Comprehensive Health Impact Assessment: Clark County Bicycle and Pedestrian Master Plan

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ACKNOWLEDGMENTS

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Executive Summary

Purpose

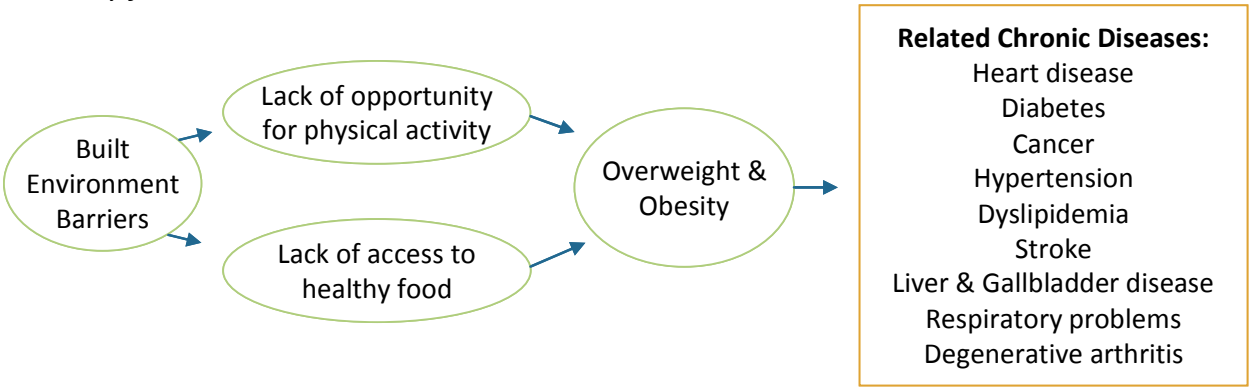
This Comprehensive Health Impact Assessment (HIA) was undertaken by Clark County Public Health to identify the nature of health impacts associated with the Clark County Bicycle and Pedestrian Master Plan and to recommend implementation strategies. The plan identifies priority projects, policies, and programs to facilitate cycling and walking, and was adopted in November 2010. This HIA builds on an earlier Rapid HIA (May 2010) that made recommendations on ways to prioritize projects, policies, and programs to maximize health benefits for all county residents. This assessment examines the likely impacts of the master plan based on prioritized proposals.

The Built Environment and Health

Where we live, work, learn, and play shapes our health. The built environment interacts with social conditions to produce both positive and negative effects on health, and we can influence these effects by proactively planning for health. The Clark County Pedestrian and Bicycle Master Plan contains proposals that can provide additional opportunities for active lifestyles. Implementing the plan in a way that increases the number of residents engaging in these forms of physical activity will promote health and reduce disparities.

Research demonstrates many relationships between the built environment and health. For instance, lack of access to healthy food and physical inactivity are the primary factors contributing to increasing rates of obesity among children and adults, which in turn lead to a higher prevalence of many chronic diseases. Characteristics of the built environment that are associated with physical activity include the presence of sidewalks and bikeways, parks, street network density, residential density, land use mix, and urban design. Bicycle and pedestrian infrastructure improvements are associated with more adults and children meeting physical activity recommendations through both leisure and transportation-related physical activity. In addition, residents of traditional, walkable neighborhoods get more physical activity than residents of typical suburban developments. The graphic below is an example illustration of the pathway by which the built environment influences chronic disease.

Pathway from the built environment to chronic disease



The Costs of Obesity

In 2008, a national study estimated the annual medical cost of obesity at $147 billion. Obesity accounts for 9.1% of annual medical spending in the United States, rivaling the amount spent due to tobacco-related health problems. The same study found that the average annual medical spending for obese people (BMI >30) was 42% more than for healthy weight people. On average, a person who was obese had $1,429 additional medical costs per year. Using this estimate and current obesity rates, the annual cost in Clark County is $110.9 million.

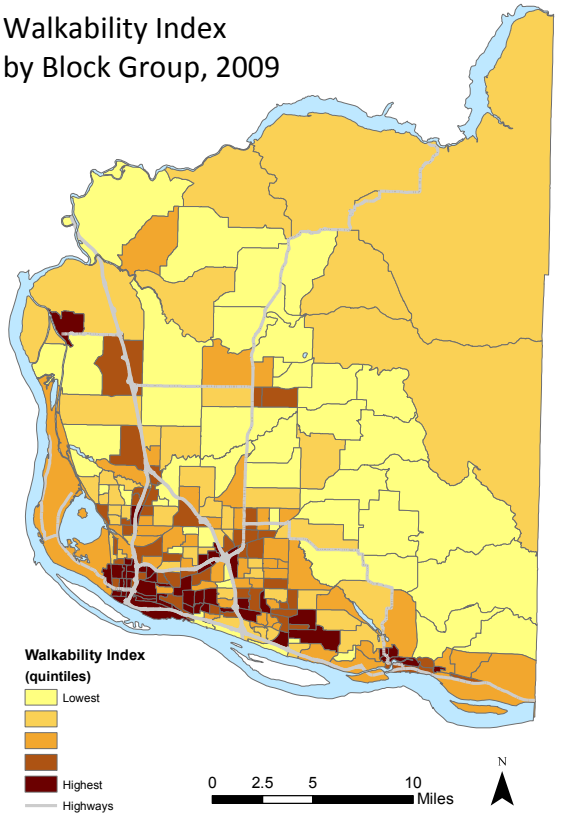
Baseline Assessment

In this HIA, Clark County Public Health examined existing conditions relating to social determinants of health, the built environment, and health outcomes. In combination with other local reports on community health, such as the Community Assessment, Planning, and Evaluation report, this assessment helps to identify areas of potential and areas of need within the county. We looked for neighborhoods where overlapping conditions result in locations where bicycle and pedestrian improvements would result in the most opportunity for physical activity. As discussed in the Rapid HIA, many block groups south of the I-5/ I-205 junction, west of 182nd Avenue, and north of Vancouver city limits have either high infrastructure needs or high potential for active travel.

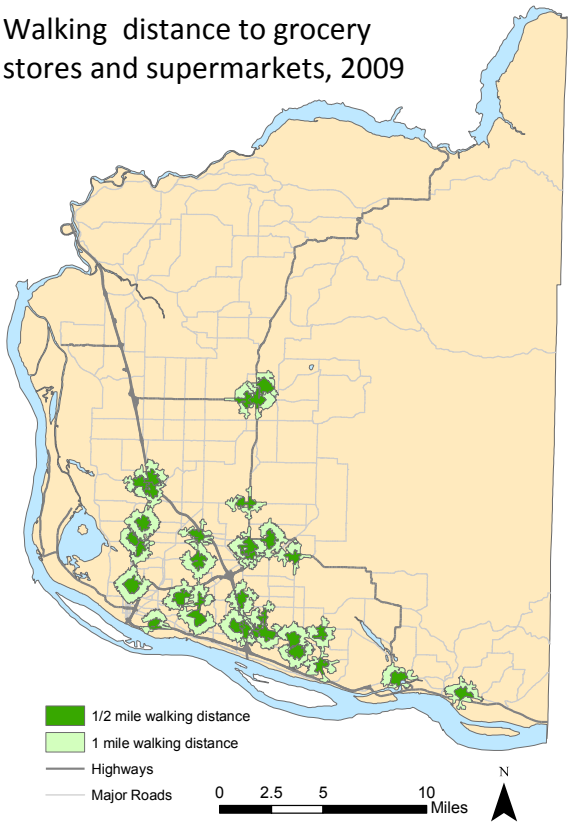
The table below summarizes key findings of the baseline assessment, and mapped examples of built environment characteristics can be found on the following page. The walkability index map reflects a composite of four measures: land use mix, density, urban design, and street connectivity. The adjacent map represents the area within walking distance of grocery stores and supermarkets. Measures of food access aid our understanding of risk for obesity by addressing the influence of the built environment on nutrition and diet.

Key Findings	
Social Determinants	• Lower socioeconomic status (SES) residents fare worse by most measures of health. • The lowest income block groups are located mostly within the Vancouver Urban Growth Area (UGA).
Built Environment	• The most walkable and bikeable areas of the county are in the Vancouver UGA. • About 15% of county residents live within ½ mile walking distance of a grocery store or supermarket. • About 42% of county residents live within ½ mile of a fast food restaurant or convenience store. • About 44% of county residents live within ½ mile walking distance of a park.
Health Outcomes	• The difference between the zip code with the highest life expectancy and that with the lowest life expectancy is about 6 years. • In 2008, 64% of Clark County adults and 23% of tenth graders were overweight or obese. • The percent of adults who are overweight or obese ranges from 51% to 74% by zip code.

Walkability Index
by Block Group, 2009



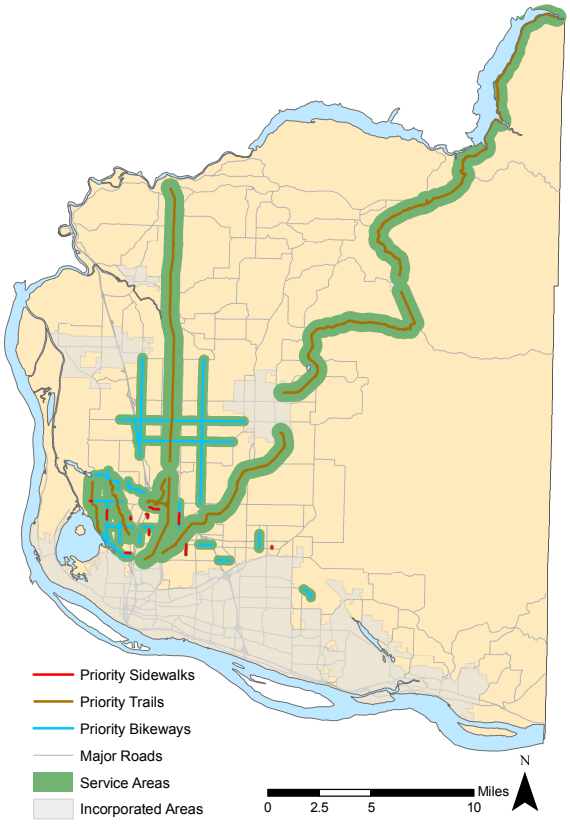
Walking distance to grocery
stores and supermarkets, 2009



Impact Assessment

Public Health finds that the projects, policies, and programs in the Bicycle and Pedestrian Master Plan will positively impact health by increasing opportunities for physical activity. Impacts of projects are listed in the table below.

Facility Type	Impact on Physical Activity	Strength of Evidence	Potential Magnitude			
			Residential Population Served	School Population Served	Parks Population Served	Neighborhood Services Population Served
Bikeways	Positive	Moderate	31,073	22,876	11,338	12,376
Restriping	Positive	Moderate	17,242	15,078	8,413	4,966
Trails	Positive	Strong	62,540	31,652	21,241	13,348
Sidewalks	Positive	Moderate	4,655	3,973	1,909	2,401
All Projects	Positive	Moderate	94,969	53,805	33,428	28,797



The populations listed in the table on the preceding page are served by the proposed projects mapped at left.

Lower income groups have higher risk for obesity and chronic disease. As shown in the table below, proposed bikeway and sidewalk projects are found disproportionately in lower income neighborhoods. This is consistent with project selection criteria, which included neighborhood socioeconomic status. Given the higher risk in these neighborhoods, this plan will likely improve health for those most in need.

Block Group Median Income	Percent of Proposed Sidewalk Miles	Percent of Proposed Bikeway Miles
Lowest 1/3	51%	45%
Middle 1/3	17%	25%
Highest 1/3	32%	30%

Recommendations

Based on the assessment portion of this HIA, Public Health developed the following recommendations for implementing and updating the bicycle and pedestrian master plan.

Overarching Recommendations

1. Update the plan in five years.
2. Use data to prioritize projects and track progress.
3. Plan and provide for the needs of a continuum of users and trip types.

Policy Recommendations

6. Ensure full implementation of policies.
7. Target zero pedestrian and bicycle crashes.
8. Use crash data in prioritization criteria.
9. Prioritize improvements in low socioeconomic status neighborhoods.

Project Recommendations

4. Use innovative designs and a variety of facility types.
5. Create a comprehensive inventory of sidewalks.

Program Recommendations

10. Develop criteria for selecting programs.
11. Use proven approaches in schools programs.

SECTION 1: LAYING A FOUNDATION

Introduction

Health Impact Assessment (HIA) is a combination of procedures, methods, and tools used to evaluate the potential health effects of a policy, program, or project.
- World Health Organization

Purpose

This HIA was undertaken by Clark County Public Health (CCPH) to identify the nature of health impacts associated with the Clark County Bicycle and Pedestrian Master Plan (adopted November, 2010) and to recommend management strategies. CCPH examined not only whether there will be positive impacts on health, but also how elements of the plan could be prioritized in order to maximize health benefits.

There are three types of proposals contained in the plan: projects, programs, and policies. **Projects** include physical infrastructure for cycling and walking such as sidewalks and bike lanes. **Programs** are efforts to increase cycling and walking through encouragement, marketing, and promotion. **Policies** are broad decisions aimed at improving underlying conditions for walking and cycling. The likely health impacts of these three proposal types are analyzed in this HIA, with an additional discussion of the **planning** process used to develop each.

HIA Process

Specific Aims:
1. *Conduct Rapid HIA*
2. *Conduct Comprehensive HIA*
3. *Evaluate effects of HIA recommendations*
4. *Explore decision-making process*

This HIA was funded by the Robert Wood Johnson Foundation through a grant with four specific aims (see left). The Rapid HIA was issued in May, 2010 with the intent of identifying likely health impacts and providing input on the draft plan. Whereas the Rapid HIA was somewhat speculative in nature and addressed some proposals that were in early stages of development, this document is a more in-depth analysis that focuses on the plan as adopted (for a discussion of the planning process, see page 48).

The process of conducting this HIA involved many partners. The core team included staff from CCPH and Clark County Community Planning (Community Planning). Valuable contributions were welcomed from staff from Clark County departments of Public Health, Community Planning, and Public Works, as well as the Sheriff's office and the region's Metropolitan Planning Organization. A local not-for-profit health equity organization,

Community Choices, provided technical review to ensure that the research was relevant to and reflective of community needs. A county-sponsored Bicycle and Pedestrian Technical Advisory Committee developed the plan and provided extensive input on the HIA. Additionally, other organizations informally reviewed both the plan and HIA, enhancing the document through their feedback. These included the Friends of Clark County Active Transportation Committee and a regional network of HIA practitioners.

Findings from the HIA were formally presented to the county's Public Health Advisory Council, Planning Commission, and Board of Health/Board of County Commissioners (two entities with the same membership). The Public Health Advisory Council reviewed the plan and suggested further research questions. The Planning Commission reviewed the plan, made recommendations for changes where needed, and eventually endorsed it for adoption by the Board of County Commissioners. The board of County Commissioners adopted the plan, which will be incorporated into the 2014 County Comprehensive Growth Management Plan Update.

Meeting practice standards

It is the intention of Clark County Public Health to advance the practice of HIA while producing a useful tool for policy evaluation. In the interest of this goal, CCPH consulted Practice Standards for Health Impact Assessment (North American HIA Practice Standards Working Group, 2009), which provide guidance on best practices and offer a metric for comparison to other HIAs. In accordance with these standards and in the interest of transparency, a description of the HIA process is detailed below.

Screening

At the onset of the planning process for the Bicycle and Pedestrian Master Plan, CCPH was invited by Community Planning to conduct an HIA on the plan. In the interest of building capacity for HIAs and to maximize the health benefits of the plan, CCPH accepted this invitation. In this sense, the screening decision was somewhat opportunistic. Pursuant to the grant awarded by Active Living Research, this HIA is meant to identify "highest value implementation strategies" for increasing physical activity in the county. The HIA considers both *whether* to adopt the plan, as well as *how* and *where* to prioritize projects.

Scoping

Decision & Alternatives

The primary decision assessed by this HIA is whether to adopt the Bicycle and Pedestrian Master Plan. The decision makers include the county Planning Commission and the Board of County Commissioners. As the adoption decision is a yes/no decision, the only considered alternative is a no-build option. A subset of decisions made by committee during the development of the plan determined the prioritization scheme used to select near-term projects. This prioritization scheme is analyzed in addition the decision of whether to adopt the plan.

Potential impacts

Physical activity is the focus of the HIA. Lack of physical activity is a cause of obesity, which in turn leads to various chronic illnesses resulting in premature death. The influence of the built environment on this trend is the primary impact considered in the HIA. Other impacts are considered to a more limited extent, including potential impacts on access to food and injuries & fatalities.

Boundaries of Analysis

Whereas the baseline assessment covers the entire county, the assessment of impacts is limited to the unincorporated areas of Clark County for the 20-year period ending in 2030. The plan is divided into near-term and long-term proposals, with implementation of near-term proposals expected within roughly 6 years. Long-term proposals have no definite implementation strategies and were not prioritized in the plan, therefore they were not analyzed in the HIA. This effectively limits the time horizon of the HIA to 6 years. The entire population of the county is considered in the analysis, with special attention given to low socioeconomic status (SES) populations and youth due to documented health disparities.

Research & Data Gaps

Existing data is used in the analysis, including county assessor's parcel data, roadway networks, and census data. A donation of updated census estimates from ESRI, Inc. enables us to use 2009 figures for many variables. Health data come from the Healthy Youth Survey (HYS), Behavioral Risk Factor Surveillance System (BRFSS), and Kaiser Permanente (KP) electronic health records as mapped by Portland State University. HYS data include variables

on youth physical activity and nutrition. KP provided data on member obesity rates. Additional description of data sets can be found in Appendix B.

