



A Health Impact Assessment for Proposed Marion County Transportation Expansion

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The mission of the Center for Health Policy is to collaborate with state and local government and public and private healthcare organizations in policy and program development, program evaluation, and applied research on critical health policy-related issues. Faculty and staff aspire to serve as a bridge between academic health researchers and government, healthcare organizations, and community leaders. The Center for Health Policy has established working partnerships through a variety of projects with government and foundation support.

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Overview of Health Impact Assessments

In 1986 the World Health Organization (WHO) called on policy makers to “be aware of the health consequences of their decisions and to accept their responsibilities for health” [1] . In 1995 the Commission of the European Communities, in article 129 of the European Union Treaty, determined Health Impact Assessment’s (HIA) would be a part of policy development and

Evaluation [2]. Yet it is only in the past few years that HIA’s have been a part of policy, project and program development in the United States. The Human Impact Project (HIP) is a collaborative project between the Robert Wood Johnson Foundation and The Pew Charitable Trusts. HIP is leading a national initiative to promote the use of health impact assessments in the United States [3].

What is a Health Impact Assessment?

Health Impact Assessment is frequently defined as “a combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, efforts of a policy, plan, program or project on the health of a population and the distribution of those effects within a population. HIA identifies appropriate actions to manage those effects” [1]. HIA is a process that uses public health data to predict the potential health impact of proposed policies, projects or programs. These impacts on health can have positive or negative

outcomes. The HIA process uses input from stakeholders of those potentially affected and decision makers to provide policy recommendations. For example, what would the health impacts be of a proposed project that involved the tearing down or redevelopment of an apartment complex? It might cause air pollution that would impact people with asthma as well as stress and anxiety for those displaced. It could have economic impact if the new construction is priced such that the original residents cannot afford to live there.

Why Conduct Health Impact Assessments?

The health of a community is influenced by the environment. Community members need to have adequate housing, a source of livelihood, access to schools, parks, unpolluted water, air and soil, and freedom from violence. Most communities want to be part of a society that promotes opportunity, cooperation, trust and equity. When resources change, the health of the community can be impacted. HIAs attempt to predict the

impact before the event occurs in order for plans to be altered or mitigating efforts put into place. HIAs identify both the benefits and hindrances before decisions are made and encourage the democratic process in the decision-making. HIAs also aim to promote social equity and justice by primarily focusing on the vulnerable populations impacted by the proposed policy or plan.



What are the steps in conducting a health impact assessment?

The methods of the new science of HIAs are in evolution but typically include the following steps:

1. Screening: defines the decision that will be addressed, determines if an HIA should be conducted, and if it is feasible
2. Scoping: develops the framework and plan for the HIA, maps the pathway, includes literature review, and describes the affected population; this step also determines who will do the HIA as well as the process
3. Assessment: analyzes the baseline health conditions that are present using qualitative and quantitative data as well as research methods to predict the potential health effects
4. Recommendation: develops health-based recommendations and a feasible plan to implement the HIA, determine the actions and who will take them

5. Reporting: produces a summary of useable findings for decision makers, the public and stakeholders
6. Monitoring/Evaluating: continuing review of the HIA process, including the impact of conducting the HIA and the outcomes of implementation

HIAs can also vary in breadth and depth. For example, a rapid assessment could be done in a few days or weeks using only available information and the knowledge of those involved. An intermediate HIA could be conducted in a few weeks or months with a limited collection of new information. A comprehensive HIA can be done over months or years including intensive new data collection and community involvement in all process steps [1].

What Health Determinants are used for HIAs?

The health determinants are very holistic; health can be impacted by health behaviors, community services, and public infrastructures,

environmental, social, economic, and political factors. Examples of each determinant are identified in Table 1.

Table 1 Potential Health Determinants used with Health Impact Assessments

Health Behaviors	Community services and public infrastructures	Environment factors	Social, Economic, and Political factors
Dietary patterns	Education	Housing	Employment
Physical Activity	Health care	Air quality	Inequalities
Obesity	Public transportation	Water quality	Social cohesion
Diabetes	Parks	Food safety	Civic engagement
Smoking	Water and waste systems	Noise	Crime

(Bhatia, 2010; Cole, 2007)



What methods are used in HIAs?

Health impact assessments have technical challenges in establishing causal relationships to health determinants, including:

- The relationships between the health determinants and health outcomes [4]

- Lack of reliable and valid indicators and intermediates
- Data on interventions to improve health status

Problem statement for this HIA

Geographic information systems are used to profile baseline conditions, such as: noise, air pollution, housing, or the locations of various services. Epidemiology tools are used for disease and exposure related conditions. Environmental modeling is used for “prediction of hazardous exposures both spatially and temporally” [1]. Economic

modeling paradigms, such as cost benefit and cost effectiveness methods, are used for predicting the future cost impacts. Focus groups and surveys are used to obtain stakeholder inputs and other primary data. A review of the literature is conducted to gather secondary data from other research studies and HIAs.

Modes of Transportation to Work

The metropolitan city of Indianapolis is not coherently transport oriented. The city suffers from disconnected neighborhoods, employment fragmented from employees, and declining health. However city planners have recently made connectivity and community cohesion through transport a priority, as evidenced by the expansion of the Monon Trail, the Cultural Trail, and a new project to enhance the bikeability of the

downtown area [5]. The connection between health and transportation has a growing evidence base in the literature, and the “epidemic of sedentary behavior in the developed world” has a profound effect [6]. The Indy Connect Transportation Initiative is a 25- year comprehensive plan to combat further urban inequalities from a socio-ecological model which includes multiple determinants of health.

In Marion County, the most common means of transportation to and from work was driving alone (82%), followed by carpooling

(10%) [7]. Additional information is necessary to determine the reasons and effects of these choices.



Table 2: Number and Percentage of Marion County Residents Commuting to Work by Mode of Transportation (American Community Survey, 2007-2009)

Mode of Transportation	Number	Percent
Car, truck, or van - drove alone	341,714	82.2%
Car, truck, or van – carpoled	41,948	10.1%
Public transportation (excluding taxicab)	7,492	1.8%
Walked	8,564	2.1%
Taxicab, motorcycle, bicycle, or other means	4,532	1.1%
Worked at home	11,661	2.8%
Total	415,911	100.0%

Source: U.S. Census Bureau

Secondary data regarding Indianapolis' mass transit system was collected and utilized for this HIA to characterize transportation options for Marion County residents. Listed below are key features [8]:

- Indianapolis has bus-only mass transit, no rapid transit or light rail system.
- The bus system currently in place lacks cross-town travel, so individuals must ride into the city before finding another bus to take them across town; time and distance is doubled, and even tripled, for some travelers.
- The schedules for the bus routes prove to be inconvenient for most riders; many had to choose whether to get to their destinations very early or late.
- The bus route lacks a night service, individuals who work night shifts are unable to commute to work with the help of public transportation.
- Residents are upset with the city planning; they lack discussion by City Planners for improving bike paths and sidewalks. People are concerned the high volume of automobiles will lead to air pollution and environmental degradation.
- Individuals in the community believe there is a “lack of vision” in building a transportation system based on old technology and non-renewable sources.
- Residents complain about the increased funding for building, repairing and replacing roads. If a public transit system that included light rail were developed people might drive less, in turn causing less damage to the existing roads.



Screening steps of HIA

The Manager of Chronic Disease in the Marion County Health Department approached the IU Center for Health Policy and the Indianapolis Metropolitan Planning Organization (MPO) to conduct a HIA. It was determined that this rapid HIA would be completed as part of a new class on HIAs in January 2011. Students would work

in small groups with faculty and community partners to begin the process. The goal was developed to have the data and summary report by fall of 2011. The focus of the HIA will be predicting the impact of expanding the bus service (tripling routes, hours and days of operation) on physical activity, obesity and diabetes.

Scoping steps of HIA

The questions and data gathering steps developed include the following:

1. Identify the potential Pathways, the connection between the project and each health determinant based on scientific evidence and potential relationships with the environment
2. Key informant interviews
3. Review the literature for each topic with a focus on transportation related HIAs containing data on physical activity, obesity and diabetes

4. GIS mapping to include assets and locations, such as: diabetes education classes, pharmacies, full service grocery stores, central Indiana neighborhoods with high populations without available vehicles, central Indiana crime and unemployment rates, public transportation use, and community centers without vehicle access
5. Access data from Marion County studies, annual reports, the MPO transit rider survey and household transportation data, census data, and BRFSS data for the U.S. and Indiana.

