

# CHIA

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## HEALTH IMPACT ASSESSMENT: THE IMPACTS OF INCREASING TREE CANOPY COVERAGE IN MARION COUNTY, INDIANA

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### **Abstract**

**Background:** Urban tree canopies help to address issues of climate change related to all dimensions of health. Certain areas of the city of Indianapolis are more prone to the negative effects that lack of tree coverage can cause. This assessment explored the short term and potential long-term impacts of the efforts to increase the tree canopy coverage in vulnerable areas of Indianapolis. This effort was a collaboration of faculty members from the Indiana University Richard M. Fairbanks School of Public Health, Indianapolis Department of Public Works, Keep Indianapolis Beautiful, and the Indianapolis Office of Sustainability.

**Methods:** Our team used the standard seven-step Health Impact Assessment (HIA) process to make the recommendations provided. Using direct observation of the neighborhood, secondary data collection, literature review, and a key stakeholder interview, we examined key dimensions of health including environmental, physical, and personal health outcomes resulting from increased tree canopy coverage within census tract 3505 of Marion County, Indiana.

**Results:** Increasing the percentage of tree canopy coverage in census tract 3505 – Crown Hill has significant positive health impacts with minimal negative outcomes. Such impacts may be, but are not subject to, lower temperatures, reduced cases of respiratory and cardiac infections/illnesses, promoting animal life, increasing neighborhood property values and filtering pollutants that result from human production activity.

**Conclusions:** Further implementation of the Thrive Indianapolis project has broad positive implications for the community members living in this area. While few negative implications were found, we make recommendations to mitigate these effects while attempting to supplement the current project plan with a focus on the effects to human health.

**Keywords:** HIA, Health Impact Assessment, Census Tract 3503, Crown Hill, Indianapolis, Marion County, tree canopy, Thrive Indianapolis, Keep Indianapolis Beautiful (KIB)

## Introduction

As the climate patterns change across the world, there must be action taken within communities to adapt to these changing temperatures. In Indianapolis, extreme weather changes affect certain populations disproportionately and areas of high poverty are especially prone to the negative side effects of poor climate-centered infrastructure planning (Vilfranc, 2021). Tree canopy coverage in urban areas has many benefits to the health of the individuals who live and work there (Indianapolis Office of Sustainability, 2019).

The local nonprofit organization, Keep Indianapolis Beautiful (KIB), has been working toward addressing this issue, along with numerous other nature related tasks in the community, for over 40 years (Keep Indianapolis Beautiful [KIB], 2022). In 2006 KIB began an initiative in partnership with the Indianapolis Office of Sustainability to address the need for more tree canopy coverage in Indianapolis (Sheridan, 2021). This health impact assessment explores the reasoning behind this program, how the program was implemented, the successes of the program, and how it can be improved to better address the social determinants of health as identified. The primary objective of this assessment is to evaluate the Thrive Indianapolis program and provide recommendations to maximize the positive outcomes while minimizing the negative consequences of the program.

## Project Under Assessment

An urban tree canopy is defined as the layer of leaves and the amount of coverage or shade that is provided by a tree to the ground below (U.S. Department of Agriculture, Forest Service, 2019). Cities can assess the amount of coverage provided by a canopy and use this information to track the growth and progress of the canopy. These tree canopy projects are more than

just an effort to beautify a community; they also assess and evaluate specific social and environmental health determinants in areas that are lacking resources (U.S. Department of Agriculture, Forest Service, 2019). After an assessment and analysis has been conducted on a specified area, stakeholders provide input on the best places to strategically plant trees to address the identified environmental, social, and health risks. In addition to the initial implementation of the tree plantings, continued short- and long-term monitoring of these canopies is vital to the project. The monitoring not only assesses the growth and progress of the canopy, but also the effectiveness of addressing the health impacts and goals initially intended. This HIA was conducted by graduate students at the Indiana University Richard Fairbanks School of Public Health.

