12/8/2011

HEALTH IMPACT ASSESSMENT

ABERDEEN PEDESTRIAN TRANSPORTATION PLAN

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Acknowledgements

We would like to thank our community partner, Melissa Watford of FirstHealth of the Carolinas, for her assistance throughout this project. We are also grateful for the advice and assistance of Kathy Liles, Planning Director for the town of Aberdeen; Pam Silberman, Clinical Professor at UNC-Chapel Hill; and our key informants in Aberdeen who generously shared their time and expertise with us.

Introduction

Childhood and adolescent overweight and obesity are associated with chronic health problems, increased risk of adult obesity, and early morbidity and mortality (Whitlock et al., 2005). There is no single cause of childhood obesity; rather, it is the result of a complex interaction of variables. Contributing factors include genetics (American Academy of Pediatrics, 2003); behavior, including eating habits (Colorado Department of Public Health and Environment, Colorado Physical Activity & Nutrition Program, 2005; United State Department of Agriculture, 2010), physical activity (Center of Disease Control and Prevention, 2009) and screen time (United State Department of Agriculture, 2010); environment; and socio-demographic characteristics (Institute of Medicine, 2004; American Academy of Pediatrics, 2003; Ogden, Caroll & Flagen, 2008). Over the last 30 years, the prevalence of obesity has increased globally among adults and children, with a disproportionate burden on poor and minority populations. Obesity has a measurable impact on physical and mental health and quality of life, and it generates high direct and indirect costs for society (Dixon, 2010). The growing prevalence of childhood obesity and related complications merit public health intervention.

Environmental factors contributing to obesity prevention include characteristics of neighborhoods, child care settings, schools, and communities. Access to healthy food choices and a safe environment for physical activity are important characteristics of an environment that promotes health. Interventions that attempt to change human behavior have limited effects when people have no control over their environment (Hill et al., 2010). Environmental changes, however, have the potential to facilitate healthy choices regardless of personal resources. Policy and environmental approaches that make healthy choices available, affordable, and easy can extend the reach of strategies designed to raise awareness and support people who would like to make healthy lifestyle changes.

Robert Wood Johnson Foundation (RWJF) offers grant funding to local communities to target environmental determinants of childhood obesity through the *Healthy Kids, Healthy Communities* program. *Healthy Kids, Healthy Communities* aims to reach children who are at the highest risk for obesity due to their race or ethnicity, socioeconomic status, or geographic location (RWJF, 2011). In

2010, FirstHealth of the Carolinas received a grant to reduce childhood obesity in Moore County and Montgomery County, NC. In August 2011, the Town of Aberdeen in Moore County released the proposed Aberdeen Pedestrian Transportation Plan (APTP). The goals of the APTP are to create more walkable spaces, increase pedestrian connectivity, calm traffic patterns, and increase pedestrian safety (APTP, 2011). During the fall semester of 2011, our team collaborated with Melissa Watford of FirstHealth and conducted a Health Impact Assessment (HIA) to evaluate the potential impacts of the APTP on child health and health disparities in Aberdeen.

HIA is a tool to help decision-makers understand the potential health impacts of policy decisions (Dannenberg et al., 2008). In 2011, the National Research Council (NRC) assembled the Committee on Health Impact Assessment, a multidisciplinary group of professionals, to develop a guide for conducting HIA. The committee wrote a consensus definition of HIA:

> "HIA is a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population (NRC, 2011, p. 4)."

For this analysis, we used the six-step process that the committee recommended for HIA, and this report is organized according to the steps. In the first step, screening, we defined the policy issue and evaluated the need for an HIA. In the second step, scoping, we defined the health outcomes and population of interest, developed research questions, and selected our data sources and analytical methods. For the third step, assessment, we analyzed the baseline health status of the population and the potential health impacts of each recommendation in the APTP. In the fourth step, recommendations, we developed suggestions for policies and programs that could maximize the potential health benefits of the APTP. In the fifth step of HIA, reporting, we created a dissemination strategy for sharing our results. Finally, for the sixth step of HIA, monitoring and evaluation, we created recommendations for on-going data collection.

Background

Childhood obesity, especially among underserved minority populations, is a major problem that warrants public health intervention. The Centers for Disease Control and Prevention (CDC, 2011) refers to obesity as an epidemic. More than one-third of U.S. adults (over 72 million people) and 17% of U.S. children are obese, and obesity rates doubled for adults and tripled for children from 1980-2008 (CDC, 2011). Sixteen percent of children from 2-19 years of age are overweight (Ogden, Caroll & Flagen, 2008). Obesity has both immediate and long-term consequences. Rosner (2010) concluded that obesity shortens life in children and adults. Overweight children and adolescents are at increased risk for many health problems throughout life: cardiovascular disease (CVD), stroke, high blood pressure, cancer, high cholesterol, liver and gallbladder disease, sleep apnea and respiratory problems, osteoarthritis, reproductive health complications such as infertility, and mental health conditions (Cali & Caprio, 2008; Fuemmeler, Pendzich & Tercyak. 2009; Hart, Cairns & Jelalian, 2011; Noal, Menezes, Macedo & Dumith, 2011; Reilly & Kelly, 2011). Impaired glucose tolerance and other symptoms of metabolic syndrome worsen with the degree of obesity (Yeste & Carrascosa, 2011).

Epidemiologic studies have examined associations between childhood and adolescent body size, diet, and physical activity and the risk of health problems in adulthood. Unhealthy behaviors that develop early in life and persist over time increase the risk of certain types of cancer (breast, ovarian, endometrial, colon and renal) and cancer mortality (Fuemmeler, Pendzich & Tercyak, 2009). Children who were overweight or obese at 8 years of age are 7 times as likely to have CVD risk factors in adolescence than their peers who were not overweight or obese (Garnett et al., 2007). CDC (2009) reported that approximately 80 percent of children who were overweight at age 10-15 years were obese at age 25, and conversely, 25 percent of obese adults were overweight as children. CDC has also reported that if overweight begins before 8 years of age, obesity in adulthood is likely to be severe. Children with BMIs higher than the 85th percentile are more likely than children whose BMI is lower than the 50th percentile to continue to gain weight and reach overweight status by adolescence (Nader et al., 2006).

Childhood overweight also has psychological and emotional consequences. Overweight children are at an increased risk of teasing and bullying, low self-esteem, and poor body image (Ebbeling, 2002). Researchers have reported that overweight females complete fewer years of education and experience higher rates of poverty and lower rates of marriage and household income (Dietz, 1998; Maffeis & Tato, 2001).

According to the U.S. Department of Health and Human Services (USDHHS, 2001), overweight and obesity and their associated health problems have a significant economic impact on the U.S. health care system. Medical costs associated with overweight and obesity include direct and indirect costs (Wolf, 1998; Wolf & Colditz, 1998). Finkelstein, Trogdon, Cohen and Dietz (2009) have reported that in 2008, overall medical care costs related to obesity for US adults were estimated at $147 billion, and people who were obese had medical costs that were $1,429 higher than the cost for people of normal body weight. Obesity has also been linked with reduced worker productivity and chronic absence from work, and child/adolescent overweight and obesity are associated with significantly increased risk of later disability pension (Reilly & Kelly, 2011).

Screening

During the screening phase of HIA, it is important to consider whether the proposed program, policy, or plan has the potential to create beneficial or adverse health effects; whether there are sufficient resources, time, and staff expertise to conduct the HIA; and whether there will be an opportunity to apply the results of the HIA to policy decisions or implementation (NRC, 2011).

Potential for Health Impacts

The APTP (2011) includes four major strategies to improve the pedestrian environment: adding sidewalks, improving road crossings, building greenways, and traffic calming. The APTP offers 13 specific recommendations for improvements at various locations in Aberdeen. This HIA was solicited by Melissa Watford of FirstHealth of the Carolinas because many of the risk factors for obesity can be traced

to the built environment, and changes to the pedestrian infrastructure in Aberdeen have the potential to increase physical activity and prevent obesity among local children.