As recommended by the Practice Standards, it is important to acknowledge data gaps in order to increase transparency and aid interpretation of our findings.
Notable gaps in available data include:

- Qualitative data on existing bicycle and pedestrian infrastructure
- Comprehensive inventory of pedestrian facilities
- Local health data (morbidity/mortality) linked to built environment data
- Data on most types of morbidity by neighborhood
- Data on physical activity by neighborhood
- Data on racial/ethnic disparities (due to small numbers)

Roles
The Bicycle and Pedestrian Advisory Committee determined key elements of the plan, including the vision, goals, and project selection criteria. The Planning Commission decided whether to recommend the plan for adoption, with the final adoption decision belonging to the Board of County Commissioners. CCPH led the HIA, with support from Community Planning. Additionally, technical support was provided by the county Assessor & GIS office. The community non-profit Community Choices acted as a reviewer with the specific task of ensuring that research is relevant to community needs and policy goals.

Standards
The HIA is based on relationships identified in peer-reviewed literature. The direction of the change in health outcomes is based on a research literature review, and magnitude of change was determined based on GIS analysis. We use the Center for Disease Control and Prevention definition of and recommendations on physical activity.

We recognize that research on the connections between physical activity and the built environment is still being developed and there is statistical uncertainty surrounding the causal nature of the relationship. Most of the studies available, including those relied upon for this HIA, are cross sectional in design (Brownson, 2009; TRB & IOM, 2005). To reflect the varying levels of certainty, associations that are supported by theory and by multiple

studies with similar outcomes are classified as having the strongest evidence. Evidence coming from a smaller body of published research is categorized as "moderate". For many proposals, there is emerging evidence or examples of successful implementation. These cases are labeled "some evidence".

Where evidence is lacking, assessment is based instead on case studies, best practices, and theory. We categorize such findings as "limited". Table 1 provides a summary of this system of categorizing evidence, which is used to evaluate polices and programs in Section II.

Table 1. Strength of evidence

Category	Description
+	Limited evidence: Few case studies, theoretically supported.
++	Some evidence: Limited research, some case studies.
+++	Moderate evidence: Rigorous, peer reviewed research.
++++	Strong evidence: Multiple rigorous, peer reviewed research studies with similar findings.

Facility Service Areas
Sidewalks: 500 ft.
Bike lanes: 1/4 mile
Off-street paths: ~ 1/2 mile

Due to lack of data and limitations of pedestrian and bicycle demand forecasting, magnitudes of impact are very rough estimates. For projects, they are based on the population served within a certain distance of facilities. These distances are based on the Dill study of cyclist behavior using GPS devices (2009). Further discussion of methods can be found in Appendix B.

Additionally, disparities based on socioeconomic status, race/ethnicity, and age are reported when apparent.

Review & Dissemination

As noted above, Community Choices provided review of the products and process, and will also help in dissemination. In addition, the regional network of HIA practitioners was consulted during the process and will provide feedback. This network includes public health experts from public agencies, non-profit organizations, health care organizations, and academia. The HIA will be posted on the county's website and distributed through committees and public outreach events. Also, through the participation of community groups such as the Community Choices Health Equity Coalition and the Friends of Clark County Active

Transportation Committee, the HIA will be shared among many community groups.

Assessment

The assessment portion of this HIA includes baseline conditions, identification of health impacts, and recommended strategies for implementing and updating the plan. Baseline conditions are reported for the county population as a whole as well as for vulnerable sub-populations. Limitations, gaps in data, and uncertainties are made explicit (see Appendix B). Assessment of project impacts is based on GIS analysis combined with relationships established in research literature. Recommendations are based on the findings from assessment and on the best available evidence from research literature.

Reporting

This report and executive summary constitute the primary reporting activity related to this HIA. The report includes a summary of findings and discussion of evidence for the identified health impacts.

Monitoring

A unique feature of this HIA is the grant funding provided to engage in monitoring and evaluation. Following the release of this report, CCPH will study the impact of health information on the final plan and on the decision making process. Monitoring of health outcomes and changes in the determinants of health will take place through routine assessments conducted by CCPH, most notably through the Community Assessment Planning, and Evaluation (CAPE) report.

Pathways

The central goal of this HIA is to make explicit the relationship between health and the built environment. A better understanding of this relationship informs decision-making processes by raising issues that would otherwise not receive attention and by articulating the trade-offs involved. It also provides a factual basis to justify some of the proposals in the plan. Accordingly, research on the pathways from social context and the built environment to health is summarized below. In response to requests from planners and community members, research relating to the economic costs of obesity and economic benefits of physical activity is also included.

Research on Social Determinants of Health

The term "social determinants of health" refers to what some call "the causes of the causes". This approach recognizes the fact that health starts not in a doctor's office, but where we live, work, learn, and play. Therefore, the conditions in which we live have a powerful influence on our overall health. Disparities in these conditions lead to avoidable differences in health outcomes based on such factors as socioeconomic status, education, race, ethnicity, gender, and geographic location (Marmot, 2005; Adler, 2008).

"Our zip code may be more important to our health than our genetic code"
- Commission to Build a Healthier America

Among the strongest predictors of overall health is socioeconomic status (SES). Research shows that across the entire range of income, better health is associated with higher income (Adler and Newman, 2002). Additionally, our surroundings have an impact on our health, and neighborhood measures of deprivation, such as neighborhood median income, are associated with worse health outcomes (Pickett and Pearl, 2001), which has led public health experts to point out that "our zip code may be more important to our health than our genetic code" (Commission to Build a Healthier America, 2009).

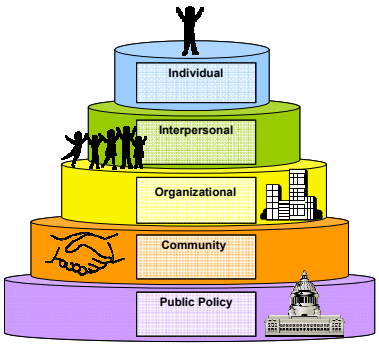
Research on Health, Physical Activity, and the Built Environment

Obesity: Trends and Causes

Nationwide, overweight and obesity are among the top three preventable causes of death, and a 2004 study estimated that obesity and inactivity will soon overtake tobacco as the leading cause of death (Mohad, et al, 2004; Dinaei et al, 2009). Obesity

is like tobacco in that it is a key contributor to many chronic diseases; however, it is a more challenging health threat because obesity itself is caused by multiple and complex factors, with poor nutrition and physical inactivity widely acknowledged as primary (TRB & IOM, 2005). Physical activity and diet are in turn influenced by numerous factors at many levels. CCPH recognizes these multi-level influences on individuals as articulated by the socio-ecological model of health. The socio-ecological model emphasizes that barriers and opportunities for physical activity and healthful diets may affect people on many levels.

Socio-ecological Model of Health



Adapted from: Kendrick, S; Inman, K; Hoskins S. Clark County Public Health, 2010

Pathway

While there are many social determinants of health, such as socioeconomic status and race/ethnicity, the built environment can also influence health. Food access and physical activity are the primary factors contributing to increasing rates of obesity among children and adults, which in turn leads to a higher prevalence of many chronic diseases. Among all age groups, overweight and obesity lead to chronic diseases such as heart disease, diabetes, and cancer.

This theoretical causal pathway is illustrated below in figure 1.

Figure 1. Pathway from the built environment to chronic disease

Related Chronic Diseases:
Heart disease
Diabetes
Cancer
Hypertension
Dyslipidemia
Stroke
Liver & Gallbladder disease
Respiratory problems
Degenerative arthritis

Barriers & Opportunities for Physical Activity

Built environments that provide opportunities for physical activity lower the risk for obesity. Measures of the built environment that are correlated with physical activity include presence of bicycle and pedestrian infrastructure, parks, street network density, residential density, land use mix, and urban design (Sallis, et al, 2009; Saelens and Handy, 2008; Saelens, Sallis, and Frank, 2003). Bicycle and pedestrian facilities are associated with more

Built environment determinants of physical activity:

- ***Connectivity***
- ***Density***
- ***Urban Design***
- ***Land Use Mix***
- ***Sidewalks***
- ***Bikeways***
- ***Access***

adults and children meeting physical activity recommendations through both leisure and transportation-related physical activity (Owen et al, 2004; Dill, 2009; Pucher, Dill, and Handy, 2010). Residents of traditional (pre-WWII), walkable neighborhoods get more physical activity (Sallis et al, 2009). A recent study of neighborhoods in Seattle and Baltimore found that even among high–income neighborhoods, there are differences in physical activity. In high-income, low-walkable neighborhoods, residents had about a 50% increased risk for obesity compared to high-income, walkable neighborhoods (Sallis et al, 2009). These studies demonstrate a clear and convincing association between the built environment and physical activity, but certain aspects of the built environment warrant additional explanation.

The literature identifies two types of cycling and walking. The first is leisure, also known as recreational or non-derived demand travel. This type of walking and cycling is done simply for the sake of the activity, and has the strongest associations with the proximity, quantity, and quality of recreational facilities (Brownson et al, 2009). The second type of cycling and walking is for travel, also known as utilitarian travel or active transportation. This type of activity is a means to some ends, such as commuting to work, and is likely influenced by route directness, proximity of destinations, and cycling and walking facilities (Brownson et al, 2009; Dill, 2009; Sallis et al, 2009).

The influence of the design of buildings and streetscapes is somewhat difficult to measure, although several studies link certain characteristics of design to walkability and physical activity. Ewing et al (2006) outline a conceptual framework that associates physical, quantitative design features with walking behavior, as well as more qualitative characteristics. The measurable physical features include sidewalk width, street width, traffic volumes, tree canopy, building height, number of people present, and weather. The more qualitative, subjective measures include

Table 2. Urban Design Measures of Walkability

Imageability	The quality that makes a place recognizable and distinct
Enclosure	The degree to which streets and spaces are defined by buildings, trees, and other elements
Human Scale	The size, texture, and articulation of physical elements that match the size and proportions of humans and match the speed at which humans walk
Transparency	The degree to which people can see or perceive what lies beyond the edge of a space, especially the degree to which they can see other human activity
Complexity	The visual richness of a place, defined by variety in the physical environment

concepts described in table 2. Whereas these measures are associated with physical activity, they require intensive data collection to be useful for assessment.

Access to parks is associated with physical activity. In one study of adults, this has been measured in terms of perception; adults who perceive that they have access to parks are almost twice as likely to meet physical activity recommendations (Brownson, 2001). Among children, the actual number and size of parks correlates with increased physical activity. For example, one study found that for each 1 percent increase in park area within a community, there was a 1.4 percent increase in physical activity (Roemmich et al, 2006). The strongest link between this type of research and the Clark County Bicycle and Pedestrian Master Plan relates to the use of parks for active transportation, specifically trails. Living near a trail is associated with a 50% increase in the likelihood of meeting physical activity recommendations (Huston et al, 2003; Pierce et al, 2006).

Auto-dependent development reinforces sedentary lifestyles. In a study of counties across the United States, researchers found that residents of the most sprawling counties walk less, weigh more, and have a greater prevalence of hypertension than their counterparts in denser counties (Ewing, et al. 2003). Each additional hour per day spent in a car increases the odds of obesity by 6%, while each additional kilometer walked results in about a 5% reduction in the odds (Frank, Andreson, & Schmidt, 2004).

Automobile trips that can be safely replaced by walking or bicycling offer the first target for increased physical activity in communities.

- Dr. Jeffrey Koplan and Dr.William Dietz, Centers for Disease Control and Prevention

Safety

Real and perceived danger to pedestrians and bicyclists from traffic crashes can deter individuals from choosing non-motorized methods of transport. Over the past decade, research has more closely examined features of our built environments that may increase risk of pedestrian and bicyclist injury. Some approaches have looked at area characteristics on the census tract level, finding that traffic volume, arterial streets without transit, land area, land use, and population characteristics (socioeconomic and demographic factors) were all significant predictors of pedestrian injury (Wier et al., 2009). Additionally, studies have found that crash risk is higher around schools, and risk in this area is further increased among non-white populations (Abdel-Aty, Chundi, and Lee, 2007; Clifton and Kreamer-Fult, 2007; Campos-Outcalt et al., 2002). Other studies have

Associations between the built environment and physical activity are strong enough to compel action and guide public policy.

looked at even smaller geographical areas; an examination of traffic corridors in King County, Washington found that increased usage of transit stops is associated with more pedestrian-motor vehicle collisions (Hess, Vernez Moudon, and Matlick, 2004), while an analysis of pedestrian crash points in New Zealand found significant associations between both traffic volume and curb parking in relation to pedestrian-motor vehicle collisions (Roberts et al., 1995). While these are not measures of risk because of differences in the level of pedestrian and motor vehicle exposure, they are indicative of environmental attributes that may promote or dissuade individuals from walking.

Strength of Research

Research on the relationship between the built environment and physical activity, while still relatively new, is moving toward consensus. In a joint report in 2005, the Transportation Research Board and Institute of Medicine pointed out that while the causal relationship between physical activity and health is well established, research on the built environment and physical activity, which deals with more variables, does not show causal relationships with certainty. However, since 2005, the literature has grown rapidly and there are many studies supporting the association of built environment characteristics with physical activity. Such evidence remains largely cross-sectional and further investigation is needed to resolve uncertainty about both the degree of causation and the about which environmental characteristics are the most important factors in this relationship. Nevertheless, the associations between the built environment and physical activity are strong enough to compel action and guide public policy (Brownson et al, 2009). The research summarized in this document reflects the growing consensus and current findings on the relationship between the built environment and physical activity.

A consistent feature of the research on the built environment and physical activity is the prominent influence of characteristics outside of the obvious infrastructure associated with cycling and walking. While sidewalks and bicycle facilities are undeniably crucial investments, many of the strongest associations between the built environment and physical activity are broader structural issues best addressed through policies that are beyond the scope of the Clark County Bicycle and Pedestrian Master Plan. As recommended in the Rapid HIA, research encourages consideration of these additional factors, such as street network density and

land use patterns, when planning for the future of walking and cycling in the county.

Economic Benefits of Promoting Physical Activity

Most of the benefits of physical activity lie in the prevention of chronic disease. Put another way, the economic benefit of physical activity is avoidance of costs related to treating chronic disease. Some cost benefit studies of bicycle facilities are plagued with problems, often relating to the measurement of benefits. Measuring the value of health improvements resulting from bicycle and pedestrian facilities is therefore somewhat unreliable (Krizek, 2007). However, several studies have been successful in demonstrating the value of bicycle and pedestrian facilities. In one study using interviews of trail users and actual trail construction costs in Lincoln, Nebraska, researchers estimated that for every one dollar invested in trails, about three dollars is saved in direct medical costs (Wang et al, 2004).

For every $1 invested in trails, about $3 is saved in direct medical costs.

Economic Costs of Obesity

Although the costs of obesity are multiple and difficult to measure thoroughly, there are several rigorous estimates that quantify the costs of obesity. Note that these estimates refer only to measurable direct medical costs. In 2008, the direct cost of obesity nationwide was estimated at $147 billion (Finkelstein, 2009). Obesity accounts for 9.1% of annual medical spending in the US, rivaling the amount spent due to tobacco. The same national study found that the average difference in medical spending between healthy weight and obese people was $1429 annually. This difference amounts to 42% more spending than healthy weight people (Finkelstein, 2009). Using this estimate, the annual cost in Clark County is $110.9 million. Finkelstein estimates the annual per-capita cost to each US taxpayer at about $180, paid through Medicare and Medicaid benefits directly attributable to obesity. As Finkelstein put it, “Medicare and Medicaid spending would be spending 8.5 and 11.8 percent lower, respectively, in the absence of obesity.” The Clark County share of this burden is $37.7 million annually.

Estimated excess annual medical spending in Clark County due to obesity:
$110.9 million

Estimated annual Medicare and Medicaid tax burden in Clark County due to obesity:
$37.7 million

The costs discussed above refer only to direct medical costs, and only a part of these costs is attributable to physical inactivity. However, given the influential role of physical inactivity as cause of obesity, even a small increase in physical activity could result in millions of dollars in savings, especially when savings are mul-

tiplied over a lifetime. With only 44% of Clark County tenth graders meeting physical activity recommendations (Clark County Public Health, 2010), the cost of physical inactivity will likely continue to rise.

In addition to these costs, there are profound impacts that are less measurable in monetary costs. Multiple studies demonstrate a decrease in both the length and quality of life associated with obesity (Olshansky et al, 2005). One study found that obesity results in a shortened lifespan of 5 to 20 years (Fontaine et al., 2003). Another found that obesity resulted in 4 fewer quality adjusted life years for men and 7 fewer for women (Muennig, 2006). These findings point to the cost of obesity that is perhaps the most difficult to quantify: "today's youth may be the first generation in American history to live shorter, less healthy lives than their parents" (Levi, et al, 2010). Clearly the cost of obesity is massive, and the full benefits of prevention are realized over lifetimes and generations.

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SECTION 2: ASSESSMENT

Baseline conditions

Knowing more about where we are helps us make better decisions about where we want to go. This assessment of baseline conditions in Clark County presents the current status of social and built environment determinants of health measured at the neighborhood level. In combination with other reports on community health in Clark County, such as the Community Assessment, Planning, and Evaluation report (Clark County Public Health, 2010) and the Community Report Card (Community Choices, 2010), this assessment helps to identify areas with high potential for active transportation and areas of high infrastructure needs within the county. Findings are grouped into three categories: Determinants, Built Environment, and Outcomes.