## Health Impact Assessment Methodology

Our HIA sought to evaluate census tract 3505 (the Crown Hill area) within Marion County, Indiana. The graduate student research team used the standard seven-step Health Impact Assessment (HIA) process adapted from Ross and colleagues (2014); the steps are outlined below:

1. **Screening** – determine if usefulness of HIA for the project
  2. **Scoping** – plan the HIA
  3. **Assessment** – identify immediate and long-term impacts of project
  4. **Recommendations** – provide strategies to enhance the positive impacts of the project while minimizing any negative impacts
  5. **Reporting** – communicate and disperse findings to stakeholders and community
  6. **Evaluation** – understand the implications of the project
  7. **Monitoring** – continue to track key metrics over time after project implementation
- (Ross, Orenstein, & Botchwey, 2014)

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### Screening

Due to time limitations, faculty members at the Indiana University Fairbanks School of Public Health conducted this step in the HIA process. Prior to student engagement, the faculty members identified project opportunities which allowed our team to proceed through the subsequent steps of a rapid HIA. Further discussion of the screening step included: 1) an evaluation of whether the project will affect a new population; 2) an evaluation of whether the decision makers are open to collaborating; and 3) an HIA, if there was a value-add to the decision and if there was sufficient information to conduct additional research (KA Hilts, 2022).

### Scoping

Our team relied on literature reviews, secondary data collection, and a stakeholder interview to assist in the development of a scoping document to guide the execution of this HIA. Stakeholders were identified by the faculty members in the screening process of the HIA and included decision-makers from the Indianapolis Office of Sustainability, Department of Public Works, and Keep Indianapolis Beautiful. In our hour-long interview with the stakeholders, 10 priority areas were identified to expand tree canopy coverage using the Key Neighborhood Identification Tool (KNIT). A KNIT score is derived using four major factors:

- Social Vulnerability Index (SVI) data
- Percent Canopy Coverage
- Concentration of litter and illegal dumping complaints
- KIB Program Score  
(Adler, Kincius, & McReynolds, 2022)

One of the priority areas having a high KNIT score was selected by the graduate student research team for subsequent evaluation and is the focus of this HIA – census tract 3505 in Marion County, Indiana. This census

tract represents a 0.6 square mile area within Marion County, Indiana having a population of approximately 2,379 (U.S. Census Bureau, 2022). The team selected census tract 3505 for review due to time limitations. Familiarity of the area, proximity, and background knowledge of inequities occurring in this area were additional contributors to the selection of this census tract.

After conducting a literature review, we developed a scoping document which outlines the goals of the HIA. These goals were extracted from action plans developed by various governing agencies with the intent of implementing the Thrive Indianapolis program:

1. Increasing community resilience through a focus on equity (Indianapolis Office of Sustainability, 2019)
2. 100% renewable energy use by 2028 (WHO, 2022)
3. Achieve net zero greenhouse gas emissions in Marion County, Indiana by 2050 (Indianapolis Office of Sustainability, 2019)
4. Plant 30,000 native trees in Marion County, Indiana by 2050 (Indianapolis Office of Sustainability, 2019)

The above outlined goals are the principal drivers in the selection and subsequent assessment of further expanding tree canopy coverage in census tract 3505.