Feasibility

Our team was available to work on the HIA for approximately 12 weeks, which limited our ability to collect primary data or perform complex quantitative modeling to predict health effects. However, we had access to existing demographic and health status data, including qualitative data that had previously been collected by FirstHealth and the Town of Aberdeen. By analyzing these existing sources, reviewing existing literature, and strategically collecting new data, it was feasible for our team to conduct a rapid HIA to offer qualitative predictions and recommendations.

Opportunities to Influence Policy Decisions

Although the APTP is complete, there will be opportunities to incorporate health information into future decisions about the implementation of the plan and supporting policies. We see two major opportunities for this HIA to influence policy decisions in the future. First, we hope that we can provide guidance to town leaders about the importance of each recommendation in the APTP for children's health. Since there are thirteen separate recommendations included in the APTP, it is likely that town leaders will have to prioritize projects, and they should consider child health as they determine which recommendations to adopt first. Second, the built environment is not the only factor that influences physical activity and child obesity. We will offer recommendations for additional policies and programs that can be implemented to maximize the benefits offered by the new and improved pedestrian infrastructure.

Screening Summary
The Aberdeen Pedestrian Transportation Plan could have significant impacts on community health in Aberdeen. The HIA is feasible because of existing data and research and the availability of a student team to complete the assessment, and it is useful because it can be used to guide implementation of the plan in the future.

Scoping

The scope of this HIA was determined collaboratively by Melissa Watford of FirstHealth and the UNC student research team. The definition of health has broadened over time, and the World Health Organization (WHO), defines health as "a state of complete physical, mental, and social well being, not merely the absence of disease or infirmity." With such a broad definition of health, it is vital to narrow the population of interest and the specific health outcomes of interest in the scoping phase. In this phase, we also developed research questions, reviewed existing data sources, selected data collection methods to gather new data, and gathered stakeholder input to inform our assessment and recommendations.

Target Population

Our population of interest includes all children between the ages of 5 and 14 who live in Aberdeen. In Moore County, 20% of children between the ages of 5-14 are obese, and 16% are overweight (RWJF, 2010). As described above, overweight and obese children face a variety of physical and psychological health problems in childhood and adulthood. For these reasons, it is important to conduct a health impact analysis specifically to address the impact of the APTP on children.

We have paid particular attention to include traditionally underserved children of minority race and low socioeconomic status. Certain ethnic minority and socioeconomic populations have increased rates of childhood overweight (Institute of Medicine, 2004). Approximately 40% children ages 5-17 years in Moore County and Montgomery County live near or below the federal poverty level (RWJF, 2010). Low income families face numerous barriers to health-promoting behavior including food insecurity, lack of safe places for physical activity, and inconsistent access to healthy food choices (American Academy of Pediatrics, 2003). Recent reports also indicate racial disparities in childhood overweight, with the greatest prevalence among Mexican American boys and African American non-Hispanic girls. With both sexes combined, 21 percent of both Mexican Americans and African American non-Hispanics are overweight, compared to 15 percent of white non-Hispanics (Ogden, Caroll & Flagen, 2008).

Health Outcomes

In the short term, we examine the impact that the Aberdeen Pedestrian Transportation Plan will have on children's physical activity, including recreation and active transportation to school. Many studies have demonstrated an inverse association between physical activity and body weight (Ebbeling et al., 2002; Thorp et al., 2011). In other words, children who participate in more moderate and vigorous activity are less likely to be overweight or obese. Obesity develops when energy intake exceeds energy expenditure over time and excess energy is stored as fat. In the long term, we are interested in the impact that the APTP will have on childhood overweight and obesity.

Research Questions and Methods

The following research questions guided our HIA:

- What features of the built environment encourage and/or discourage walking and biking among elementary and middle-school aged children?
- What are the current barriers to walking and biking for recreation and transportation for children in Aberdeen?
- How will the Aberdeen Pedestrian Transportation Plan change the built environment? How are these changes likely to affect walking and biking among children in Aberdeen?
- During the implementation of the Aberdeen Pedestrian Transportation Plan, how should decision-makers prioritize projects to have the greatest impact on improving child health and reducing health disparities?

HIA methods may include quantitative methods (e.g. modeling of health effects), qualitative methods (e.g. focus groups and interviews), or a combination of both (NRC, 2011). To answer our research questions, we evaluated peer-reviewed literature, collected observational data during a windshield tour of Aberdeen, mapped children's activity spaces using ArcGIS, and gathered stakeholder input through key informant interviews and survey data. For this HIA, it was not feasible to create quantitative forecasting models to predict the impact of built environment changes on physical activity. As a result, we can make qualitative predictions about the direction of change, but not the magnitude (Dannenberg et al., 2008).

Stakeholder Engagement

Stakeholder engagement is an important part of the HIA process, but rapid assessments are often forced to limit stakeholder input because of time or resource constraints. Since this HIA was conducted in a relatively short period of time and the authors were located in Chapel Hill, there were limited opportunities to engage stakeholders in this analysis. However, there are three ways that we incorporated stakeholder opinions into this HIA.

First, we reviewed the community engagement section of the APTP and extracted relevant data. To guide the development of the APTP, the Town of Aberdeen, the North Carolina Department of Transportation, and the Division of Bicycle and Pedestrian Transportation developed a Steering Committee, held two public forums, collected public comment cards, and hosted a meeting with business leaders. Unfortunately, it is not possible to tell whether the responses came from families with children. However, half of the responses came from residents between the ages of 26-45 years, the group most likely to have elementary or middle-school aged children. We incorporated data from the public comment cards (n=94) into our assessment below.

Second, we analyzed data that was collected from Aberdeen Elementary School students earlier in the year by Melissa Watford of FirstHealth. Students between the ages of 8-11 years completed surveys about their walking habits and their perceptions of pedestrian safety. They also participated in a photovoice project. Photovoice is a method of encouraging community engagement in which participants are given cameras and asked to photograph aspects of their community (Wang and Burris, 1997). The photographs are used to help community members tell stories about the strengths or weaknesses of their community. In Aberdeen, children walked outside in teams, observed and photographed pedestrian conditions, and wrote short narratives explaining their photographs.

Finally, in October and November 2011, we conducted key informant interviews with five town leaders from education, government, and business who were knowledgeable about children's health and lifestyles in Aberdeen. We asked our informants to describe popular destinations in town for children, the current barriers to walking and biking for transportation, and their recommendations for how the town

could encourage more walking and biking. We have incorporated their feedback into the assessment and recommendations sections.

Scoping Summary
This HIA considers the impact of the Aberdeen Pedestrian Transportation Plan on physical activity, overweight, and obesity for Aberdeen children, ages 5-14 years. Our data sources include quantitative health behavior data from past community health assessments, qualitative photovoice and survey data from children at Aberdeen Elementary School, spatial data (maps) from the local government. In addition, we conducted a literature review, collected qualitative data through key informant interviews, and conducted a windshield tour to gather observational data.

Assessment

Baseline Health Status and Health Behaviors

Aberdeen has a total population of 5,810 (males 2,752 and females 3,058). The estimated median household income is $32,706, the median house value is below the state average, and the poverty rate is much higher for black residents than for white residents (City-data.com, 2009). As mentioned previously, 20% of children between the ages of 5-14 years in Moore County are obese, and 16% are overweight (RWJF, 2010). The prevalence of adult diabetes is 10.2%, compared to the North Carolina state rate of 9.8%. More than half of Moore county adults (51.3%) are sedentary; they participate in less than one hour of physical activity daily (Moore County Health Department, 2009). According to our key informants, it is rare for Aberdeen children to walk or bike to school. No children bike to Aberdeen Elementary School, and only about 10 students walk. Some students occasionally ride bikes to Southern Middle School.

Many Moore County residents feel that it is important to improve walking conditions in Aberdeen and the town should consider non-automobile transportation a priority (APTP, 2011). Of the 94 residents who submitted surveys during the development of the APTP, 93% rated the current walking conditions in Aberdeen as fair or poor. However, 93% of residents reported that they would walk more if sidewalks, trails, and roadway crossings were provided for pedestrians. Residents are interested in reaching a variety of destinations on foot, including downtown (76%), Aberdeen Lake Park (64%) and other parks (54%), restaurants (55%), and shopping (51%), but fewer respondents reported interest in walking to work or school (17%) (APTP, 2011).