Each of the three small groups prepared a report and an oral presentation. This report is a summary of the findings.

It is important to bear in mind that health impact assessments are new in the United States. Available data based evidence was used, but caution was exercised in projections

of likely effects. The HIA is intended to aid the Central Indiana Regional Transportation Authority (CIRTA) and Indy Connect decision makers as they determine private and public policies about transport in the Indianapolis Metropolitan Region.



Chapter 1 – Physical Activity

Background

The IndyGo’s bus extension plan can impact physical activity levels in Marion County and has the

potential to optimize public health opportunities within the community.

In the United States 40-50 million adults are sedentary, with minimal physical activity. A sedentary lifestyle is thought to contribute to the second greatest modifiable risk of developing chronic disease. Only 5% of adults in the U.S. adhere to the Centers for Disease Prevention and Control (CDC) physical activity guidelines [6]. The current recommendations from the CDC and American College of Sports Medicine (ACSM) are for 30 minutes of physical activity at a moderate level each day for adults. In addition, resistance training and flexibility exercises should be done twice a week. These are not sufficient to prevent unhealthy weights but do promote a habit of physical activity and higher quality of life [9]. The Institute of Medicine recommends 60 minutes of physical activity per day to prevent weight gain in addition to the overall benefits of moderate physical activity. The American Heart Association listed physical inactivity as the fourth modifiable coronary heart disease risk factor in 1992 [9].

Healthy People 2020 strives to improve health, fitness and quality of life through daily physical activity. More than 80% of adults do not meet the Physical Activity Guidelines for Americans [10] and more than 80% of adolescents do not participate in adequate aerobic physical activity. Regular physical activity can improve the health of all American’s regardless of age by lowering the risk of: early death,

coronary heart disease, stroke, hypertension, type 2 diabetes, breast and colon cancer, falls, and depression[1].

Physical activity for adults is positively associated with both social and economic success and a conducive environment. Adults are more likely to be active if they have a postsecondary education, enjoy exercising, expect benefits from the activity, have a history of being active, receive social support from family and friends, have access to facilities with enjoyable scenery, and a safe neighborhood. Barriers to physical activity include advancing age, low income, lack of time, low motivation, rural residency, being overweight or obese, perception that exercise requires great effort, have poor health or are disabled [12].

Despite attention to the health benefits of physical activity, to promote health, increase social interaction, and decrease disparities only an estimated 6% of trips are taken by foot or bicycle in the United States [13]. Less than 15% of children walk or bike to school. Each additional hour in the car equals a 6% increased likelihood of obesity. Finally, the estimated cost of sedentary lifestyle on a person’s health in the U.S. is upwards of \$150 billion [14].

The next step in linking lack of physical activity to health outcomes, as it pertains to public transport, is evolving in the literature. One powerful study on the impact of the



transition from car commutes to public transportation suggests that the energy expenditure is the equivalent loss of one pound of body fat every six weeks [15] in addition to an average -1.18 reduction in BMI and 9-11% higher odds of meeting physical activity targets [5].

The Indy Connect Initiative follows the guidelines of the U.S. National Physical Activity Plan to include four strategies within transportation [16]:

- Increase accountability of project planning and selection to ensure infrastructure supporting active transportation and other forms of physical activity

- Prioritize resources and provide incentives to increase active transportation and other physical activity through community design, infrastructure projects, systems, policies and initiatives
- Integrate land-use, transportation, community design and economic development planning with public health planning to increase active transportation and other physical activity [17]
- Increase connectivity and accessibility to essential community destinations to increase active transportation and other physical activity

HIA Methodology

Screening

The screening step was omitted from the report.

Scoping

To gain a better understanding of the IndyConnect Initiative and its impact on physical activity, the scoping phase asked the following questions:

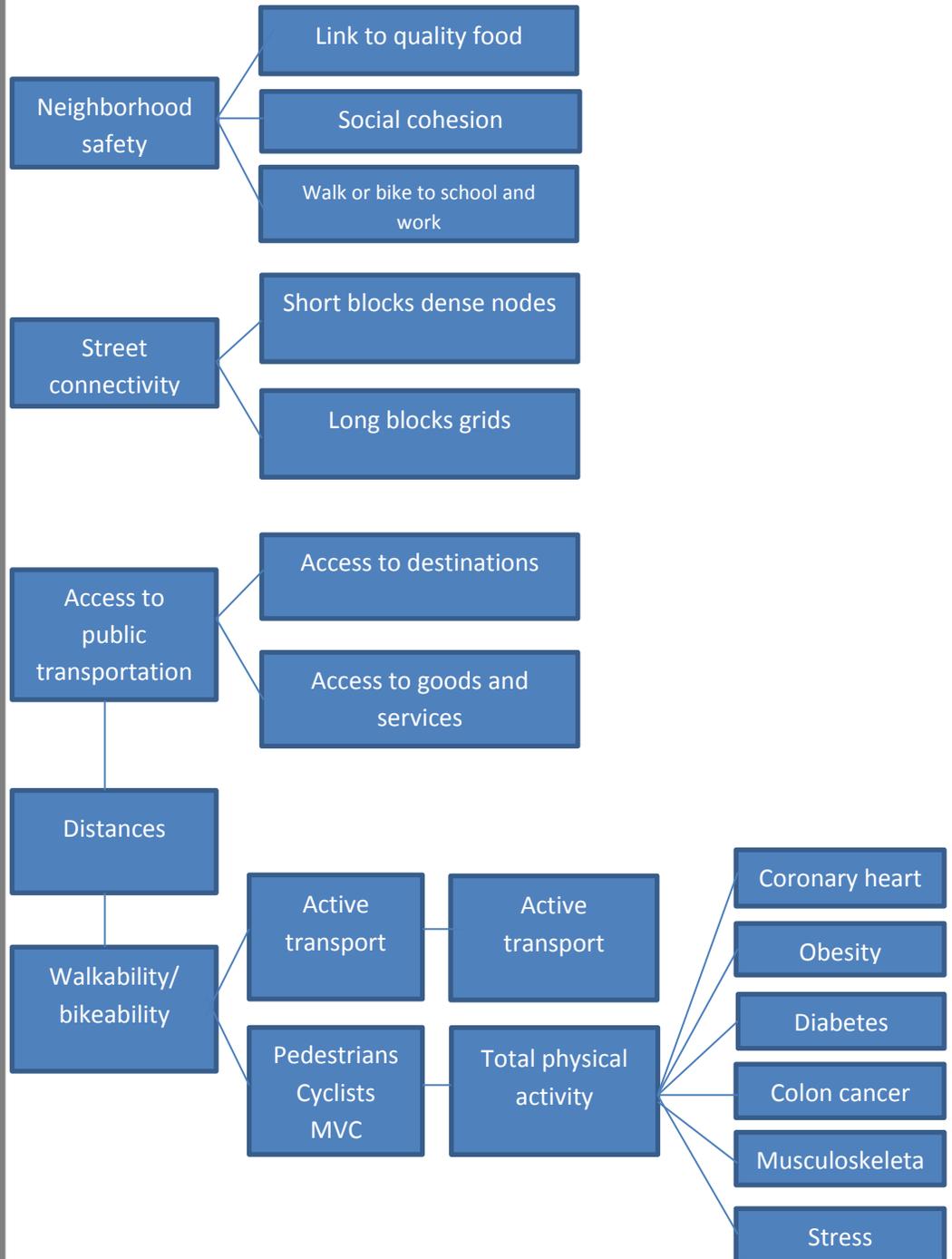
- What are the problems and needs that are being addressed by the proposed project?
- What are potential positive or negative impacts of the proposed program?
- What specific sub-populations will be impacted (e.g., vulnerable populations)?
- How can we evaluate the impact of the proposed project?
- What is the current health status of the target population (baseline)?
- How does Marion County compare to other Indiana counties regarding physical activity?
- What data are already available?



Time, costs, primary focus and activities involved were also assessed in the scoping phase. Stakeholders invested in physical activity include: League of American Bicyclists; IndyCOG;

Healthy By Design; Transportation End Users; Health Professional Associations; INDTO; Indy Connect; AARP; and the Marion County Health Department.