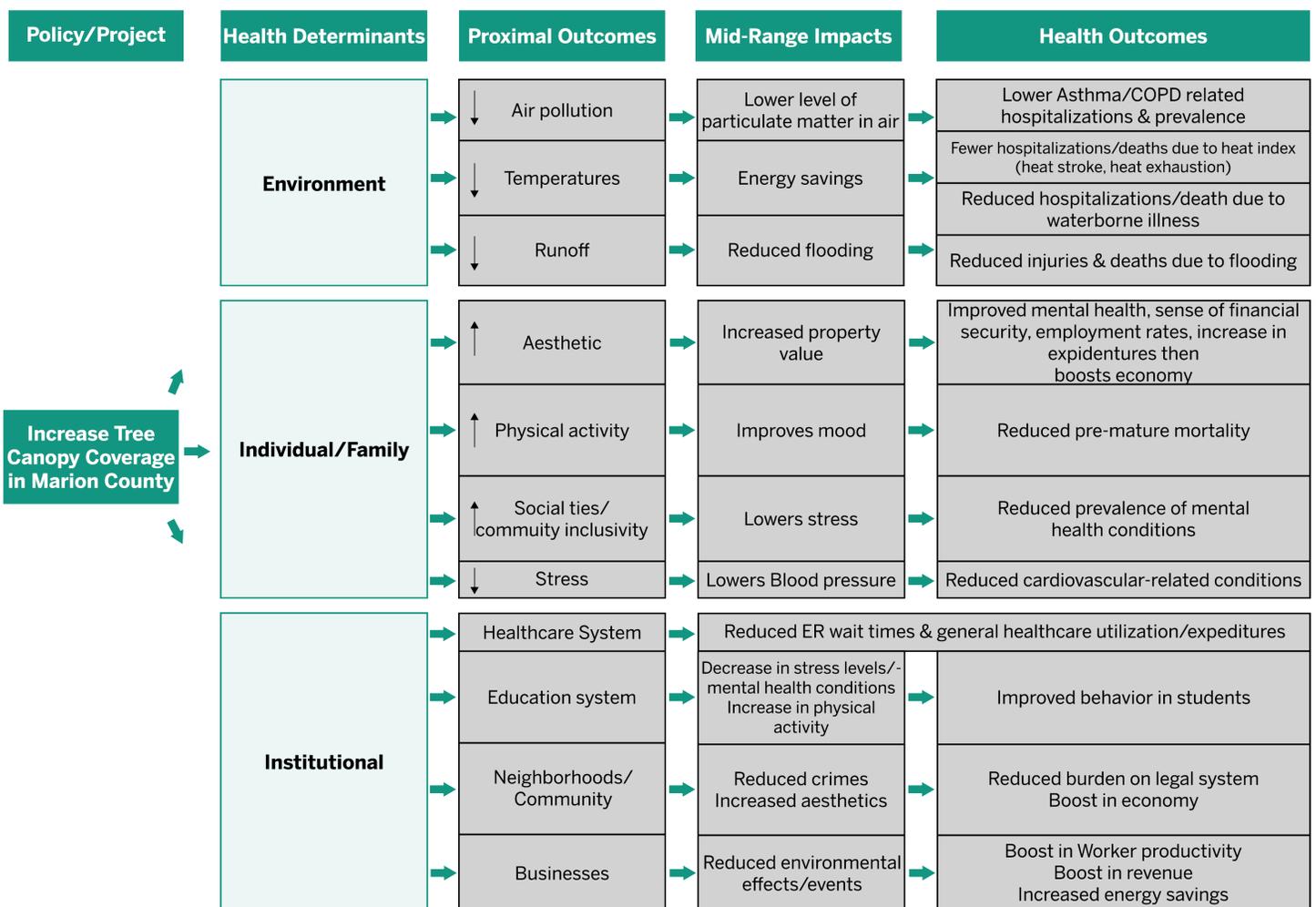
### Assessment

Our team relied on stakeholder interviews, literature reviews, secondary data collection and direct observation of the area to develop baseline health, social and environmental metrics, and a community profile. To aid in the prioritization of health-specific outcomes, we created a pathway diagram displaying how increasing tree canopy coverage in census tract

3505 would affect the three primary groups of social determinants of health (environment, individual/family, and institutional). The pathways diagram (**Figure 1**) further outlines the proximal, intermediate, and long-term effects that increasing tree canopy coverage might have. Our literature review also elicited the development of four research questions that this report further discusses in the results section:

1. What impact will an increase in tree canopy coverage have on premature deaths, hospitalization rates, and mental health outcomes?
2. What are the necessary requirements to reduce any negative outcomes related to increased tree canopy coverage?
3. How will increasing tree canopies affect food insecurity, cost of living, and other equity-related issues?
4. How will increased tree canopies affect climate change challenges such as heat waves, droughts, and flooding?

**Figure 1: Pathways Diagram**



Note: Arrows under the proximal outcomes section represent the direction (positive/negative) of the predicted outcomes

**Results**

**Summary**

We conducted three distinct analyses to develop a community profile and baseline health metrics worthy of further monitoring and evaluation. First, our team developed a community profile by reviewing publicly available data sets from SAVI, the Centers for Disease Control and Prevention (CDC), Environmental Protection Agency (EPA), and through direct observation of the neighborhood. These results are outlined in the sections below. Quantitative data were compared to Marion County, Indiana rates to comprehend possible disparities occurring in this area.

*Community Profile – Quantitative Results*

SAVI data were used to understand the demographic characteristics of the population in census tract 3505; results are presented in **Table 1**. As a benchmark, we used Marion County, Indiana to understand how census tract 3505 compares using the same metrics. SAVI data were also used to understand organizational resources currently available in this area; findings can be viewed in **Table 2** and **Figure 2**. Secondly, our team completed a windshield survey/direct neighborhood observation focusing on the housing characteristics, environmental infrastructure, resources, and neighborhood life to get a sense of this population’s living circumstances.