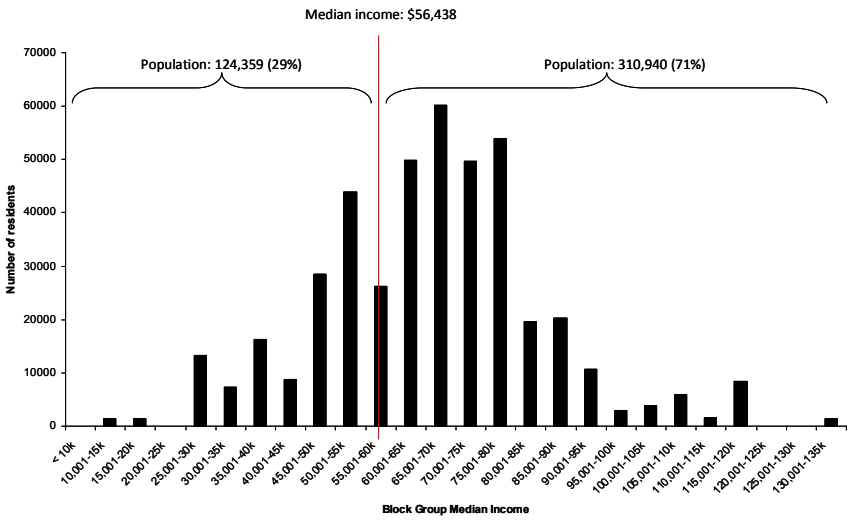
For a discussion of how determinants influence health, see Section 1.

Determinants

Income

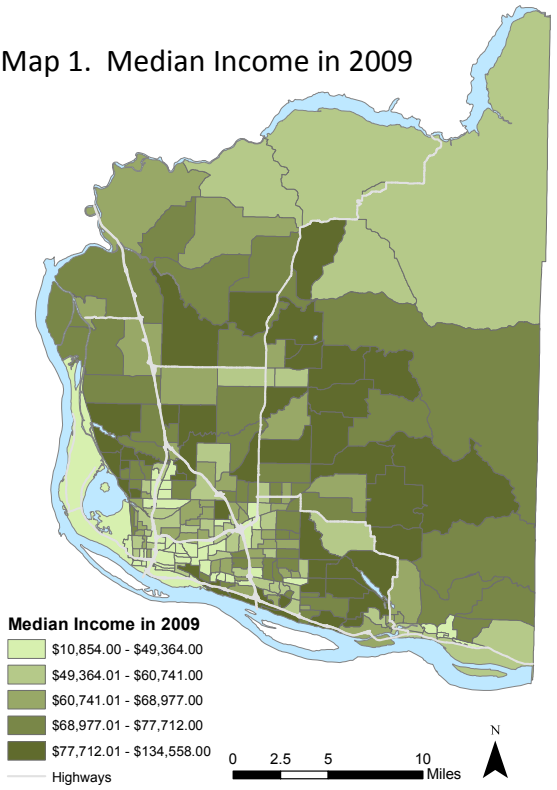
Median income is an indicator of income distribution and equality. Median income for all Clark county residents in 2009 was $56,074, similar to the statewide median of $56,548 (US Census Bureau, 2010). Map 1 shows the distribution of income by block group, revealing a pattern of higher incomes in outlying areas and lower incomes in older, more developed areas. Dramatic differences are seen between the lowest median income block group ($10, 854) and the highest ($134,558). Living in lower in-

Chart 1. Number of Residents by Block Group Median Income

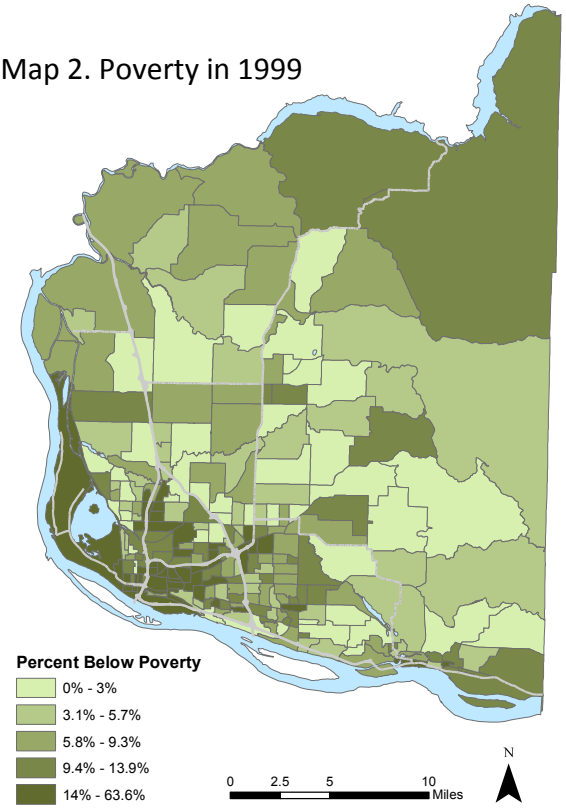


come neighborhoods is a risk factor for health, whereas higher income neighborhoods can be protective. Of the county's 233 block groups, 159 (68%) have a median income above the county median; these block groups are home to 71 percent of the county population (see chart 1). Although these block groups are home to over 70 percent of the population, in 1999 they were home to just 43% of the population living in poverty.

Map 1. Median Income in 2009



Map 2. Poverty in 1999

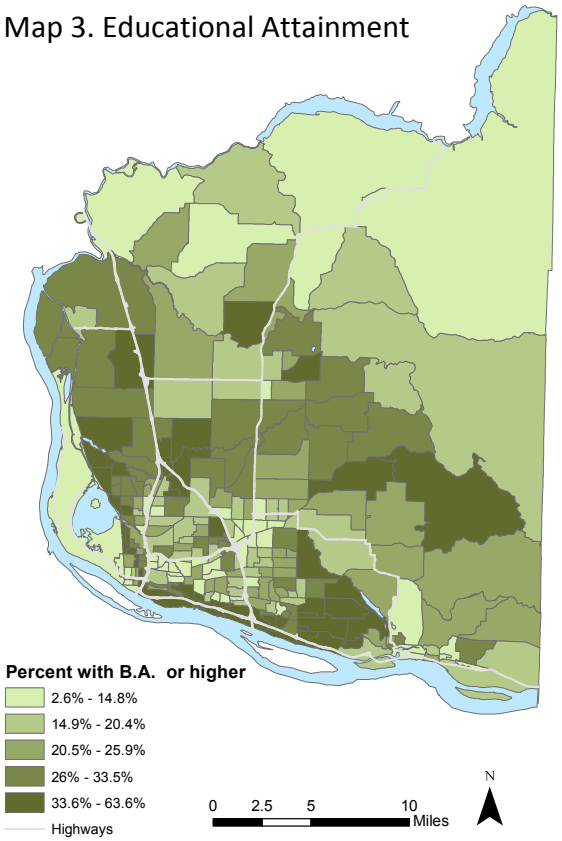


Equality of income distribution refers to the difference between the highest income earners and lowest income earners in a community. Whereas perfect income equality (everyone earning the same) may not be realistic or ideal, the concept is useful in assessing the influence of SES on health. Studies indicate a strong correlation between greater income equality and improved health outcomes (Adler and Newman, 2002; Adler and Rehkopf, 2008). To help communities assess the impacts of income inequality, the US Census bureau calculates an index of income inequality known as the gini index, where 1 represents perfect inequality and 0 represents perfect equality (US Census Bureau, 2010). In 2009 the gini index of income inequality for Clark County was .42, similar to the statewide index of .44.

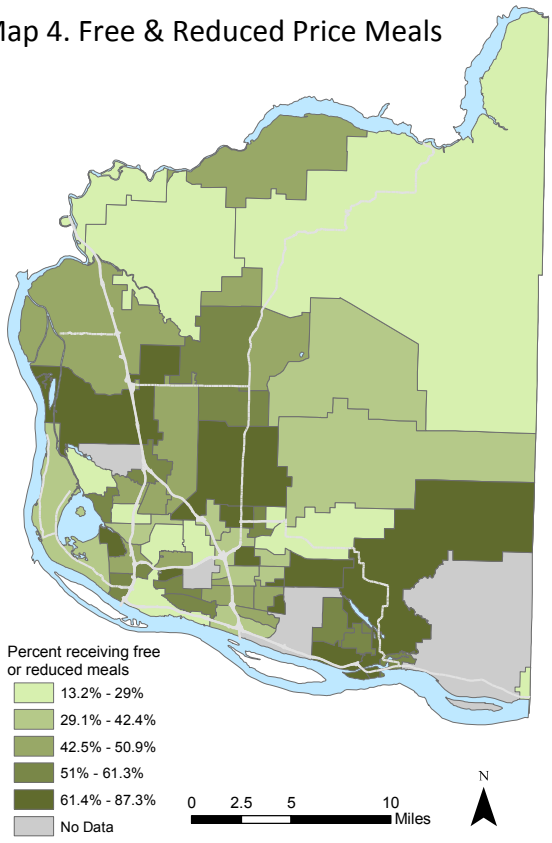
Education

Educational attainment is another measure of equality; higher educational attainment is associated with better health outcomes, giving an advantage to those with access to greater lifetime earnings resulting from quality higher education. In Clark County, about 24% of adults over age 25 have attained a bachelor's degree or higher (US Census Bureau, 2010). As one would expect, 2009 data on educational attainment (see map 3) roughly follows the same pattern as median income, unevenly distributed throughout the county. However, a nearly continuous set of block groups with lower educational attainment is found along SR 500 and in the Orchards area.

Map 3. Educational Attainment



Map 4. Free & Reduced Price Meals



Poverty

As an indicator of need, poverty is a stronger measure than income or education. Given that many block groups have a relatively high median income, the level of material need among residents can be difficult to detect through measures such as median income. The poverty rate in 2009 was 11.8%, similar to

the statewide rate of 12.3% (US Census Bureau, 2010). Unfortunately, recent estimates are not available at a small geographic scale, but a data from Census 2000 is displayed by block group in map 2. The map shows that poverty is largely concentrated in and around Vancouver, and reaches over 50% of block group populations in extreme cases.

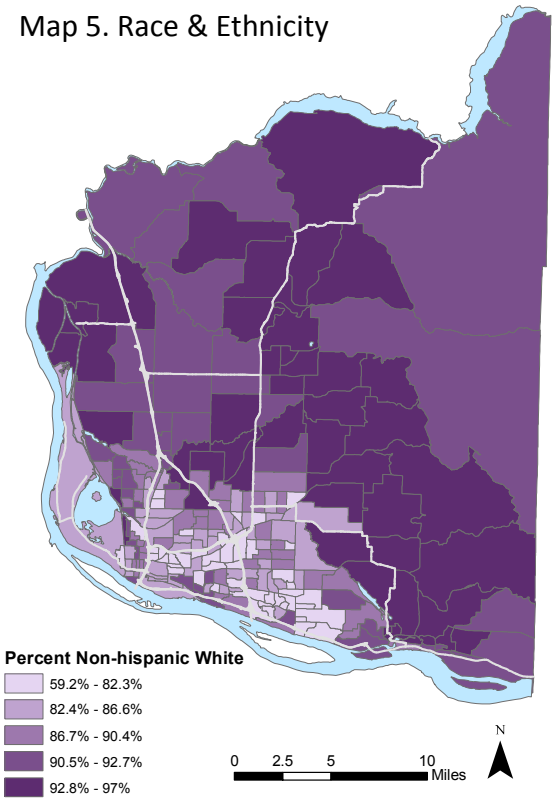
Free and Reduced Price Meals

Another measure of material need is the percent of students who participate in free or reduced meal programs at school. This measure is shown in map 4 by elementary school attendance area, reflecting a somewhat different distribution of need from that shown in the maps of income and poverty, with higher need shown along SR 503. This is partially due to different geographic units (school attendance areas rather than census block groups), but may also be indicative of specific conditions for the population of families with children.

Race & Ethnicity

Clark County has relatively small populations of racial and ethnic minorities. As discussed in Section 1, racial and ethnic minorities often face higher health risks than their white neighbors. The 2009 American Community Survey estimates that about 88% of Clark County residents are white, and 83% are non-Hispanic or Latino white. The percent white population by block group in 2009 is shown in map 5, indicating that minority populations are largely concentrated in the more densely populated areas in and around Vancouver.

Map 5. Race & Ethnicity



Language

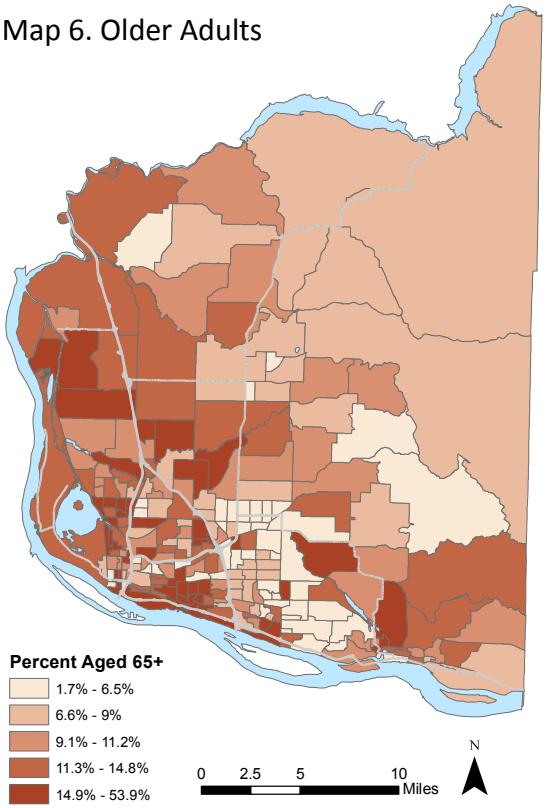
Recent estimates from the American Community Survey indicate that there are two large non-English-speaking populations in Clark County: Spanish and Indo-European. These populations are roughly the same size, each between 8,000 and 9,000 people (CCPH, 2009). Recent data on this variable are not available for geographies smaller than the county as a whole, but based on ethnicity we can approximate the location of Spanish speakers. The Indo-European language speakers are likely Eastern Euro-

pean, and therefore are not distinguishable through racial or ethnic data because they are classified as white by the US Census.

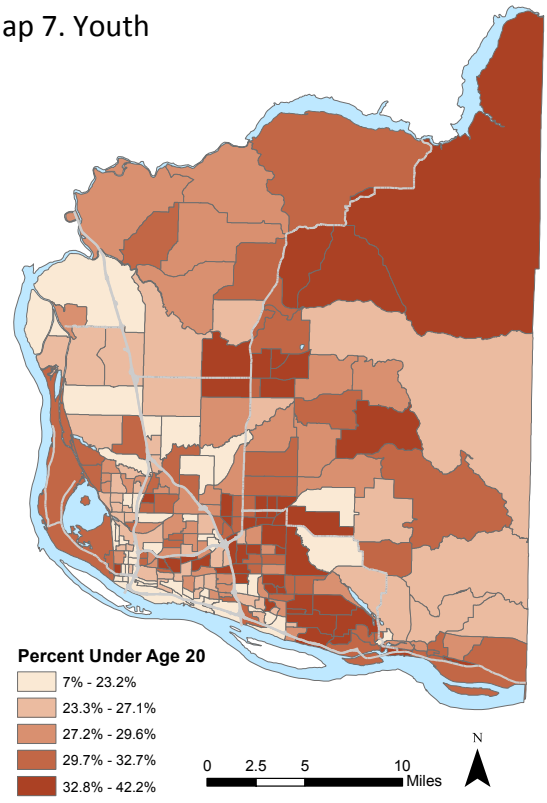
Age

Age is a particular concern related to cycling and walking, as those at both ends of the life cycle often require special consideration to accommodate their physical and informational needs as they navigate the transportation system. Map 6 shows older adults as a percent of population by block group, accompanied by map 7 displaying the percent of youth in each block group. The distribution pattern appears to be similar to that of median income, with some exceptions. There are youthful pockets in Battle Ground, Orchards, and Highway 99 area, whereas the older population is more concentrated west of I-5 and along the Columbia River.

Map 6. Older Adults



Map 7. Youth

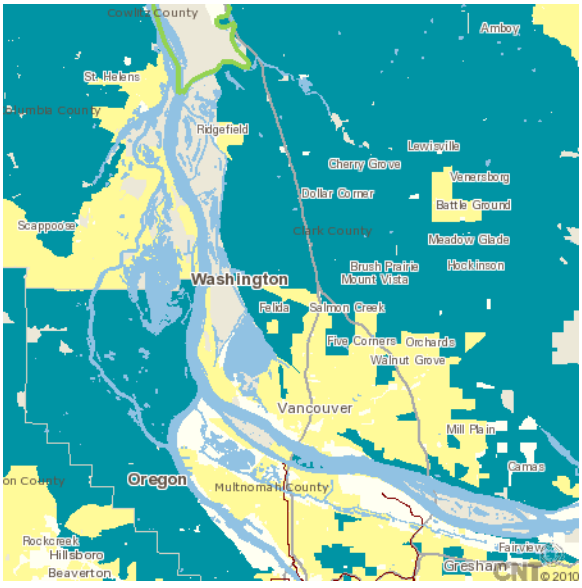


Housing affordability

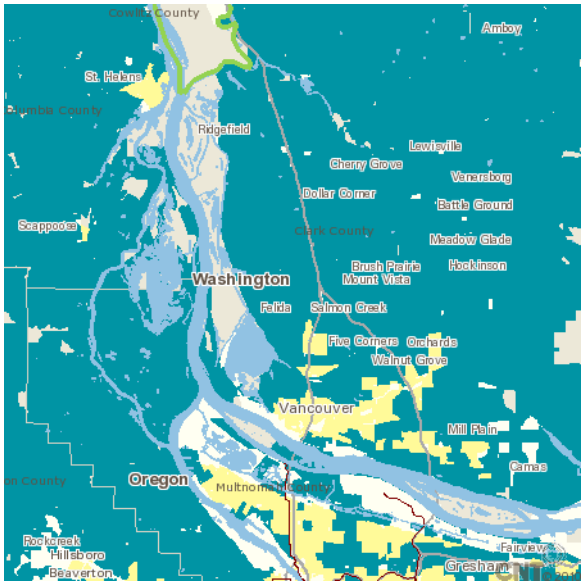
Housing affordability effects both equality and chronic stress, both of which influence chronic illness (CSDH, 2008). A standard measure of housing affordability is percent of household income spent on housing, with 30% considered the threshold of afforda-

bility (CNT, 2010). In this study we are using an alternative definition of affordability that takes transportation costs into account, for the reasons that follow. As much of the county is heavily dependent on automobiles, transportation options are limited and costs are highly related to oil prices. The two maps below show the impact that transportation costs can have on affordability. In map 8, yellow areas are considered affordable using the threshold of 30% of income spent on housing costs. Map 9 shows how affordability changes when the definition is expanded to include housing plus transportation costs using a 45% threshold. When transportation costs are included, much of the county is unaffordable, with most of the affordable housing located in or just outside Vancouver city limits. Clark County as a whole is considered affordable using the 30% threshold, with the average household spending just 28.8% of household income on housing. However, when transportation costs are included, the county surpasses the 45% threshold, as households can expect to spend 51.6% of their incomes on housing and transportation (CNT, 2010). The large number of employees with lengthy commutes to Oregon (about 60,000) may partially explain this pattern.