Impact of the Built Environment on Walking and Biking

The design of communities influences physical activity among residents (Saelens et al., 2003). In highly "walkable" neighborhoods, many people live close to shopping, recreational facilities, and government services, and they can easily find a direct route to reach those places. These neighborhoods often have multi-family housing, mixed land use, and highly connected streets arranged in a grid pattern. In less walkable neighborhoods, residents rely more heavily on their cars for transportation. There are long distances between housing and stores, and there may also be high-speed roads, long blocks and cul-de-sacs that do not connect to other roads (Sallis and Glanz, 2006).

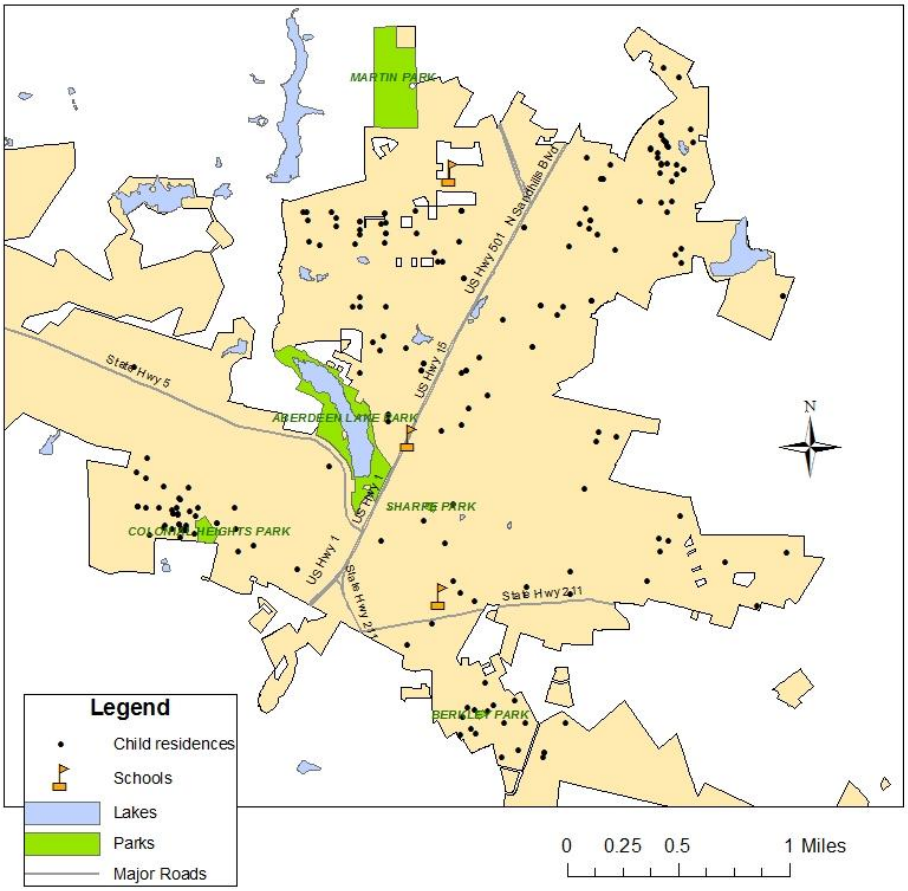
For children, it is important to consider different types of physical activity, including recreation and active commuting to school. Parks, open spaces, and recreational facilities provide opportunities for recreation, and some studies have found an association between the number of parks in a child's neighborhood and the child's daily physical activity (American Academy of Pediatrics, 2009). Children are more likely to walk to school if they live in neighborhoods with more sidewalks. Sallis and Glanz (2006) observed that in several communities in California, more children walked or biked to school after local officials made improvements to road crossings and sidewalks. If the community is not safe for pedestrians, fewer children walk to school. Thus, changes to the pedestrian landscape can increase active commuting among children who live within a reasonable walking distance from school.

Activity Spaces for Children in Aberdeen

The activity space is the space where people spend time, including home, school, work, retail establishments, and recreational facilities (Cromley & McLafferty, 2002). When activity spaces are well-connected with pedestrian walkways, people are more likely to walk for transportation (Community Preventive Services Task Force, 2010). Figure 1 shows the locations of the common activity spaces for children in Aberdeen. Key informants stated that children, particularly young children, spend most of their time in their own neighborhoods, often accompanied by their parents. Children's homes are scattered throughout Aberdeen, with one cluster near Colonial Heights Park and one cluster in the northeastern corner of town. There are also many children living in the area south of Martin Park near Southern

Middle School and in the southern area near Berkley Park. Away from home, children spend time at Aberdeen Lake Park and other neighborhood parks, schools, and the downtown area. Older children occasionally visit Thomas Tire, which offers air for bicycle tires, and retail establishments (e.g. McDonalds, Starbucks) towards the northern end of town. Currently, according to our key informants, children rarely travel to these destinations by walking or biking.

Figure 1. Activity spaces for children in Aberdeen, NC



Barriers to Walking and Biking in Aberdeen

Through our observations, interviews, and analysis of secondary data, we identified five major barriers that prevent children from participating in active transportation in Aberdeen: 1) lack of sidewalks, 2) lack of street crossings, 3) parental perceptions of safety, 4) prohibitive distances to destinations, and 5) inconvenience and time constraints.

Lack of sidewalks. Many key streets in Aberdeen do not have sidewalks. Streets without sidewalks include Poplar Street, a major road leading to the downtown area, Elm Street/Lakeshore Drive, which connect Aberdeen Lake Park and Aberdeen Elementary School, and Johnson Street, the main road leading to Southern Middle School. When elementary school students conducted a photovoice project on pedestrian safety in Aberdeen, several student teams noted that sidewalks were missing, cracked, or narrow and recommended repairing or adding sidewalks. During the public comment period for the APTP, 76% of survey respondents felt that the lack of sidewalks and trails was a barrier to walking (APTP, 2011).

Lack of street crossings. Our key informants reported that traffic along US Highway 1 is a barrier to active transportation in Aberdeen. At the center of town, US Highway 1 accommodates between 24,000 and 28,000 vehicles daily (NCDOT, 2010). The road bisects the town, separating eastern residential neighborhoods from Aberdeen Lake Park and Aberdeen Elementary School and western residential neighborhoods from the downtown area. On the APTP public comment survey, significant percentages of residents cited automobile traffic and speed (61%), lack of crosswalks (42%), and aggressive motorist behavior (41%) as barriers to walking (APTP, 2011). Elementary school students reported that they felt unsafe crossing streets because there were no crosswalks, and several teams noted that street signs were faded or difficult to see. In an illustrative comment, one student team wrote, "We felt unsafe when we were walking here [near US 1]. We need sidewalks, crosswalks and stop signs to make this intersection safe."

Perceptions of safety. Individual perceptions of the environment are equally as important as objective measures of the environment in influencing behavior (Sallis et al., 2006). Perceptions of safety in Aberdeen will continue to influence behavior, even as technical safety improvements (e.g. sidewalks, crosswalks) are made to the pedestrian environment. As one key informant said, "The pedestrian plan is great, as long as people think that it's safe." Several key informants noted that parents would not allow children in elementary school to walk alone, even if there were suitable sidewalks and road crossings. For example, one informant suggested that the pedestrian tunnel crossing to Aberdeen Elementary School is

underused because of vandalism and the fear of strangers possibly hiding in the tunnel. Children younger than 11 or 12 are generally accompanied by parents when they leave their homes, whether they are traveling to school, playing in the park, or walking around their neighborhoods. When children are in middle school, their parents may be more comfortable allowing them to walk or bike alone.