**Table 1: Demographic Characteristics and Composition of Census Tract 3505 Population**

Metric	Census Tract 3505 Crown Hill	Marion County, Indian
Population	2,379	951,869
Unemployment Rate	13%	6%
Poverty	47	18
Per Capita Income	15,339	30,013
Violent Crime Rate Per 1,000	92	6
% African American	78%	28%
Median Age	35	34
Poverty (children under 18)	55%	24%
Poverty (65+ yo)	27%	10%
Educational Attainment - Bachelor's Degree	6%	32%

(SAVI, 2010; U.S. Census Bureau, 2022)

**Table 2: Organization Resources Available Within Census Tract 3505, Crown Hill**

Metric	Census Tract 3505 - Crown Hill
Material Assistance	 0
Fire Stations	 0
Education Programs	 1
Emergency Food	 0
Community Center	 1
Basic Needs Organizations	 1

**Figure 2: Organizational Resources of Census Tract 3505 Map**



One member of our research team surveyed census tract 3505 – Crown Hill on a Thursday morning during the summer season; this Thursday morning was laden with heavy rain and thunderstorms with a temperature of 69 degrees Fahrenheit. Photographs were taken to express housing characteristics, available open spaces, community resources, and the neighborhood life in the area.

**Housing Characteristics**

Per the U.S Census Bureau survey completed in 2020, there are a total of 1,235 housing units in this census block (**Figure 2**); 21% of these

units are vacant which is nearly double the rate of Marion County, Indiana (11% vacancy) (U.S. Census Bureau, 2022). The number of housing units outweigh the number of households (seen in **Figure 3**) in this area – there are 973 households with an average of 2.4 persons per household (U.S. Census Bureau, 2022). Majority of these households are owned by female members which is 1.5 times the rate of Marion County, Indiana (U.S. Census Bureau, 2022). It was also observed that numerous houses had boarded-up or broken windows, with a run-down appearance.

**Figure 3: Housing Unit Located in census tract 3505 – Crown Hill**



**Figure 4: Representative Household & Structure in census tract 3505 – Crown Hill**



### **Open Spaces**

While this area had open spaces, the appearance aligned with that of some of the housing characteristics. The state of the observed open spaces can be seen in **Figure 5**. There were a handful of empty gravel or concrete-paved lots not in use – some construction debris could be seen laying in these areas. The buildings in proximity to these lots had graffiti in addition to vacant buildings.

**Figure 5: Open Space Example Within Census Tract 3505 – Crown Hill**



### Community Resources

As discovered in our quantitative overview, it was found that this area has very limited resources; however, within near proximity outside the census tract boundaries, more resources can be found. Our team found no fire or police stations in the area although police presence was observed (**Figure 6**). One elementary school was found to be in the area. There are extreme limitations to food in the area – a Dollar General, McDonald's, a few gas stations, and liquor stores were found in the area suggesting limited potential for obtaining healthy food options. Per SAVI, this census tract has been deemed a food desert (SAVI, 2018) and could benefit from alternative project options like a community garden or farmer's market to provide healthy food options. This area has also been deemed a medically underserved area – meaning there are no hospitals or healthcare clinics. Due to this fact, we found it essential to prioritize baseline metrics including hospitalization rates due to inhaled air pollutants, rates of disease correlated with inhaled air pollutants including COPD, asthma, cardiovascular-related disease, and mental health-related disease. Finally, it was found that there are six churches in this census tract that could provide additional resources and feedback.

### Figure 5: Open Space Example Within Census Tract 3505 – Crown Hill



### Neighborhood Life

Our team observed a largely African American population confirmed by our quantitative results that this area is 78% African American (U.S. Census Bureau, 2022). Although not observed at the time of the windshield survey, a member of our team has previously observed homelessness when driving through the area on sunny days. We suspect that no interaction was occurring from members of the neighborhood due to the rain in the area at the time of observation; previous sightings by a team member of neighborhood interaction had occurred outside of the survey timing.