Map 8. Housing Affordability



Map 9. Housing + Transportation Affordability

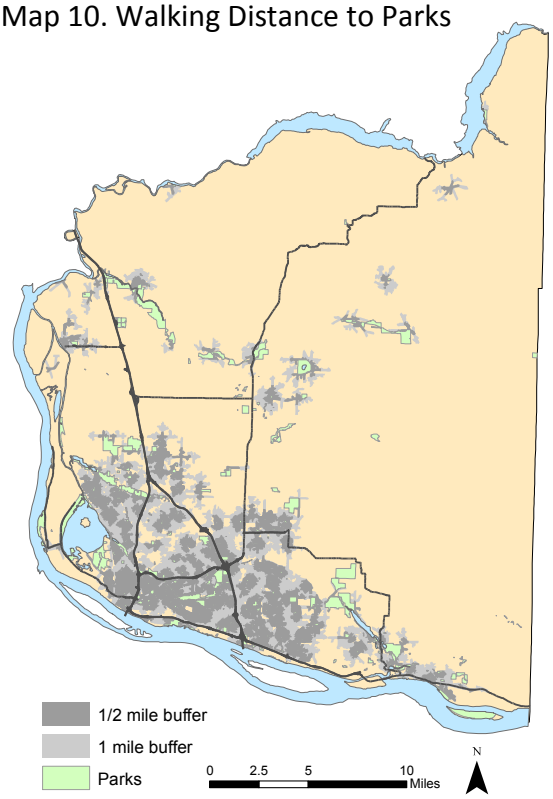


Built Environment

Access to parks

Parks provide important opportunities for physical activity. Park access in Clark County is nearly ubiquitous in close-in areas of Vancouver and Camas, with increasing gaps moving northward.

Map 10. Walking Distance to Parks

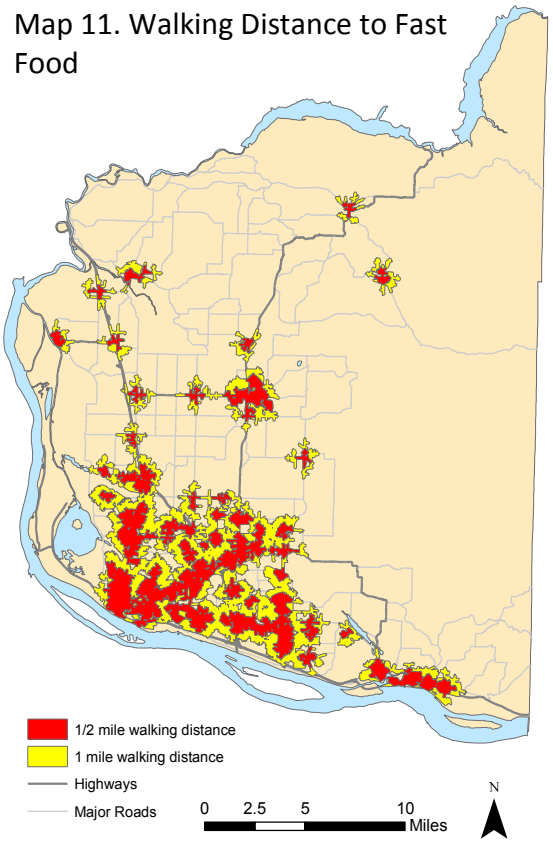


About 45% of the county population is within ½ mile walking distance of a park access point, and about 70% is within one mile. Vancouver-Clark Parks and Recreation defines neighborhood parks as those that serve roughly a ½ mile walking distance and provides these only within Vancouver and its UGA. This explains why within incorporated areas, nearly 60 percent of residents live within walking distance of a park, but only 31 percent of unincorporated residents live within walking distance of a park. Of all residents living within ½ mile walking distance of a park, 99 percent live within a city or the Vancouver UGA.

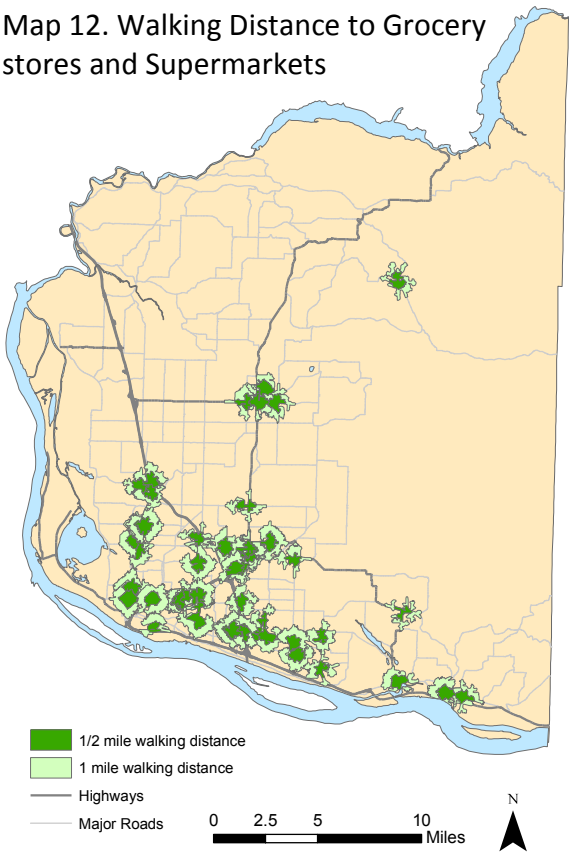
Access to food

With physical activity, nutritious food can help prevent obesity. Access to nutritious food varies widely in Clark County, as shown in maps 11 and 12. Sometimes the nearest food outlet may not be a healthy one – inexpensive, calorie-dense food is often closer or more convenient than fresh pro-

Map 11. Walking Distance to Fast Food



Map 12. Walking Distance to Grocery stores and Supermarkets



duce. This is especially true in lower income areas, as reflected in the correlation between the density of fast food restaurants and median incomes among census block groups (Pearson correlation -0.405; p<0.000). Table 3 illustrates the relative ease of access for different types of food stores.

Table 3. Population within walking distance of food stores

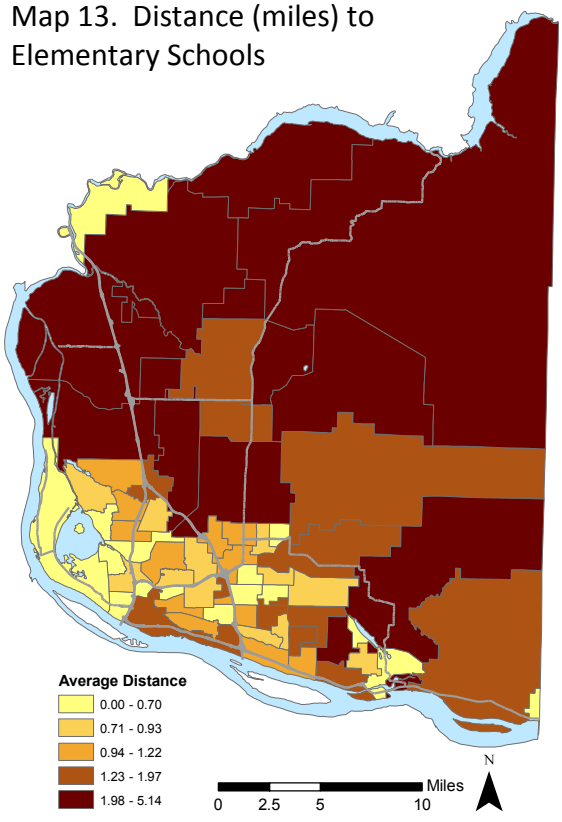
	1/2 mile	2/3 mile	1 mile
Produce Only	0.5%	1%	4%
Grocery	7%	11%	21%
Supermarket	9%	16%	34%
Grocery or Supermarket	15%	23%	42%
Convenience Store	32%	45%	65%
Fast Food	35%	47%	66%

Having healthy food stores nearby is not only important for healthy eating, it also serves as a destination for active transportation.

Access to schools

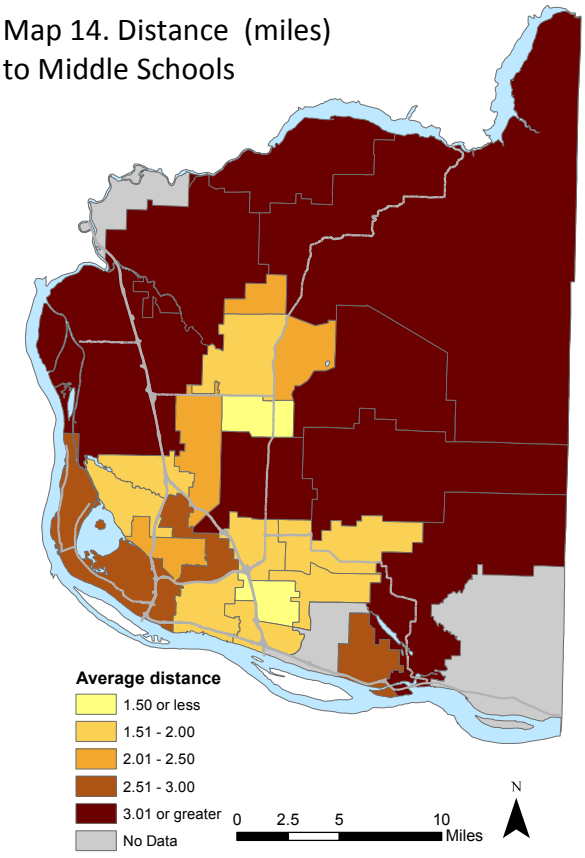
Among the most prominent built environment concerns is the accessibility of schools (TRB & IOM, 2005). Distance to school is cited by parents as the leading barrier to allowing their children to walk to school, an issue exacerbated by the tendency of new schools to locate on the suburban fringe where land is less expensive. In Clark County, there are examples of both highly walkable, urban school attendance areas as well as schools separated from other land uses by distance or lack of appropriate facilities such as sidewalks, low-traffic streets, and safe crossings.

Map 13. Distance (miles) to Elementary Schools

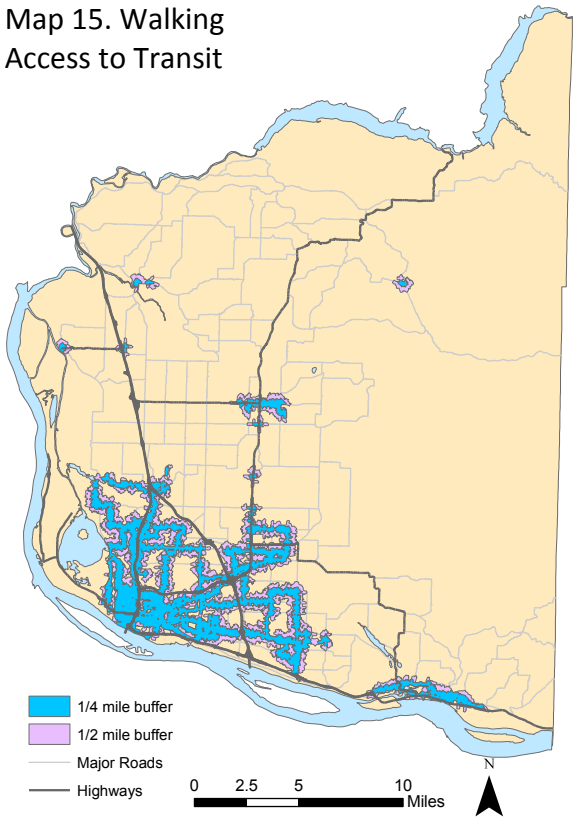


Maps 13 and 14 show the average distance from each residential parcel within a school attendance area to that school. Schools with lower average distances have higher potential for walking or cycling, such as many of the elementary schools located in and around Vancouver with average distances under 1 mile (in Washington State, there is no bus service for children living within 1 mile of school). As students transition to middle school, the distance from home typically becomes greater, making walking and cycling less

Map 14. Distance (miles) to Middle Schools



Map 15. Walking Access to Transit



likely. This is reflected in the larger middle school attendance areas and higher average distances. While distance is not the only determinant of whether children walk to school, it is often cited as among the most important (CDC, 2005; Kerr et al 2006). A high average distance to school, while a significant challenge, does not preclude walking or cycling for students who live nearby. However, higher average distances are partially explained by development patterns that result in few students living near enough to school to feasibly walk, or in few route options that offer safe facilities.

Access to transit

Studies find that transit use is associated with a decreased likelihood of obesity, and that 29% of those who use transit achieve daily physical activity recommendations solely by walking to and from transit (Besser and Dannenburg, 2005). Proximity to public transit has repeatedly been associated with higher transit use and to higher levels of physical activity (McCormak, Giles-Corti, and Bulsara, 2008). In Clark County, about 27% of the county population lives within ¼ mile of a transit stop, and about 52% are within ½ mile. Map 15 shows the areas that are within ¼ and ½ mile of a transit stop. Central Vancouver enjoys ubiquitous service, whereas eastern and northern areas have sparse service or none at all. Proximity to transit stops helps illustrate its availability, but does not complete the picture. The quality and frequency of service greatly impacts transit's ability to serve as a primary mode of transportation. While some areas of the county, such as the Fourth Plain corridor, are well-served by frequent and direct lines, large areas have infrequent or minimal transit service.

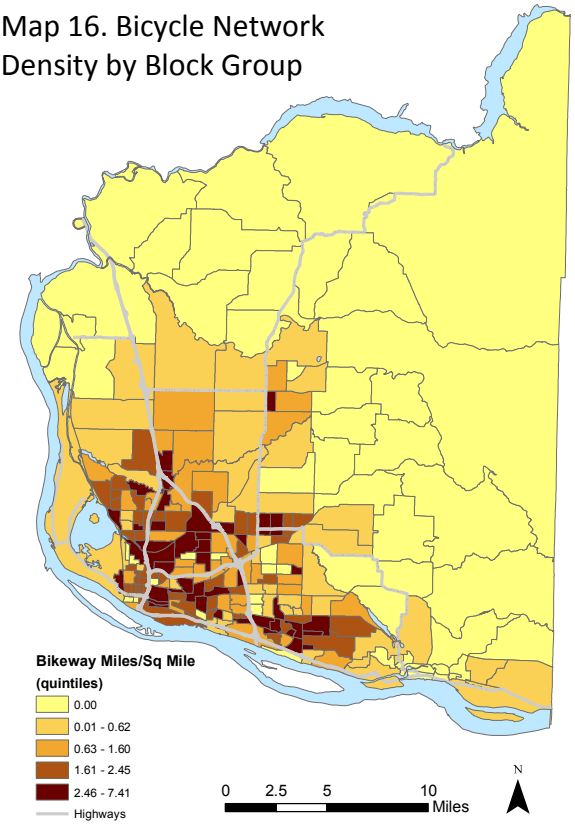
Bikeability

The presence of bicycle facilities contributes to increased bicycling (Pucher et al, 2009). One way of measuring the presence of facilities is bicycle network density, which compares census block

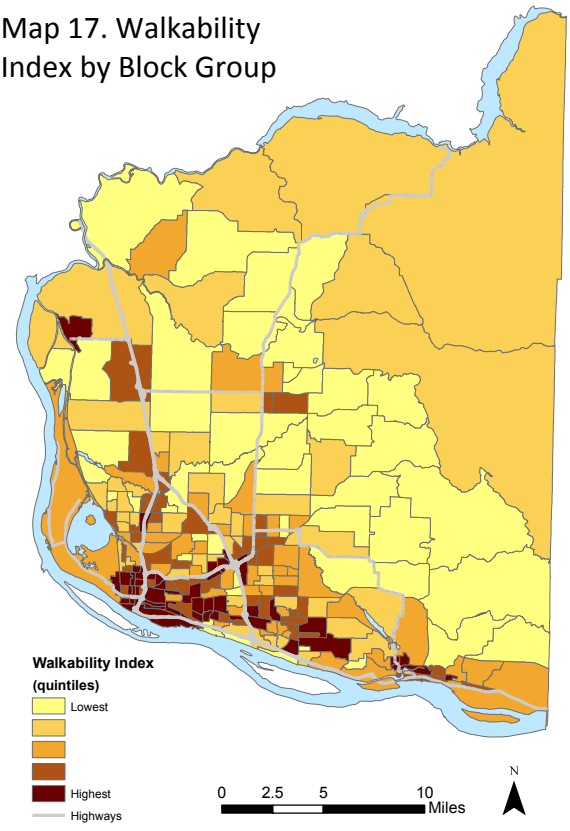
groups within the county by calculating bikeway miles per square mile. By this measure, much of unincorporated Clark County compares well to other areas of the county, particularly within the Vancouver UGA. This pattern is displayed in map 16, which shows bikeway network density by census block group. However, research also shows that infrastructure is only one of many factors that influences cycling (Krizek, 2006; Pucher et al, 2009). Many other factors that influence bicycling also influence walking, such as street network connectivity and the proximity of destinations. For this reason, it is important to consider the map of bikeability in the context of measures of walkability shown in the map 17.