Figure 1 Pathway of physical activity with determinants of health and outcomes





Assessment

Key findings from literature

A review of the literature was completed. Secondary data were collated from the U.S. Census, Centers for Disease Control and Prevention, IndyConnect, IndyGO,

and the Marion County Department of Health. Primary data was collected from interviews of key informants.

Articles identifying the impact of people using public transit in the U.S. and Europe were reviewed. Physical activity has been documented to reduce the incidence of heart disease, diabetes, decreased risk of cancer and depression and increased bone health.

Americans that use public transit:

- Spend a median of 19 minutes daily walking to and from transit stops
- A total of 29% achieve 30 minutes of physical activity a day [18]
- Household travel surveys show active travel bouts of 10 min can accumulate for great health benefits [19]
- Less time in car, more time for physical activity
- Living closer to transit increases the use of public transportation even with available personal transportation [19]
- Access to active transportation decreases health disparities [20]

- Lose on average 6.45 pounds by walking an extra mile for 250 days [21]

Americans with disparities are disproportionately affected by lack of public transportation. These residents are least likely to be able to afford cars and therefore drive less. They tend to live in urban environments and have limited access to jobs when public transport is limited. Other groups affected by transport options are senior citizens and those who are handicapped. These citizens are “trapped”, without access to public transportation. In addition, children without safe routes to school must travel even short distances by car.

Profiling the existing status of physical activity of Hoosiers was obtained from the CDC SMART data from 2006 [22], U.S. Census Bureau, American Community Survey [7] using the SAVI data base, and Marion County Health Department data [23].

Results

In the Indianapolis Metropolitan area, 24% reported no leisure time physical activity in 2007;

27% reported no leisure time physical activity in 2005 [22]



Table 3 Indianapolis Metropolitan region 2001-2007 Reported Physical Activity Levels

Year	Recommended physical activity	Insufficient	Inactive	No leisure physical activity
2007	47.7	39.7	12.7	24.0
2005	47.7	39.3	13.1	27.0
2003	46.7	39.0	13.9	26.1
2001	45.9	40.6	13.6	26.1

Reference Note: SMART BRFSS 2001-2007, [22]

Marion County Data[2]:

- Lower income groups were most likely to walk in their neighborhood every day, 27% vs 18%
- Lower income groups were least likely walk in the neighborhood just for exercise, 20% vs 29%
- Obese younger residents exercised more than obese older residents, 86.3% vs 27.3%
- Obese older residents had the lowest level of physical ability to meet CDC recommended guidelines, 27.3% vs 78.9%
- Obese individuals were half as likely to walk every day as normal/underweight residents, 12% vs 23%
- The majority of county residents had access to a safe convenient and affordable place to exercise, 84-89%

Data from key informants:

To gain a better understanding of the IndyConnect Initiatives and the impact on physical activity, interviews were conducted with the following individuals: the Executive Director of Health by Design, a Physical Therapist, a 23 year old in an emergency room, a public transportation user at a bus stop, and a pediatrician in Marion County that also uses public transportation. Each respondent was asked:

- Have you used public transportation in Marion County in the last year? If yes, how often per month? If no, what are some barriers that you think keep you from utilizing this service?
- List three positive and 3 negative things related to health that might come with increased use of public transportation.
- What should happen in order for public transportation to better suit your needs?



Barriers reported by the key informants included:

- Public transportation not considered family friendly
- Limited capacity and lack of frequency of routes
- Disconnect between where an individual is and where they need to be

Recommendations from key informants included:

- Expand hours, frequency, better capacity, timeliness
- Accommodate mothers with children
- No smoking
- Connect to parks and places of employment
- Increase bike lanes to transit stops since the buses can carry bikes
- Increase safety and security around bus stops

Recommendation

The recommendations to decision makers are the following:

- Enhance the existing environment to maximize physical activity of the population
- Expand the bus service
- Increase complete streets programs in the region (programs that promote walking/biking with more sidewalks, bike lanes and bike racks)

- Encourage Safe Routes to Schools funding (to enable kids to walk safely to school)
- Encourage public policies to that improve the safety and attractiveness of pedestrian environments linking home, work and transit stops to increase use of public transit for commuting to work
- Expand the bus rider survey and survey non-bus riders

Reporting

This report will be shared on the Center for Health Policy Website. It will be available for the CIRT decision makers and regional

planners. It will be available for the Health by Design coalition and the general public.



Monitoring / Evaluation

The HIA provides a baseline of health status of Marion County residents, but the impact of the expansion of the bus services on the health of residents can only be monitored and evaluated after completion of the project. We propose that the health indicators assessed for this HIA (physical activity) be reassessed two years after expansion of bus services to allow time for changes to occur and in reasonable intervals thereafter.

In addition, to determine the project's impact, conduct a survey of Marion County residents on the expansion of bus services, including: frequency of bus service use, reason for use (e.g., work, grocery shopping etc.), estimated distance or blocks walked to and from the bus stop, satisfaction with services, and areas that need improvement.

Conclusion

IndyGo proposes tripling existing bus service in the Greater Indianapolis area and this HIA has assessed the impact this change could have on increased physical activity in Marion County. We found that 25.9% of Hoosiers are physically inactive in the Indianapolis metropolitan area. The literature projects that less time in

the car leads to more time spent on physical activity. People utilizing public transit spend 19 minutes a day walking to and from transit stops and can more readily achieve the CDC recommended 30 minutes of daily physical activity. Active transport programs also decrease health disparities [18-20].



Chapter 2 – Obesity

Background

The IndyGo’s bus extension plan has a potential impact on obesity levels in Marion County and the HIA will provide recommendations

about health-promoting modifications and the potential to optimize public health opportunities within the community.

Diet and body weight are closely related to health status. Individuals at a healthy weight are less likely to develop certain diseases or die prematurely. Unfortunately, the rate of obesity in the United States has increased rapidly over the past years. The percentage of obese adults rose from 15.9% in 1995 to 27.6% in 2010. The distribution of obesity by race/ethnicity illustrates that African Americans have the highest prevalence rates, followed by Hispanics and Caucasians. Obesity prevalence rates are higher in the South and some Midwest regions as compared to the rest of the nation [22].

decrease and prevent overweight and obesity. Surgeon General David Satcher stated, "overweight and obesity may soon cause as much preventable disease and death as cigarette smoking." In fact, an estimated 300,000 deaths per year may be attributable to obesity, compared to more than 400,000 deaths a year associated with cigarette smoking. The risk of death rises with increasing weight.

Overweight and obesity status has been associated with a variety of diseases and adverse health conditions, including high blood pressure, dyslipidemia, type 2 diabetes, heart disease, osteoarthritis, some cancers, complications during pregnancy, and premature death [11]. In 2001 the Office of the Surgeon General released a *Call to Action* [24] to

Overweight and obese persons have a significant economic impact on the U.S. healthcare system, attributing to direct and indirect costs. Direct medical costs include preventive, diagnostic, and treatment services related to obesity. Indirect costs include financial loss due to decreased productivity, restricted activity, and absenteeism due to illness, and future income for family due to premature death [25]. The annual medical spending attributable to obesity was an estimated \$147 billion in 2008 [26].

How to Define Overweight and Obesity

The definitions for overweight and obesity are based on body mass index (BMI). BMI, considered a fairly reliable indicator of body fat for most people, is calculated from weight and height.¹ Among adults ages 20 and older, a BMI between 25.0 and 29.9 is considered overweight and a BMI at or

above 30.0 is considered obese. Among children and adolescents between 2 to 19 years of age, a BMI between the 85th percentile and 94.9th percentile is considered overweight and a BMI at or above the 95th percentile is considered obese [27].



HIA Methodology

Screening

The screening step was omitted from the report.

