with the widening of Banner Road creating more room, resulting in potential changes in road use. The direct effects again include: a potential change in speed, non-motorized shoulder use (bicycles and pedestrians), motorized shoulder use (parking and drop-off), public transit use, and school bus use. All of these factors contribute to the potential alteration in physical activity, ultimately resulting in the outcomes of general health and chronic disease, including hypertension, diabetes, and cardiovascular disease.

Health Determinants Considered but Not Addressed (and Resulting Pathways)

Throughout the initial phases of the HIA process there were several issues that were considered but ultimately not addressed in the final HIA report (See Figure 4 for full pathway diagram and separate pathways for changes made). After analysis of relevant and available data, the decision was made to eliminate asthma as a health determinant, due to limited local data. As a result of the elimination of asthma, air quality was removed as well. Social capital was eliminated due to the difficulty in measurement and the scarcity of local data. Perception of safety (pedestrian and bike) was changed to safety for clarity and measurement purposes and as a result, perception of risk was removed as a direct effect. We have addressed the connection between perception of safety and use based on existing literature in our assessment, however, we did not consider there to be enough data or capacity locally to measure a change in perception of safety of residents and road users. Truck volume was also removed from the list of direct effects due to a lack of knowledge regarding existing truck patterns and difficulty documenting and measuring changes in volume and road usage.

Figure 5: Injury Pathway

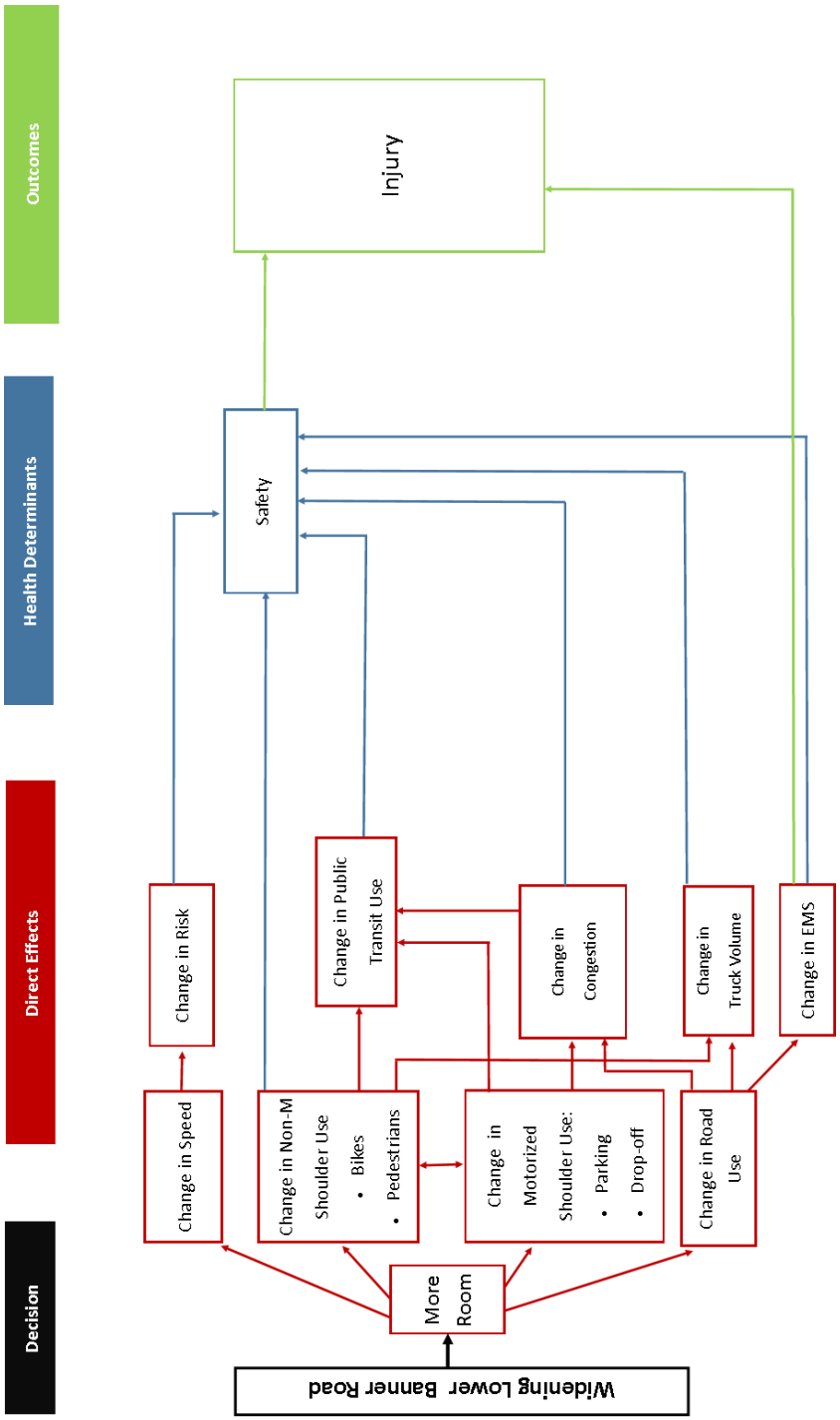

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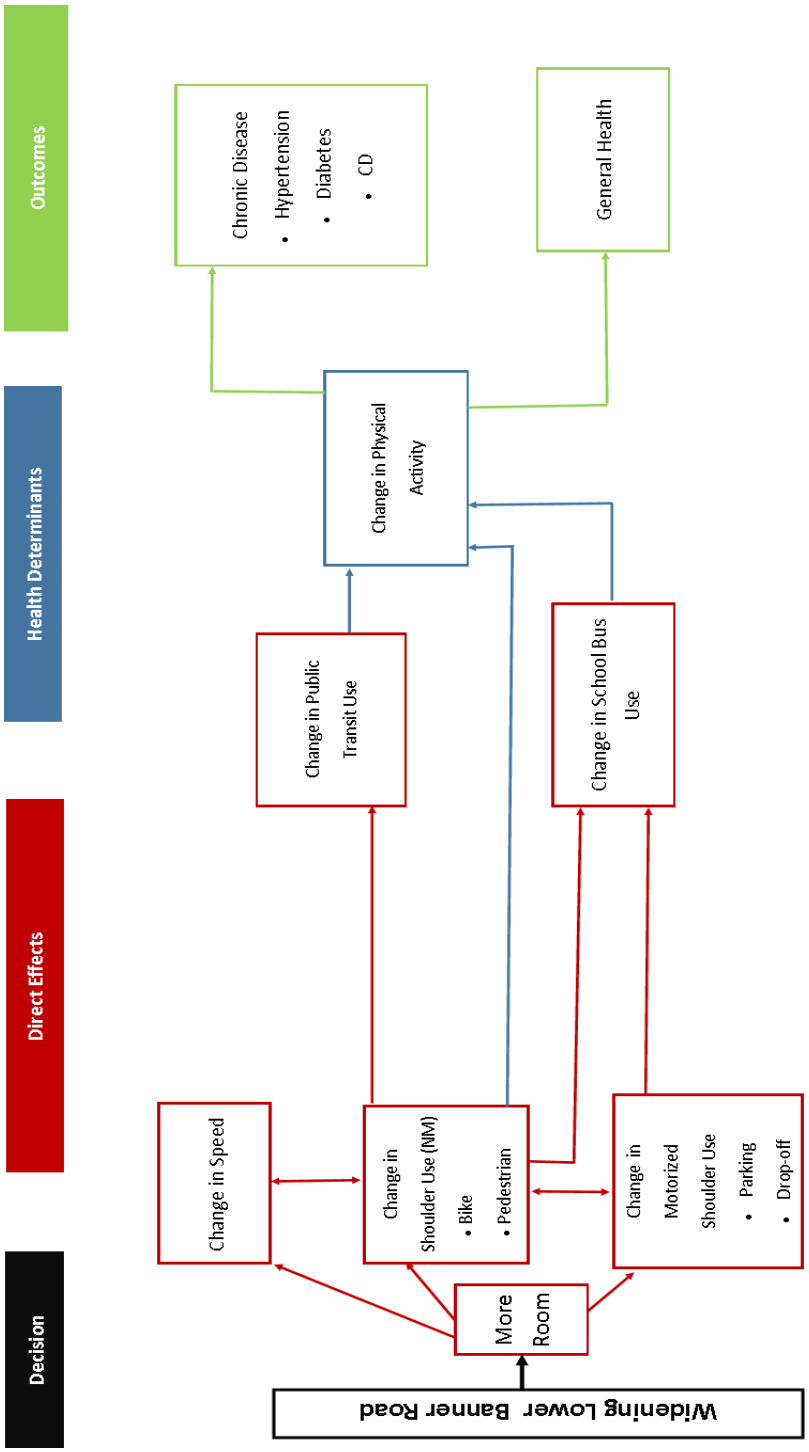
Figure 6: Physical Activity Pathway



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Assessment

This section of the HIA includes a description of baseline health conditions of the affected community and the analysis of potential impacts of the decision to widen lower Banner Road. Included are the following:

- Existing Health Conditions
- Banner Community Survey Results
- Key Informant Interviews
- Impact Analysis

Existing Health Conditions

It is important to look at the health of South Kitsap in relation to the rest of the county and state in order to understand the health disparities that exist in this area. The existing health conditions data were derived from state data sources and the Banner Community Survey.

South Kitsap has a higher percentage of obese and overweight adults than the state, as well as compared to the county as a whole (Table C). We do not have data for South Kitsap children specifically, but for Kitsap and WA there is no difference in the percentage of obese or overweight children. For depictions of the intra-county differences regarding heart disease and diabetes hospitalizations see Appendix A.

Table C: Obesity levels in Washington State, Kitsap County and South Kitsap

	South Kitsap	Kitsap County	Washington State
Adults Overweight or Obese	**69%**	**61%**	**59%**
Youth Overweight or Obese		**26%**	**25%**

WA BRFSS 2012 and Healthy Youth Survey 8th grade 2012.

Banner Community Survey Results

Survey Limitations

When looking at the survey results from the Banner Road area, there is a possible sampling bias in the respondents. In other words, the survey likely missed some of the intended recipients due to our outreach methods or resident decision not to participate. Because we used Kitsap Transit's ridership list serve to disseminate surveys, we may have missed those who commute along lower Banner Road as Transit does not have stops along this stretch of the road. Furthermore, we sent postcards to residents that lived along lower Banner Road but the mailing went out two weeks later than expected and some of the addresses and

inhabitants may have been incorrect in the database. By using the school list serve, we may have also missed parts of the community affected by lower Banner Road, omitting important perspective from those without children attending South Colby (or practicing there). Due to these limitations in our survey methods it is important to note that while the survey results depict an overall better health for the community compared to the county, the results may not be a realistic depiction of existing conditions in the area.

As can be seen below in Figure D, the Community Survey was generally representative of the greater population regarding race, but not an accurate portrayal of the gender or age distributions in the greater South Kitsap area.

