



WORLDS FURTHER APART

THE WIDENING GAP IN LIFE EXPECTANCY AMONG
COMMUNITIES OF THE INDIANAPOLIS METROPOLITAN AREA

AUGUST 2021

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Indianapolis metro area residents are a diverse group of people. What we have in common is that many of our best and worst days have been lived within this larger community. We may recall warm summer hours in our favorite park, a day spent at “the track,” or taking the kids to the Children’s Museum. We may also remember days spent at the bedside of a sick family member in an area hospital or places of tragic loss. Year after year, we build our lives within the Indianapolis metro area. In this way, our lives are linked by a shared community.

However, in the neighborhoods we each call home, our daily lives are often vastly different. For some, getting groceries means lugging plastic sacks onto the IndyGo bus after waiting on a patch of worn grass. For others, grocery shopping is a quick drive to one of three favorite options, and the farmer’s market is a weekend routine for fresh produce. Some kids go to school with laptops and fresh-smelling pages of new textbooks, while others have worn books and no internet access. Playing outside with friends in one neighborhood builds fitness and friendships, while in another playing outside triggers an asthma attack because of all the car exhaust along the busy roadway.

Place differences add up over the days of our lives to affect our health and length of life. The children of one neighborhood have the same biological capacity for a long and healthy life as do the children of any other neighborhood, but where they live and grow and learn often unfairly cuts short their opportunities and their life.

In our updated analysis of 104 ZIP Codes in the metro area (2014-2018), we identified the northern suburb of Fishers as our longest living community and just 17 miles away, within the Indianapolis city limits, is the shortest living community within the metro area. **Though only 17 miles of distance separate them, their life expectancy is worlds apart.**

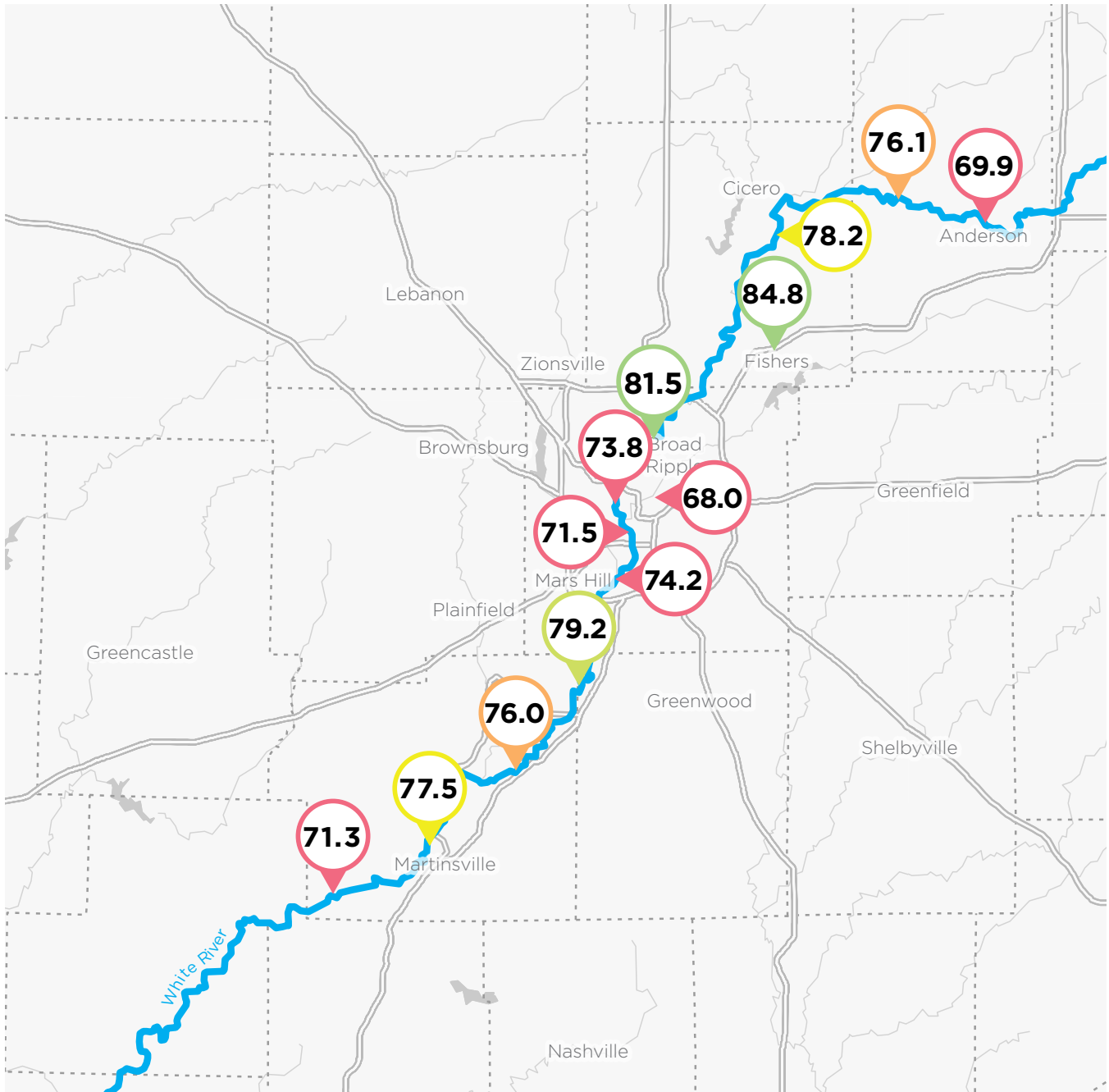
As the White River winds its way through the metro area, flowing northeast to southwest, it connects us as a larger community across time and space.