Scoping

To gain a better understanding of the IndyConnect Initiative and its impact on obesity, the following questions were asked:

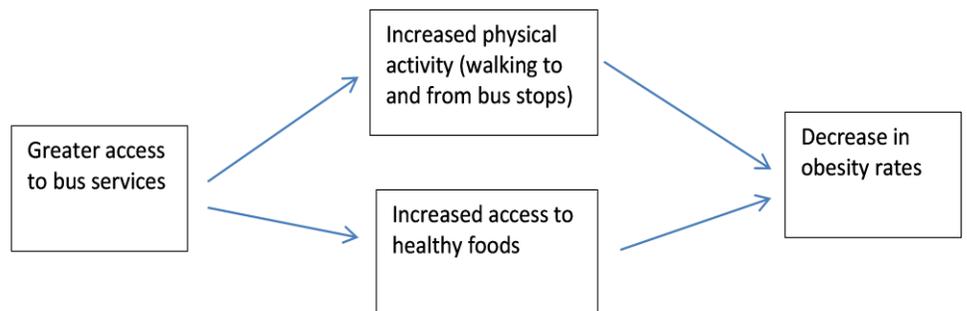
- What are the problems and needs that are being addressed by the proposed program?
- What are potential positive or negative impacts of the proposed program?
- What specific sub-populations will be impacted (e.g., vulnerable populations)?
- How can we evaluate the impact of the proposed project?
- What is the current health status of the target population (baseline)?

- How does Marion County compare to other Indiana counties regarding obesity rates?
- What data are already available?

Stakeholders invested in obesity prevention include: people who are obese or overweight; healthcare providers caring for obese patients, including physicians, nurses, and dietitians; school corporations interested in preventing childhood obesity; and the Marion County Health Department.

Based on literature reviews, a pathway diagram showing the connection between public transportation and obesity rates was developed (Figure 1).

Figure 1: Pathway Diagram Showing the Links between Bus Service and Obesity



¹ BMI = weight (lb) / [height (in)]² x 703



Assessment

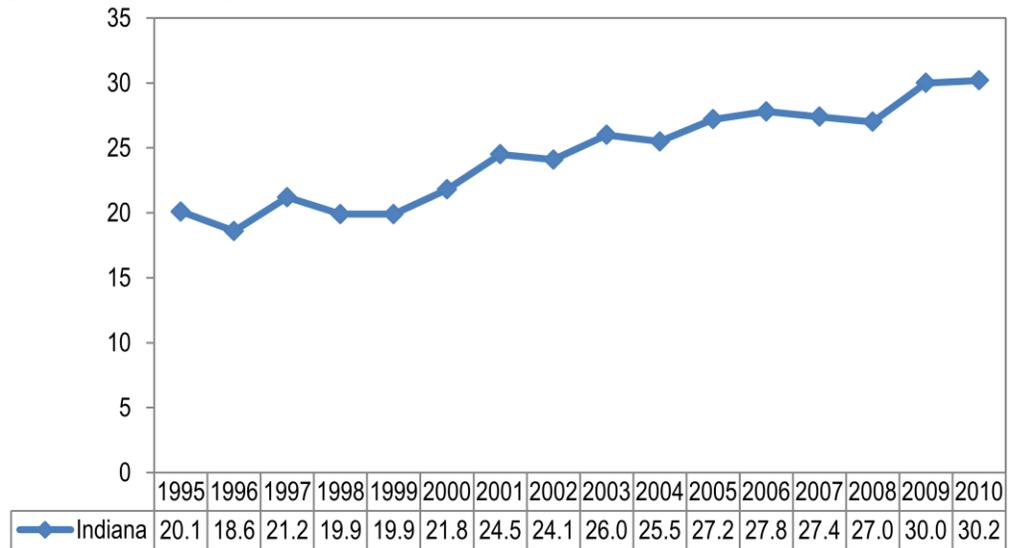
Secondary data were collated from the U.S. Census, Centers for Disease Control and Prevention (CDC), IndyConnect, IndyGo, and the Marion County Health Department. In addition, primary data was collected from interviews with key informants, including a collaborator on the 2005 Marion County obesity needs assessment and a member of Indianapolis Metropolitan Planning Organization.

Adults

Based on findings from CDC's

Behavioral Risk Factor Surveillance System [28], the percentage of overweight adults in Indiana remained stable from 1995 through 2010 at 36%. However, the percentage of obese adults increased significantly during that time period, from 20.1% to 30.2% (Figure 1) [22]. Furthermore, almost 21% of Indiana residents reported consuming fruits and vegetables at least five times a day and nearly 74% of Hoosiers said they participated in physical activities during the past month [22].

Figure 1: Percentage of Indiana Adults who are Obese (BMI \geq 30.0)



Source: CDC [22]



Children and Adolescents

According to the 2007 National Survey of Children’s Health, among Indiana children ages 10 to 17, 64.8% had a healthy weight, 15.3% were overweight, 14.6% were obese, and 5.3% were underweight. Additionally, 71.4% of Indiana children ages 0-5 were breastfed for some period, and 66.2% of children ages 6 to 17 engaged in vigorous

physical activity 4 or more days during the week [29].

Economic Impact

Based on a study by Finkelstein, Fiebelkorn, and Wang [30], obesity-attributable medical expenditures for Hoosier adults were an estimated \$1.6 billion, which included Medicaid and Medicare expenditures of \$522 million and \$379 million respectively (Table 1).

Table 1: Estimated Adult Obesity-Attributable Medical Expenditures in Indiana, 2003

	Amount
Total Obesity-Attributable Medical Expenditures	\$1,637 Million
Obesity-Attributable Medical Expenditures in Medicaid Population	\$522 Million
Obesity-Attributable Medical Expenditures in Medicare Population	\$379 Million

Source: Finkelstein, Fiebelkorn, & Wang [30]

Obesity in Marion County

The most recent information available on obesity in Marion County is from the 2005 Adult Obesity Assessment, conducted by the Marion County Health Department in collaboration with the Bowen Research Center at Indiana University School of Medicine [31].

In 2005, among the adults in Marion County, 35% were overweight (Indiana: 35%; U.S.: 37%) and 26% were obese (Indiana: 27%; U.S.: 24%). Prevalence rates can be further delineated by gender, race/ethnicity, and age group (Table 2). Significant statistical differences in obesity prevalence

rates between groups were found for the following:

- Black non-Latino adults had higher rates than any other race/ethnic group; this was particularly true for black women.
- The percentage of obese adults generally increased with age; however, this trend reversed after reaching 65 years.
- Individuals with household incomes over 300% above the federal poverty guidelines¹ had lower rates than individuals with less income.
- College graduates had lower rates than those without a college degree.



Table 2: Marion County Residents by BMI Category and Socio-demographic Characteristics / Percentage and 95% Confidence Interval (2005 Marion County, Indiana, Adult Obesity Needs Assessment)

	Underweight or Normal	Overweight	Obese
GENDER			
Male	33.8 (31.4-36.2)	41.9 (39.5-44.3)	24.3 (22.2-26.4)
Female	44.8 (42.8-46.8)	28.3 (26.6-30.1)	26.9 (25.1-28.7)
AGE GROUP			
18 to 24	59.1 (52.5-65.6)	25.0 (19.3-30.6)	16.0 (10.9-21.0)
25 to 34	47.0 (43.3-50.7)	30.0 (26.6-33.5)	23.0 (19.9-26.1)
35 to 44	36.2 (32.8-39.6)	36.4 (32.9-39.9)	27.4 (24.2-30.6)
45 to 54	32.1 (29.0-35.3)	37.1 (33.8-40.4)	30.8 (27.7-33.8)
55 to 64	29.0 (25.7-32.3)	39.9 (36.3-43.5)	31.1 (27.8-34.5)
65 to 74	35.0 (30.8-39.1)	38.0 (33.7-42.2)	27.1 (23.2-31.0)
75 or older	40.9 (36.4-45.4)	43.1 (38.5-47.6)	16.0 (12.6-19.4)
RACE/ETHNICITY			
White non-Latino	41.7 (39.9-43.6)	34.9 (33.1-36.7)	23.3 (21.7-24.9)
Black non-Latino	32.0 (28.6-35.5)	33.8 (30.4-37.1)	34.2 (30.9-37.6)
Latino	37.2 (31.8-42.7)	40.7 (35.1-46.3)	22.0 (17.5-26.5)
Other Race / Ethnicity	42.5 (32.0-53.0)	40.2 (29.7-50.7)	17.3 (9.2-25.3)
RACE/ETHNICITY AND GENDER			
White Male	33.9 (31.0-36.7)	42.4 (39.4-45.3)	23.7 (21.2-26.2)
Black Male	33.3 (27.7-38.9)	38.2 (32.8-43.6)	28.4 (23.4-33.5)
Latino Male	32.5 (25.5-39.6)	47.1 (39.6-54.5)	20.4 (14.6-26.2)
Male, Other/ Unknown Race	35.7 (23.6-47.9)	48.3 (35.9-60.8)	16.0 (6.9-25.0)
White Female	49.3 (47.0-51.6)	27.8 (25.7-29.9)	22.9 (21.0-24.8)
Black Female	30.9 (26.7-35.0)	29.7 (25.7-33.8)	39.4 (35.1-43.7)
Latino Female	45.8 (37.4-54.2)	29.2 (21.8-36.6)	25.0 (18.0-32.0)
Female, Other/ Unknown Race	50.8 (39.1-62.5)	28.8 (18.3-39.3)	20.4 (10.8-29.9)
HOUSEHOLD INCOME AS A PERCENT OF FEDERAL POVERTY GUIDELINES (FPG)			
Less than 100% FPG	33.2 (26.3-40.0)	33.3 (27.0-39.6)	33.6 (27.1-40.0)
100% to < 200% FPG	36.7 (32.5-40.8)	31.6 (27.7-35.4)	31.8 (27.8-35.7)
200% to < 300% FPG	39.5 (35.5-43.5)	32.1 (28.3-35.8)	28.4 (24.8-32.1)
Over 300% FPG	39.8 (37.7-41.9)	37.7 (35.6-39.7)	22.5 (20.8-24.3)
EDUCATION			
No high school degree	38.0 (32.7-43.3)	33.7 (28.8-38.6)	28.3 (23.7-32.9)
High school graduate	37.0 (34.0-39.9)	34.1 (31.3-37.0)	28.9 (26.2-31.6)
Some college	36.0 (32.9-39.0)	36.0 (33.0-39.0)	28.0 (25.2-30.9)
College graduate	43.9 (41.3-46.5)	35.6 (33.1-38.1)	20.5 (18.4-22.6)