Table D: Demographic Comparison of Survey Respondents to South Kitsap Population

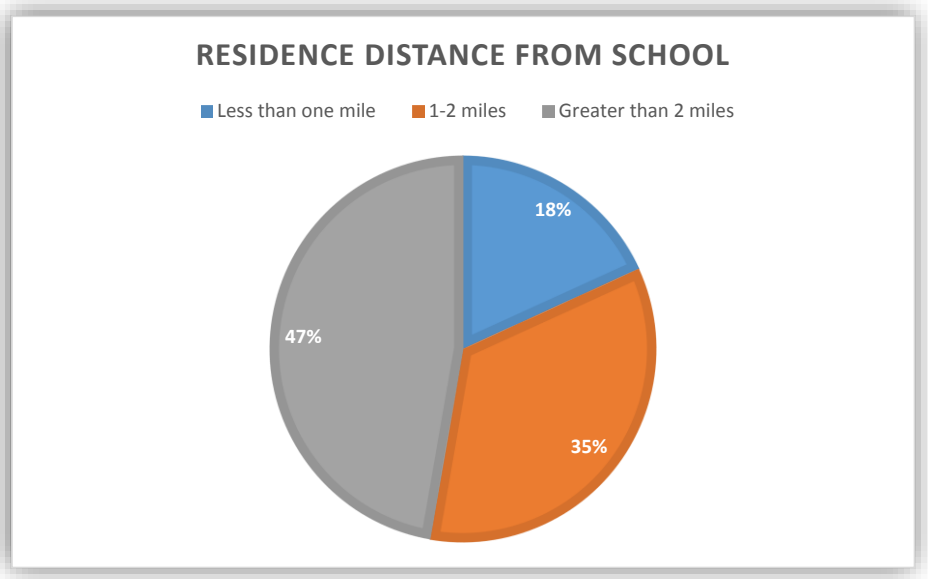
		Survey	South Kitsap
Race*	White	86%	84%
	Black	2%	2%
	Native Hawaiian/Pacific Islander	2%	1%
	Hispanic	9%	5%
	American Indian	4%	1%
	Asian	0%	3%
	2 or more	N/A*	5%
Age	19-29	7%	15%
	30-39	32%	18%
	40-49	32%	16%
	50-59	19%	20%
	60-69	4%	18%
	70+	4%	14%
Gender	Female	77%	50%
	Male	18%	50%
	Undeclared	5%	N/A

Source: ACS 2009-2013 and Banner Road Community Survey.

***In the Banner Road Community Survey, respondents were asked to check all that apply for Race.**

Figure 7 below depicts the distance that survey respondents live from South Colby Elementary School. Over half were within two miles of the school. It is important to note that because nearly half of the respondents live greater than two miles from the school there may be a bias regarding transportation modes and reasons for road use within our geographical scope.

Figure 7: Community Survey Residence Distance from South Colby Elementary School



Our survey respondents were from two zip codes with 32 respondents from 98366 and 19 respondents from 98367. For a geographical representation of these zip codes within the county, please refer to Appendix B.

Survey respondents reported a lower rate of hypertension/high blood pressure (19%) compared to both South Kitsap and Kitsap. Additionally, diabetes prevalence seemed only marginally different (Appendix C).We also looked at respiratory disease, depression and overall poor physical health within our survey respondents and the county. Regarding poor physical health in the last 30 days, the survey population results were 3.8 poor health days out of the last 30, South Kitsap was 5.7 days, and the greater Kitsap County result was 5 days.

In addition to understanding the baseline health conditions of the Banner Road community, it was important to gage community members' perceptions regarding what impacts their health and wellbeing.

Banner Community Survey respondents cite "Not enough places nearby to exercise" as the most common negative neighborhood condition (Figure 8).

Figure 8: Proportion of Community Survey Respondents Identifying that the Following Neighborhood conditions Negatively Affect Their Health and Wellbeing

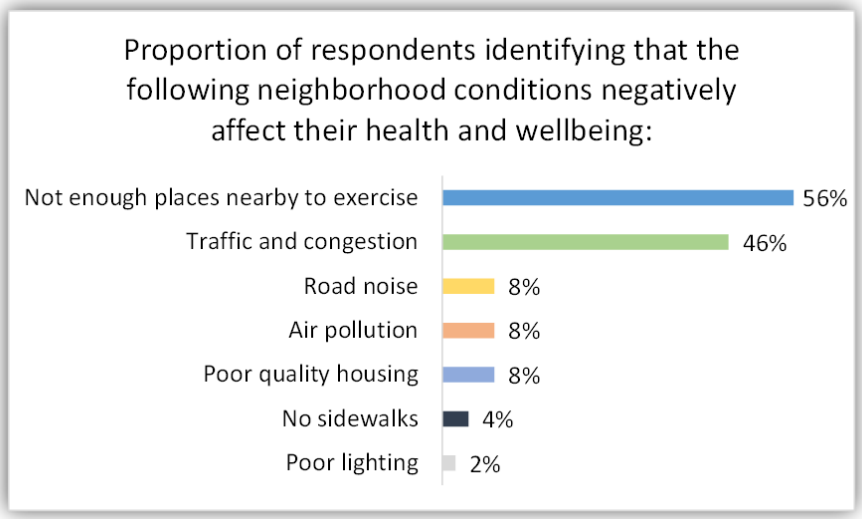


Figure 9 depicts the hierarchical ordering of the barriers people feel exist and the improvements that they prioritize. The most important reason respondents would use Banner Road more is if it had wider shoulders.

Figure 9: Desired Conditions Banner Community Survey Respondents Give To Increase Lower Banner Road Use, In Ranked Order

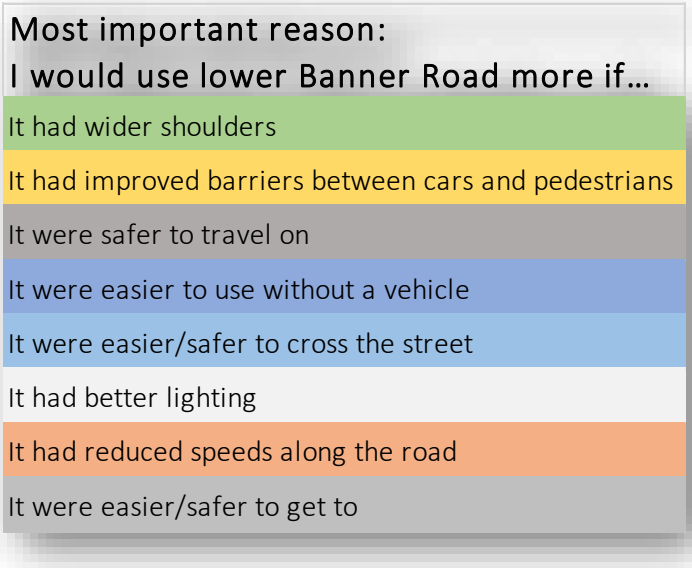


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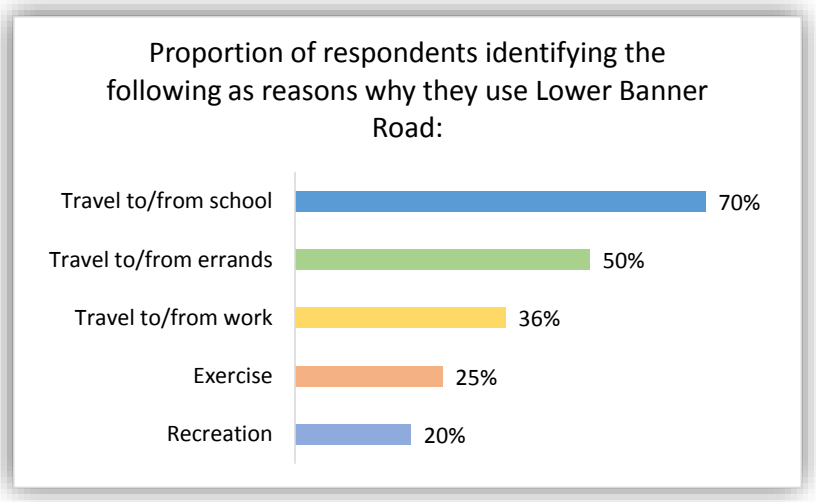
Figure 10 depicts survey respondents picking top three aspects of road use, rating them from 1-3, with 1 being most important. The answers represented in this figure show, in descending order, how frequently each road attribute was voted most important. The most common uses for the road are travel to school, running errands or going to work, followed by exercise and recreation. We did not explicitly ask if exercise and recreation occur on the road itself or if the respondents use the road to travel to exercise or recreation. Respondents were asked to check all that apply.

Figure 10: Community Survey Reasons for Lower Banner Road Use in Past 30 Days



Key Informant Interviews

Telephone and in-person interviews were conducted with representatives from Kitsap County Departments of Community Development and Public Works, Kitsap Transit, South Kitsap School District, South Colby Elementary and a Kitsap County Commissioner. The following themes arose from the interviews:

- Current concerns regarding lower Banner Road included safety issues related to the physical landscape of the road and the school area.
- When asked about the possible short term and long term impacts of Banner Road remaining the same the theme regarding safety remained. Two stakeholders mentioned that they did not anticipate a large growth in population for that area but were still concerned for safety due to the number of children at risk.
- If Banner Road is widened, stakeholders expressed potential for more walking in the area. The principal of the elementary school stated that there could be an increase in both kids and their families using the schools grounds for recreational purposes. Transit noted that there may be additional riders walking to the bus stop.
- Stakeholders described what they would like to see changed in the area. Two change themes arose: policy and physical. Public Works identified that the general practice is not to stripe rural road but wonders if there is room for policy regarding areas that will largely impact children. Physical changes discussed included traffic calming strategies and programmatic interventions such as school engagement and additional crossing guards.

Impact Analysis

In analysis of this project we looked to answer two main questions:

1. Would widening the shoulders of Banner Road have an impact on injury risk?
2. Would widening the shoulders of Banner Road have an impact on physical activity?

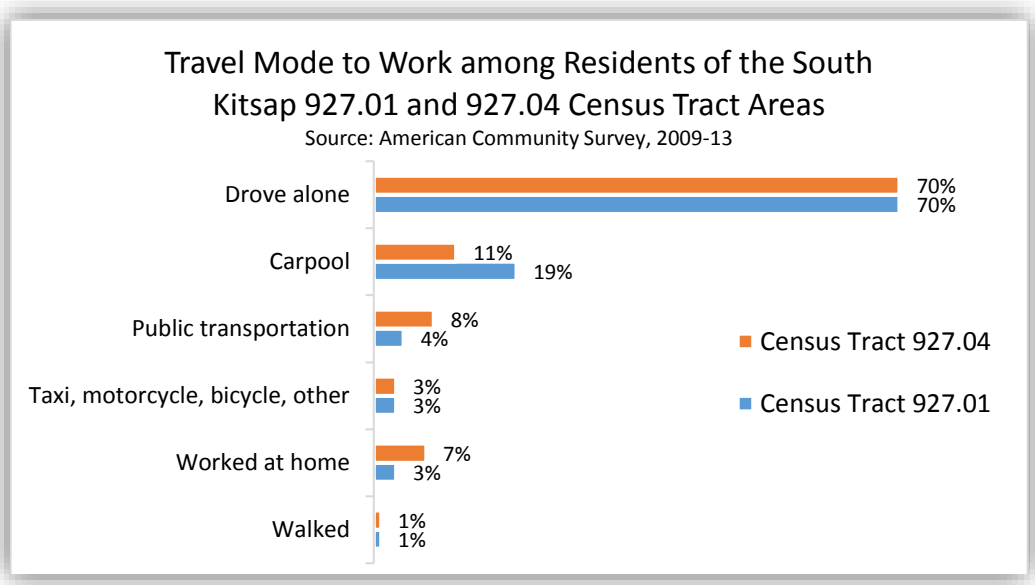
When addressing these questions we looked at available, appropriate data and evidence base. When available, we utilized *local, relevant data*; when that level of data was unavailable we used one or more of the following: literature reviews, stakeholder interviews, and/or primary data from our Banner Road community survey.