"Facility" is a catch-all term that can refer to any type of infrastructure, such as bike lanes, bike boulevards, or sidewalks.

Map 16. Bicycle Network Density by Block Group



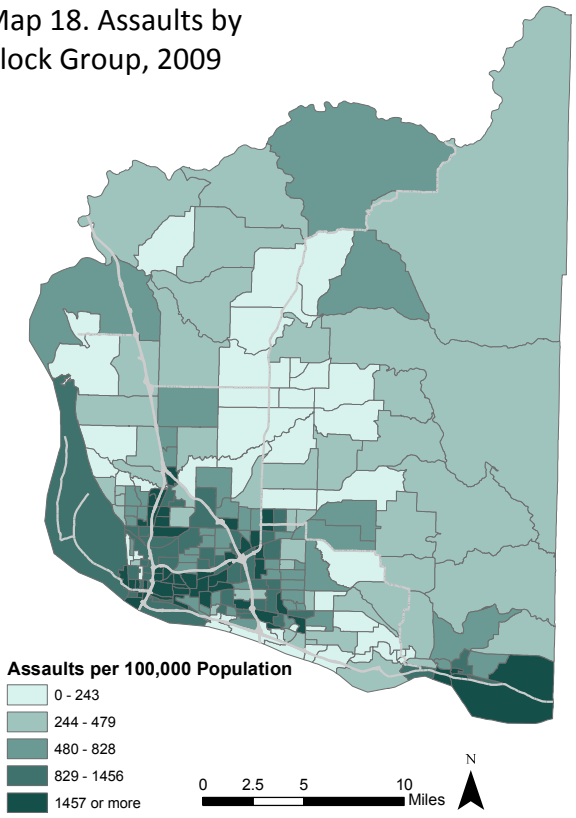
Map 17. Walkability Index by Block Group



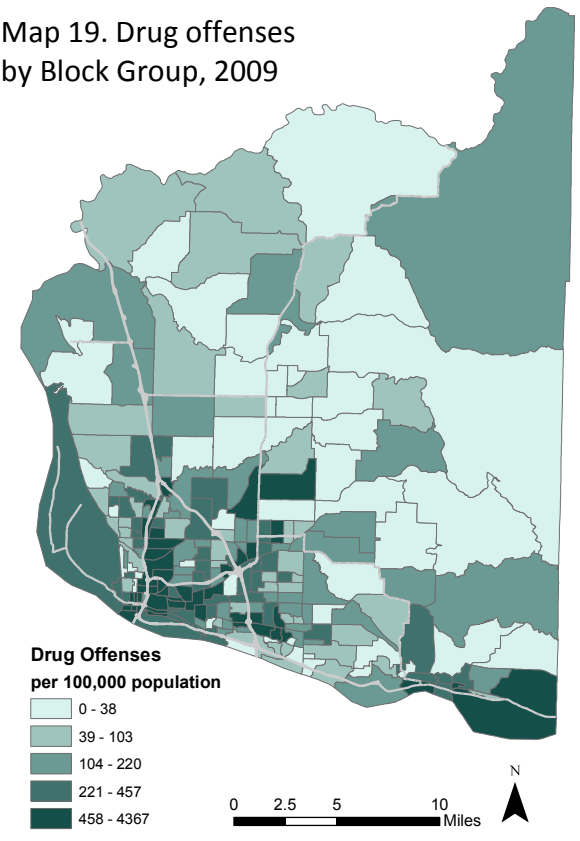
Walkability

Several studies associate measures of walkability with physical activity (Sallis et al, 2009; Frank et al, 2007; Clifton et al, 2006). There are many methods of measuring the influence of the built environment on walking, but the walkability index developed by Sallis and Frank is used in this HIA because it offers the following advantages: first, it is consistently linked with obesity and physical activity in research; second, it can be calculated using archival

Map 18. Assaults by Block Group, 2009



Map 19. Drug offenses by Block Group, 2009



GIS data rather than by means of intensive primary data collection efforts. The walkability index is a combined measure of net residential density, road network connectivity, retail floor-area ratio, and land use mix.

In map 17, darker areas have higher walkability index scores, indicating better conditions for walking. As might be expected, many of the most walkable locales are in and near downtown Vancouver, while much of the rural area is less walkable. The walkability map also shows the urban growth areas and incorporated areas, giving a clearer picture of the area impacted by the Bicycle and Pedestrian Master Plan. It is important to note that this index does not take into account the presence or quality of bicycle and pedestrian facilities (these data are still being developed). As such, the index can be considered more of a walkability *potential* index, rather than a measure of current activity or service levels. Also, it is a relative measure, meaning that a high walkability score in one block group does not necessarily reflect a very walkable environment, only that it is *more* walkable than other block groups in the county.

Crime

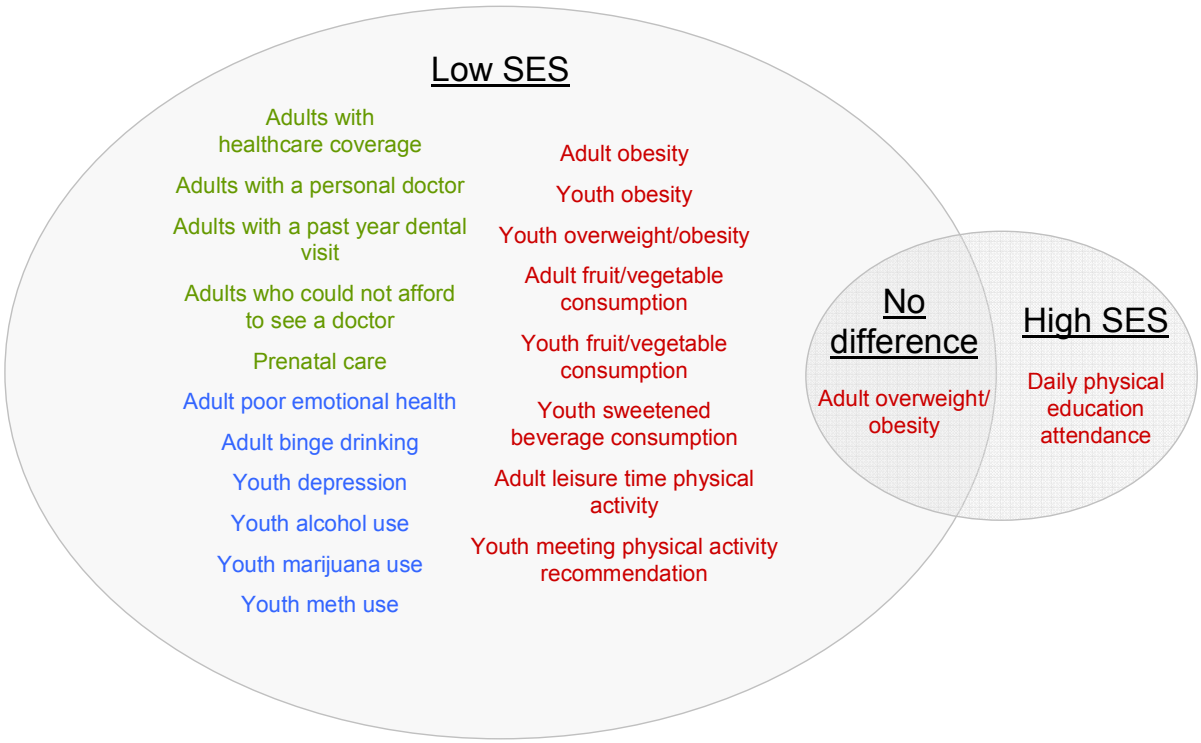
Research and theory suggest that personal safety from crime is a key component in people's willingness to engage in physical activity in their neighborhoods. At least one study found that low-income residents in walkable neighborhoods tend not to get as much physical activity as their wealthier counterparts (Sallis et al, 2009). This finding suggests that there may be necessary preconditions for a truly walkable neighborhood, such as diminishing the real or perceived threat from crime. Crime rates (maps 18 and 19) for Clark County show that lower income areas such as central Vancouver have higher crime rates.

Outcomes

Disparities

In Clark County, there are populations with worse health outcomes than others, a situation known as a health disparity. In many cases these differences are preventable by focusing resources based on social conditions. For example, those with lower socioeconomic status fare worse on the majority of measures of health (Clark County Public Health, 2010). Figure 2 shows differences in various measures of health specific to Clark County based on socioeconomic status. Health indicators in green are related to medical care, those in blue measure emotional health and substance abuse, and those in red are indicators of risk for chronic disease. Each section of the diagram contains indicators for which the corresponding group is relatively worse off than other groups. For example, measures of adult obesity are higher among low SES adults, and daily physical education attendance is lower among high SES students. When compared to maps of SES (see page 16), it is clear that there is some degree of geographic clustering of people with similar SES, and that this is reflected in the geographic distribution of health outcomes.

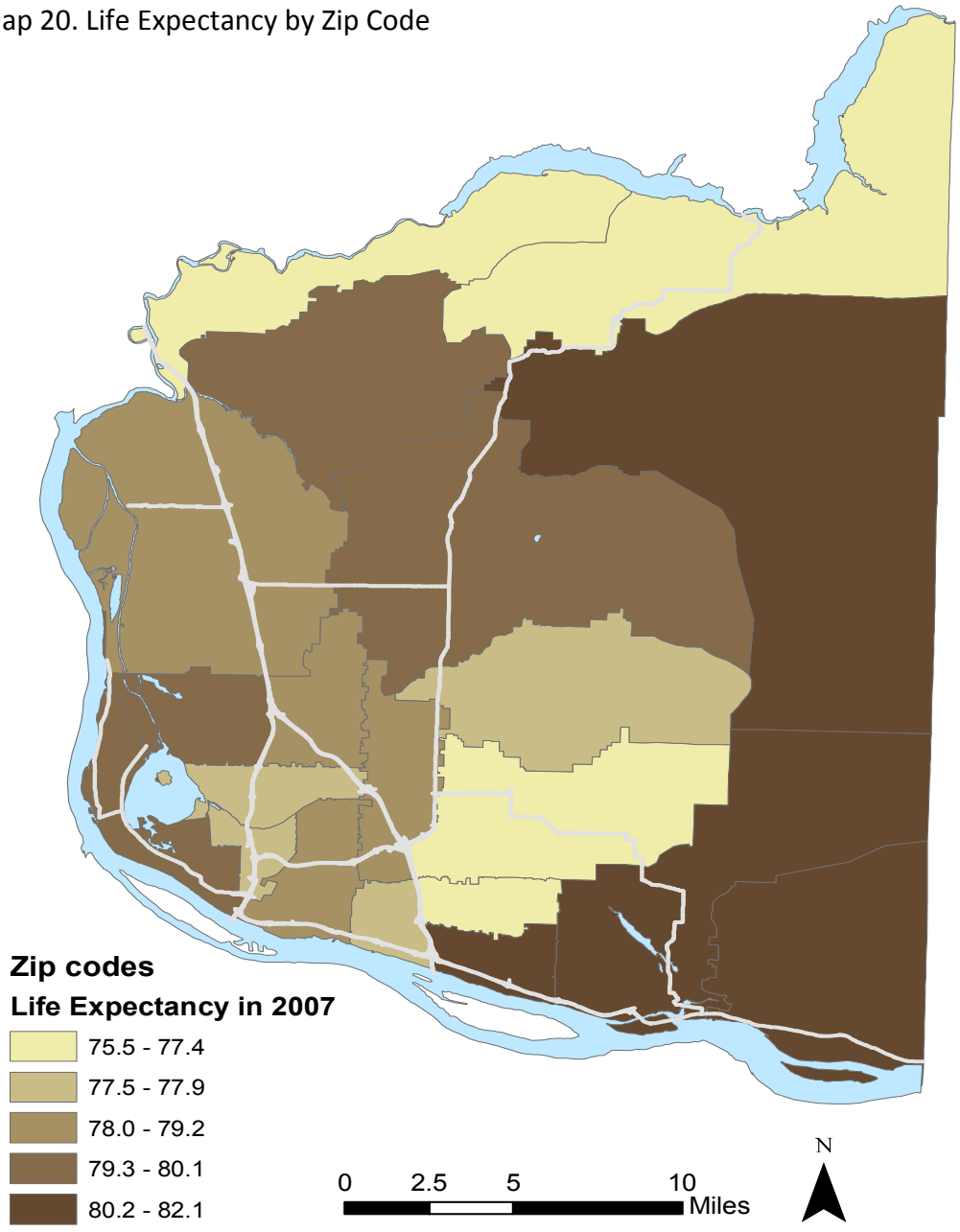
Figure 2. Health disparities in Clark County



Life expectancy

One of the most basic indicators of overall health, Life Expectancy at Birth (LEB), tells us how long a person born in a given year can expect to live. This measure is particularly helpful in illustrating disparities based on social and environmental influences on health or SES. In Clark County, the total variability in LEB between zip codes is roughly six years. As shown in map 20, LEB is higher in eastern zip codes, with lower expectancies found in northern and south-central zip codes. Based on assessment of existing socioeconomic conditions (page 16), it is clear that this pattern is partially coincident with measures of SES.

Map 20. Life Expectancy by Zip Code

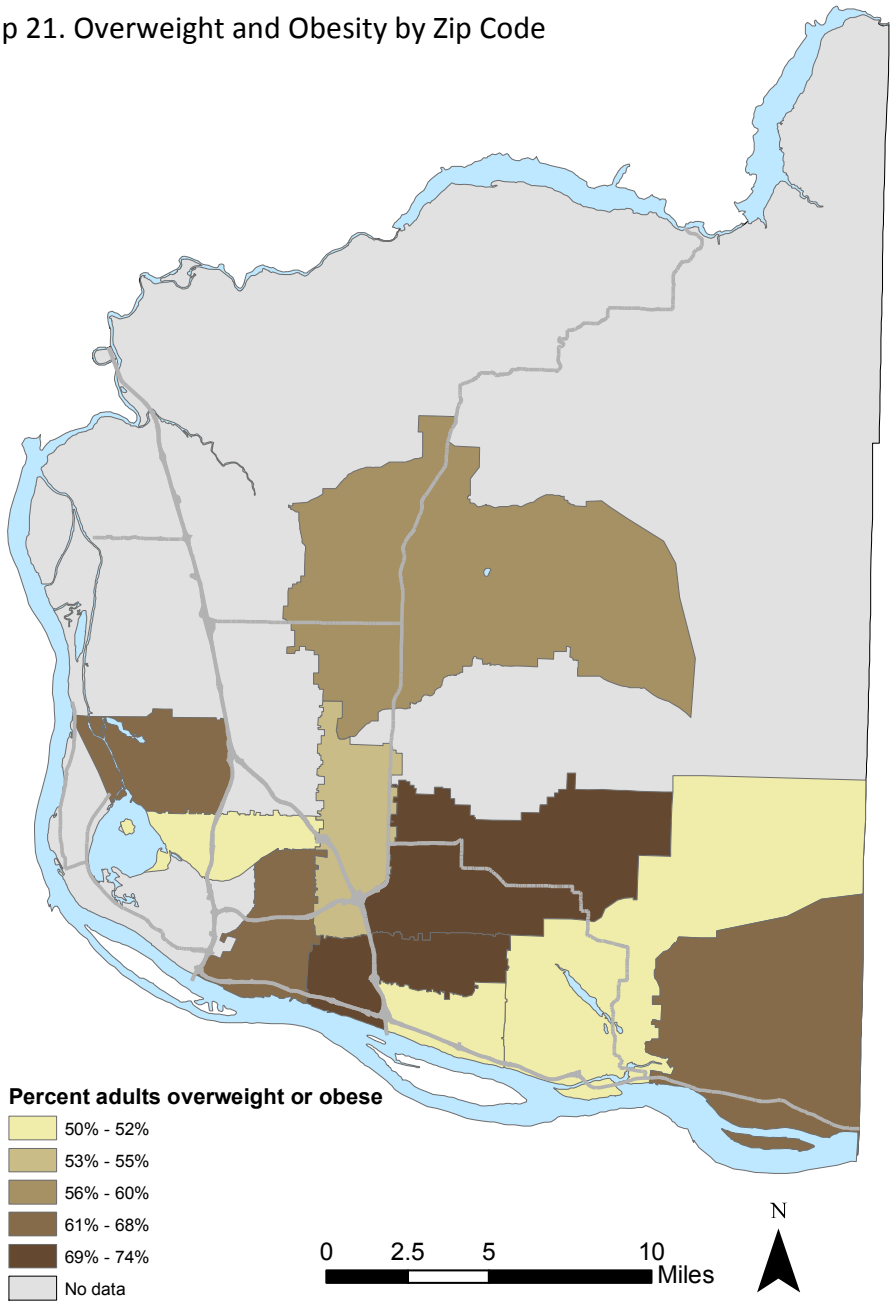


Obesity

In Clark County, 26% of adults are obese (BMI>30), and an additional 38% are overweight (BMI >25-30). These percentages are similar to Washington State overall and have increased over the past decades. As shown in map 21, the distribution of overweight and obesity is not equal throughout the county. While there is a substantial amount of missing data, it appears that there is higher concentration of overweight and obese residents in south-central zip codes. This is corroborated by a separate

64% of Clark County adults are obese or overweight.