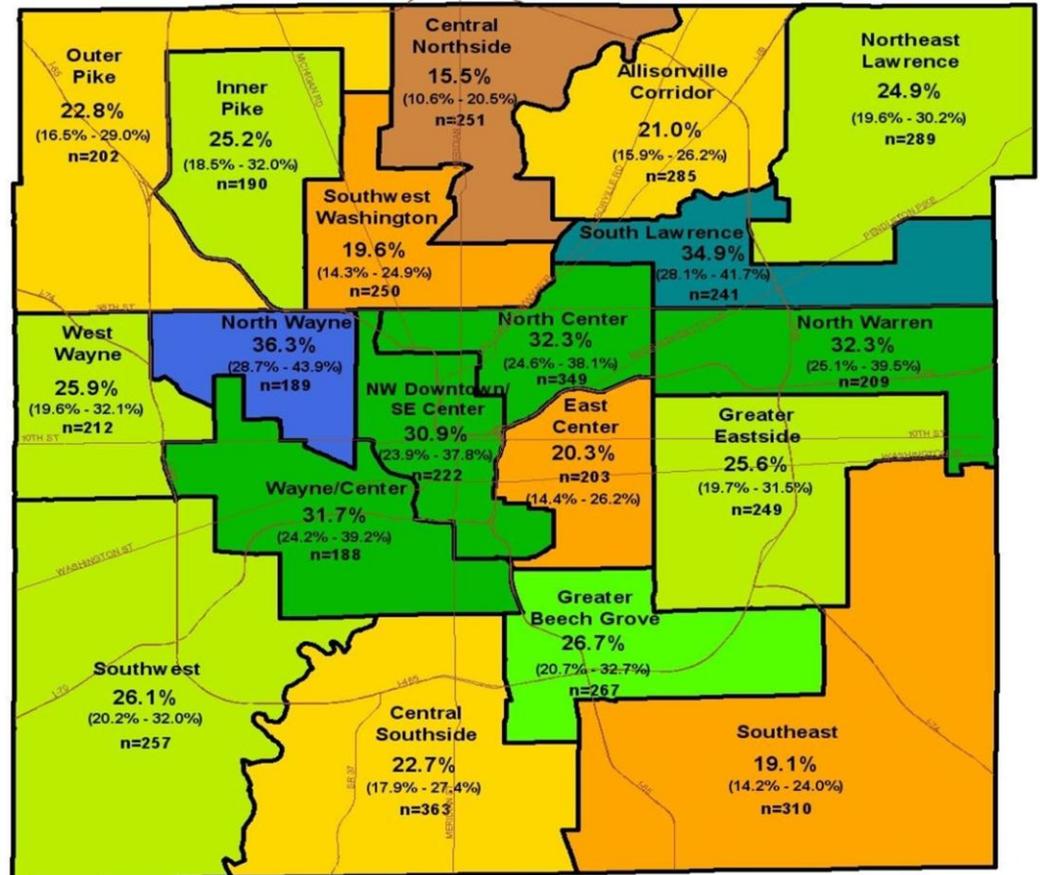
Source: Gibson, et al., [31]



A visual perspective on the distribution of obesity prevalence rates in Marion County is provided (Map 1) [32]. Townships with the

highest prevalence rates for obesity were north Wayne and south Lawrence.

Map 1: Adult Obesity Prevalence by Health Planning Area in Marion County, 2005



Note: Darker colors represent higher obesity prevalence rates, lighter colors represent lower rates.

Source: Marion County Health Department, 2011

Access to Healthy Foods

Increases in obesity and diet-related diseases may be worse in some communities due to limited access to affordable and nutritious foods. A key concern for people who live in these areas is their reliance on small grocery or convenience stores that may not carry all the foods necessary for a healthy diet and/or may offer these foods at higher Prices [33].

A study by Morland, Roux, and Wing [34] found an association between the presence of supermarkets and lower prevalence of obesity and overweight, while the presence of convenience stores was associated with a higher prevalence of obesity and overweight. Increasing access to affordable, healthy nutrition is an important strategy in reducing obesity rates and increasing overall health within the population.



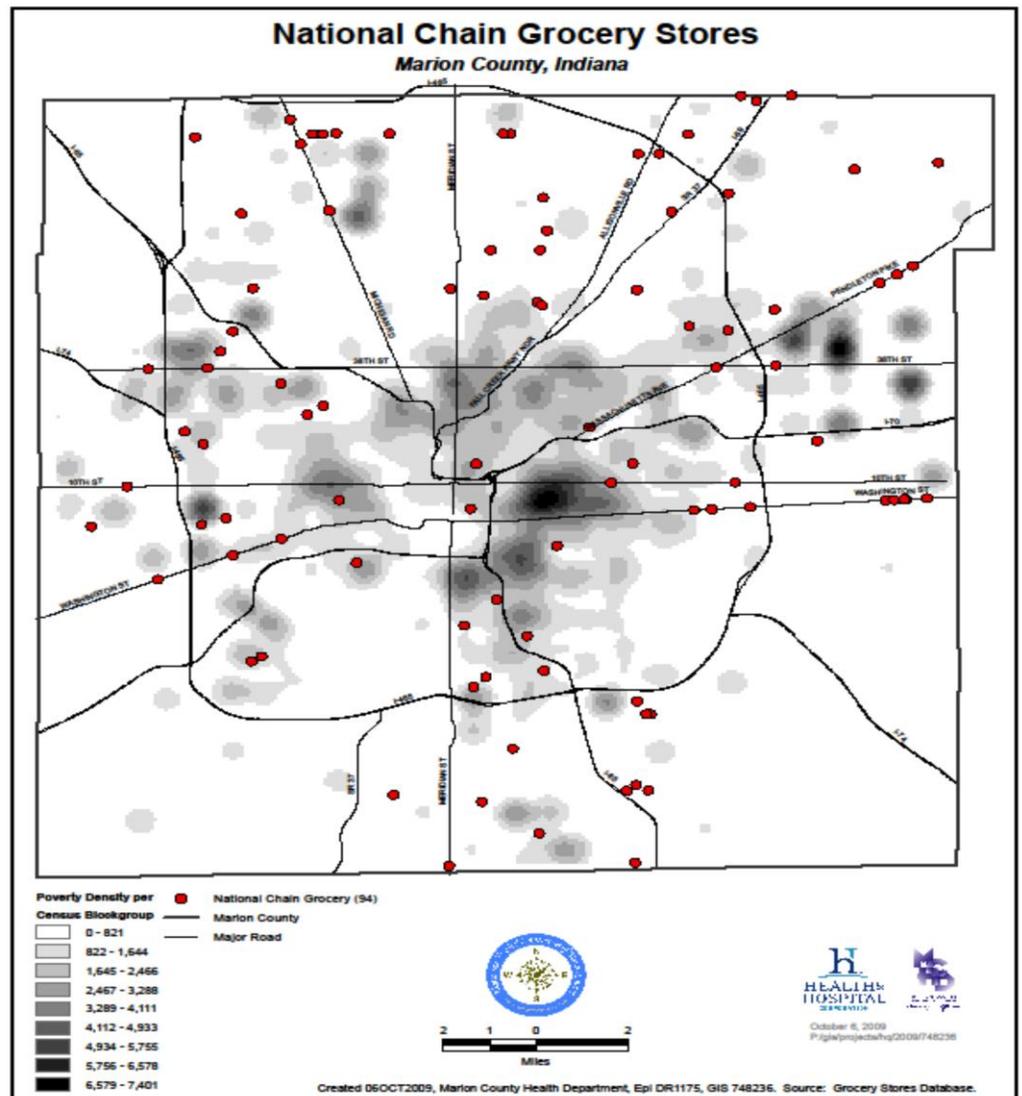
In the United States, 2.3 million households (2.2%) live more than a mile from a supermarket and do not have access to a vehicle. An additional 3.4 million households (3.2%) live 0.5 to 1 mile from a supermarket, with no access to a vehicle [33].