Injury Risk

Mode shares on lower Banner Road

While we do not have specific mode counts for this stretch of Banner Road, we know mode counts for one of the census tracts it edges as well as a nearby, similarly rural census tract. We can infer that due to the proximity and shared space that mode shares in our area of focus are likely similar to those depicted in Figure 11. Additionally, we asked our Community Survey respondents what modes they used and how frequently, as shown in Figure 12.

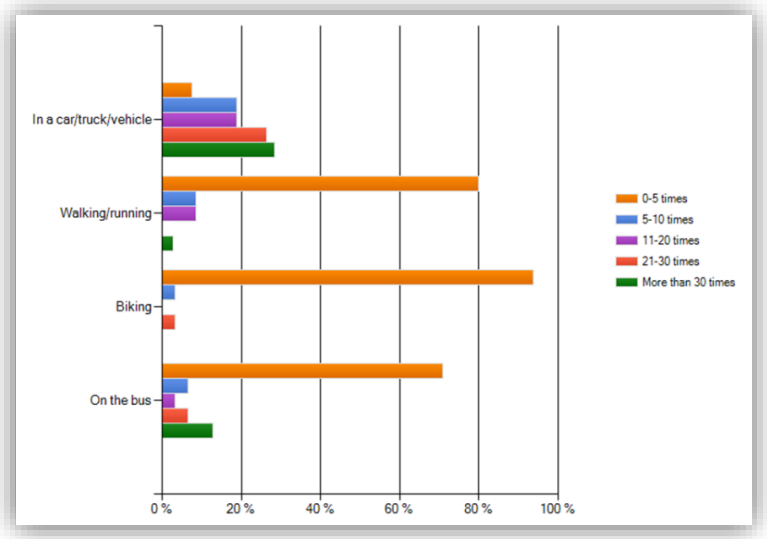
Figure 11: Travel Mode to Work Among Residents of South Kitsap Census Tract Areas



Source: American Community Survey 2009-2013.

KITSAP PUBLIC HEALTH DISTRICT

Figure 12: Community Survey Results of lower Banner Road Mode/Frequency in Last 30 Days



We were informed that Banner Road, between Southworth and Sedgwick, is defined as a Major Collector route classification, primarily serving vehicles, and categorized as a rural setting. Additionally, this route does not serve any transit or heavy vehicle routes. There is the possibility that lower Banner Road may serve as a conduit to a road that had transit hub or access, being used as a bike or pedestrian route to the roads that lie to the north or south. However, there are no transit stops along this road and therefore no public transportation mode share. Numbers for biking and walking use are unknown, yet this corridor is identified as a bicycle route in Kitsap County's Bike Facilities Plan and we know from stakeholder interviews as well as community input that there are people and groups that bike along Banner regularly.

Current width

The segment of lower Banner Road addressed in this HIA is 20 feet (ft.) wide, including both lanes, with shoulders adding another 0-8 ft. on each side. There is no visual separation of the shoulder from the road.

Table E: Lower Banner Road Measurements

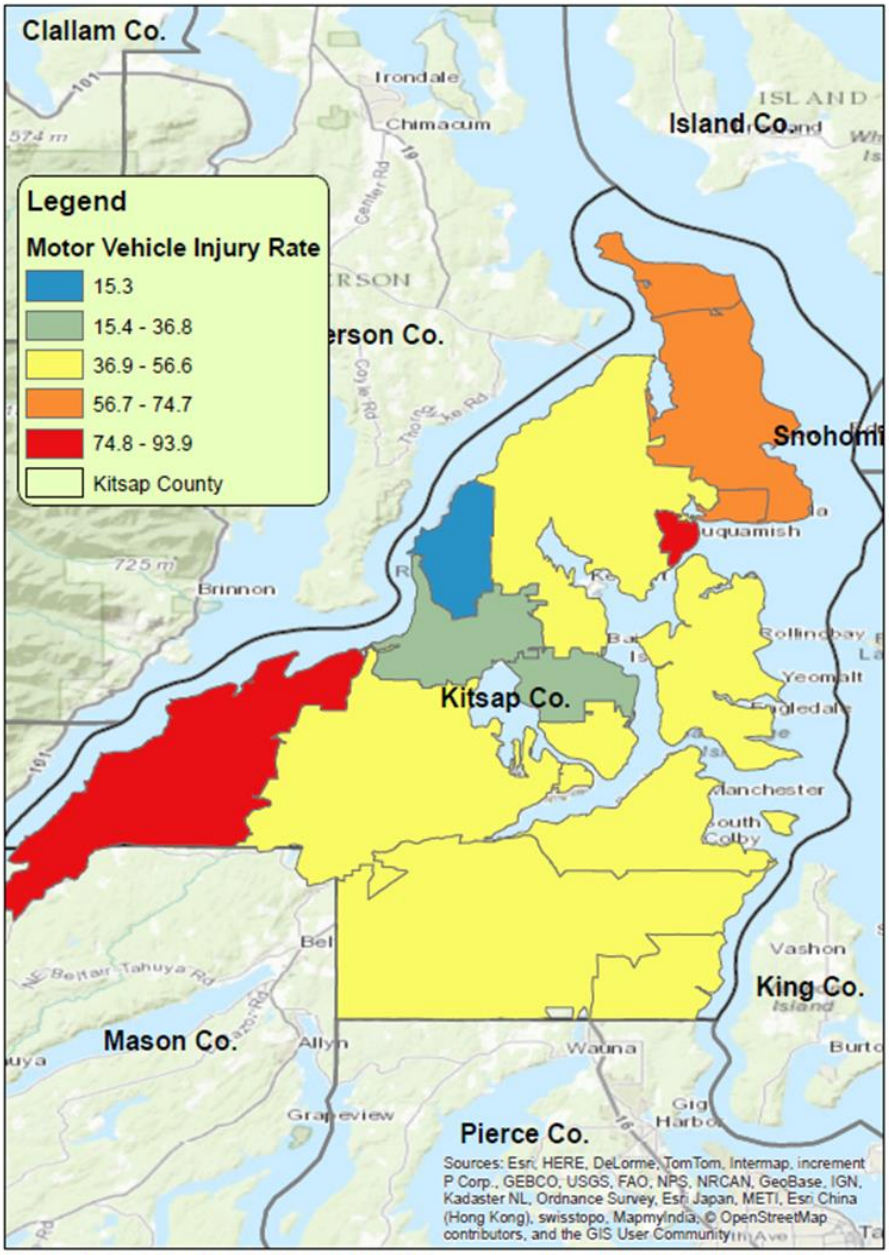
From	To	NB Lane	SB Lane	Shoulder Width
SE Southworth Dr.	**SE South St**	10 ft.	10 ft.	0-4 ft.
SE South St	**Martin Ln SE**	10 ft.	10 ft.	0-8 ft.
Martin Ln SE	**SE Red Hawk Ln**	10 ft.	10 ft.	0-5 ft.
SE Red Hawk Ln	**SE Sedgwick Rd**	10 ft.	10 ft.	0-4 ft.

Source: Kitsap Public Works.

Current injury rates

From 2011-2013, annually, there were an average of 29 motor vehicle injury related hospitalizations among residents of the South Kitsap region (WA DOH Community Health Assessment Tool 2011-2013). South Kitsap resident motor-vehicle related injury hospitalizations are in the middle quintile compared to other Kitsap areas (See Figure 13), however, we don't know where these events occurred and they could have been outside our area of interest. From 2011 to 2013 South Kitsap experienced an average of 6 motor vehicle injury related deaths annually. One motor vehicle related death in 2013 was in the 98359 zip code and 1 was in 98367 zip code, neither of which houses lower Banner Road but both of which are in South Kitsap (See Appendix B). (DOH Death Certificate Database and KPHD Analysis 2013).

Figure 13: Motor-Vehicle Injury* Hospitalization, Age-Adjusted Rate 2004-2013

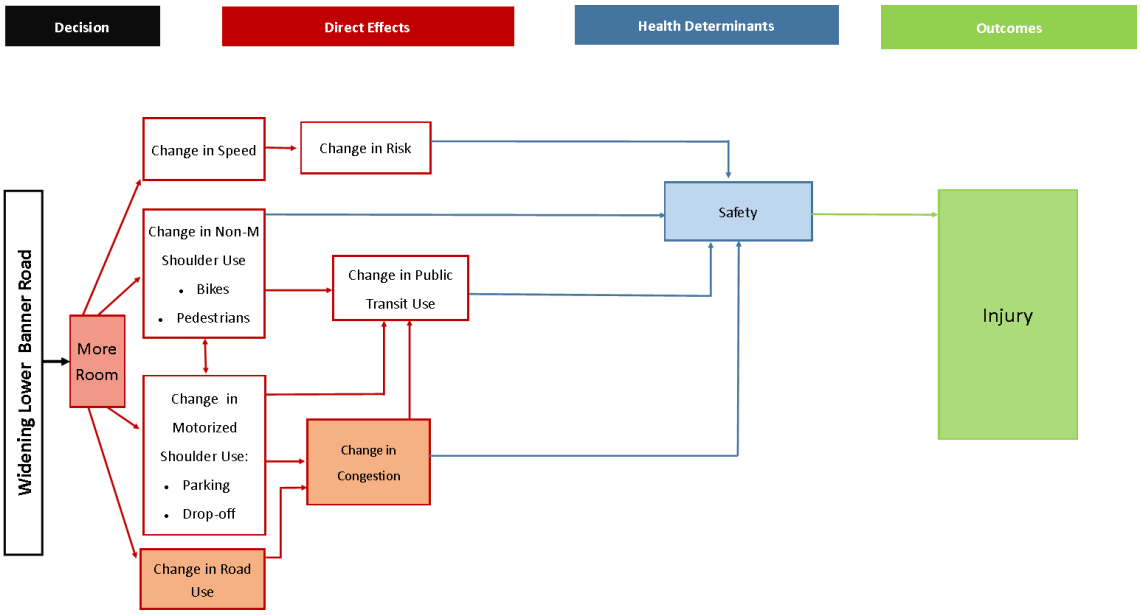


Washington State Department of Health, May 2015 Data: WA DOH, CHAT 2004-2013

*Injuries are mapped according to the address of the individual(s) injured, not the location of the incident

What associations are known between modes of road use and injury risk?

Figure 14: Change in Road Use Pathway



Previous research

Both bicycling and walking have clear health benefits, but are considered to be riskier than car travel in regards to safety (Cycling in Cities, 2015). In a national study examining vehicle injury rates by mode of travel it was found that motorcyclists have the highest fatality rate, followed by other vehicle occupants (large truck, motor home, taxi, limousine, and hotel/airport shuttle), bicyclists, pedestrians, passenger vehicle occupants, and bus occupants. The study determined that a shift from passenger vehicle travel to non-motorized travel could result in an overall increase in the number of people killed in traffic related accidents and that the benefits of physical activity should be balanced against the increased injury risks for pedestrians and bicyclists traveling on roadways (Beck et. al, 2007). Factors that have been proven to reduce injury risk include: sidewalks, bicycle lanes, bicycle helmets, reduction in vehicle speeds, and engineering measures such as traffic signals at high speed intersections; exclusive walk signal phasing; refuge islands and raised medians on multilane, high-traffic-volume roads: and increased intensity of roadway lighting to reduce nighttime pedestrian crashes (Beck et al, 2007).