Prohibitive distances to destinations. Although Aberdeen is a relatively small town, it is prohibitively far for some families to walk to shopping, downtown, parks, or school. One key informant reported that the children she observes walking in the downtown area are usually children who live in the immediate neighborhood. Neighborhood parks, including Sharpe Park and Berkley Park, are most often visited by children who live within a few blocks. Figures 2-4 show the residences of children who attend each school in Aberdeen, with a one-mile radius drawn around the school. Although the maps only include a sample of students (1st graders for Aberdeen Primary School, 3rd and 5th graders for Aberdeen Elementary, and 7th graders for Southern Middle), they show that a large proportion of students live farther than one mile from their school. Two key informants felt that people would walk more if there were more places within easy walking distance. One town leader explained that her vision was for people to be able to go "from their homes to various destinations, like the library, the post office…parks, church, without having to use motor vehicles."

Inconvenience and time constraints. One key informant stated that people do not walk often because driving reflects "the culture we live in." It takes longer to travel to school, parks, and recreational facilities on foot than by car. Many Aberdeen parents work, and some are single parents. There are many military families in the area, and these families may be temporarily headed by one parent while the other is deployed. Aberdeen parents are busy, and it saves time to use the car to transport their children to school, sporting events, and after-school activities.

Figure 2. Residences of 7th grade students within one mile of Southern Middle School

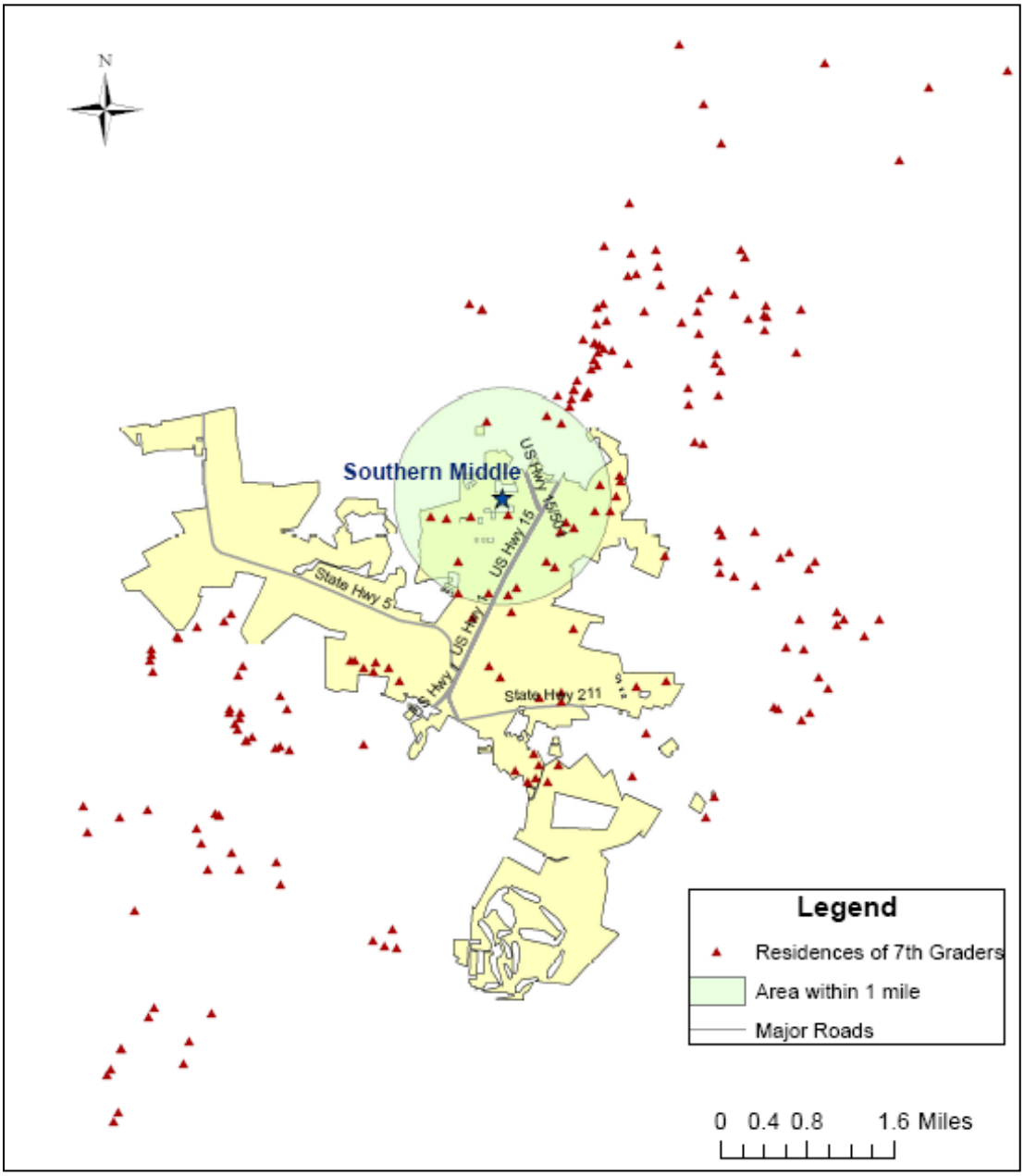


Figure 3. Residences of 3rd and 5th grade students within one mile of Aberdeen Elementary School