The University of Wisconsin Population Health Institute [35] measures access to healthy foods as the percent of zip codes in a county with a healthy food outlet, defined as a grocery store or produce stand/farmers' market. According

to this methodology, 33 out of 37 zip codes in Marion County have access to healthy foods, representing an 89% access rate. By tripling bus services in Marion County, access to healthy foods will increase; this is particularly important for residents who live in neighborhoods without a grocery store or access to a car.

Map 2 shows the distribution of national grocery chains (94 grocery stores) and poverty density in Marion County.

Map 2: National Chain Grocery Stores in Marion County, Indiana



Source: Marion County Health Department [32]



Recommendation

The literature identifies a link between public transit and obesity; areas with higher levels of public transportation generally have lower obesity rates [36]. The recommendations to decision makers are the following:

- Implement the expansion of the IndyGo bus services.
- Provide maps and brochures with locations of grocery stores and restaurants with healthy food options along the bus routes.
- Consider collaboration between grocery stores, supermarkets, restaurants, and IndyGo to provide incentives for riders to go to these stores (e.g., customers save money on healthy foods if they have a bus ticket, or purchasers of healthy foods may be eligible for a free bus ride).
- Provide easy access to information on bus routes and services (e.g., toll-free numbers, web access, phone apps).
- Start marketing campaigns to attract new/additional ridership.

Reporting

This report will be shared on the Center for Health Policy Website. It will be available for the CIRTA

decision makers and regional planners. It will be available to the general public.

Evaluation

The HIA provides a baseline on the health status of Marion County residents, however the specific impact of the expansion of bus services on the health of residents can only be monitored and evaluated after completion of the project. We propose that the health indicators assessed for this HIA (obesity rates, access to healthy foods) be re-assessed two years after expansion of bus services and

in reasonable intervals thereafter.

Additionally, a survey of Marion County residents on the expansion of bus services, including frequency of use of bus services, reason for use (e.g., work, grocery shopping, etc.), estimated distance or blocks walked to and from bus stop, satisfaction with services, and areas that need improvement to determine the impact.



IndyGo recently proposed tripling existing bus services in the Greater Indianapolis area. We found that 35% of residents in Marion County are overweight and an additional 26% were obese. Those most affected by obesity were vulnerable populations, particularly black females and the those in the lower economic status.

Obesity is a major risk factor

for numerous diseases, including heart disease and some cancers. Public transportation has been identified as a way of lowering BMI and decreasing obesity rates. We recommend the expansion of the bus system in Marion County to help residents have greater access to healthy food options, increase their level of physical activity and mobility, and reduce obesity rates.



Chapter 3 - Diabetes

Background

The IndyGo bus extension plan could have an effect on diabetes rates in Marion County and the HIA will provide recommendations

Diabetes is an inability to properly metabolize glucose (sugar), due either to an inability of the pancreas to produce adequate amounts of the hormone insulin or the body becoming resistant to insulin. This can lead to a variety of serious health complications. In the Healthy People 2020 publication [37], the U.S. Department of Health and Human Services (DHHS) identified diabetes as a public health problem affecting an estimated 23.6 million people in the United States. Diabetes increases the risk of heart disease by 2 to 4 times and can lower life expectancy by up to 15 years. It is also the leading cause of kidney failure, lower limb amputations, and adult-onset blindness. Further evidence is emerging that diabetes is associated with cognitive impairment, incontinence, fracture risk, and cancer risk and prognosis.

Nation-wide diabetes has been on the rise, in parallel with the obesity epidemic, for the last 20 years. It is currently the sixth leading cause of death in the United States [38]. The age-adjusted prevalence rate of U.S. adults diagnosed with diabetes has increased from 3.7% in 1980 to 8.3% in 2009 [39]. The economic cost of diabetes in the United States was an estimated \$174 billion in 2007, including medical expenditures and lost

on health-promoting modifications with the potential to optimize public health opportunities within the community.

Productivity [40]. For an individual with diabetes, health care expenses are 2.3 times higher than for those without diabetes [41].

Types of Diabetes

There are two types of diabetes, type 1 and 2. More than 90% of diabetics have type 2 [28]. Type 1 typically has a childhood onset, developing from a failure to produce insulin as a result of a genetic predisposition [42]. Type 2 is typically developed in adulthood and is also a genetic tendency; however, major risk factors contributing to type 2 diabetes include overweight and insufficient physical activity [43]. Many type 2 diabetics can regulate or even eliminate diabetes through weight control and exercise. Overall, diabetes has been on the rise nation-wide. Childhood obesity has also been increasing, leading to more cases of type 2 diabetes in children [38].

Pre-diabetes is a condition of impaired glucose tolerance, but not full diabetes. It is defined by either a fasting plasma glucose between 100 and 125 mg/dl or plasma glucose between 140 and 199 mg/dl, 2 hours after an oral glucose challenge, or both. People with pre-diabetes have a 25-40% risk of developing diabetes within 5 years [38].



**HIA
Methodology**

Screening

Scoping

The screening step was omitted from the report.

Individuals with diabetes or at-risk for diabetes in Marion County were the population examined to determine the potential impact of the IndyGo bus expansion plan. Within Marion County, certain vulnerable populations deserve special attention due to high risk for developing diabetes; this includes African Americans, Hispanics, those over the age of 45, people with lower incomes, and those without health insurance [43].

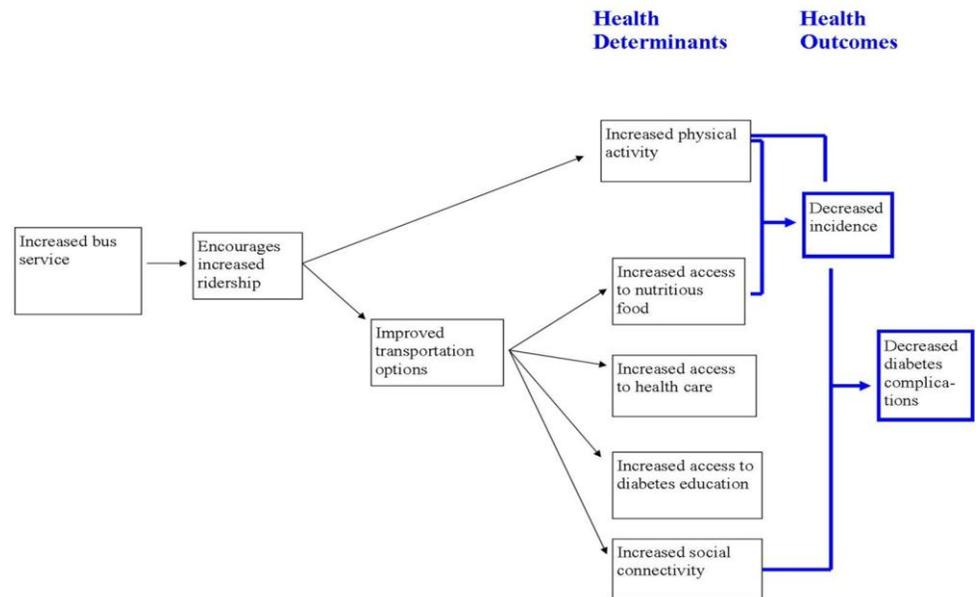
During the scoping phase, the following risk factors for becoming diabetic or having complications from diabetes were identified [44]:

- Maintaining a proper weight
- Good nutrition

- Physical activity
- Regular blood glucose checks
- Proper medication use
- No tobacco use

Stakeholders invested in diabetes prevention and treatment include: people with diabetes or at risk for diabetes, particularly if they do not have access to a vehicle; healthcare providers who care for diabetics, including physicians, nurses, dieticians and diabetes educators; organizations serving diabetics, including the local chapters of the American Diabetes Association and the YMCA; and the Marion County Health Department.