Approximately 14.6% of total highway fatalities were not occupants of motor vehicles *or* motorcycle riders. This category is primarily (85%) composed of pedestrians, but also includes bicyclists, other non-motorized users, and those who may be living or working adjacent to the highway. Greater than 90% of pedestrian fatalities occurred in collisions with automobiles and light trucks (Savage, 2013).

While motor vehicle crashes involving pedestrians occur in urban areas more frequently than rural areas, rural crashes are nearly twice as likely to result in fatality as those occurring in urban areas. This is thought to be due to that fact that the majority of accidents in rural areas occur at night, at midblock

locations, and involve high speeds and two lane roads that lack sidewalks and paved shoulders (Complete Streets, 2015).

Methodology

Literature Review.

Findings

There are greater safety risks for those traveling by non-motorized modes. Despite health benefits it is apparent that many do not use these modes along Lower Banner Road due to the risks present. Through our literature review we found that much of the risk that we see in the United States associated with walking and biking is in fact due to a less well-structured network and road space for bike and pedestrian users. The data tells us that street design matters, and that when the needs of all users are taken into consideration and all modes of travel are incorporated, that the streets are safer for all.

Data limitations

Though we do not have this data specifically for this stretch of Banner Road, based on media coverage, we do know that there have been a couple of instances where pedestrians have been hit in the neighboring areas, close to schools and due to issues of bad line of sight and lighting.

How does the perception of safety change when roadways are altered/widened?

Previous research

A link has been established between a parent's perception of safety and how likely children are to walk to school. Factors impacting safety perceptions amongst parents are: higher sidewalk availability, well maintained sidewalks and safe road crossing (Oluyimi et. al, 2014).

Roadway design plays a significant role in a cyclist's perception of safety, and there is a direct correlation between a cyclist's perceived sense of safety and the number weekly trips they make by bicycle (McNeil, 2014). Research has shown that both cyclists and motorists prefer roads that have a distinct and separate area for bicycles, especially those that are divided by some sort of barrier (Sanders, 2013). When examining barrier styles and their influence on a cyclist's perception of safety, both striped/painted buffers and buffers that offer a sense of physical protection, such as a plastic flex post, increase feelings of safety (Monsere et al 2014). Additionally, pedestrians benefit greatly from traffic calming measures which tend to increase their perceptions of safety (USDOT, 2013).

Methodology

Literature Review.
Community Survey.

Findings

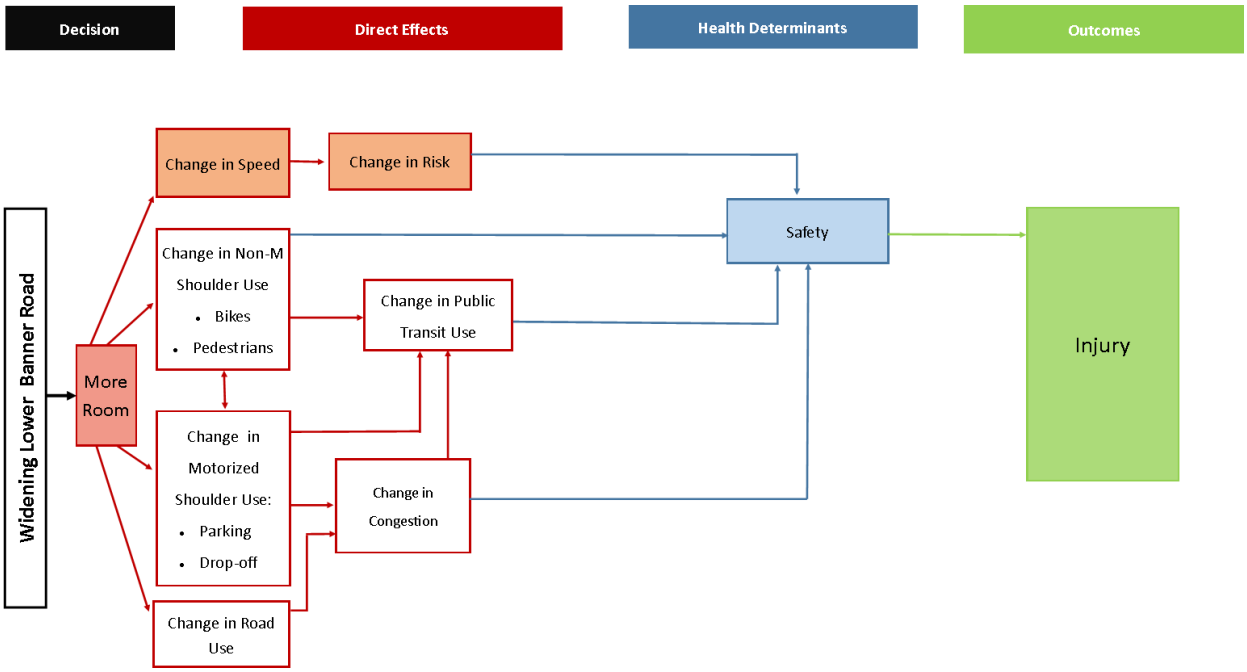
Based on literature and the community survey, perception of safety is an issue, and a barrier to use of lower Banner Road. Evidence shows that if widened and altered with appropriate measures such as barriers or considerations to traffic and parking options that these changes would in fact heighten the perception of safety. By widening shoulders and creating a distinct area to be used by cyclists, we predict more people will feel comfortable riding bicycles and walking in these designated areas.

Data limitations

The limitations to the data in answering this question are in the ability to locally measure perception change prior to the actual widening of this stretch of road. We can look at the general perceptions but it is difficult to measure change in this concept.

What are the safety implications for various road design aspects?

Figure 15: Change in Speed Pathway



Previous research

Shoulder width has been shown to influence the number of motor vehicle crashes occurring on both rural and urban roadways. A study conducted on the impact of shoulder width and median width on safety found that increasing shoulder width by 1 foot for undivided highways decreased the risk of crashes by six percent. For sections of rural, two lane roads, widening both shoulders by approximately 2 - 8 feet

should reduce run-off accidents and opposite direction accidents by 16 percent (Zegeer, 1980). On undivided highways the crash rate drops by 5 percent, demonstrating an inverse relationship between shoulder width and the number of crashes. Median width has also been shown to impact motor vehicle crash rates, with an approximate eight percent reduction with every 10 foot increase in median width (Stamatiadia et. al, 2009).

Paved shoulders provide numerous safety benefits for motorists and pedestrians. Installing or widening paved shoulders has the following benefits:

- Provides a stable surface off of the roadway for pedestrians to use when sidewalks cannot be provided.
- Reduces numerous crash types including the following:
  - Head on crashes (15%–75% reported reduction)
  - Sideswipe crashes (15%–41%)
  - Fixed object crashes (29%–49%)
  - Pedestrian (walking along roadway) crashes (71%)
- Improves roadway drainage
- Increases effective turning radii at intersections
- Reduces shoulder maintenance requirements
- Provides emergency stopping space for broken-down vehicles
- Provides space for maintenance operations and snow storage
- Provides space for variable message signs
- Provides an increased level of comfort for bicyclists

(Safety Benefits, USDOT, 2013)

Road width recommendations vary based on whether the road is in an urban or rural location. Due to an increased risk of cross-centerline head-on or cross-centerline sideswipe crashes on high speed, two lane rural roadways, a wider width is recommended by the United States Department of Transportation (Lane Width Safety, USDOT, 2014). Lower Banner Road is classified as a Major Collector.

Table F: USDOT Rural Road Width Recommendations

Type of Roadway	Width (U.S. feet)
Freeway	**12**
Ramps (1-lane)	**12-30**
Arterial	**11-12**
Collector	**10-12**
Local	**9-12**

USDOT, 2014.

Traffic Calming and Speed

Vehicle speed is a contributing factor in pedestrian fatality crashes. The National Pedestrian Crash Report from 2008 noted that the greatest number of pedestrian fatalities were on roads with speed limits exceeding 50 miles per hour. Roads with speeds of 30 to 39 and 40 to 49 accounted for 29.1 percent and

24.5 percent of all pedestrian fatalities, respectively (Complete Streets, 2015). Vehicle speed has serious consequences regarding the level of injury sustained by a pedestrian. A pedestrian hit at 40 mph has an 85 percent chance of being killed. At 30mph the likelihood is reduces to 45 percent and at 20 mph is only 5 percent.

Table E: Vehicle Speed in Relationship to Pedestrian Death

Vehicle Speed	Odds of Pedestrian Death, Source 1	Odds of Pedestrian Death, Source 2
20 mph	5%	5%
30 mph	45%	37%
40 mph	85%	83%

Limpert, 1994 and MacLean et. al 1994.

It is important to again reference the specific risks associated with speed and visibility that were addressed in the vulnerable populations section of this report.

Rumble Strips and Rumble Stripes

More than half (57%) of U.S traffic fatalities occur after a driver crosses the centerline of a roadway. Two thirds (65%) of such crashes occur in rural areas. Rumble strips and rumble stripes use noise and vibration to alert a driver that they are nearing or crossing the center or edge line. Rumble strips and stripes are especially effective in getting the attention of drowsy or distracted driver, along with drivers who have reduced visibility due to adverse weather conditions such as rain, snow, dust, and fog. Studies conducted in eleven states that have implemented rumble strips have shown that crossover crashes were reduced 18 to 64 percent, with the majority of studies showing the reduction being between 40 and 60 percent. On rural freeways, edge line rumble strips reduced single vehicle run-off-road fatality crashes were reduced by nearly 29 percent (Rumble Strips and Rumble Stripes, USDOT, 2015), however, it is important to note that they are often hazardous to bicyclists.

Methodology

Literature Review
Stakeholder Interviews.

Findings

Much of the feedback we received from our community members, stakeholders and partners articulated the safety issues they felt were present on this stretch of road. We concluded that there were elements such as lack of line of sight, dangerous dips into the ditch just on the side of the road, no fog lines discerning where a car's right of way ends and insufficient traffic calming measures in certain places as well as unsafe behaviors exhibited by motorists. Based on these findings we conclude that regardless of whether the shoulder is widened there should be design alterations to increase safety for both motorized and non-motorized users (see Recommendations on p. 40).

When asked about feasible changes they would like to see implemented transportation planners and traffic engineers at Public Works listed these additions to increase safety and use:

- Stripe it bolder (visual cue). Lower Banner Road doesn't have striping currently.
- Implement a 4-6 inch stripe.
- Potentially change policies regarding width and clarity where kids are walking. Kitsap generally doesn't stripe rural roads, perhaps there is room for a policy change.
- Recommended avoiding over-signage as it often leads to people ignoring them (There is currently a 20 mph sign with flasher, kids walking ahead, speed limit, and a crosswalk).

Additionally, the director of South Kitsap School District Transportation said that he would like to see safety measures implemented along this road, including a decrease of the speed limit to 25 mph at the bottom of the hill as well and speed bumps or beds.

Data limitations

None noted.

Physical Activity

Current physical activity levels in the area

When asked about physical activity and exercise over the past month, 84% of South Kitsap adults report getting at least some leisure time activity daily; 51% report getting 60 minutes or more of physical activity daily (BRFSS, 2013). When 6th graders at South Colby Elementary School were asked "In the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?" 28% answered "7 days" compared with 29% statewide (WA Healthy Youth Survey, 2014).

Previous research

While there seems to be ample research regarding how perception of safety (both traffic and crime related) affect how often and where people exercise, there is little research found that connects physical activity directly with the widening of roads without emphasizing the ways in which it should be done.