Map 21. Overweight and Obesity by Zip Code



24% of Clark County tenth grade students are overweight or obese.

data set that uses electronic medical records from a single provider to map obesity rates by census tract. This second data set indicates that obesity rates are highest in the south-central area around the junction of I-205 and SR 500. Rates vary from 21% in downtown Vancouver to 39% east of Washougal (Institute of Portland Metropolitan Studies, 2010). Note that these rates are for the insured population covered by a single provider and represent obesity rates only among a sub-population of insured adults.

A survey of Clark County tenth graders indicates that about 13 percent are overweight and 11 percent are obese (Clark County Public Health, 2010). For both youth and adults, obesity rates decrease with higher SES as measured by education level. Compared to White residents, overweight and obesity rates are higher among Hispanics and Black residents.

Injuries & fatalities

Perhaps the most obvious health outcome related to any bicycle and pedestrian plan is the incidence of traffic injuries and fatalities for cyclists and pedestrians. Recent data from the Washington State Department of Transportation show that of the 61 pedestrian fatalities in Washington in 2009, only 1 occurred in Clark County. Bicyclist fatalities totaled 9 in Washington, 1 of which occurred in Clark County. Table 5 reflects a diminishing number of fatalities for pedestrians in recent years, but similar numbers of cyclist fatalities year-to-year. The numbers are too small to indicate a trend for cyclist and pedestrian injuries, but some variability may be related to inconsistent reporting.

Studies have found that despite some predictions, significant increases in pedestrian and bicyclist traffic are associated with reduced incidence of pedestrian-motor vehicle and bicyclist-motor vehicle collisions (Jacobsen, 2003). This effect has been ob-

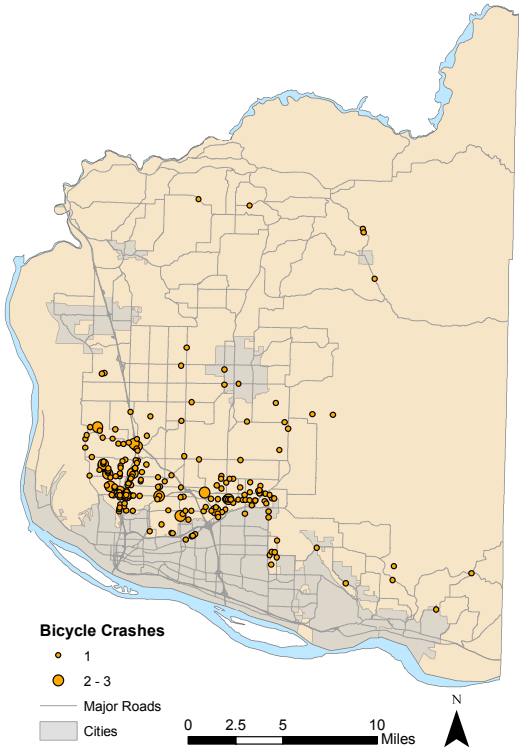
Table 5. Bicycle and Pedestrian Fatality Rates

Year	Pedestrian fatalities	Pedestrian Serious Injuries	Bicyclist Fatalities	Bicyclist Serious Injuries
2006	5	14	1	5
2007	5	7	2	7
2008	2	20	2	20
2009	1	18	1	9

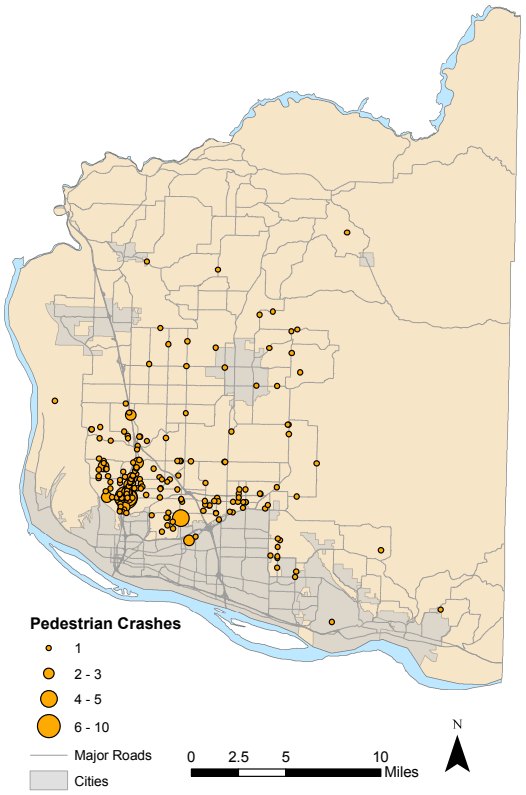
served locally in Portland. Thus, there is two-fold benefit to building communities that promote pedestrian and bicyclist activity – expected decreases in chronic health conditions due to improved activity levels as well as decreases in the incidence of pedestrian and bicyclist injury due to "safety in numbers".

Maps 19 and 20 show locations of bicycle and pedestrian crashes from 1997-2010. The highest number of crashes at any single place in Clark County is the intersection of NE 78th Street and Highway 99, with ten pedestrian crashes and three bicycle crashes.

Map 19. Bicycle injury and fatality crashes, 1997-2010



Map 20. Pedestrian injury and fatality crashes, 1997-2010



Impact of Proposed Actions

Proposed projects, policies, and programs and their likely impacts are described below. Findings on impacts are summarized at the beginning of each set of proposals. For discussion purposes, projects are aggregated by type and in total to give a sense of overall impact. Also included is a discussion of the impact of the planning process. Relevant research and sources are listed in Appendix C.

An important consideration in the assessment of the policies and programs proposed in the plan (as opposed to projects) is that they essentially remain proposals unless funded, codified or otherwise implemented. Due to the broad range of implementation options for each policy and strategy, the population served is not estimated for these proposals. Instead, we comment on whether there is an impact, whether the effect is positive or negative, and whether the effect directly increases physical activity or merely supports it. To translate the findings of this assessment into action, recommendations on implementation are included in section 3.

Public Health finds that, if implemented, all proposed projects will have a positive impact on health by providing increased opportunities for physical activity.

Projects

Impact

CCPH finds that, if implemented, all proposed projects will have a positive impact on health by providing increased opportunities for physical activity. The proposed projects will produce no adverse impacts on vulnerable populations, and could help low SES and older residents.

Strength of Evidence

This finding is supported by multiple peer-reviewed research studies that show a consistent association between bicycle and pedestrian infrastructure and physical activity (Pucher et al, 2009; Krizek, 2006; Dill and Carr, 2003; Dill, 2009; Dill and Gliebe 2008).

Magnitude

This analysis assumes that projects will be fully implemented as proposed. The magnitude of the proposed projects was analyzed based on their proximity to populations that could benefit from increased opportunities for physical activity in their neighborhoods. Implied in this approach is that being nearer to a facility increases the likelihood of using it, which is generally

supported by research (Pucher et al, 2009, Krizek, 2006). While this does not represent the true magnitude of health impacts in a highly quantified form, it is an attempt to identify the potential magnitude through quantifying the population that will have access to increased opportunities for physical activity.

Findings from a study of cyclist behavior indicate that facility types vary in their appeal to cyclists (Dill, 2009). Using these findings, we calculated the service areas for each bicycle and pedestrian project based on their attractive "pull". This approach involves a degree of arbitrary cut-off distances. We assume that ¼ mile is the "pull", or service area, for bike lanes, which is supported both by other planning approaches (City of Portland, 2010), and by research showing that residents living within 400 meters of a bike lane are more likely to cycle (Krizek, 2006). Based on Dill's study, we calculated that the relative attractiveness of an off-street trail to a bike path increases the service area to nearly ½ mile. Whereas Dill's study affirms the attractiveness of several types of bicycling facilities, such as bicycle boulevards and low-speed streets, only trails and bike lanes are prioritized in the Clark County Bicycle and Pedestrian Master Plan.

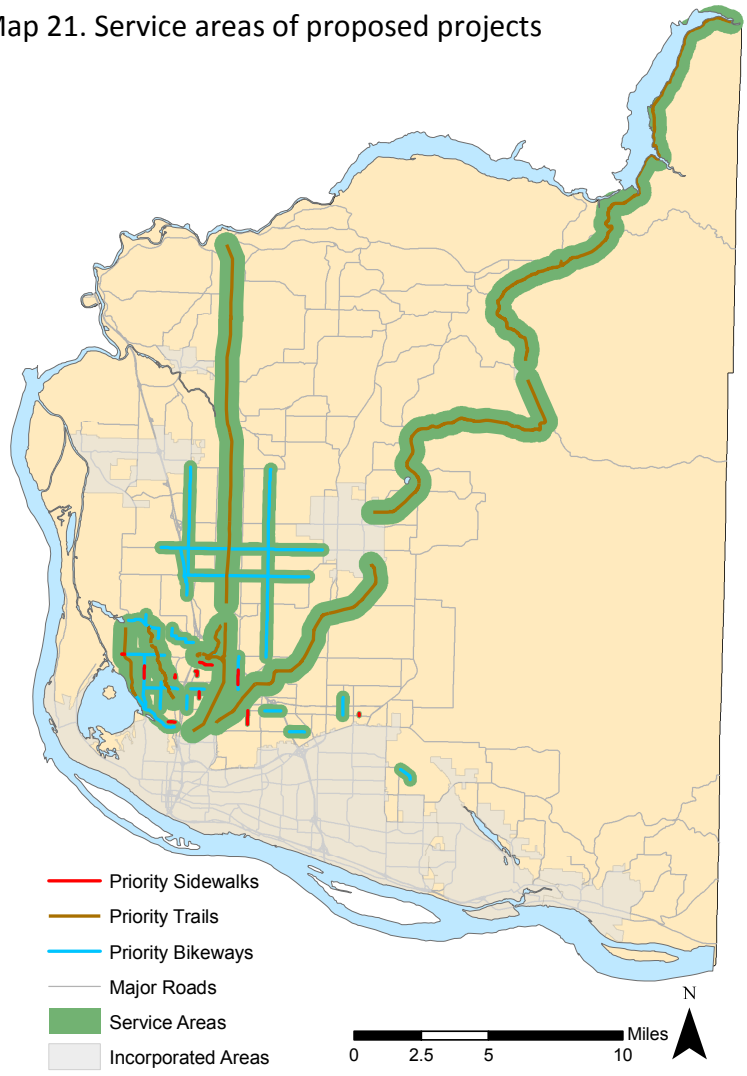
"Service areas" refer to the area that can be reasonably served by a destination or facility, such as a park or trail, if users access it by walking or cycling.

After reviewing existing research, we were unable to determine a specific distance as a service area for sidewalks based solely on empirical observations. Presence of sidewalks is typically measured by their continuity (percent of streets covered) or by pedestrian behavior (Brownson et al, 2009; Saelens et al, 2003). Without a basis for determining sidewalk service areas, we assume that residents within 500 feet (two blocks) will be served by new sidewalks. At assumed walking speeds of four feet per second (FHWA, 2009), a 500 foot route deviation would take about two minutes. This equates to a 16% deviation on a .6 (1km) mile walk trip commonly used as a standard in transportation research and planning (Lee and Moudon, 2006) or a 14% deviation on a .7 mile walk trip reported as the mean distance for all walk trips on the 2009 National Household Transportation Survey. This deviation is at the lower range of those found for cycling facilities. Although pedestrian and bicycle behavior is not directly comparable, CCPH uses the distance of 500 feet because it falls within an observed range of deviation and is easily understandable when communicated as a 2-block radius.

These service areas are shown in green in map 21. We use proximity-based measures for three reasons: a) data availability,

b) ease of analysis, and c) research supporting the association between physical activity and facility proximity. Although much of the research on the association between cycling and the proximity of bikeways focuses on residential location (Krizek, 2006), we estimate the service population for locations for where people live, learn, play, and access services. Table 6 describes the geographic boundaries of service populations for each type of destination.

Map 21. Service areas of proposed projects



Census block groups approximate neighborhoods and are used for residential service populations. School populations are measured by 1-mile buffers. This distance was chosen because a) state law does not require bussing within 1-mile of schools, b) it translates to a reasonable travel time to expect students to walk or bike to school, and c) 1 mile has been used in other analyses

(Dill and Haggerty, 2009). The entire population is included, rather than just the school aged population for three reasons: a) priority projects may not be completed while the current school age population is still in school, b) parents and families are indirectly served if their students can walk to school, and c) improvements targeted at school children can be enjoyed by anyone. Park service areas are defined as ½ mile buffer, a distance recognized by Vancouver Clark Parks & Recreation as the walkable service area of neighborhood parks, expecting that people will walk about ten minutes to access smaller parks. Finally, the service population for neighborhood services is defined as a 1-mile buffer, which roughly corresponds to a 20-minute walking distance referenced in the plan as a desirable neighborhood scale (Bicycle and Pedestrian Master Plan, page 4).

The population served is defined as the population that will have increased opportunities for physical activity as a result of priority projects. We have reason to believe that this group will benefit from increased physical activity as a result of greater access to physical activity.

The estimated current population that would be served by proposed improvements is displayed in table 7 by facility type. In unincorporated Clark County, there are about 211,800 residents. Using the service areas described above, CCPH estimates that about 95,000 or 45% of the unincorporated population will be directly served by the improvements prioritized in this plan.

Table 6. Service area definitions

Population	Geographic definition
Residential	Census block groups
School	1 mile buffer around k-12 schools
Parks	½ mile buffer around park access points
Neighborhood Services	1 mile buffer around grocery stores & supermarkets

Projects within the Urban Growth Areas (UGA) can be compared to research studies of other urbanized areas. When all projects are completed, the bikeway network density in unincorporated Clark County within UGAs will increase from 1.11 to 1.76 bikeway miles per square mile, or 59 percent. Excluding off-street paths, the bikeway density will increase from 0.93 to 1.31 bikeway miles per square mile, or 40 percent. A study of US metropolitan areas found that an increase of 1 bike lane mile per square mile is associated with a 1 percent increase in the share of commuters traveling by bicycle (Dill & Carr, 2003). If the same relationship is present in Clark County, we can expect an increase from 0.25 to 0.62 percent of commuters traveling by bicycle. This translates to an additional 240 workers commuting by

When all projects are completed, at least 95,000 residents will have increased access to opportunities for physical activity in their neighborhoods.

"Commute mode share" is the proportion of commute trips made by each mode of travel.

For example, in 2009, 78% of Clark County commuters drove alone to work (US Census Bureau, 2010).

bicycle, some of whom may have changed from sedentary to active transportation. This calculation assumes that the bicycle commute mode share in block groups in the Urban Growth Area is the same in 2009 as it was in 2000. However, of 70 block groups within the Urban Growth Area, only 13 had a bicycle commute mode share greater than zero in the 2000 census. Additionally, the study that serves as a basis for this calculation is cross-sectional and doesn't measure "before and after" effects of adding bicycle lanes, although some longitudinal studies have shown increases following the installation of bike lanes.

Table 7. Potential magnitude of impact by project

Facility Type	Impact on Physical Activity	Strength of Evidence	Potential Magnitude			
			Residential Population Served	School Population Served	Parks Population Served	Neighborhood Services Population Served
Bikeways	Positive	Moderate	31,073	22,876	11,338	12,376
Restriping	Positive	Moderate	17,242	15,078	8,413	4,966
Trails	Positive	Strong	62,540	31,652	21,241	13,348
Sidewalks	Positive	Moderate	4,655	3,973	1,909	2,401
All Projects	Positive	Moderate	94,969	53,805	33,428	28,797

Disparate impacts

Disparate impacts were assessed based on four measures of advantage: SES, Race/Ethnicity, Youth, and Older adults. For each measure, geographic areas were designated as high, medium, or low based compared to other areas of the county. These categories are identified in table 8. It should be noted that, with the exception of SES, these populations were not specific focus areas in the plan. Tables present variation in average bikeway density

Table 8. Analysis categories for determining disparate impacts

	Description	Values	# Block Groups
Income	Highest 1/3 of block groups	$76,245 - $117,968	37
	Middle 1/3 of block groups	$64,629 - $76,244	37
	Lowest 1/3 of block groups	$27,711 - $64,628	38
Race/Ethnicity	High percent non-Hispanic White	92.7% - 97.0 %	38
	Medium percent non-Hispanic White	88.9% - 92.6%	37
	Low percent non-Hispanic White	62.3% - 88.8%	37
Age: Youth (1-18)	High percent youth	30.7% - 42.2%	37
	Medium percent youth	26.9% - 30.6%	37
	Low percent youth	18.7% - 26.8%	38
Age: Older Adults (65+)	High percent older adults	12.3% - 32.3%	37
	Medium percent older adults	8.9% - 12.2%	37
	Low percent older adults	2.8% - 8.8%	38

and sidewalk mileage for each disadvantaged population. However, given the small number of proposed sidewalk miles (7.15), tables relating to sidewalk projects should not be interpreted as conclusive regarding avoidable negative differential impacts. Recommendations on how programs and policies can be implemented to avoid negative differential impacts are included in section 3.

45% of new project mileage will be in lower income block groups.

Disparate Impacts in Neighborhoods

Socioeconomic Status (SES)

There is a mix of disparate impacts among block groups based on median income. Of all new project miles, 45 percent are planned for the 33 percent of block groups with the lowest median incomes. The priority projects could therefore be said to address the existing higher health risks faced by residents of lower income block groups. However, if projects were to fully respond to disparate health risks based on SES, one would expect to see a greater proportion of project miles in middle income block groups than in higher income block groups. As evident in table 9, this is not the case.

Table 9. Proposed bikeway miles by SES

Income group	Proposed bikeway miles	Percent of total
Lowest 1/3	48.3	45%
Middle 1/3	27.0	25%
Highest 1/3	31.7	30%

There is no significant difference in average bikeway network density (bikeway miles/square mile) based on block group income categories. One-way ANOVA tests showed that, both for income quintiles and tertiles, there is no significant difference between groups. Similarly, comparing the 10 percent of block groups with the lowest incomes to the other 90 percent shows

ANOVA (analysis of variance) is a common statistical test used to determine whether there are significant differences between groups.