Figure 1: Pathway Diagram Showing the Links between Bus Service, Health Determinants and Health Outcomes for Diabetes





Assessment

Diabetes in Indiana

Along with a scientific literature review, key informants were interviewed. These included: a dietitian, a diabetes educator, and a registered nurse from the Marion County Health Department. The data was analyzed and mapped to the existing data.

Diabetes is the sixth leading cause of death in Indiana [45]. In 2007 the age-adjusted mortality rate attributable to diabetes was 72.3 per 100,000 residents [46]. Age-adjusted prevalence rates for adults nearly doubled from 4.8% in 1994 to 9.0% in 2009, now affecting almost half a million Hoosiers. Rates differed by age group, with 65- to 74-year-olds being most affected, at 23.6% [39].

Diabetic retinopathy is a common complication of diabetes affecting the tiny blood vessels of the retina, leading to impaired vision over time. More than 88,000 Indiana adults ages 40 and older are estimated to have diabetic retinopathy [47].

The total cost of diabetes for Indiana residents was estimated at nearly \$3.1 billion in 2006. This included excess medical costs of over \$2.0 billion attributed to diabetes and lost productivity valued at almost \$1.1 billion [41].

Diabetes in Marion County

Diabetes is a public health concern in Marion County. The county has the same rate of diabetes as the U.S. as a whole and has experienced a similar rate of increase. Ten percent of adults in Marion County had diabetes in 2008, representing a 60% increase from the 2000 rate of 6.1% [48]. Diabetes in Marion County was responsible for 1,400 hospital admissions and 36 lower

limb amputations in 2008, and in that same year the death rate due to diabetes was 15.1 per 100,000 residents [48].

The total cost of diabetes for people in Marion County (Congressional District 7) was estimated at \$375 million in 2006. This included excess medical costs of nearly \$248 million attributed to diabetes and lost productivity valued at almost \$128 million [41].

According to the results of the 2009 Behavioral Risk Factor Surveillance System [28], 22.9% of Indiana adults ages 35 to 44 reported a doctor diagnosed diabetes had affected their eyes; 22.5% stated that they never check their blood glucose levels outside of a clinic or hospital; and 43.0% were currently taking insulin to control their blood sugar levels [28].

In 2009, IndyGo conducted a system-wide on-board survey on all routes to analyze travel patterns, transit use, demographic characteristics of riders, and other aspects of transportation information [49]. A total of 3,999 survey's were completed. The results indicated a large portion of IndyGo riders belong to vulnerable populations at a higher risk for diabetes: 65% of riders were African American (compared to 31% Caucasian); 70% of riders earned less than \$25,000 per year; and over 50% of riders were from households that did not own a car and were transit-dependent. Walking was the primary method used to access transit, accounting for 89% of those surveyed. In the absence of bus services, 26% indicated that they would not have commuted; nearly 4% of riders used transit to access medical services or go to the hospital.



Recommendation

Weight loss and management is an important method for diabetics to maintain and control their blood sugar levels. Public transit may provide a necessary prompt to add exercise to everyday lives. Those who utilize public transit can potentially lower their body mass index in 18 months [50]; this decrease in weight translates to a loss of approximately 6.5 pounds for a 5', 5" individual. An average rider would reduce their risk for obesity and obesity complications, including diabetes, by an astounding 81% [50]. This is attributed to the walking distance from one transit stop to another.

Based on key informant interviews and literature reviews, the following recommendations are made:

- Increase ridership with incentives, such as free bus passes or reduced rates offered to first time riders (reach out to target populations; alleviate stigma associated with public transportation)

- Improve bus access, particularly in areas of high diabetic incidence (the north central area of Marion County has the highest rate of diabetes) to enable residents to reach medical appointments, diabetic education classes, and diabetic support groups
- Increase access to healthier food options by adding additional bus stops close to full-service grocery stores and produce markets
- Encourage the development of farmers' markets, grocery stores, and restaurants (with healthy food options) in the area
- Increase bus service to provide sufficient opportunity for diabetic residents to attend diabetes education classes, provided at libraries throughout Marion County
- Increase awareness of diabetes and how it is related to public transportation by creating a factsheet, highlighting the most pertinent information

Reporting

This report will be shared on the Center for Health Policy Website. It will be available for the CIRTA

decision makers and regional planners. It will be available to the general public.



Monitoring / Evaluation

The HIA provides a baseline on the health status of residents in Marion County, however the impact of the expansion of bus services on the health of residents can only be monitored and evaluated after completion of the project. We propose that the health indicators we assessed for this HIA be re-assessed two years after expansion of bus services and in reasonable intervals thereafter.

Additionally, the following evaluation/monitoring activities are proposed:

- Include additional questions in IMPO's On-Board Survey to determine the number of riders with diabetes / pre-diabetes, and use the bus system to reach diabetes resources and services.

- Include reports from stakeholder organizations, such as community health centers, clinics, pediatricians, school nurses, diabetes education centers, and local health department, identifying significant health changes in their diabetes population to monitor any link between those changes and expansion of bus services.
- Conduct annual interviews to monitor any changes as perceived by stakeholders.

Conclusion

In Marion County, the prevalence rates for diabetes and pre-diabetes are 10% and 1.5%, respectively [48]. These rates have been on the rise in recent years, contributing to a significant health and economic burden of an estimated \$375 million per year [41]. Studies have shown that a successful battle against obesity would have the potential to prevent 58% new cases of Type 2 diabetes [51]. Expanding existing bus services would likely

increase the level of physical activity, decrease obesity, and consequently lower diabetes rates in Marion County. Additionally, a greater availability of buses would allow residents, particularly those without access to a car, to travel to healthcare facilities, diabetes education classes, diabetes support groups, and other useful resources, further reducing the rate of diabetes in the county.