Methodology

Literature Review.
Community Survey.
Stakeholder Interviews.

Findings

We predict that if the shoulders were created in a way that increased the perception of traffic safety for users of lower Banner Road that this project would indeed increase physical activity. See the injury risk

and safety perception sections (pp. 24-29) to read about designs and options for increasing the safety and perception of safety on the road. We take this into consideration as we make our recommendations.

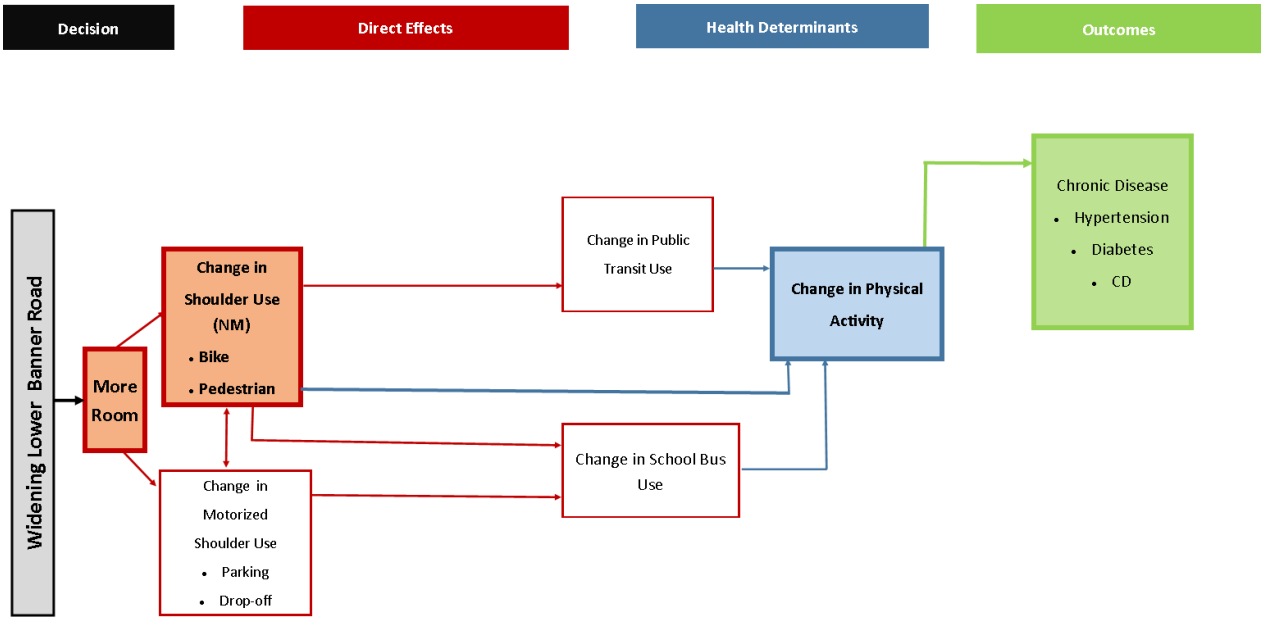
Additionally, the principal of South Colby Elementary School predicted that there would likely be an increase in recreational use of the road and a parent of a child who attends the school stated that she foresaw more children walking and biking to school and an overall rise in physical activity in addition to an increase in opportunities for elementary classes to explore the neighborhood.

Data limitations

See previous research.

Does walking and biking to school impact overall physical activity?

Figure 16: Change in Shoulder Use Pathway



Previous research

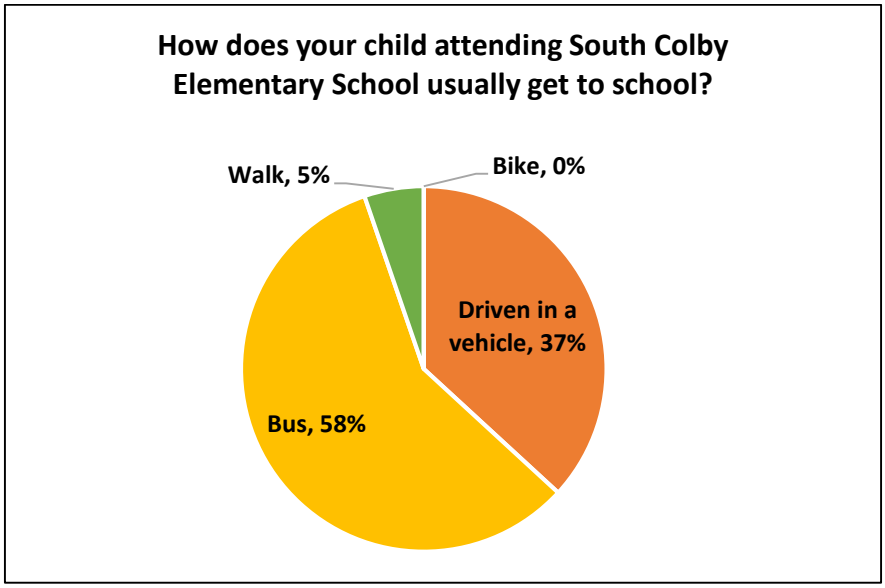
Children who actively commute to school seem to be more physically active than those who get rides to school or take the bus regularly. In addition to the active commute directly increasing a child's physical activity, it may also lead to children being more physically active at other times during the day. Additionally, children who walk or bike to school are more likely to bike or walk to other activities and places in their day-to-day (National Center for Safe Routes to School 2010).

A walk zone around a school is typically a ½ mile span in which children are deemed able to walk to school and therefore, in which buses do not pick kids up. In South Kitsap 0.5% of public school bus riders

are picked up in the walk zone, compared with 1% in Kitsap County and Washington State (WA OSPI 2013-14). 95% of South Colby Elementary School 6th graders report they never walk to school and 94% report never riding a bike to school (WA Healthy Youth Survey 2014).

Community Survey results indicate there are very few children walking to school and none of the respondents reported a child in the household biking to school (Figure 17).

Figure 17: How Children Attending South Colby Elementary School Usually Get to School, Banner Community Survey



Banner Community Survey.

Methodology

Literature Review.
Banner Road Community Survey.

Findings

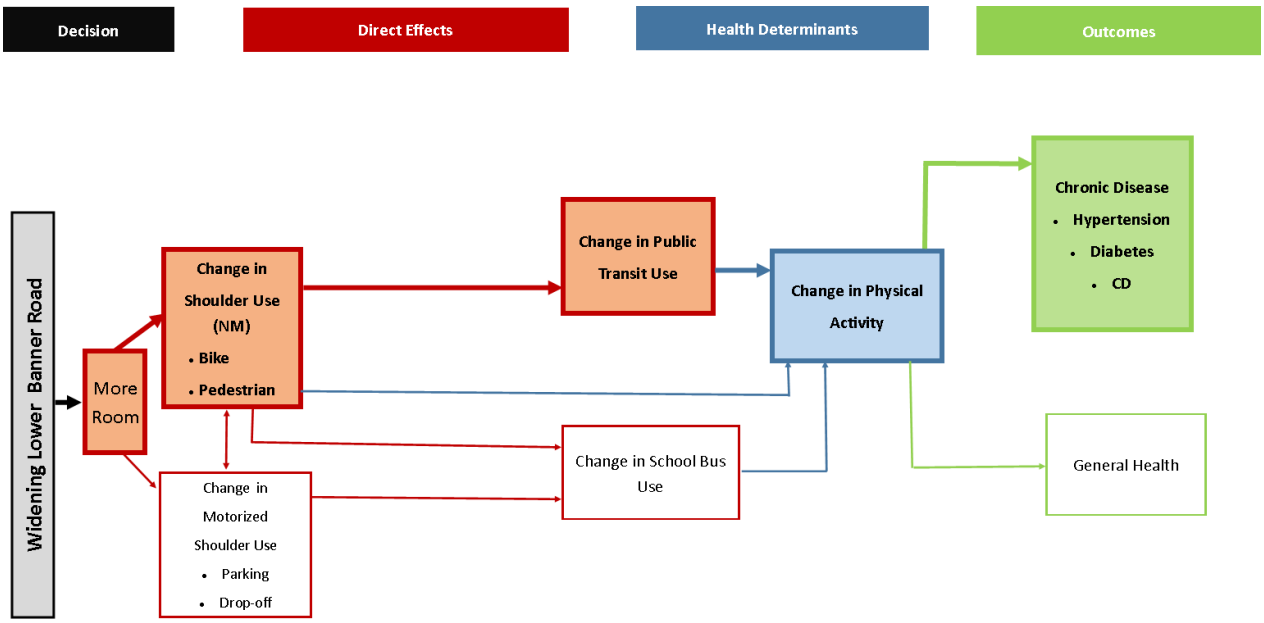
The literature tells us that the more frequently a person commutes to work or to school by non-motorized methods that there is a stronger likelihood that they will be more physically active on a regular basis, even beyond commuting. When we look at the current trends along lower Banner Road it is evident that there is very little non-motorized activity among school commuters. We can conclude that if the route was more bike/pedestrian friendly and more people felt comfortable either letting their children walk or bike to school or commuting themselves by these modes, that there would be an increase in physical activity in this population.

Data limitations

There could have been additional Community Survey data collected on the reasons for mode use to school as well as, for all respondents, what other day-to-day physical activities were.

Does increased shoulder width impact transit use?

Figure 18: Change in Shoulder Use Related to Change in Transit Use Pathway



Previous research

While we found data that indicated the use of shoulders for transit vehicles, within certain speed limit ranges, we did not find any peer-reviewed literature that connected shoulder use by pedestrians and bikers to the use of transit.

Methodology

Community Survey.
Stakeholder Interview.

Findings

Based on the responses that we received from the survey regarding what would prompt community members to use the road more, as well as our partner and expert stakeholder input, we believe that a wider

shoulder would increase transit use not only due to the increased perception of safety waiting for the bus but also in providing a safer (in perception and actuality) route to access the transit stop itself.

Our transit planner stated that if the road is widened without a sidewalk connector to transit stops, there might be additional riders long-term, under the best circumstances. He believes ridership is unlikely to grow more than a few individuals until there is change in land use along the roadway, including wider, safer space for transit users.

Data limitations

There is no research on the direct connection between shoulder width and persons taking transit that we could find at this time.

Does transit use impact physical activity?

Previous research

One review showed that on average, an additional 8-33 minutes of additional physical activity is associated with adults who use public transportation and that if more people were to use public transit that the number of sufficiently active adults would increase (Rissel et. al, 2012). Additionally, another study found that 29% of people walking to and from transit are successfully active for at least the recommended 30 minutes per day. This study also pointed out that walking to public transportation especially helped low-income and minority groups (Besser and Dannenberg, 2005).

Methodology

Literature Review.

Findings

Research supports that individuals who use public transportation are more active, and are therefore less susceptible to certain chronic diseases. Additionally, it is probable that a wider shoulder could increase transit use through enabling safer wait zones and increased non-motorized access. Due to the above-mentioned research and links between wider shoulders and safety perception, we believe that widening the shoulder could potentially increase transit use and, through subsequent physical activity increase, reduce risk of chronic disease in the community long-term.

Data limitations

None noted.

What street characteristics are associated with increased bike/pedestrian use?

Previous research

Wide, paved shoulders are ideal for bicycle use, especially in rural areas. These shoulders should be a minimum of 4 feet wide and smoothly paved. They should also have the strength and stability to support vehicle loads without rutting (USDOT FHWA Safety Program). Factors that can affect the recommended width are: traffic volume, posted speed limit, and the presence of heavy truck traffic along the roadway.