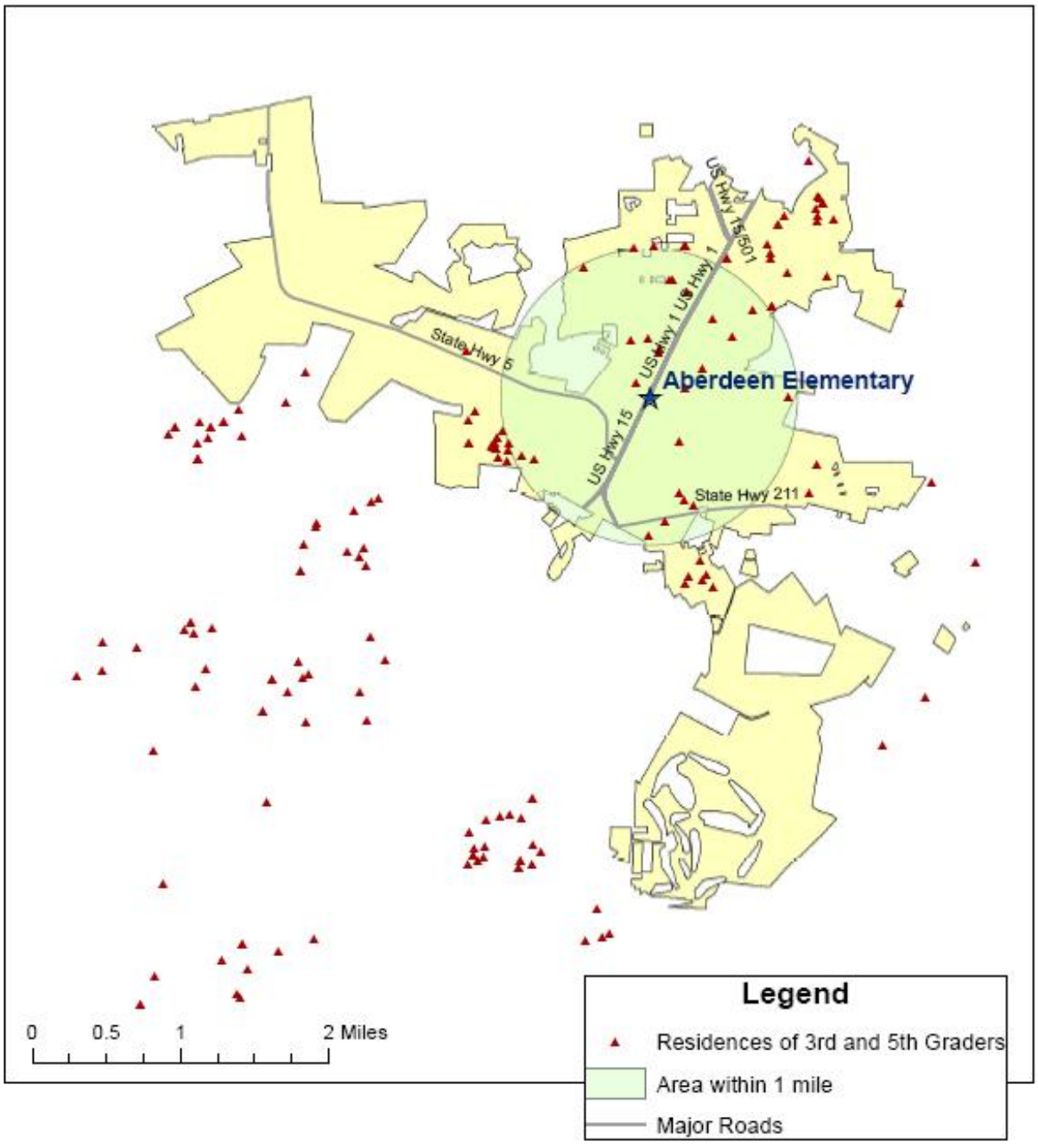
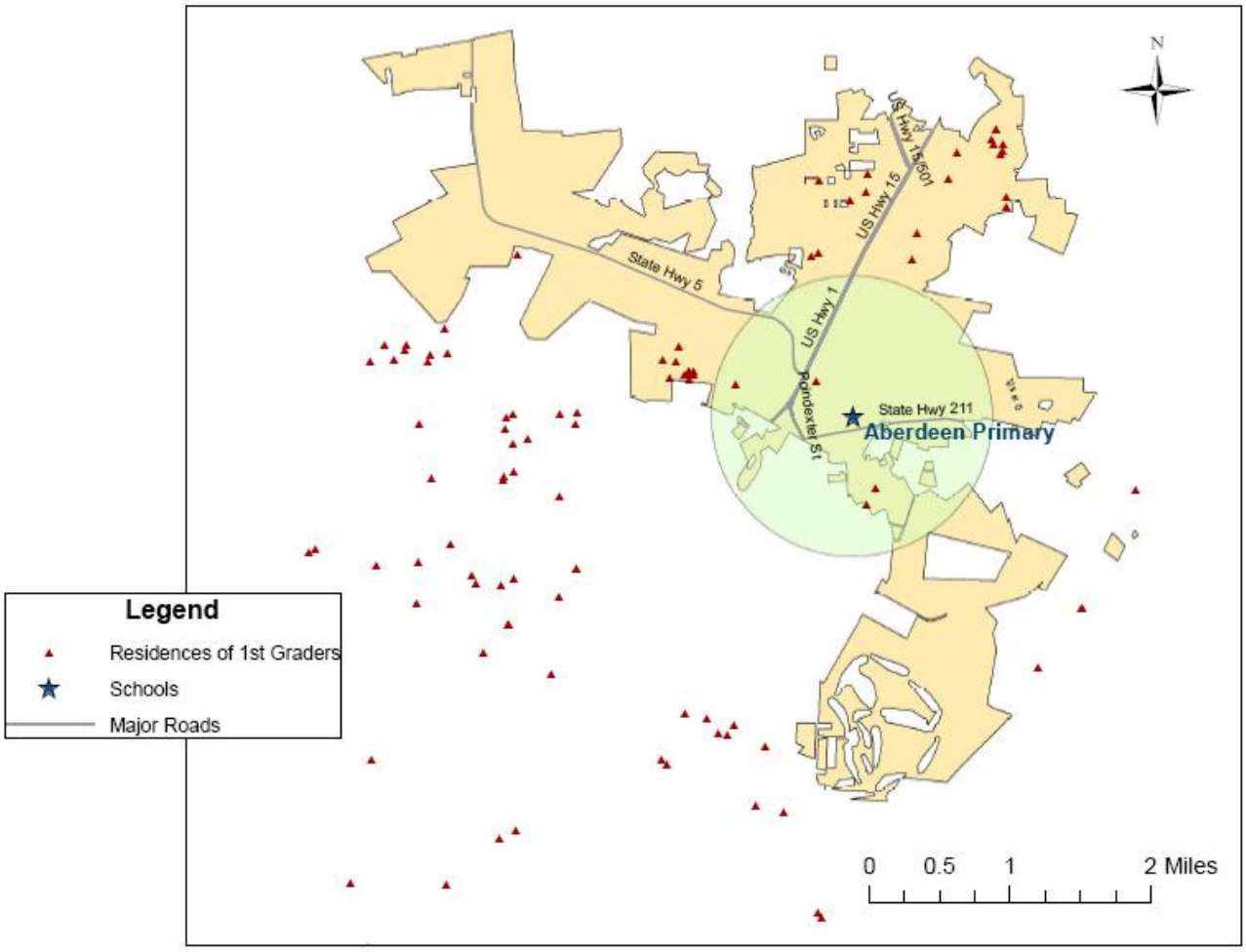


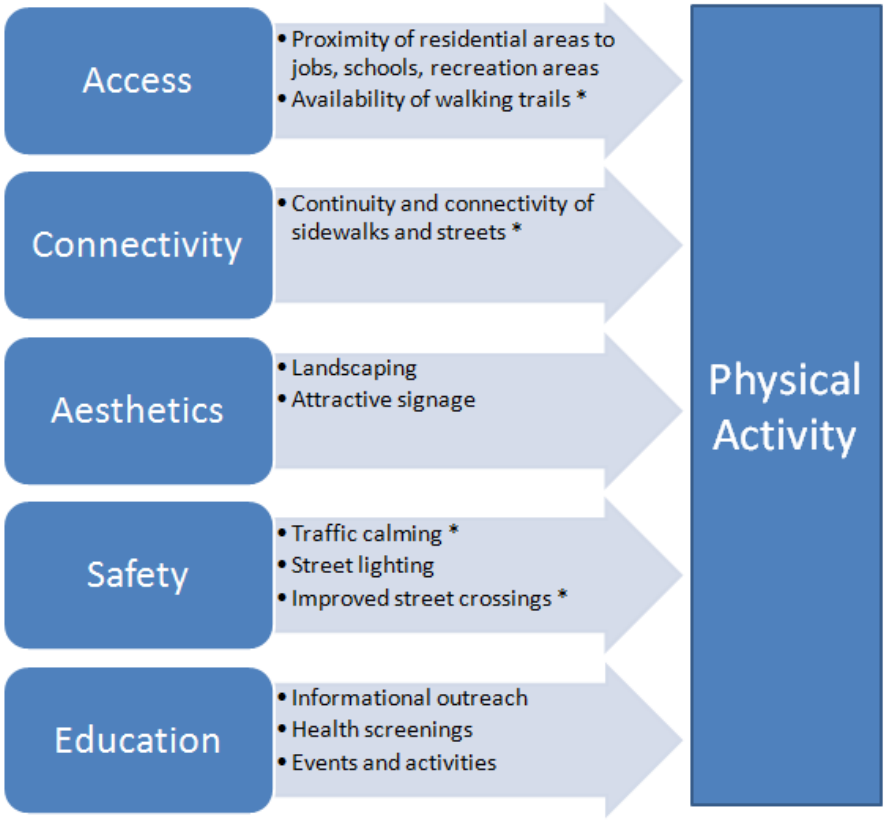
Figure 4. Residences of 1st grade students within one mile of Aberdeen Primary School



Health Implications of the APTP

Overall, the APTP is likely to have a positive impact on children's physical activity because it uses evidence-based strategies to change the built environment. Figure 5 shows the environmental and policy interventions that are recommended by the Community Preventive Services Task Force (2010) to increase physical activity, and the APTP includes several of the recommended interventions. Specifically, the APTP will improve access, connectivity, and safety by addressing the availability of walking trails, continuity and connectivity of sidewalks, traffic calming, and improved street crossings.

Figure 5. Interventions to increase activity recommended by the Community Guide



* Indicates an intervention included in the Aberdeen Pedestrian Transportation Plan

Figure 6 shows the existing sidewalk and the new sidewalks that are proposed in the APTP. This map shows that the new sidewalks will improve connectivity between children's activity spaces. When the new sidewalks are complete, there will be a continuous path from each quadrant of town to central

Aberdeen, where Aberdeen Lake Park and the downtown area are located. The new loops of sidewalks on both sides of US Highway 1 in southern Aberdeen will be particularly beneficial for low-income children. The southwestern loop will serve the cluster of children living near Colonial Heights Park in the Roseland Road mobile homes and the affordable housing units of Woodgreen Apartments. The southeastern loop will connect the low-income neighborhoods near Berkley Park to the downtown area.