References

1. Bhatia, R. *A guide for health impact assessment*. California Department of Public Health. 2010; Available from: <http://www.scribd.com/doc/50792048/Guide-for-Health-Impact-Assessment>.
2. Scott-Samuel, A., *Health impact assessment. An idea whose time has come*. British Medical Journal, 1996. **313**: p. 183-184.
3. Human Impact Partners. *Health should be considered in all decision-making*. n.d. November 14, 2011]; Available from: <http://www.humanimpact.org/>.
4. Cole, B., *Health impact assessment: A tool to help policy makers understand health beyond health care*. Annual Review of Public Health, 2007. **28**: p. 293-412.
5. Murray, J., *Indy to add nearly 33 miles of bike lanes this year*, in *Indianapolis Star* 2011.
6. Berrigan, D., Pickel, L.W., & Dill, J. , *Associations between street connectivity and active transportation*. International Journal of Health Geographics, 2010. **9**(20).
7. *2007-2009 American Community Survey 3-year estimates*. [cited 2011 June 30]; Available from: http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=ACS&_submenuId=&_lang=en&_ds_name=ACS_2008_3YR_G00_&_ts=>.
8. Indianapolis Metropolitan Planning Organization. *On-board Passenger Survey*. 2009 November 3, 2011]; Available from: <http://www.indympo.org/Data/SurveyData/Pages/OnBoardPassengerSurvey.aspx>.
9. Blair, S.N., LaMonte, M.J., & Nichaman, M.Z. , *The evolution of physical activity recommendations: How much is enough?* . American Journal of Clinical Nutrition, 2004. **79**(5): p. 913-920.
10. *Physical activity guidelines for Americans*, 2008, United States Department of Health and Human Services, Office of Disease Prevention and Health Promotion: Washington, DC.
11. *Healthy People 2020 - nutrition and weight status*. [cited 2011 June 6]; Available from: <http://healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicId=29>
12. *Physical Activity*. [cited 2011; Available from: <http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=33>].
13. Panter, J.R., & Jones, A. , *Attitudes and the environment as determinants of active travel in adults: What do and don't we know?* . *Journal of Physical Activity & Health*, 2010. **7**(4): p. 551-561.
14. Pratt, M., Macera, C.A., & Wang, G. , *Higher direct medical costs associated with physical inactivity*. *Physical Sportsmedicine*, 2000. **28**(10): p. 63-70.
15. Morabia, A., Mirer, F.E., Amstislavski, T.M., Eisl, H.M., Werbe-Fuentes, J., Gorczynski, J., et al. , *Potential health impact of switching from car to public transportation when commuting to work*. *American Journal of Public Health*, 2010. **100**(12): p. 2388-2391.
16. Heath, G.W., *The role of public health sector in promoting physical activity: National, state and local applications*. *Journal of Physical Activity Health*, 2009. **6**(2): p. 159-167.
17. Frank, L.D., & Kavage, S., *A national plan for physical activity: the enabling role of the built environment*. *Journal of Physical Activity & Health*, 2009. **6**: p. 186-195.
18. Besser, L.M., & Dannenburg, A.L. , *Walking to public transit: Steps to help meet physical activity recommendations*. *American Journal Preventive Medicine*, 2005. **29**(4): p. 273-280.
19. Merom, D., van der Ploeg, H.P., Corpuz, G., & Bauman, A.E. , *Public health perspectives on household travel surveys active travel between 1997 and 2007*. *American Journal of Preventive Medicine*, 2010. **39**(2): p. 113-121.
20. Hofweber, T. *Humboldt County General Plan Update Transport Indicators*. 2010; Available from: http://www.humanimpact.org/evidencebase/category/active_transportation_can_contribute_t.
21. MacDonald, J.M., Stokes, R.J., Cohen, D.A., Kofner, A., & Ridgeway, G.K. , *The effect of light rail transit on body mass index and physical activity*. *American Journal of Preventive Medicine*, 2010. **39**(2): p. 105-112.
22. Centers for Disease Prevention and Control. *State Physical Activity Indicators*. 2006; Available from: <http://www.cdc.gov/physicalactivity/professionals/data/index.html>.
23. Savi, *Central Indiana Databases*. 2011.
24. *The Surgeon General's call to action to prevent and decrease overweight and obesity*. 2001 [cited 2011 June 15]; Available from: <http://www.surgeongeneral.gov/topics/obesity/>.
25. Prevention, C.f.D.C.a. *Economic consequences*. 2011 [cited 2011 July 19]; Available from: <http://www.cdc.gov/obesity/causes/economics.html>
26. Finkelstein, E.A., Trogon, J. G., Cohen, J. W., & Dietz, W. , *Annual medical spending attributable to obesity: Payer- and service-specific estimates*. *Health Affairs*, 2009. **28**(25): p. 822-831.



27. Prevention, C.f.D.C.a. *About BMI for adults*. 2011 [cited 2011 July 19]; Available from: http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html
28. Prevention, C.f.D.C.a. *Behavioral Risk Factor Surveillance System - prevalence and trends data*. 2011 [cited 2011 June 15]; Available from: <http://apps.nccd.cdc.gov/brfss/>
29. Initiative, C.a.A.H.M. *National survey of children's health*. [cited 2011 June 16]; Available from: <http://nschdata.org/DataQuery/SurveyTopics.aspx>.
30. Finkelstein, E.A., Fiebelkorn, I. C., & Wang, G, *State-level estimates of annual medical expenditures attributable to obesity*. *Obesity*, 2004. **12**(1): p. 18-24.
31. Gibson, P.J., Zollinger, T.W., Moriarty, S.R., Lahsae, H., Saywell, R.M., Muegge, C.M., & Caine, V.A. . *2005 Marion County Adult Obesity Needs Assessment Telephone Survey Report*. 2005 [cited 2011 June 17]; Available from: http://www.mchd.com/obesity/Obesity_Report_2nd_edition_for_web.pdf.
32. *Obesity-related maps, by health planning area in Marion County*, Marion County Health Department: Indianapolis, IN.
33. *Access to affordable and nutritious food*. 2009 [cited 2011 June 30]; Available from: <http://www.ers.usda.gov/Publications/AP/AP036/AP036.pdf>
34. Morland, K., Roux, A., and Wing, S. , *Supermarkets, other food stores, and obesity: the atherosclerosis risk in communities study*. *American Journal of Preventive Medicine*, 2005. **3**(4): p. 333-339.
35. *County health rankings*. [cited 2011 June 30]; Available from: <http://www.countyhealthrankings.org/>
36. Bassett, D., Pucher, J., Buehler, R., Thompson, D., and Crouter, S. , *Walking, cycling, and obesity rates in Europe, North America, and Australia*. . *Journal of Physical Activity and Health*, 2008. **5**: p. 795-814.
37. *Healthy People 2020 -diabetes*. [cited 2011 July 25]; Available from: <http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicId=8>
38. Powers, A.C., *Diabetes mellitus*. 17 ed. *Harrison's Principles of Internal Medicine (online)* ed. E.G. A. S. Fauci, D. Kasper, S. L. Hauser, D. L. Longo, J. L. Jameson & J. Loscalzo 2008: McGraw-Hill Companies.
39. Prevention, C.f.D.C.a. *Diabetes data and trends*. 2010 [cited 2011 July 25]; Available from: http://www.cdc.gov/diabetes/statistics/prevalence_national.htm
40. Dall, T., Mann, S. E., Zhang, Y., Martin, J., Chen, Y., & Hogan, P. , *Economic costs of diabetes in the U.S. in 2007*. *Diabetes Care*, 2008. **31**: p. 596-615.
41. Association, A.D. *Diabetes cost calculator*. [cited 2011 February 3]; Available from: <http://www.diabetesarchive.net/advocacy-and-legalresources/cost-of-diabetes.jsp>.
42. *Diabetes*. 2011 [cited 2011 February 3]; Available from: <http://www.mayoclinic.com/health/diabetes/DS01121/DSECTION=risk-factors>.
43. *Medline plus: Type 2 diabetes - risk factors*. 2011 [cited 2011 February 3]; Available from: <http://www.nlm.nih.gov/medlineplus/ency/article/002072.htm>.
44. *Prevent diabetes problems: Keep your diabetes under control* N.I.o.D.a.D.a.K. Diseases, Editor 2008, National Diabetes Information Clearinghouse: Bethesda, MD.
45. *Diabetes in Indiana: A report on diabetes morbidity and mortality*. 2008 [cited 2011 February 3]; Available from: http://www.in.gov/isdh/files/2-08_burden_Diabetes_in_Indiana_FINAL.pdf
46. Prevention, C.f.D.C.a. *Chronic disease indicators – Indiana*. 2007 [cited 2011 July 25]; Available from: <http://apps.nccd.cdc.gov/cdi/SearchResults.aspx?IndicatorIds=12,61,34,31,24,19,38&StateIds=15&StateNames=Indiana&FromPage=HomePage>.
47. *Vision Problems in the U.S.* . 2008; Available from: <http://www.preventblindness.org/sites/default/files/national/documents/diabetic-retinopathy.pdf>
48. Fleming-Moran, M., *Diabetes facts for Marion County 2009*, M.C.H. Department, Editor 2010: Indianapolis, IN.
49. *2009 IndyGo On-board Transit Survey*, 2009, Indianapolis Metropolitan Planning Organization Indianapolis, IN.
50. Stokes, R.J., MacDonald, J., & Ridgeway, G. , *Estimating the effects of light rail transit on health care costs*. *Health & Place*, 2008. **14**(1): p. 45-58.
51. Iqbal, N., *The burden of type 2 diabetes: strategies to prevent or delay onset*. *Vascular Health Risk Management*, 2007. **3**(4): p. 511-520.