Although rumble strips have been shown to decrease motor vehicle crashes, many cyclists view them as being unsafe, due to the fact that they are nearly impossible to ride a bicycle on for even a short distance. They can also cause flat tires and damage bicycle wheels (Bicycling and Rumble Strips). Due to these negative implications, many cyclists will avoid crossing over rumble strips, which often results in them riding in the road instead of along the shoulder. Due to their negative impact on cyclists, it has been recommended by the American Association of State Highway and Transportation Officials and the Federal Highway Administration that rumble strips should not be used indiscriminately on roadways that are not limited access. Their recommendation goes on to state: "rumble strips should be used where there is a history of run-off-the-road crashes; especially where there is sufficient recovery room for a motorist to react to the alert provided by the rumble strip; and when the impact cyclists can be minimized. This means that at least four feet of unobstructed roadway shoulder remains after the rumble strips have been installed (Bicycling and Rumble strips). Like cyclists, pedestrians are more likely to walk frequently when they feel safe doing so. Providing pedestrians with an area that is separate from motor vehicles increases their sense of safety and the amount of time they spend walking (Safety Benefits, USDOT, 2013).

Increased rates of walking were found to be related to greater perceived neighborhood safety and shade in a study conducted by Cao in Austin Texas (Cao 2006). Hooker et. al found that regular walking was associated with greater perceived safety and that regular walking was in fact associated with heavier trafficked areas. One study (Li 2005) found there were higher rates of resident walking activity in areas where there was higher traffic safety reported.

Methodology

Literature Review.
Stakeholder Interviews.

Findings

A wealth of evidence directly connects certain designs with increased bike and pedestrian usage. Therefore, we can confidently state that when safer designs are in place, people express more willingness to use them to bike and walk.

Data limitations

We did not find an abundance of literature on rural scenarios where there was a clear association between design and non-motorized use. There were studies on design and safety, as well as perception of safety. The research question below summarizes one of the only examples on use after design implementation that we found.

What impact has widening had on physical activity in other rural areas?

Previous research

In 2009, the community of Wells, Minnesota received funding and support through the State Health Improvement Program (SHIP) to address active living. There is a highway (MN 109) that runs through this community that has similarities to the lower Banner Road area, rural, one lane each way, with gravel shoulders. When an opportunity for repaving arose, the Active Transportation Coordinator for the Minnesota Department of Health worked with a Walkability Committee and the state Department of Transportation to get the shoulders paved and rumble strips integrated into the road design (MDH SHIP Stories).

Methodology

Literature Review.

Findings

The feedback from this endeavor was that the road was safer and immediately there was an increase in those using the road for walking and biking purposes.

Data Limitations

We have not found many instances where, in a similar rural setting, this type of shoulder widening project was conducted and there was significant assessment post-project to measure use and comfort. Because there is a lack of before and after in these types of sittings we are unsure of the evidence based connection.

Recommendations

Barriers between pedestrians and road users

We recommend that regardless of whether the shoulders on lower Banner Road are widened or not that barriers be put in place to divide and delineate room on the road for different users. We would encourage a conversation between the school, the community and the transportation planners prior to designing these barriers, if installed.

Designated spots for pull-off and turnaround

Based upon our conversations with both the principal of South Colby Elementary School and the Transportation Director for the South Kitsap School District, we recommend that if the road shoulders are widened and paved that there be explicitly marked areas that cars and other motorized vehicles can pull over and turn around, including a possible turn lane into the school so that there is no longer a backup of cars in the school zone during drop off and pickup times during the day. It was brought to our attention that there are people who attempt to drive around the congestion, deviating into the opposing traffic lane and posing great risk both to other drivers and passengers as well as pedestrians and bikers.

Education and outreach

Regardless of whether the road is altered we would recommend that there be educational opportunities for community members, parents and commuters who use lower Banner Road for any purpose, including school use. In our conversations with a number of stakeholders the idea was introduced to hold more frequent awareness-building events at the school, and to use both the school and transportation network to disseminate more frequent messaging about mode use and safety along the road.

Additional calming measures

We would highly recommend traffic calming measures be put in place; including fog lines, shading of the areas outside of the lines, and decreased speed limit, speed beds, with increased enforcement. These recommendations are supported by the literature evidence as well as feedback from our stakeholders.

Alternate drop-off route

We recommend creating a secondary drop-off route to the back side of South Colby Elementary, with accompanying supervision at the back entrance in the morning and afternoon, allowing for a drop-off and pick-up site at both the front and back of the school.

Monitoring Plan

We will be monitoring various data points in the lower Banner Road area including: mode use along lower Banner Road, the number of children that walk and bike to school, bus ridership, transit ridership, and uses of lower Banner Road. We will be monitoring these indicators through our continuing partnerships with South Kitsap School District Transportation, Kitsap Transit, Kitsap County Public Works and the Department of Community Development.

A few of our partners and stakeholders have already committed to future work with us, incorporating ongoing partnership and data sharing.

We will continue to work with Kitsap Transit, through evaluation of ridership data in the lower Banner Road area, and also to hopefully conduct another Health Impact Assessment on a new transit hub location in East Bremerton. Our hope is that this upcoming HIA will give us the opportunity to look at a wider range of vulnerable populations, and gain more experience in primary data collection through community survey and workshop implementation.

We plan to explore Safe Routes to School (SRTS) funding opportunities to address the safety of students in rural settings getting to school, not just for one school but hopefully district wide. One such thought would be to contribute to a rural toolkit for SRTS and plan to continue our conversations with the transportation planners at Kitsap County Public Works regarding assessments of other schools through the health criteria integration into the TIP process.

We plan on evaluating our process internally as well as with our partners and stakeholders.

References

American Community Survey, 2009-2013.

Beck L, Dellinger A, O'Neil M. Motor Vehicle Crash Injury Rates by Mode of Travel, United States: Using Exposure-Based Methods to Quantify Differences. *American Journal of Epidemiology*. http://aje.oxfordjournals.org/content/166/2/212.full.pdf+html. 2007

Behavioral Risk Factor Surveillance System (BRFSS), 2000, 2001, 2002, 2012, 2013. Centers for Disease Control and Prevention.

Bicycling and Rumble Strips: Problems for Cyclists. *League of American Bicyclists.* *http://www.advocacyadvance.org/docs/rumble_strips.pdf*.

Cao, Xinyu; Handy, S L; Mokhtarian, Patricia L. (2006). The influences of the built environment and residential self-selection on pedestrian behavior: Evidence from Austin, TX. *Transportation*, 33(1), 1 - 20. UC Davis: Retrieved from: http://escholarship.org/uc/item/4jn1w8qn

Complete Streets, Select Treatment. *Chicago Metropolitan Institute for Planning.* http://pedbikesafe.org/PEDSAFE/guide_statistics.cfm. 2015

Cycling in Cities. *The University of British Columbia.* http://cyclingincities.spph.ubc.ca/injuries/. March 2015

Dangerous by Design, Smart Growth America, 2012.

Hardened Shoulders Make for Better Sharing. *Physical Activity Network.* http://www.physicalactivitynetwork.ca/article/hardened-shoulders-make-better-sharing. 2013

Healthy Youth Survey, 2012-2014.

Hine J. Traffic barriers and pedestrian crossing behavior. *Journal of Transport Geography*. http://www.sciencedirect.com/science/article/pii/0966692393900474. 1993

Hooker, S. P., Wilson, D. K., Griffin, S. F., & Ainsworth, B. E. (2005). Perceptions of Environmental Supports for Physical Activity in African American and White Adults in a Rural County in South Carolina. *Preventing Chronic Disease*, *2*(4), A11.

Killing Speed and Saving Lives, UK Dept. of Transportation, London, England. See also Limpert, Rudolph. Motor Vehicle Accident Reconstruction and Cause Analysis. Fourth Edition. Charlottesville, VA. The Michie Company, 1994, p. 663.

Lane Width Safety: Mitigation Strategies for Design Exceptions. *US Department of Transportation.* http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/chapter3/3_lanewidth.cfm. 2014

Li F., Fisher J., Brownson R., Bosworth M. Multilevel modelling of built environment characteristics related to neighbourhood walking activity in older adults. Research report. Journal of Epidemiology and Community Health 2005;59:558-564 doi:10.1136/jech.2004.028399.

Local and Rural Road Safety Program. *US Department of Transportation.* http://safety.fhwa.dot.gov/local_rural/. 2015.

McNeil N. The Influence of Bike Lane Buffer Types on Perceived Comfort and Safety of Bicyclists and Potential Bicyclists. *Portland State University, Center for Transportation Studies.* http://trec.pdx.edu/sites/default/files/Paper%2015-3701%20Buffers.pdf. 2014.

Monsere, Christopher; Dill, Jennifer; McNeil, Nathan; Clifton, Kelly J.; Foster, Nick; Goddard, Tara; Berkow, Mathew; Gilpin, Joe; Voros, Kim; van Hengel, Drusilla; and Parks, Jamie, "Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S."(2014). *Civil and Environmental Engineering Faculty Publications and Presentations.* Paper 144.

National Association of County and City Health Officials. (2002) "Creating health equity through social justice" working paper.

National Center for Safe Routes to School. (2010).

Non-Motorized User Safety: A manual for local road owners. *U.S Department of Transportation.* http://safety.fhwa.dot.gov/local_rural/training/fhwasa010413/nonmotorize.pdf. 2012.

Office of Superintendent of Public Instruction, 2013-2014.

Oluyomi A, Lee C, Nehme E, Dowdy D, Ory M, Holescher D. Parental safety concerns and active school commute: correlates across multiple domains in the home-to-school journey. *International Journal of Behavioral Nutrition and Physical Activity.* http://www.ijbnpa.org/content/11/1/32. 2014

Prevention for the Health of North Carolina: Prevention Action Plan. North Carolina Institute of Medicine.

Rissel C., Curac N., Greenaway M., and Bauman A. Physical Activity Associated with Public Transport Use - A Review and Modelling of Potential Benefits. *Int. J. Environ. Res. Public Health* 2012, *9*, 2454-2478; doi:10.3390/ijerph9072454

Rumble Strips and Rumble Stripes. *US Department of Transportation.* http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/safety.cfm. 2015.

Rural Road Safety. *The Royal Society for the Prevention of Road Accidents.* http://www.rospa.com/roadsafety/advice/road-users/rural/. 2011

Safety Benefits of Walkways, Sidewalks, and Paved Shoulders. *U.S Department of Transportation.* http://safety.fhwa.dot.gov/ped_bike/tools_solve/walkways_trifold/. 2013

Sanders R. Examining the Cycle: How Perceived and Actual Bicycling Risk Influence Cycling Frequency, Roadway Design Preferences, and Support for Cycling Among Bay Area Residents. *University of California, Berkley.* http://www.uctc.net/research/UCTC-DISS-2013-03.pdf. 2013

Savage, I. Comparing Fatality Risks in United States Transportation Across Modes and Over Time. *Research in Transportation Economics.* http://faculty.wcas.northwestern.edu/~ipsavage/436-manuscript.pdf. *2013*

Sisiopiku VP, Akin D. Pedestrian Behaviors and perceptions towards various pedestrian Facilities: an examination based on observation and survey data. *Transportation Research Part F: Traffic Psychology and Behavior.* http://www.sciencedirect.com/science/article/pii/S136984780300041X

Stamatiadia N, Pigman J. NCHRP Report 633: Impact of Shoulder Width and Median Width on Safety. *National Cooperative Highway Research Program.* http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_633.pdf. 2009

State Best Practice Policy for Shoulders and Walkways: FHWA Safety Program. *U.S Department of Transportation.* http://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa11018/fhwasa11018.pdf

Teschke, K. Is Cycling Safe? *Monument Magazine.* http://momentummag.com/is-cycling-safe/ 2014

The Pedestrian Safety Guide and Countermeasure Selection System. *U.S Federal Highway Administration.* http://pedbikesafe.org/PEDSAFE/guide_background.cfm. *2015*

Vehicle Speeds and the Incidence of Fatal Pedestrian Collisions prepared by the Australian Federal Office of Road Safety, Report CR 146, October 1994, by McLean AJ, Anderson RW, Farmer MJB, Lee BH, Brooks CG.