Figure 6. Existing sidewalks and proposed sidewalks of the APTP

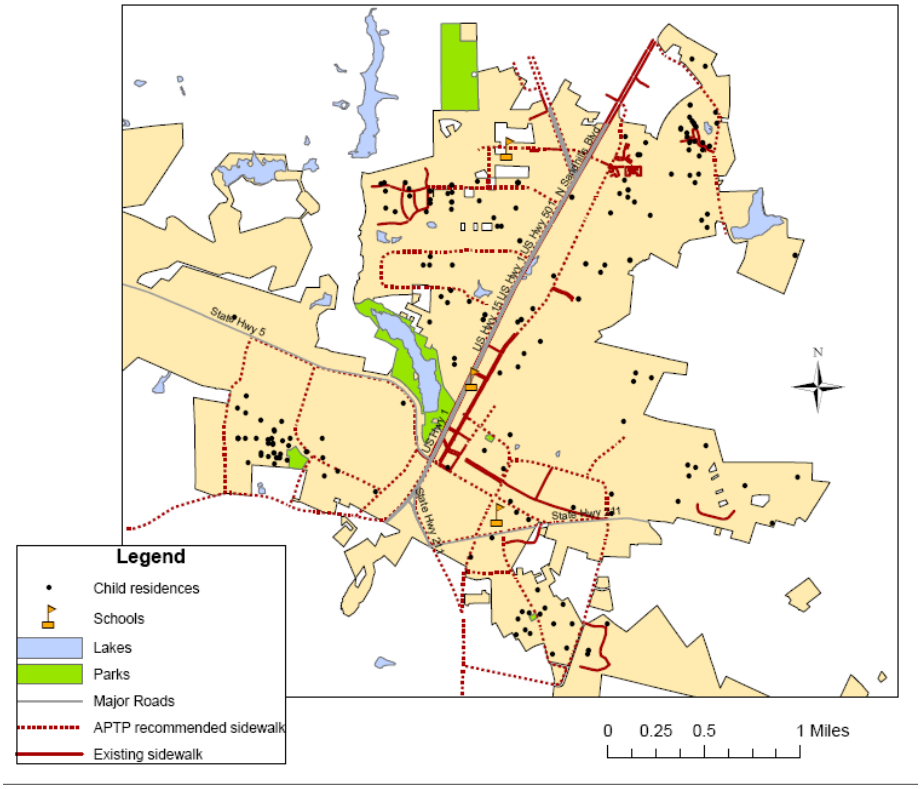


Table 1 provides a more in-depth assessment of the impacts of the APTP. The table lists each of the 13 recommendations in the APTP and offers a specific assessment of the most likely affected populations and potential health impacts of each recommendation.

Table 1.

Plan Recommendations	Affected Populations	Potential Health Impacts
1. Aberdeen Lake Park to Downtown (US 1 crossing)	Pedestrians wanting to cross US 1 between Aberdeen Lake Park and Downtown at the intersection of Maple Street and US 1	-More pedestrians walking and exercising between Aberdeen Lake Park and Downtown -Reducing unsafe crossing of US 1
2. Aberdeen Creek Trail	Pedestrians such as those using the existing Aberdeen Lake trail, students from the Aberdeen Middle School and Aberdeen Elementary School neighborhoods, and Downtown area	-More residents walking and exercising along Aberdeen Creek, and more children walking to school
3. Poplar Street sidewalk	Pedestrians traveling between Downtown to the south near Peach Avenue and the shopping area north near Johnson Street; a parallel, less-traveled alternative to residents east of US 1	-More residents walking and exercising between Downtown and the shopping area near Johnson Street -Reducing unsafe crossing and traveling along US 1
4. Johnson Street sidewalk	Pedestrians, primarily residents and students, that walk regularly between Southern Middle School and commercial destinations near US 15-501 along Johnson Street	-More residents walking between Southern Middle School and commercial destinations near US 15-501 -Reducing unsafe travel along Johnson Street
5. Greenway to Rays Mill Pond	Pedestrians traveling to Rays Mill Pond and to other points of interest such as Paint Hill Preserve, Malcolm Blue Farm, and Bethesda Cemetery	-More residents walking and exercising to Rays Mill Pond
6. Downtown to Malcolm Blue Farm Greenway	Pedestrians traveling between Sycamore Street, in Downtown, to Bethesda Road, to connect downtown residents to the historic destinations of Malcolm Blue Farm and Bethesda Cemetery	-More residents walking and exercising between Downtown and Malcolm Blue Farm
7. Maple Street Improvements	Pedestrians on Maple Street between US 1 and Sycamore	-More residents walking and exercising on Maple Street between US 1 and Sycamore -Reducing unsafe crossings
8. Aberdeen Elementary entrance	Pedestrians, mainly students and parents, using the US 1 underpass to Aberdeen Elementary School and walking through the school parking lot	-More students walking to school -Reducing unsafe crossing of the Aberdeen Elementary School parking lot -Increasing accessibility for a broader range of the population
9. US 15-501 improvement	Pedestrians in the area of US 15-501 and Johnson Street around the grocery stores and fast-food restaurants, including students from the middle school	-More residents and students walking in the area of US 15-501 and the shopping area near Johnson Street -Reducing unsafe crossing and travel of US 15-501 and Johnson Street

Table 1. (continued)

Plan Recommendations	Affected Populations	Potential Health Impacts
10. US 1 Sidewalk and crossing	Pedestrians along US 1	-More residents walking and exercising along US 1 -Reducing unsafe crossing of US 1
11. South Street improvement	Pedestrians along South Street in Downtown	-More residents walking and exercising Downtown on South Street -Reducing unsafe crossing and travel along South Street
12. Downtown railroad crossing improvement	Pedestrians crossing the railroad at Main Street and South Street in Downtown	-Reducing unsafe crossing of the Downtown railroad
13. Elm Street sidewalk	Pedestrians on Elm Street walking to Aberdeen Elementary	-More residents and students walking between neighborhoods east of Poplar to Aberdeen Elementary School -Reducing unsafe crossing and travel along Elm Street

Overall, the APTP provides new opportunities for children to participate in physical activity by creating new sidewalks and road crossings to link residential neighborhoods to schools and parks. These new linkages will make it safer and easier for some children to commute to school and recreational facilities on foot.

Limitations of the Assessment

One limitation of our assessment is the lack of literature on child activity and the built environment. Many of the studies to date have involved adults only. It is only recently that researchers have begun to study the impact of the built environment on active transportation to school and other topics related to child health (Sallis et al., 2006). It is also difficult to predict the changes in physical activity based on certain pedestrian transportation infrastructure improvements and changes. There have been several studies on the association between the built environment and physical activity, but very few studies demonstrate a causal relationship between the two (Williams, 2007).

There are also many factors that influence physical activity beyond the built environment. As we discussed earlier, the APTP does not address some of the current barriers to walking: long distances

between destinations, parent perceptions of safety, and time constraints for busy families. With limited time to engage with community members in Aberdeen, it is difficult for us to determine how many families experience these barriers and whether they will prevent people from taking advantage of the new pedestrian facilities. Pilots of these changes will need to be implemented in the community to get feedback and measure the effect of the improvements on physical activity.

Finally, it is difficult to say with certainty whether the APTP will have a measurable impact on long-term health outcomes of childhood overweight and obesity. Although the improvements present new opportunities for physical activity, there are many other factors beyond activity levels that contribute to the obesity epidemic. Without examining other factors, it is not possible to make predictions about likely changes in children's weight status.

Assessment Summary

Based on the current health status of Moore County residents and their opinions on walking conditions for children, non-automobile transportation is a priority for Aberdeen. In order to encourage walking, it is important to improve community design and create activity spaces for children. The barriers children face to walking include lack of sidewalks, lack of street crossings, parental perceptions of safety, prohibitive distances to destinations, and inconvenience and time constraints. The APTP addresses some of these barriers by ensuring walking trail availability, continuity and connectivity of sidewalks, traffic calming and improved street crossings. The limitations of this assessment include the lack of literature on child activity and the built environment as well as the difficulty in predicting health outcomes with precision.