### Neighborhood Infrastructure

The observations in this section promote a significantly higher health risk for the members living in this census tract – in particular, members whose houses border major streets. This community is adjacent to a main highway, I-65; this community is also segregated by several major Indianapolis streets, including 38th Street, Illinois Street, and Capitol Street. All these heavy traffic areas increase the citizen's exposure to particulate matter, and toxic air pollutants. Furthermore, it was found that multiple major bus routes move through this area further increasing the chances of air-pollutant related hospitalizations and disease prevalence (**Figure 7**). These bus routes serve as a point of transportation for the citizens living in this area; however, the risks of the bus routes may outweigh the benefits and further research would be necessary to determine this. Finally, the overall infrastructure was run-down, consistent with the housing characteristics. To better align this area with the goals outlined in the Thrive Indianapolis plan, funding to improve the built environment to include the displacement of debris-laden vacant lots with a community garden or plant native

trees may improve the mental health of this area’s citizens and subsequently reduce the excessive prevalence of violent crimes by providing a more serene, aesthetically pleasing appearance (Park, et al., 2011).

**Figure 7: Bus Routes Moving Through Census Tract 3505 – Crown Hill**



*Baseline Health Status*

We reviewed various health, behavioral, and environmental metrics to evaluate the inequities occurring in census tract 3505 – Crown Hill. Disease prevalence and health risk behavior data were obtained from the PLACES database – these data are a combination of the Behavioral Risk Factor Surveillance System (BRFSS) and census data (CDC, 2022). The environmental metrics are a combination of data from the Environmental Protection Agency’s (EPA) Environmental Justice Screening and Mapping Tool (EPA, 2022) and Thrive Indianapolis action plan reports. Baseline metrics were prioritized by us to express potential disease exacerbations directly correlated with exposure to poor air quality as well as the underlying mechanisms of stress influencing poor mental health status. The selected rates are displayed in Table 3 comparing census tract 3505 to Marion County, Indiana.

**Table 3: Baseline Metrics of Census Tract 3505 – Crown Hill Compared to Marion County, Indiana: Disease Prevalence Rates, Behavioral Risk Factor Rates, and Environmental Metrics**

Metric	Census Tract 3505 - Crown Hill	Marion County, Indiana
<b>Baseline Health Metrics</b>		
High Blood Pressure	52%	35%
COPD	13%	7%
Asthma	14%	10%
Stroke	8%	4%
Heart Disease	10%	6%
Diabetes	25%	13%
Depression	21%	20%
Obesity	48%	34%
<b>Baseline Health Behavioral Metrics</b>		
Physical Inactivity	51%	34%
Sleep < 7 hours	48%	38%
Mental Health Status ("not good" for >=14 days)	23%	16%
Physical Health Status ("not good" for >=14 days)	23%	13%
<b>Environmental</b>		
Respiratory Risk due to cumulative air toxics	0.472 - 0.777	N/A
Summertime Maximum Daily Temperature	97.1 - 98 Degrees	N/A
Social Vulnerability	High	N/A
Percent Tree Cover	5 - 15%	N/A

**Table 4: Summary Outcomes, Likelihood, Magnitude, and Additional Considerations in Implementation**

Outcome	Likelihood	Magnitude	Additional Considerations & Details
High Blood Pressure	Likely	Small to Moderate	Literature suggests more green space may lower the odds of hypertension, diabetes and cardiovascular disease (Astell-Burt & Feng, 2019)
COPD	Likely	Small to Moderate	Certain trees are associated with higher levels of allergens (Sousa-Silva, et al., 2021). Allergies have the potential to exacerbate symptoms for those with COPD (Gayle, et al., 2020). Exacerbation of symptoms could be minimized by planting trees approved by those directly affected.
Asthma	Likely	Small to Moderate	Certain trees are associated with higher levels of allergens, it would be essential to seek guidance from community members where trees will be placed to ensure increased asthma-related conditions are mitigated (Sousa-Silva, et al., 2021)
Stroke	Likely	Small to Moderate	Those living in greener areas had a lower risk of death in those having a prior stroke (Kondo, et al., 2020)
Heart Disease	Likely	Small to Moderate	Literature suggests more green space may lower the odds of hypertension, diabetes and cardiovascular disease (Astell-Burt & Feng, 2019)
Diabetes	Likely	Small	Literature suggests more green space may lower the odds of hypertension, diabetes and cardiovascular disease (Astell-Burt & Feng, 2019)
Depression	Likely	Small to Moderate	Higher levels of green space are associated with lower depressive symptoms, anxiety and stress (Beyer, et al., 2014)
Obesity	Likely	Small	Increasing tree canopy coverage shows an increase in physical activity thereby having the potential to reduce rates of obesity (Wolf, et al., 2020)
Physical Inactivity	Likely	Small	Increased heat is directly correlated with lower levels of physical activity; increasing tree canopy coverage from 4% to 60% reduced daily maximum temperatures by approximately 3 - 5.23 degrees Celsius (Esfehankalateh, et al., 2021)
Sleep < 7 hours	Likely	Small	The odds of insufficient sleep were lower among participants having higher tree canopy coverage (Astell-Burt & Feng, 2019) - low-level vegetation was not associated with sufficient sleep (Astell-Burt & Feng, 2019)
Mental Health Status (not good for >=14 days)	Likely	Moderate	Higher levels of green space are associated with lower depressive symptoms, anxiety and stress (Park, et al., 2011)