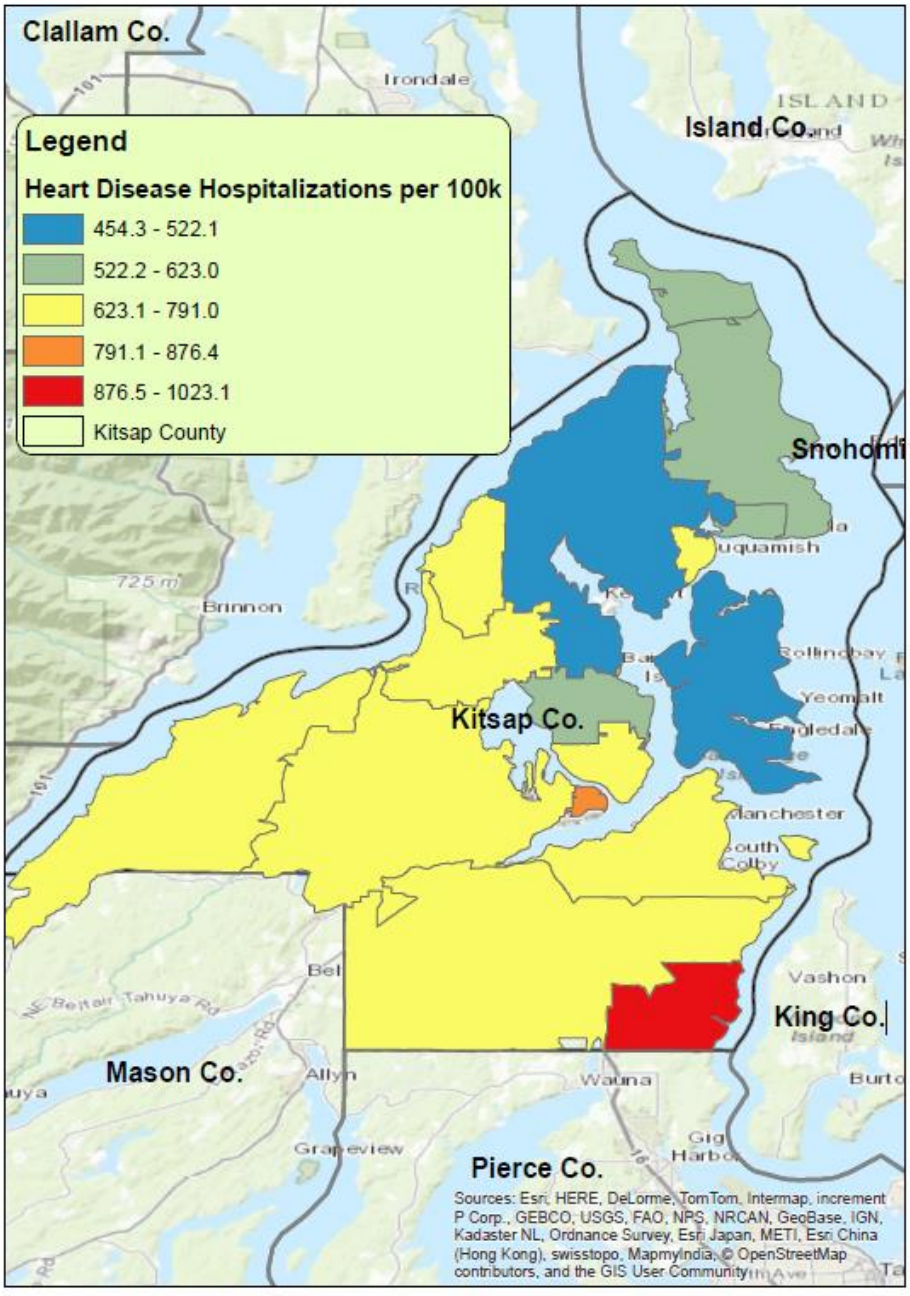
Washington Department of Health, Community Health Assessment Tool (CHAT) 2004-2013.

Washington State Behavioral Risk Factor Surveillance System 2012

Zegeer C., Deen R., Mayes J. The Effect of Lane and Shoulder Widths on Accident Reductions on Rural, Two-lane Roads. Department of Transportation Commonwealth of Kentucky. Research report. October 1980

Appendix A:

Kitsap County Heart Disease Hospitalizations per 100,000 people, Age Adjusted Rates 2009-2013, by zip code.



Washington State Department of Health, May 2015 Data: WA DOH, CHAT 2009-2013

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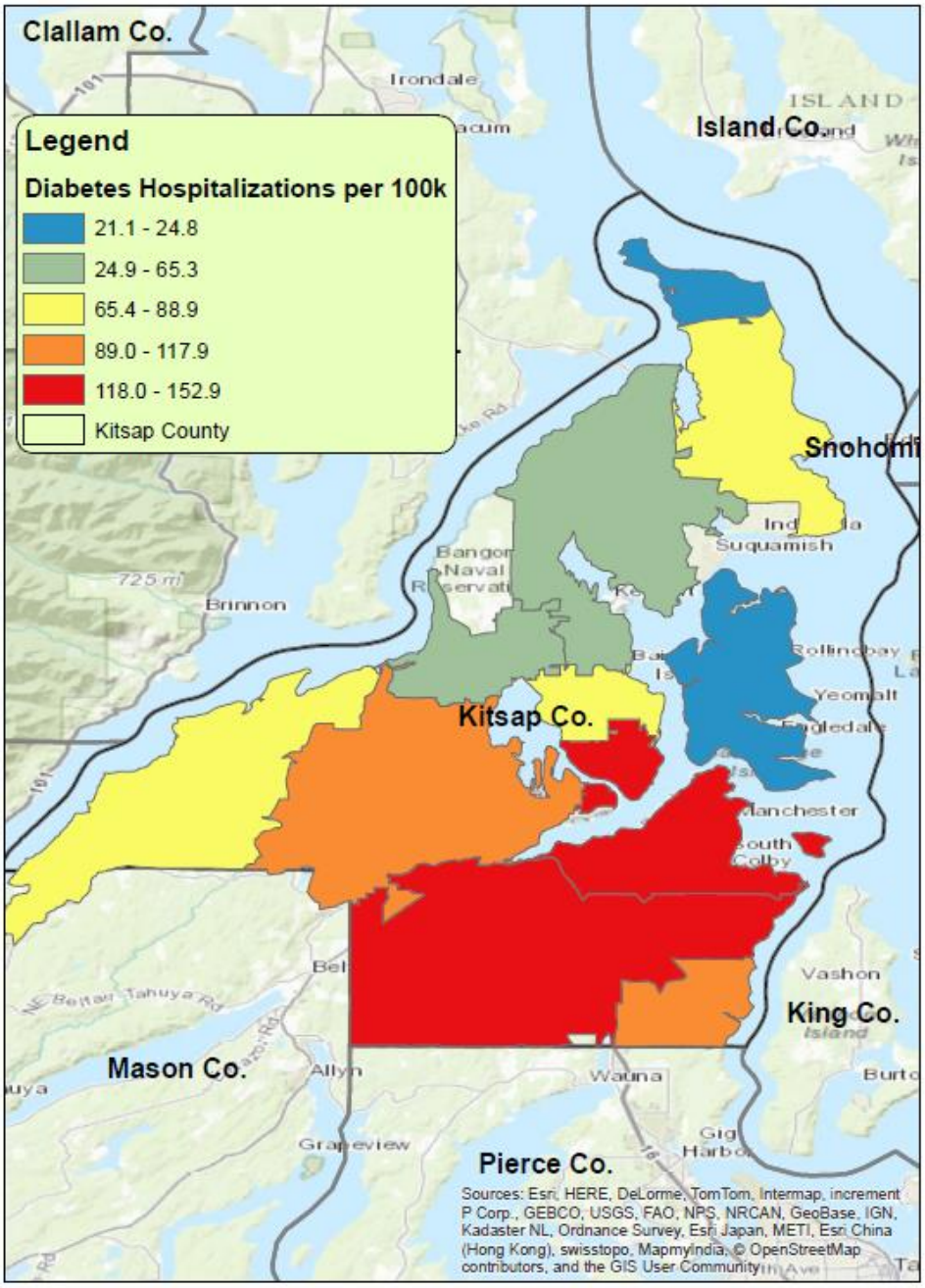
Kitsap County Diabetes Hospitalizations per 100,000, Age Adjusted Rates 2009-2013, by zip code.



Washington State Department of Health, May 2015 Data: WA DOH, CHAT 2009-2013

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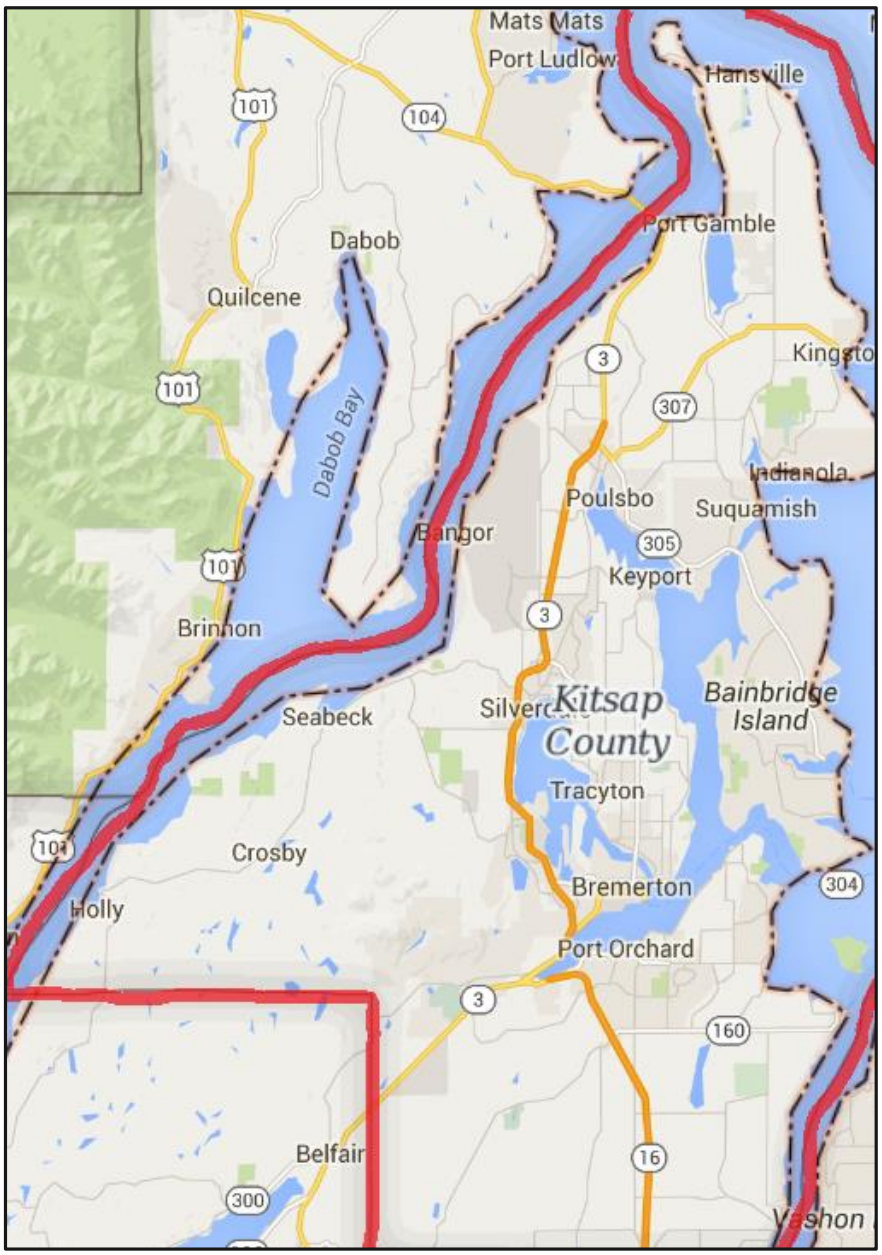
Appendix B:

Maps of Kitsap County and Zip Codes of Banner Community Survey Area (Triangle indicates South Colby Elementary School)



Source: maptechnica.com.