Recommendations

A comprehensive approach to encouraging physical activity and preventing childhood obesity includes strategies that target individuals, social environments, and community policies, as well as the physical built environment (Sallis et al., 2006). According to Sallis and colleagues (2006), "the most powerful interventions should (*a*) ensure safe, attractive and convenient places for physical activity, (*b*) implement motivational and educational programs to encourage use of those places, and (*c*) use mass media and community organization to change social norms and culture" (p. 299). The APTP is a promising strategy to make improvements to the built environment, and additional policies, programs, and strategies could maximize its impact on child health. The APTP recommends programs that fall into three categories: education, encouragement, and enforcement. All of the recommended programs would

benefit public health in Aberdeen. Below, we have selected one strategy from each category that would have the greatest impact on child health.

Education: Public Information Campaign

Figure 7. Durham County park sign

The APTP recommends that the town distribute information about pedestrian safety, and the Community Guide (CDC, 2010) suggests educational outreach as a strategy to increase physical activity. As mentioned above, parent perceptions of safety influence children's walking and biking habits. As safety improvements are made to the pedestrian infrastructure, these changes could be publicized in a variety of ways to encourage Aberdeen residents to walk more. As the APTP recommends, the town could distribute bumper stickers, buttons, flyers, and other promotional materials with safety information. Also, signs could be used to mark pedestrian zones and highlight routes to local parks (Figure 7). Print advertisements in local publications, school and church newsletters, and billboards could carry messages that promote active transportation and walking for recreation. These messages could also address the perception that walking is inconvenient and time-consuming by suggesting ways that families can incorporate short bursts of activity into their daily routines.

Encouragement: Safe Routes to School

Based on our interviews and surveys from school children, it is clear that very few children walk or bike to school in Aberdeen, for a variety of reasons. Safe Routes to School (SRTS) is a national program that supports community-driven efforts to encourage active transportation to school (AASHTO, 2011). It encourages communities to organize advocacy groups, identify barriers to active transportation, and devise creative solutions that are appropriate for their settings. The APTP and this HIA would be a helpful starting point for a SRTS group, as these reports have identified many of the current barriers to active commuting. Since some parents may not have time to walk with their children, but are concerned about children walking alone, Aberdeen might consider a "walking school bus," a group of children and supervising adults who walk to school together. In addition to brainstorming creative solutions to increase

walking to school, creating a STRS group would be an excellent opportunity for community organizing. Bringing together community members who support STRS could raise awareness about active lifestyles for children and build capacity for future health promotion efforts. As mentioned earlier, many students live too far from school to commute on foot and need additional opportunities for activity. A SRTS group could organize community events, like fun runs and bike rides, for families. Since most children, particularly young children, do not spend much of their leisure time away from their parents, it is important to have a community group that sponsors family-based programs to encourage physical activity. Keeping in mind that parents have busy schedules, it will be important to conduct formative research to determine the best times to hold events.

Enforcement: Crossing Guards and Patrol Officers

The schools in Aberdeen are located near major roads. Aberdeen Elementary School, in particular, is adjacent to US Highway 1. Although there is a tunnel under the road, there is still a need for a crossing guard as children approach the school. The APTP recommends trained crossing guards for peak school hours and peak tourist season for beach traffic (APTP, 2011). Crossing guards would increase safety for children and offer peace of mind for parents who may allow their older children to walk to school alone. Since there are often events and group gatherings in Aberdeen Lake Park when the weather is pleasant, it may also be beneficial to have a crossing guard on weekends during the summer to facilitate travel between the downtown area and the park. In addition, town police officers are needed to patrol pedestrian facilities and protect them from vandalism and crime.

Support from Aberdeen Organizations and Leaders

In any community-wide initiative aimed to improve the health status of the population, it is important to include several organizations and leaders that will support the recommendations, implementation, and sustainability of the project. In Aberdeen, the most important of these are the Aberdeen Parks and Recreation Department and local schools. These organizations have the ability to advocate for the use of pedestrian transportation improvements in the community. Additionally,

community churches and other community organizations may also be utilized to promote these improvements through their work with residents and students in Aberdeen.

Evaluation and Monitoring

The improvements made to the pedestrian transportation infrastructure should be evaluated as they are implemented to determine effectiveness and opportunities for future improvement. The most practical ways to evaluate these changes, especially those directly impacting students and routes to school, are to track the number of students that walk or bike to school and to monitor child fitness. This data is already collected by schools in Aberdeen and could be assessed to determine if the infrastructure improvements have impacted the health and physical activity of students. Additionally, health data for other members of the population can be collected through community health assessments and surveys of residents about health status, physical activity, and use of pedestrian infrastructure.

Recommendations Summary
Implementing the APTP in a timely manner is recommended to increase physical activity and promote community health in Aberdeen. To maximize public health benefits, improvements to the pedestrian infrastructure should be publicized to parents and children in the community. Building a community coalition to start a Safe Routes to School program could bring health-conscious families together to advocate for pedestrian and bike-friendly policies and programs. Enforcement of traffic laws and pedestrian laws is important to promote a culture of safety for pedestrians.

Reporting

The final phase of conducting a Health Impact Assessment is disseminating the results to decision-makers. This written report will be delivered to Melissa Watford of FirstHealth for distribution to any interested parties. In addition, the HIA authors (UNC student research team) will create a PowerPoint presentation summarizing the results. The presentation will be delivered to students, faculty, and guests associated with our course in the Department of Health Policy and Management, and copies of our slides will be available upon request.

Conclusion

The Aberdeen Pedestrian Transportation Plan is likely to have a positive impact on the health of children ages 5-14 in Aberdeen. It will use evidence-based strategies to change the built environment in ways that will increase physical activity. These strategies include improving connectivity of sidewalks, improving road crossings, traffic calming, and building new walking trails. Some of the new sidewalks will benefit low-income neighborhoods where many children live. Making these improvements will directly address two current barriers to children walking in Aberdeen: lack of sidewalks and lack of road crossings. Additional barriers to walking and biking include parental perceptions of safety, long distances between homes, schools, and other destinations, and limited time to walk for transportation. The Town of Aberdeen can attempt to increase perceived safety by enforcing safety laws, educating the public about pedestrian safety improvements, and implementing a Safe Routes to School program. Distances between locations cannot be changed, but Aberdeen leaders can encourage neighborhood events and maintain neighborhood parks to encourage residents to walk within their neighborhoods. Finally, it is important to recognize families' busy schedules and offer family-friendly events like running races, walks, and bike rides on weekends, afternoons, and evenings. To monitor the impacts of the APTP, it is important to measure the prevalence of active transportation to school, fitness, and weight status of Aberdeen children on an on-going basis.

References

Aberdeen Pedestrian Transportation Plan. (2011). *Aberdeen Pedestrian Transportation Plan & Aberdeen Bicycle Transportation Plan.* Greenways Inc. Retrieved from www.greenways.com/aberdeen_ download.html

American Academy of Pediatrics. (2003). Committee on Nutrition Report. Prevention of pediatric overweight and obesity. *Pediatrics, 112*, 424-430.

American Academy of Pediatrics. (2009). The built environment: Designing communities to promote physical activity in children. *Pediatrics* 123 (6): 1591-1598.

American Association of State Highway and Transportation Officials. (2011). *Safe Routes to School: Noteworthy Practices Guide*. Retrieved from http://www.saferoutesinfo.org/sites/default/files/resources/SRTS%20Noteworthy%20Practices%20Guide%20FINAL.pdf.