**Table 4: Continued**

Outcome	Likelihood	Magnitude	Additional Considerations & Details
Physical Health Status ("not good" for >=14 days)	Likely	Small	Direct impacts can be measured through increases in physical activity and associated reductions in cardiovascular disease, diabetes, and other chronic health conditions (Wolf, et al., 2020)
Respiratory Risk due to cumulative air toxics	Likely	Moderate	The planting location of the trees are essential; research suggests that trees planted close to the street may disrupt wind flow and subsequently trap pollutants below the tree canopy line (Vos et al., 2013)
Summertime Maximum Daily Temperature	Likely	Moderate	Tree canopy coverage is associated with fewer ambulance calls for heat-related events (e.g. heat stroke, heat exhaustion) and subsequent heat-related mortality (Graham, et al., 2016).
Crime Rates	Likely	Small to Moderate	Tree canopy coverage is inversely associated with crime rates (robbery, theft, shootings). Trees planted near the street were associated with decreased crime (Troy, et al., 2012)

Explanations:

\* Likelihood: strength of evidence in the literature (likely or unlikely); Magnitude: estimated size of the impact (effect on number of disease cases or adverse events)

**Projected Impacts**

We evaluated each of the metrics outlined in Table 3 and assessed the likelihood that increasing tree canopy coverage has on influencing the respective metric and the intensity and magnitude of the effect; these effects are outlined in Table 4. In summary, increasing tree canopy coverage or additional green spaces in this community have the potential to reduce all reviewed health outcomes if the proper mitigation strategies are executed.

**Mitigation Metrics & Considerations**

While the projected impacts of expanding the Thrive Indianapolis program to include increasing tree canopy coverage are overwhelmingly positive, it is also essential in the HIA process that mitigation metrics be developed to reduce any potential negative

impacts. Our team would suggest tracking or considering the following to ensure mitigation of negative outcomes:

1. Planning proper tree planting location; literature suggests that trees planted in near proximity of the street can disrupt air flow thereby trapping air toxins (Vos et al., 2013)
2. While increased tree canopy coverage is associated with reduced gun assaults (Wolf, et al., 2020), researchers found that small view-obstructing trees are associated with increased crime rates (Donovan, 2012)
3. Careful consideration must be placed on the tree species planted to ensure community members are not allergic

4. While increased urbanization is linked to an increase in the incidence of vector-borne diseases, increasing eco-habits for these species also provides opportunity for increased exposure and hospitalizations (Diuk-Wasser, et al., 2020)

### **Recommendations**

Our team exhibited vigilance to not duplicate current efforts and measures that are being taken in conjunction with the Thrive Indianapolis program. Rather, we found limiting factors in the plans that would help to supplement and accelerate meeting currently devised metrics.

#### **Recommendation 1: Convert Empty Vacant Lots into Community Gardens or Rain Gardens**

Direct observation of census tract 3505 – Crown Hill enables the research team to recommend the conversion of vacant lots to either community gardens, rain gardens, or green spaces. This recommendation directly aligns with three of the current metrics being reported: 1) total tons of materials recycled; 2) square feet of rain garden; and 3) % impervious area (City of Indianapolis Office of Sustainability, 2021). Addressing these metrics would have further implications on select public health and safety metrics reported out like the percentage of adults who are overweight or obese (City of Indianapolis Office of Sustainability, 2021). While the 2021 report describes current funding and efforts to enhance violence prevention, the project plan does not report any mental-health related outcomes. Our team seeks to supplement the plan by encouraging additional violence-related health metrics to fully understand the effect that the built environment, including green areas, has in reducing Indianapolis-based crime. Community gardens are a proven way to encourage social connectivity in communities and enhances the sustainability of communities with this opportunity. Additionally, green areas have a

sustainable impact on the mental well-being of populations near these areas (South, et al., 2018).