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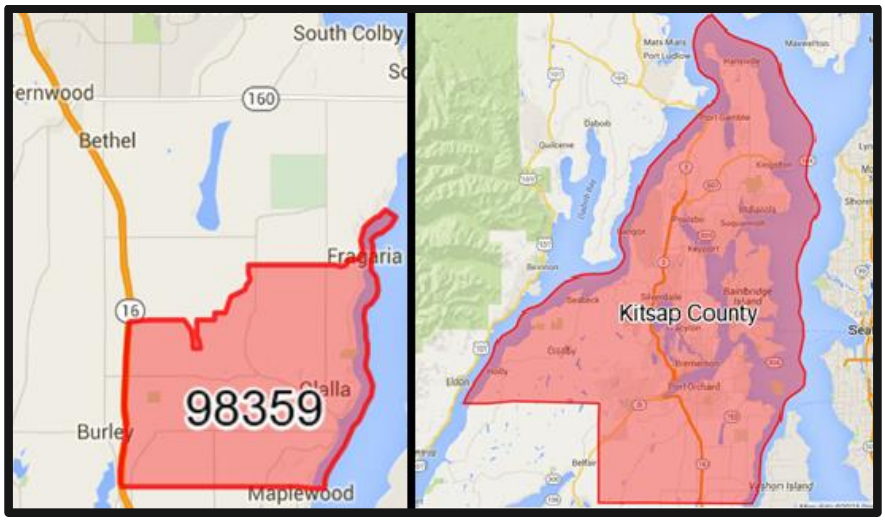

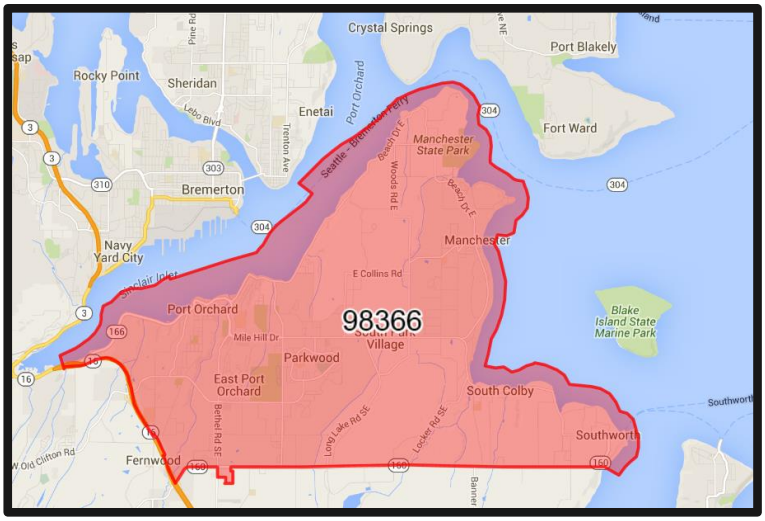

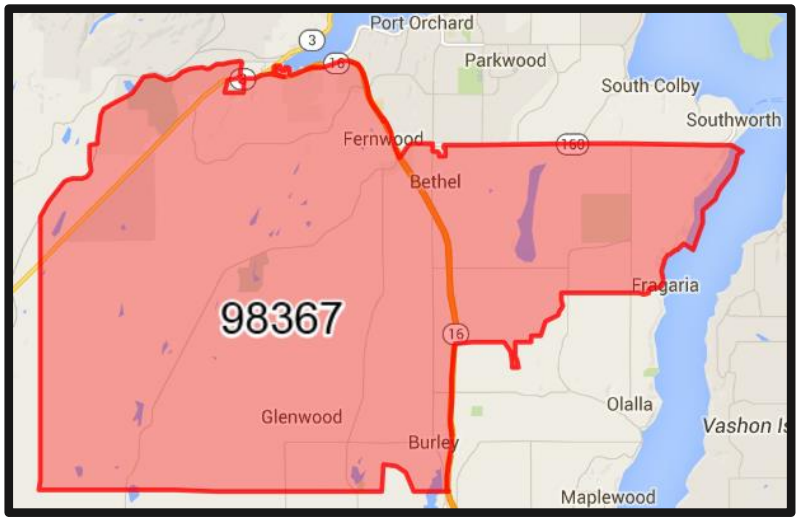

Source: maptechnica.com.

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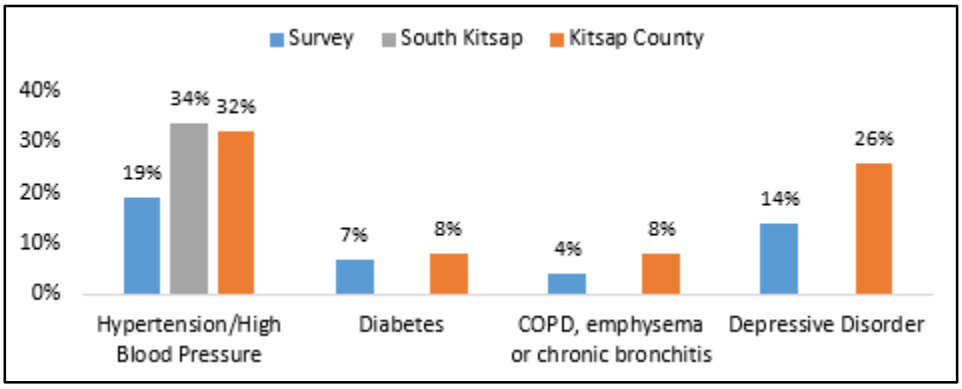
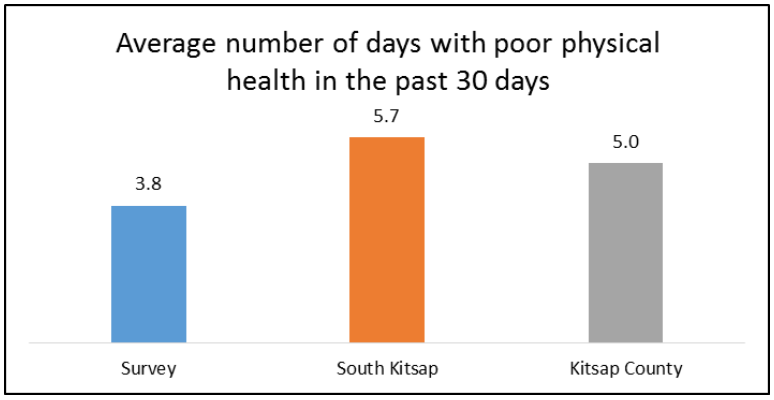
Appendix C:

Diagnoses among Community Survey respondents, South Kitsap and Kitsap County (Diagnoses included are: Hypertension/High Blood Pressure and Diabetes)



Average Number of Days with Poor Physical Health in the Past 30 Days: Among Community Survey respondents, South Kitsap and Kitsap County



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Appendix D:

Lower Banner Road Health Impact Assessment Survey

1. In the past month, approximately how many times have you used lower Banner Road for each of the transportation modes:

	0-5 times	5-10 times	11-20 times	21-30 times	More than 30 times
In a car/truck/vehicle	○	○	○	○	○
Walking/running	○	○	○	○	○
Biking	○	○	○	○	○
On the bus	○	○	○	○	○

Other (please specify type of transportation and frequency of lower Banner Rd. use)

2. Please tell us the reasons why you use lower Banner Road? (select all that apply)

- ☐ Exercise
- ☐ Recreation
- ☐ Travel to/from errands
- ☐ Travel to/from work
- ☐ Travel to/from school

Other (please specify)

3. I would use lower Banner Road more if...
Please rank the top 3 reasons:

	Most important	Second most important	Third most important
It were easier/safer to cross the street	○	○	○
It were easier to use without a vehicle	○	○	○
It were safer to travel on	○	○	○
It were easier/safer to get to	○	○	○
It had better lighting	○	○	○
It had reduced speeds along the road	○	○	○
It had improved barriers between cars and pedestrians	○	○	○
There were more frequent buses	○	○	○
It had wider shoulders	○	○	○

4. If your child attends South Colby Elementary, how does your child usually get to school? (chose only 1)

- ◯ Driven in a vehicle
- ◯ Bus
- ◯ Walk
- ◯ Bike
- ◯ No child attending South Colby Elementary

5. Race/Ethnicity (mark all that apply)

- ☐ American Indian and Alaska Native
- ☐ Asian
- ☐ Black
- ☐ Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ White

6. Age:

- ◯ 18 or under
- ◯ 19 - 29
- ◯ 29 - 39
- ◯ 40 - 49
- ◯ 50 - 59
- ◯ 60 – 69
- ◯ 70 or over

7. Gender:

- ◯ Female
- ◯ Male

8. What is the zip code of your home address?

- ◯ 98366
- ◯ 98367

Other (please specify)

9. How close do you live to South Colby Elementary?

- ◯ Less than 1 mile
- ◯ 1 to 2 miles
- ◯ Greater than 2 miles

10. How long have you lived within this distance of South Colby Elementary?

11. Thinking specifically about the neighborhood you live in, please indicate which of the following negatively affect your health and wellbeing (select all that apply):

- ☐ Traffic and congestion
- ☐ Noise from Banner Road
- ☐ Air pollution
- ☐ Poor quality housing
- ☐ Not enough places nearby to exercise

Other (please specify)

12. Has a doctor, nurse or other health professional EVER told you that you had any of the following (check all that apply):

- [ ] Hypertension
- [ ] Angina or Coronary Heart Disease
- [ ] Heart attack also called a myocardial infarction
- [ ] Stroke
- [ ] Diabetes
- [ ] Asthma
- [ ] Chronic Obstructive Pulmonary Disease or COPD, emphysema or chronic bronchitis
- [ ] Cancer
- [ ] Depressive disorder, including depression, major or minor depression, dysthymia

13. Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?

14. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?

15. Would you say that in general your health is?

- ( ) Excellent
- ( ) Very good
- ( ) Good
- ( ) Fair
- ( ) Poor

Thank you for taking our survey. If you would like more information about this survey or the HIA project please email us at HIAinfo@kitsappublichealth.org.