Cali, A., & Capiro, S. (2008). Obesity in children and adolescents. *The Journal of Clinical Enodcrinology & Metabolism, 93,* s31-s36. doi: 10.1210/jc.2008-1363

Center for Disease Control and Prevention. (2009*). Obesity, halting the epidemic by making health easier: At a glance 2009*. Retrieved November 14, 2011 from *http://www.cdc.gov/nccdphp/publications/AAG/pdf/obesity.pdf*

Center for Disease Control and Prevention. (2011). Children's food environment state indicators report, 2011. Retrieved on November 14, 2011 from http://www.cdc.gov/obesity/downloads/ChildrensFoodEnvironment.pdf

City-data.com. (2009). *Aberdeen, North Carolina*. Retrieved on November 14, 2011 from http://www.city-data.com/city/Aberdeen-North-carolina.html

Colorado Department of Public Health and Environment. (2005).*Overweight, physical activity and nutrition among Colorado children and youth: A data resource*. Retrieved November 14, 2011 from http://www.cdphe.state.co.us/pp/COPAN/olderadult/childfactsheet04.pdf

Community Preventive Services Task Force. (2010). Promoting physical activity: environmental and policy approaches. *Guide to Community Preventive Services.* Retrieved December 1, 2011 from www.thecommunityguide.org/pa/environmental-policy/index.html

Cromley, E.K., & McLafferty, S. (2002). *GIS and Public Health.* New York: The Guilford Press.

Dannenberg, A., Bhatia, R., Cole, B., Heaton, S., Feldman, J., & Rutt, C. (2008). Use of health impact assessment in the United States: 27 case studies, 1999-2007. *American Journal of Preventive Medicine, 34*, 241-256.

Dietz, W. H. (1998). Childhood weight affects adult morbidity and mortality. *Journal of Nutrition*, 128, 411S–414S.

Dixon, J. B. (2010). The effect of obesity on health outcomes. *Molecular & Cellular Endocrinology, 316,* 104-108. doi: 10.1016/j.mce.2009.07.008

Ebbeling, C. B., Pawlak, D. B., & Ludwig, D. S. (2002). Childhood obesity: Public health crisis, common sense cure. *The Lancet, 360*,473-482.

Finkelstein, E. A., Trogdon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual medical spending attributable to obdity: Payer- and service- specific estimates. *Health Affairs, 28*, w822-w831. doi: 10.1377/hlthaff.28.5.w822

Fuemmeler, B. F., Pendzich, M. K., & Tercyak, K. P. (2009). Weight, dietary behavior, and physical activity in childhood and a dolescence: Implications for adult cancer risk. *Obesity Facts, 2*, 179-186.

Garnett, S. P., Baur, L. A., Srinivasan, S., Lee, J. W., & Cowell, C. T. (2007). Body mass index and waist circumference in midchildhood and adverse cardiovascular disease risk clustering in adolescence. *American Journal of Clinical Nutrition, 86*, 549-555.

Hart, C. N., Cairns, A., & Jelalian, E. (2011). Sleep and obesity in children and adolescents. *Pediatric clinics of North America, 58, 715-733.* doi: 10.1016/j.pcl.2011.03.007.Epub

Hill, R. A., Brunt, H., Storey, M., Thomas, N. E., Thornton, C. A., … Lyons, R. A. (2010). Protocol of the baseline assessment of for the environments for healthy living (EHL) Whales cohort study. *BMC Public Health, 10*, 150-157.

Institute of Medicine. (2004). *Childhood obesity in the United States: Facts and figures*. Retrieved November 14, 2011 from http://www.activelivingresources.org/assets/Childhood_obesity_fact_sheet.pdf

Maffeis, C., & Tato, T. (2001). Long-term effects of childhood obesity on morbidity and mortality. *Hormone Research.55,* 42–45.

Moore County Community Health. (2009). Retrieved from http://www.healthycarolinians.org/library/pdf/profiles/2009/Moore_County_CHA2009.pdf

Nader, P. R., O'Brien, M., Bradley, R., Belsky, J., Crosnoe, R., Friedman, S., … Susman, E. J. (2006). Identifying risk for obesity in early childhood. *Pediatrics, 118*, e594-e601. doi: 10.1542/peds.2005-2801

National Center for Safe Routes to School (2011). *Safe Routes.* Retrieved from www.saferoutesinfo.org

National Research Council. (2011). *Improving Health in the United States: The Role of Health Impact Assessment.* Washington DC: The National Academies Press.

Noal, R. B., Menezes, A. M., Macedo, S. E., & Dumith, S. C. (2011). Childhood body mass index and risk of asthma in adolescence: A systematic review. *Obesity Review, 12*, 93-104. doi: 10.1111/j.1467-789X.2010.00741.x

North Carolina Department of Transportation. (2010). *Traffic volume maps: Moore County*. Retrieved November 2011from http://www.ncdot.org/travel/statemapping/trafficvolumemaps/.

Ogden, C. L., Carroll, M. D., & Flegal, K. M. (2008). High body mass index for age among US children and adolescents, 2003-2006. *Journal of American Medical Association, 299*, 2401-2405.

Reilly, J. J., & Kelly, J. (2011). Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature morality in adulthood: Systematic review. *International Journal of Obstetrics (Lond.), 35,* 891-898. doi: 10.1038/ijo.2010.222.Epub

Robert Wood Johnson Foundation. (2010). *Healthy Kids, Healthy Communities: Moore and Montgomery Counties.* Princeton NJ: Robert Wood Johnson Foundation.

Rosner, F. (2010). Obesity shortens life in children and adults. *Israel Medical Association Journal, 12*, 47-48. PMID: 20450131

Saelens, B. E., Sallis, J. F., & Frank, L. (2003). Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literature. *Annals of Behavioral Medicine*, *25*, 80-91.

Sallis, J. F., & Glanz, K. (2006). The Role of Built Environments in Physical Activity, Eating, and Obesity in Childhood. *The Future of Children*, *16*(1), 89-108.

Sallis, J. F., Cervero, R. B., Ascher, W., Henderson, K. A., Kraft, M. K., & Kerr, J. (2006). An ecological approach to creating active living communities. *Annual Review of Public Health, 27*, 297-322.

Thorp, A. A., Owen, N., Newhaus, M., & Dunstan, D. W. (2011). Sendentary behaviors and subsequent health outcomes in adults: A systematic review of longitudinal studies. *American Journal of Preventive Medicine, 41*, 207-215. doi: 10.1016/j.amepre.2011.05.004

Town of Aberdeen (2011). *Aberdeen, North Carolina*. Retrieved November 14, 2011 from http://townofaberdeen.net/

U.S. Department of Health and Human Services. (2001). *The Surgeon General's call to action to prevent and decrease overweight and obesity*. Retrieved November 14, 2011 from www.surgeongeneral.gov/topics/obesity

United States Department of Agriculture. (2011). *MyPlate: Fruits and Veggies Video Challenge*. Retrieved November 14, 2011 from http://www.choosemyplate.gov/index.html

Wang, C., & Burress, M. A. (1997). Photovoice: Concept, methodology, and use for participatory assessment. *Health Education and Behavior, 24,* 369-387.

Watford, M., & Liles, K. (2011). Partnership between public health, planning and parks and recreation to create pedestrian friendly environments in a rural community. *American Public Health Association 139th Annual Meeting and Exposition*: *Healthy communities promote healthy minds and bodies, Oct 29-Nov 2, 2011,* Washington, DC. Retrieved November 22 from http://apha.confex.com/apha/139am/webprogram/Paper240336

Whitlock, E. P., Williams, S., B., Gold, R., Smith, P. A., & Shipman, S. A. (2005). Screening and interventions for childhood overweight: A summary of evidence for the US Preventive Services Task Force. *Pediatrics, 116*¸ e125-e144. doi: 10.1542/peds.2005-0242

Williams, C. H. (2007). The Built Environment and Physical Activity: What is the relationship? *Robert Wood Johnson Foundation,* 18.

Wolf, A. M. (1998). What is the economic case for treating obesity? *Obesity Research, 6,* 2S-7S.

Wolf, A. M., & Colditz, G. A. (1998). Current estimates of the economic cost of obesity in the United States. *Obesity Research, 6*, 97–106.

World Health Organization (2011). *Definition of health*. Retrieved on November 14, 2011 from https://apps.who.int/aboutwho/en/definition.html

Yeste, D., & Carrascosa, A. (2011). Obesity related metabolic disorders in childhood and adolescence. *An Pediatr(Barc.),75*, 1-9. Epub 2011 May 14 (PMID: 212571600)