#### **Recommendation 2: Develop Partnership with IndyGo**

The expansion of bus routes in the Indianapolis area are contributing to increased diesel exhaust exposing members to poor air quality (EPA, 2022). Our analysis found that census tract 3505 – Crown Hill is wedged between multiple high-traffic city streets (38th Street, Meridian Street, Capitol Street, and Illinois Street) and is also adjacent to I-65. Our recommendation to engage leaders from IndyGo with the intent to evaluate bus routes to lessen the effects of air pollution from bus exhaust would improve psychological stress as well as asthma/COPD-related hospitalizations. Careful consideration must be taken to resolve the increase in air pollution while either maintaining or reducing the level of transportation options available to this community. Our team stresses that barriers to transportation would increase vulnerabilities in this population.

#### **Recommendation 3: Mitigation Measures**

The safety and security of members in this community are of utmost importance. While evidence shows an overwhelming number of positive outcomes stemming from increased tree canopy coverage on human health, environmental health, and further downstream effects, mitigation metrics are an essential component to minimize any potential negative outcomes. We further recommend the mitigation measures outlined in a prior section of this report be reported on a regular cadence to governing and funding authorities.

#### **Reporting**

Results of this analysis will be presented in three separate formats. First, this report will be provided to the stakeholders for review and

additional feedback. Second, our team will be presenting a summarized version of this report to stakeholders and faculty members. Third, we have intent to submit this report to a peer-reviewed journal for wider dissemination of findings.

### **Monitoring & Evaluation**

Project plans for the Thrive Indianapolis program currently provide robust evidence, analyses, and tracking that allow for continual reporting to governing and funding authorities. These project plans currently track metrics related to the built environment, energy-use, food and urban agriculture, transportation/land use, and waste/recycling efforts. This HIA serves as a supplement to these project plans by providing health-related metrics showing the direct effect on the populations of the target communities. We found several metrics that are formally reported with varying timelines by the project stakeholders: most occurring every year or every three years. However, there were minimal health-based outcome measures developed. Our team's recommendations would be to partner directly with data-collecting organizations such as the Indiana State Department of Health to obtain hospitalization data from mental health conditions, asthma, COPD, heat-related, and cardiovascular-related events. This partnership would aid in regularly monitoring the downstream health impacts of increasing tree canopy coverage in census tract 3505 – Crown Hill. Publishing quantitative results using these data would also be beneficial in securing additional funding to continue sustainability efforts in Indianapolis communities.

### **Conclusion**

This Health Impact Assessment was conducted to determine the health-related benefits and consequences of Thrive Indianapolis, specifically focusing on the impact of increased

tree canopy in the Crown Hill neighborhood of Marion County, Indiana. Crown Hill has disproportionately high rates of unemployment, poverty, and violent crime and thus has the most to gain from the benefits of increased tree canopy and/or green space.

The assessment was initiated by Keep Indianapolis Beautiful and the Indianapolis Office of Sustainability and conducted by graduate students at the Richard M. Fairbanks School of Public Health at Indiana University-Purdue University Indianapolis. Through key interviews, direct observation, secondary data analysis, and review of the existing literature, our team of graduate researchers assessed the impact of the increased tree canopy on morbidity and mortality, social equity, and mitigation against climate change. We also provide recommendations for maximizing the positive and minimizing the negative effects of the program. The major limitation of this assessment was time. Because of time constraints we were also unable to engage community members; additional input from these key stakeholders is essential to the success of the program and should be considered prior to planting.

In addition to engaging community members in planning and evaluation, we make the following specific recommendations: 1) convert vacant lots into community gardens or rain gardens to reduce the effects of climate change; 2) develop a partnership with IndyGo to align public services to achieve the City's climate change goals ; and 3) continuous monitoring of potential threats such as crime and vector-borne disease to ensure that conditions in the Crown Hill neighborhood are not made worse by the program initiatives.

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