Table 10. Proposed sidewalks by block group SES

Block group income	Proposed sidewalk miles	Percent of all proposed sidewalk miles
Low	3.62	51%
Middle	1.25	17%
High	2.28	32%
Total	7.15	100%

slight differences. No significant correlation was found between income and existing bikeway network density, proposed bikeway miles, or future bikeway network density.

The bikeway network is currently evenly distributed among block groups by SES and will remain so following the completion of priority projects. We are unable to determine changes in sidewalk network density or continuity due to lack of data on existing facilities, but we can determine that, similar to all priority bicycle projects, there is a slight weighting toward lower SES block groups, and a somewhat lower percentage of new mileage proposed for middle income block groups than for higher income block groups.

Table 11. Average bikeway network density by block group SES

Block group income	2009 Average bikeway density	Average additional proposed	2015 Average bikeway density
Lowest 1/3	1.36	0.68	2.04
Middle 1/3	1.19	0.34	1.53
Highest 1/3	1.15	0.62	1.76
Lowest 10%	1.44	0.52	1.96
Highest 90%	1.11	0.63	1.74

Race

Obesity rates are higher for Blacks and Hispanics in Washington State (Levi, 2010). Minority status is widely cited as a risk factor for chronic disease, adding to the importance of preventing obesity among minority populations (Williams, 2008). In this respect, the plan could be seen as successful in that it preserves and expands opportunities for physical activity in racial and ethnic minority areas. However, the plan does not reinforce the positive existing conditions, in which areas with higher percent minority populations have higher bikeway network density. There are significant differences in average bikeway network density based on percent of minority population within block

Table 12. Average bikeway network density by block group percent minority

Block group percent minority	2009 Average bikeway density	Average additional proposed	2015 Average bikeway density
Low	0.34	0.48	0.82
Med	1.31	0.84	2.16
High	1.77	0.53	2.30

groups. A one-way ANOVA with post-hoc testing confirms that on average, block groups with higher proportions of racial and ethnic minorities also have higher bikeway network density. The same holds true after proposed bikeway miles are completed. However, there is no statistically significant difference in the average additional bikeway miles proposed. Correlations show the same relationship – whereas there are significant moderate correlations for existing (.45) and future (.34) bikeway miles ($p<.001$), there is no significant relationship for miles proposed. We can conclude that areas with higher percentages of racial and ethnic minorities have somewhat greater access to opportunities for physical activity through bicycling, which will continue to be the case when all proposed improvements are completed. Whether this higher level of access is commensurate with the higher health risks faced by minorities is difficult to determine due to factors that could inhibit access to these facilities, such as lack of equipment, physical barriers (such as topography), and real or perceived safety threats.

Table 13. Proposed sidewalks by block group percent minority

Block group percent minority	Proposed sidewalk miles	Percent of all proposed sidewalk miles
Low	2.32	32%
Medium	2.17	30%
High	2.66	37%
Total	7.15	100%

Sidewalks appear to be evenly distributed among block groups based on race and ethnicity, as illustrated in table 13.

Youth

There is no significant difference in average bikeway network density among block groups based on percent youth population. A one-way ANOVA confirms that this is true for existing, proposed, and future average bikeway network densities. A notable feature of the age distribution in unincorporated Clark County is that there are few contiguous areas of concentrated youth population. Indeed, the distribution of block groups shows that the percent of the population under age 20 is relatively similar among all block groups – the mean among block groups is 29 percent with a standard deviation of only 5 percent. In this case, the "high, medium, and low" designations may be less meaning-

29.1% of Clark County residents are under age 20 (US Census Bureau, 2010).

ful, but still useful in determining whether there are disparate impacts. Given the relatively uniform population of youth, disparate impacts are not likely based on residential location. Impacts based on school locations are examined separately on the following page.

As shown in table 14, the distribution of proposed sidewalks is heavily tilted toward block groups with the middle range of youth as a percent of population, followed by block groups with a high percent of youth. This reflects the fact that two of the lengthiest projects are in block groups with a medium youth percentile. Additionally, many projects straddle or border block groups of different age demographics, providing easy access to several block groups at once. Because of this effect and due to the relatively small project mileage in question, calculations on sidewalk project distribution should not be interpreted as conclusive regarding disparate impacts.

Table 14. Average bikeway network density by block group percent youth

Block group percent youth	2009 Average bikeway density	Average additional proposed	2015 Average bikeway density
Low	1.12	0.81	1.93
Med	1.29	0.71	2.00
High	1.03	0.31	1.35

Table 15. Proposed sidewalks by block group percent youth

Block group percent youth	Proposed sidewalk miles	Percent of all proposed sidewalk miles
Low	.81	11%
Medium	4.49	63%
High	1.85	26%
Total	7.15	100%

Older adults

There is no significant difference among block groups in existing or future bikeway network density based on percent older adults. However, a one-way ANOVA shows that on average, there is a significantly higher proposed bikeway network density increase among the highest percent older population block groups compared to the lowest ($p<.05$). This analysis suggests that the plan targets areas with older populations, which is consistent with the need to provide physical activity options for healthy aging.

As with youth, sidewalks appear to be skewed toward block groups in the middle range of older adults as a percent of population. In contrast to findings on youth, it appears that there are concentrations of older adults. Map 6 (page 19) shows several contiguous areas with higher percent older adult populations, especially west of I-5. The mean among block groups is 11 percent, with a standard deviation of 5 percent.

10.6% of Clark County residents are age 65 or older (US Census Bureau, 2010).

Table 16. Average bikeway network density by block group percent older adults

Block group percent older adults	2009 Average bikeway density	Average additional proposed	2015 Average bikeway density
Low	1.30	0.35	1.65
Med	0.99	0.56	1.55
High	1.15	0.94	2.09

Table 17. Proposed sidewalks by block group percent older adults

Block group percent older adults	Proposed sidewalk miles	Percent of all proposed sidewalk miles
Low	1.97	28%
Medium	3.59	50%
High	1.59	22%
Total	7.15	100%

Disparate impacts by School SES

School SES is measured by the percent of students participating in free and reduced-price meal (FRPM) programs. Of the 51 K-12 schools in unincorporated Clark County, 11 are private and no data are available on SES. Of the 40 remaining schools, participation in free and reduced lunch programs ranges from 16.9% to 68.5% of students, with a mean of 39.8%. Similar to income data at the neighborhood level, three categories of school SES were created based on tertiles (see table 18).

Table 18. School SES analysis categories

SES Category Description	Values	# Schools
Highest 1/3 of FRPM Participation	47.5% - 68.5%	14
Middle 1/3 of FRPM Participation	31.1% - 47.4%	13
Lowest 1/3 of FRPM Participation	16.9% - 31.0%	13

About half (51 miles) of all proposed bikeway miles is are within a 1-mile network buffer of a K-12 school. As shown in table 19, low SES schools seem to be favored by existing conditions, whereas high SES schools appear to be favored by the proposed projects. Middle SES schools appear not to be as well served. However, neither an ANOVA nor tests for correlations demonstrate any statistically significant relationship between average bikeway network density and school SES. Similarly, there is no significant correlation between the percent of students participating in free or reduced meal programs and bikeway network density.

Like bikeways, about half of all proposed sidewalk miles (3.5 miles) are within a 1-mile network buffer of a K-12 school. Table 20 shows that nearly half of those sidewalks planned near schools are within 1 mile of a low SES school. While this appears as a uneven distribution of new projects, this impression is diminished by the fact that only 3.5 miles of sidewalks in total are proposed near schools, and that given the lack of data on existing sidewalks, it is impossible to tell which schools are already well served.

Table 19. Average bikeway network density by school SES

School SES	2009 Average bikeway density	Average additional proposed	2015 Average bikeway density
Low SES	2.07	0.61	2.20
Middle SES	1.30	.78	1.57
High SES	1.22	1.37	2.60

Table 20. Proposed sidewalks by school SES

School SES	Proposed sidewalk miles	Percent of proposed sidewalk miles near schools
Private Schools	0.21	5.9%
Low SES	1.75	49.6%
Middle SES	0.55	15.6%
High SES	1.02	28.9%
Total	3.53	100%

Policies

Impact

CCPH finds that, if implemented, all proposed policies will support or increase opportunities for physical activity.

Strength of Evidence

Depending on the policy, there is a range of evidentiary support for determining the impact of policies. Some policies, such as "implement a variety of facility types to meet the needs of diverse users", are strongly supported by research suggesting a link between physical activity and changes in the built environment. Others are based more on specific needs, community input, or best practices.

An important consideration in the assessment of the policies proposed in the plan is that they essentially remain proposals unless codified or otherwise implemented. This leaves a broad range of uncertainty about their impact, especially considering the potential for some policies to interact with and build on each other (such as providing new facilities and encouraging active transportation). As described in the plan, these policies will be incorporated into the 2014 Comprehensive Plan update. Therefore, for purposes of this assessment we assume that the policies will be implemented. However, if policies are not implemented, any positive effects may be lost, and existing disparities may worsen.

There are 67 policies listed in the plan as objectives or actions falling under six goals. Due the variability in possible implementation strategies, we are unable to reliably assess the magnitude of health impacts resulting from policy proposals, but the direction of change and strength of evidence are listed in the table on the following page. When applicable, disparate impacts are also listed. Policies that have an indirect impact or are related to planning & funding are categorized as "supportive", while policies that are likely to directly lead to increased physical activity are listed as "positive". The strength of evidence is categorized according to the system laid out in Section 1 (summarized in table 21). In some cases, the strength of evidence is "Limited" because it is a highly specific policy and there is no specific, relevant research.

CCPH finds that, if implemented, all proposed policies will support or increase opportunities for physical activity in Clark County.

Plan Goals:

1. ***Developing a bicycle and pedestrian network***
2. ***Jurisdictional coordination***
3. ***Traffic management/ demand management***
4. ***Education, encouragement, and safety programs***
5. ***Funding***
6. ***Active transportation planning and bicycle and pedestrian supportive land uses***

Many of these policies were addressed previously in the rapid HIA, and summaries of research supporting our conclusions can be found in appendices of that document as well as appendix C of this report. Table 22 summarizes potential impacts of policies from the plan. In addition to the enumerated policies, the plan also contains policies on bicycle parking, facility design, and implementation. Impacts are discussed below in qualitative terms informed by the literature.

Table 21. Strength of evidence

Category	Description
+	Limited evidence: Few case studies, theoretically supported
++	Some evidence: Limited research, some case studies
+++	Moderate evidence: Rigorous, peer reviewed research
++++	Strong evidence: Multiple rigorous, peer reviewed research studies with similar findings

Table 22. Policy impact

Policy	Impact on Physical Activity	Strength of evidence	Disparities
1.1 Implement plan	Positive	++++	N/A
1.1.1 Complete recommended bikeway network by closing gaps and innovative design	Positive	++++	+ Age
1.1.2 Install wayfinding signage	Positive	+	N/A
1.1.3 Integrate bicycle and pedestrian facilities into new construction/reconstruction	Positive	++++	N/A
1.1.4 Provide technical assistance and encouragement to local jurisdictions	Supportive	+	N/A
1.1.5 Design a variety of bikeway facilities for all levels	Positive	++++	+ Age
1.1.6 Include health and equity in bicycle and pedestrian project prioritization criteria	Positive	+++	+ Age, SES, Race/Ethn.
1.2 Identify network that connects to city network	Supportive	+++	N/A
1.2.1 Implement continuous network of bike lanes	Positive	++++	N/A
1.2.2 Provide safe & accessible bike & pedestrian facilities that link destinations	Positive	++++	N/A
1.2.3 Implement continuous network of pedestrian facilities for all trip purposes	Positive	++++	N/A
1.2.4 Provide sidewalks on both sides in activity centers	Positive	++	N/A
1.2.5 Complete bike/pedestrian network by closing gaps	Positive	++	+ Age
1.2.6 Provide facilities on bridges	Positive	+	N/A
1.3 Provide short & long-term bike parking	Positive	+++	N/A
1.3.1 Develop bicycle parking standards	Positive	+++	N/A
1.3.2 Incentivize development of bicycle parking by offering reduced auto parking in exchange for more bike parking	Positive	+++	N/A

Table 22 continued

Policy	Impact on Physical Activity	Strength of evidence	Disparities
1.4 Increase # of bike-transit trips and pedestrian access to transit	Positive	++++	+ SES
1.4.1 Provide on-street bicycle and pedestrian connection to transit centers and bus stops	Positive	+	+ SES, Age
1.5 Develop trails within parks	Positive	++	+ Age
1.5.1 Provide on-street bicycle and pedestrian connections to trails	Positive	+++	N/A
1.5.2 Change Title 40 to include park code that guides development standards for parks	Supportive	+	N/A
2.1 Facilitate coordination among jurisdictions	Supportive	+	N/A
2.1.1 Develop tools & guidance for local jurisdictions	Supportive	+	N/A
2.1.2 Establish & maintain regular communications	Supportive	+	N/A
2.1.3 Work with jurisdictions to ID bike & pedestrian routes throughout the county, connect to city facilities	Supportive	+	N/A
3.1 Encourage use of alternative types of transportation through TDM	Positive	++	N/A
3.1.1 Publicize availability of maps and connections to transit	Positive	+	N/A
3.2 Ensure facilities are designed to most recent guidelines & best practices	Positive	++	N/A
3.2.1 Ensure compliance with ADA	Positive	++	N/A
3.2.2 Support excellence among staff by ensuring exposure to new designs	Positive	++	N/A
3.2.3 Develop and implement a county-wide training program for engineers & planners	Supportive	+	N/A
4.1 Promote bike & pedestrian safety through education, encouragement & enforcement	Positive	+++	N/A
4.1.1 Continue existing programs	Positive	+++	N/A
4.1.2 Collaborate with schools to use federal & state SRTS funds	Positive	+++	+ Age
4.1.3 Include temporary street closures as a program proposal	Positive	++	+ Age
4.2 Promote cycling and walking for transportation	Positive	+++	N/A
4.2.1 Encourage employers to provide incentives	Positive	++	N/A
4.2.2 Encourage jurisdictions to provide incentives to businesses and residents completing development that includes facilities	Supportive	++	N/A
4.3 Promote bike & ped safety through enforcement	Positive	++	+ Age
4.3.1 Stricter law enforcement	Positive	++	+ Age
4.3.2 Recognize increasing numbers of cyclists and pedestrians as a safety strategy	Positive	++++	N/A
4.4 Maintain and improve quality, operation, and integrity of facilities	Positive	++	N/A
4.4.1 Develop maintenance program	Supportive	+	N/A
4.4.2 Install continuous counting devices to track ridership goals	Supportive	+	N/A

Table 22 continued

Policy	Impact on Physical Activity	Strength of evidence	Disparities
4.4.3 Establish policies & protocols to ensure repair and construction minimize disruption	Supportive	+	N/A
4.4.4 Use crash data to monitor bike & ped safety, target 10% reduction over 20 years	Supportive	++++	N/A
5.1 Fund construction of bike/pedestrian improvements & maximize funding	Positive	++++	N/A
5.1.1 Seek funding through current sources, leverage these sources though local partnerships	Supportive	+	N/A
5.1.2 Include cost of short term projects in CIP	Positive	++++	N/A
5.1.3 Aggressively pursue grants	Supportive	+	N/A
5.1.4 Maintain current information regarding regional, state and federal funding programs	Supportive	+	N/A
5.1.5 Partner with other agencies to pursue funding	Supportive	+	N/A
5.1.6 Coordinate development of Transportation Benefit District	Positive	+	N/A
5.2 Pursue voluntary and private funding	Positive	+	N/A
5.2.1 BPAC will pursue a voluntary fund	Positive	+	N/A
5.2.2 BPAC will work to develop private partnerships	Positive	+	N/A
6.1 Increase development practices supportive of walking and cycling	Positive	++++	N/A
6.1.1 Ensure consistent review of road projects and development proposals	Positive	+++	N/A
6.1.2 Include low-speed roadway designs as bicycle and pedestrian projects	Positive	+++	N/A
6.1.3 Prioritize projects and adopt policies that increase measures of walkability	Positive	++++	N/A
6.1.4 Change title 40 to limit construction of cul-de-sacs	Positive	++++	N/A
6.1.4 Change title 40 to promote ped & bike friendly design through human-scale development	Positive	++++	N/A
6.1.5 Change title 40 to encourage a density & provisions for facilities	Positive	++++	N/A
6.2 Improve bicycle and pedestrian access to nutritious food	Supportive	++	N/A
6.2.1 Prioritize bicycle and pedestrian improvements that provide routes to grocery stores and farmers mar-kets	Supportive	++	N/A
6.2.2 Encourage grocery stores and farmers' markets to locate along existing bike pedestrian corridors	Supportive	+	N/A

Impact of Parking Standards

In addition to the above policies, the plan dedicates chapter 5 to recommended bicycle parking standards and policies. The parking proposals, if implemented, are likely to increase opportunities for physical activity and are supported by a moderate base of evidence in addition to the experience of planning experts (Pucher and Buehler, 2008; Pucher et al, 2009).

Impact of Facility Design

Facility design will impact physical activity, as it is well documented that facility types with a greater degree of separation are safer and attract more users (Pucher et al, 2009). Chapter 6 of the plan is dedicated to a matrix of best design practices, many of which are supported by increasing evidence and experience. Design practices that incorporate separation from traffic and low-traffic speeds are likely to increase physical activity, and the approach of implementing a variety of facility types is supported by research (Pucher et al, 2009; Dill and Gliebe, 2008). Although the best practices matrix identifies numerous facility types and treatments, such as bike boulevards and cycle tracks, the plan recommends only two designs, lanes and trails, as prioritized bikeway projects. It is unlikely that such a limited variety of designs will attract any new cyclists.

"One would assume that people would be more likely to walk if walking trips became more pleasant, safer, or in any sense easier, or if alternatives to walking became more costly or more difficult."
- TRB & IOM

The plan does not link the best practices matrix to any proposed facilities or policies. Instead, the best practices matrix is presented in the plan as a basis for future committee work. A design program is referenced in Chapter 6 of the plan, but it is unclear how the program relates to codified standards or adopted guidelines, as it is not referenced in the discussion of implementation in Chapter 7. In the future, development of such guidelines could increase opportunities for physical activity, but the current plan falls short of guaranteeing any changes to design standards.

A strength of the design program is the set of key principles (reproduced below) that are included as in Chapter 6.

- All roads in Clark County are legal for the use of bicyclists, except limited access interstates which specifically prohibit bicyclists.
- Bicyclists have a range of skill levels, from Type B/C to Type A.
- Facilities will be designed for the use of Type "A" cyclists and for Type "B" cyclists to the greatest extent possible.
- Design guidelines are flexible and can be applied with professional judgment by designers.
- Clark County will have a complete network of on-street bicycling facilities to connect seamlessly to the existing and proposed off-street pathways.

Consistent with research findings on the success of low-speed, separated bicycle facilities, these principles recognize a range of cycling ability and corresponding needs. However, a notable omission in these principles is any direct reference to the needs of pedestrians. With the exception of the matrix of best practices, most of the chapter heavily emphasizes bicycle infrastructure. The result is that while it is unclear how bicycle facility design guidelines will be updated and codified, it is even more unclear how the county will proceed with pedestrian design guidelines.

Impact of Implementation Strategies

The implementation strategies discussed in Chapter 8 of the plan, including funding strategies, are likely to increase opportunities for physical activity. The implementation plan contains language advocating a sustainable funding source for bicycle and pedestrian transportation and leveraging this funding to win federal and state grants. Such funding strategies would require a commitment from the county to fund and prioritize active transportation infrastructure.

Notably, the plan articulates the need to avoid any funding strategy that would create a barrier to cycling and walking, such as a bicycle registration fee. This is an important statement, as any funding strategy that makes walking and cycling less attractive than other modes of transportation would be a disincentive for physical activity.

Two of the six implementation strategies are not directly related to funding: these include a broader integration of bicycle and pedestrian planning with other planning efforts, and a commitment to collect better data on bicycle and pedestrian activity. These two strategies will likely support increased opportunities for physical activity and related tasks have been included in the 2011-2012 work plan for Community Planning.

CCPH finds that, if implemented, proposed programs will support increased opportunities for physical activity

Programs

Impact

CCPH finds that, if implemented, the proposed programs will support increased opportunities for physical activity, and that there are no negative differential impacts of these programs. Some positive differential impacts could benefit older and younger age groups.

Strength of Evidence

The proposed programs are supported by a range of evidence relating to their influence on physical activity. Strong evidence supports school programs, and limited evidence supports all other programs.

Programs were evaluated in a similar manner to policies, recognizing that their impact depends on the degree of implementation. These programs are described as near-term proposals in the plan and the newly re-formed Bicycle and Pedestrian Advisory Committee is charged with implementing them using grant funding.

There are five programs recommended in the plan, narrowed from a field of 17 originally suggested by the plan consultant. Two of these programs (see numbers 1 and 5 in table 23) are aimed at streamlining the development of new facilities and are therefore categorized as "supportive" of physical activity.

Table 23. Program impact

Program	Impact on Phys. Activity	Strength of Evidence	Disparate Impacts
1. Revise the bicycle and pedestrian advisory committee	Supportive	+	N/A
2. Create a school education & encouragement program	Positive	++++	+ Age
3. Establish a "Clarklovia"	Positive	+	+ Age
4. Establish an east county scenic tour	Positive	+	N/A
5. Improve communications within departments	Supportive	+	N/A

Process

Impacts

CCPH finds that the planning process omitted potential data inputs, thereby limiting the ability of the plan to maximize health benefits.

CCPH finds that the planning process omitted important data inputs, thereby limiting the ability of the plan to maximize health benefits.

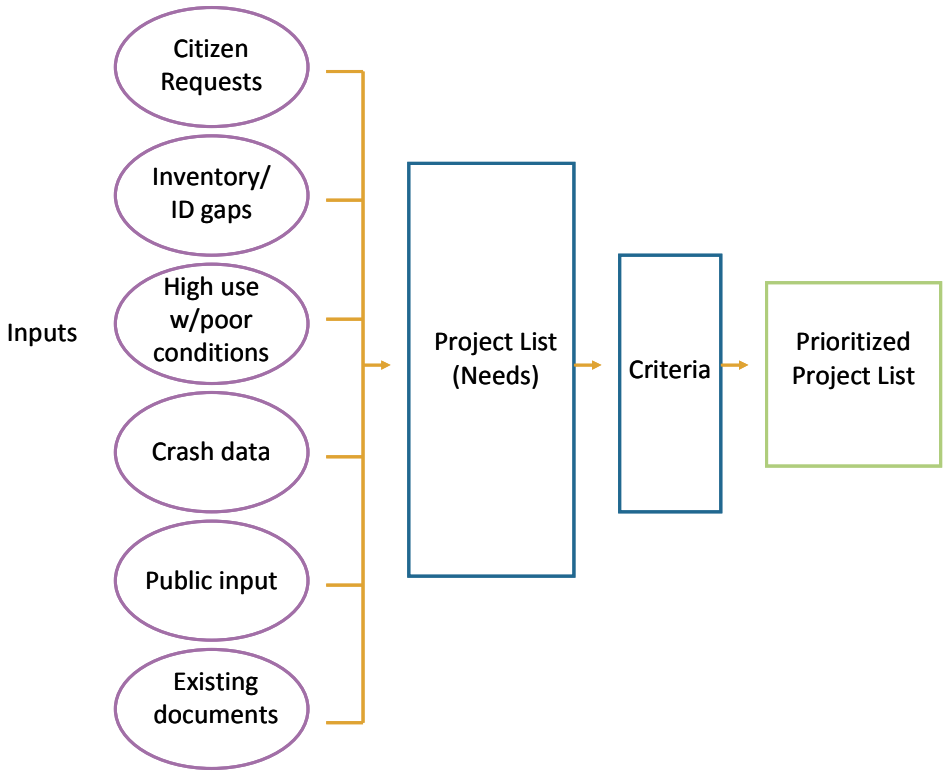
Throughout the planning process there were two areas of opportunity to maximize health benefits. First, advisory committee members were provided information on health and the built environment and encouraged by planners to find ways of maximizing health benefits through projects, policies, and programs. Second, it offered a way to improve health through empowering citizens and building social cohesion. The discussion that follows

is a description of the process and the extent to which it leveraged these two opportunities.

The planning process spanned a time period of more than 18 months. Public involvement, described in Chapter 1 of the plan, included four open houses, an online survey, a Planning Commission work session, three Board of County Commissioners work sessions, and one hearing each for the Planning Commission and Board of County Commissioners. During these outreach events, Community Planning staff discussed projects, policies, and programs with the public, focusing especially on funding strategies.

There are numerous ways to generate potential projects, policies, and programs. For this plan, the bicycle and pedestrian advisory committee drafted policies and revised them through discussions. A list of potential programs was presented by consultants, and committee members and staff selected those that seemed most feasible and effective. Projects, on the other hand, are often subject to a more quantitative analysis, as was the case in this plan. Project prioritization criteria were established by the committee, although the project list was generated from a variety of sources. Figure 3 depicts a conceptual diagram of how prioritized projects are selected. The inputs listed in this model come from other planning processes and from FHWA guidelines

Figure 3. Project List Generation



for bicycle and pedestrian planning (FHWA, 2006), and only some of them were employed in this planning process. For the both bicycle projects and pedestrian projects, four of the six strategies were used to varying degrees. In general, bicycle project list generation methods were more thorough than those used to identify potential pedestrian projects. A brief summary of project list generation for each mode is provided below.

Bicycle projects
Potential bicycle projects were generated through citizen input, an existing facility inventory, public input, and existing proposals. Citizen input accounts for a relatively minor portion of the project ideas, although many were identified by citizens at community meetings early in the planning process. Existing proposals were exhaustively compiled from all jurisdictions and Vancouver-Clark Parks. Volunteers from the Bicycle and Pedestrian Advisory Committee conducted an inventory of bicycle facilities in unincorporated areas.

Pedestrian projects
The majority of pedestrian projects are complaint/request-driven through requests made to the county's pedestrian infill program. Additional pedestrian project proposals are drawn from analysis of existing conditions and from open houses. Partial inventories have been completed for unincorporated areas, focusing on the sub-area planning areas that have recently been completed or are underway. These include the Salmon Creek and Highway 99 sub-areas.

Omitted inputs
Whereas crash data was analyzed in this HIA, it was not used as an input in project list generation for bicycle projects nor for sidewalk projects. Similarly omitted was any analysis of areas that typically receive high volumes of bicycle or pedestrian traffic, yet do not have adequate facilities. For sidewalk data, there is no comprehensive, accurate inventory of the existing sidewalk network making the identification of gaps impossible. It is possible however, that project lists from existing documents take these inputs into consideration.

Impact of the Planning Process: Maximizing Health Benefits
The project prioritization criteria appropriately focus projects where they can have the greatest impact on health. This is accomplished by targeting areas with lower socioeconomic status

and high walkability potential.
The project list generation procedure may undermine the effort to maximize health benefits of the proposed projects. Without completing a comprehensive inventory of pedestrian facilities, it is impossible to accurately map and prioritize the needs of the county. Likewise, we are unable to determine which areas are already well served by pedestrian facilities, limiting our ability to determine whether existing conditions have disparate impacts on vulnerable populations. Although safety is a prioritization criterion, it is measured only by the degree of separation offered by each proposed facility and does not take into account crash statistics. The emphasis on separation is appropriate given the importance of perceived safety in cycling and walking, but failing to include and respond to data on specific existing safety hazards may lead to missed opportunities to identify and correct these.

The policy development process considered community needs as well as research and is likely to facilitate increases in physical activity as a result. A deliberative process and multiple revisions took broad input into account in developing goals and policies, and project criteria were linked to goals and vision statements adopted by the committee. Public input is documented in the appendix of the plan.

The process of creating program recommendations was conducted by first reviewing a list of internationally recognized programs developed by a consultant, then selecting the few that appeared to be a "best fit". This selection was done by staff without explicit criteria, apparently based largely on feasibility. Staff made recommended five programs to the committee, which adopted their recommendation. This process was less transparent than the processes for developing projects and policies, so it is somewhat more difficult to judge its impacts. Whereas CCPH staff were consulted in the selection of these programs, there was no formal or explicit intent to select programs based on their potential to maximize physical activity.

Impact of the Planning Process: Building Social Cohesion
The process of developing projects, policies, and programs was largely committee-driven and highly responsive to community input, although the community of interested parties was relatively small. As a result of a large degree of control by the planning committee, the process could be characterized as a fairly

high level of citizen empowerment. However, the committee itself was formed by volunteers invited by Community Planning, and while they represent a diverse group of stakeholders and public agencies, most (13) committee members were serving in a professional capacity. An additional seven members represented an advocacy group or county committee, leaving only three unaffiliated members. We point this out not because the committee composition is in any way inappropriate or inadequate; on the contrary, the group worked diligently and productively to integrate community feedback into the plan. Rather, the composition of the group tempers our conclusion that there was a high degree of citizen empowerment throughout the process. Citizens did indeed fully participate and influence the plan, but many of them were doing so in a professional capacity. Achieving a broader base of community input was a challenge in this process, but if it could be met in the future, Clark County could create a plan with more robust community input.

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SECTION 3: RECOMMENDATIONS

As the plan is implemented and updated, there are opportunities to improve it and more fully realize health benefits. This section enumerates specific recommendations that should be incorporated either as the plan is implemented or in future updates of the plan. As in other sections of this report, we categorize recommendations as relating to projects, policies, and programs. Also included are some overarching recommendations that reflect three themes drawn from analysis of the plan.

Recommendations

1. ***Update the plan within five years.***
2. ***Use data to prioritize proposals and track progress.***
3. ***Respond to the needs of a continuum of users and trip types.***
4. ***Use innovative designs and a variety of facility types.***
5. ***Create a comprehensive inventory of sidewalks.***
6. ***Fully implement policies.***
7. ***Target zero bicycle and pedestrian crashes.***
8. ***Use crash data in project prioritization.***
9. ***Focus on low SES neighborhoods.***
10. ***Develop criteria for selecting programs.***
11. ***Use proven approaches in school programs***

Overarching Recommendations

Recommendation 1. Update the plan within five years.

Although the plan presents a 20-year vision, it prioritizes projects on a 6-year time horizon. Updating the plan could range from small-scale, ad-hoc amendments to a complete revision. An update will enable the county to revisit the prioritized projects as well as the plan vision. Additionally, updating the plan allows the community to respond to new needs and changing economic conditions.

Recommendation 2. Use data to prioritize proposals and track progress.

Quantitative indicators of progress should be adopted through the implementation of this plan and in future efforts. According to findings from the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the National Cooperative Highway Research Program, jurisdictions that successfully increase cycling and walking also use progress indicators to ensure that goals are met. Adopting indicators does not need to be tied to funding, but demonstrated success can help position the county to be competitive in grant applications. Future efforts in Clark County should include 1) objectives that lead to desirable levels of service; 2) identification of government agency implementation responsibilities and timelines; and 3) benchmarks and performance measures for assessing progress. Ensuring that the objectives of this plan are met will likely increase physical activity.

Recommendation 3. Respond to the needs of a continuum of users and trip types.

Research supports the effectiveness of using a variety of facility types to accommodate different skill levels and trip purposes. To maximize health benefits in implementation of this and future plans, increasing the number of cyclists and pedestrians is critical. Increasing the number of cyclists requires understanding their needs. Some jurisdictions have approached this by identifying a typology of cyclists ranging from the "strong and fearless" to "interested but concerned" and finally to "not interested". This approach is increasingly supported by research showing that recreational cyclists have different needs and behaviors than utilitarian cyclists, and that cyclist needs differ depending on age, gender, and skill/comfort level. Additionally, as the county population ages, we are likely to see increasing numbers of disabled individuals, emphasizing the need for universal design.

Project Recommendations

Recommendation 4. Use innovative designs and a variety of facility types.

Evidence shows that a variety of facility types, especially low-speed traffic designs, are more effective at attracting new cyclists (Pucher et al, 2009; Dill, 2009; Dill & Gliebe, 2008; FHWA, 2010). Designs such as bicycle boulevards and cycle tracks improve real and perceived safety. While many of these designs are included in the plan's matrix of best practices, they are not included in prioritized projects. A mix of low-speed traffic facility types is likely to attract cyclists and increase physical activity.

Recommendation 5. Create a comprehensive inventory of sidewalks.

Without a clear picture of existing conditions, it is difficult to identify the highest priority pedestrian projects. An inventory that includes qualitative information such as sidewalk width, presence of planted buffers, and ADA compliance would result in a better system of prioritization.

Policy Recommendations

Recommendation 6. Fully implement policies.

Many of the policies in the plan have strong potential to influence opportunities for physical activity in Clark County. To the extent possible, these policies should be codified in the county's development code or included in the work plan for various agencies.

Recommendation 7. Target zero pedestrian and bicycle crashes.

The target identified in policy 4.4.4 is a 10 percent reduction in pedestrian and bicycle crashes on a per capita basis over twenty years. If the community were to achieve this goal, bicycle and pedestrian fatalities per 100,000 population would decline from about .47 in 2009 to about .42 in 2030. Using Washington State population projections, this would result in about 2.4 fatalities in 2030, up from 2.0 in 2009. Given that such crashes are preventable, we envision a future for Clark County free of pedestrian and bicycle crashes. Adopting a target of zero pedestrian and bicycle injuries and fatalities by 2030 would be consistent with Washington State goals as articulated in Washington State's Strategic Highway Safety Plan (2010).

Recommendation 8. Use crash data in prioritization criteria.

To help accomplish a target of zero bicycle and pedestrian crashes, relevant data should be used as an element of the prioritization process. Using crash data as criteria in project list generation could lead the county to identify hazardous locations and target solutions to reduce crashes. Crash data should be in alignment with current safety criterion, which focuses on degree of separation from auto traffic. This approach would address both real and perceived safety.

Recommendation 9. Focus on low SES neighborhoods.

Data from the CAPE (Community Assessment, Planning and Evaluation) report show that lower SES residents have consistently worse health outcomes than residents of middle and high SES. One way to address this disparity is to increase opportunities for physical activity in lower SES neighborhoods.

Program Recommendations

Recommendation 10. Develop criteria for selecting programs.

Clear criteria for selecting projects are a strength of the plan, and it could be strengthened more by establishing similar criteria for programs. The plan prioritizes five program efforts to be undertaken over the next six or more years. These programs were selected by staff and adopted by the bicycle and pedestrian advisory committee without defined criteria. Future updates of the plan should establish selection criteria for programs. As with project criteria, this would facilitate staff analysis and facilitate review by advisory committee members.

Recommendation 11. Use proven approaches in school programs.

A substantial body of research exists demonstrating the effectiveness of Safe Routes to School programs. The national Safe Routes to School Partnership emphasizes the success of the 4-E approach widely recognized for its effectiveness. This approach goes beyond safety education and encouragement, citing the reinforcing effects of combining Encouragement, Enforcement, Engineering, and Education. Adopting evidence-based approaches will protect children, maximize Safe Routes funding, and prepare the county for future competitive grants.

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