The history of central Indiana is rooted in access to this shared life-supporting resource, where tribes, then towns and cities grew along its banks. Following the winding path of the White River, we see a pattern in life expectancy that also plays out throughout the metro area (See *Life Expectancy Mapped Along the White River, 2014-2018*, on next page). Life expectancy is lowest in places within the urban core of Indianapolis and also on the outer periphery of the metro area (red), while highest life expectancy is found in the suburban transitions from the city (green).

Similar to our earlier findings residents of the longest-living community are living years longer than the U.S. average with a life expectancy comparable to the top high-income countries of the world.¹ Residents of the shortest living community are living only as long as U.S. residents lived on average more than six decades ago, and **the gap has widened.**

There is no genetic reason for this inequity. These data compel us to put equity at the forefront in addressing the economic and social policies and structures driving this unfairness. Inequity, in life and health, “saps the strength of the whole society.”²

Life Expectancy Mapped Along the White River, 2014-2018



WHY NOW?

Is an assessment of life expectancy in the pre-COVID era (2014-2018) relevant in a city or a world that has been so drastically affected by COVID-19? While this follow-up study was planned before COVID began, it has taken on more significance in the current social context. Deaths from COVID during 2020, along with a continued rise in “deaths of despair” (suicide, drug & alcohol-related deaths) – a so-called “syndemic”³ – has brought into sharp focus the underlying fractures in our society that produce and perpetuate health disparities.

Drops in life expectancy have been quite rare in the U.S. with exceptions resulting from catastrophic events (the Civil War, World War I, and the Spanish Flu epidemic) - but within our current decade, we have already experienced declines twice.⁴ During 2020, white people lost 1.2 years of life expectancy, while Black people lost 2.9 years and Hispanic people lost 3.0 years of life expectancy.⁵ The higher rate of COVID-19 deaths among Black and Hispanic people in the U.S. is due to the everyday living and working conditions that increased their exposure to the virus, such as more often working jobs that put them in direct contact with others, using public transportation, and living in more crowded housing.^{6,7} According to the author of a major study about these disparities, “It is all about the exposure. It is all about where people live. It has nothing to do with genes.”⁸ The same underlying social vulnerabilities that produced this wide disparity in deaths from COVID-19 were already shortening lives in the decades before COVID, and they will continue to shorten lives in the decades to come unless we interrupt these processes with changes to policy, systems, and the environments of daily life.

Our prior analysis of life expectancy among communities of the Indianapolis metro area by ZIP Code for the period 2009-2013 brought to light substantial differences in length of life between communities separated only by a short drive around the I-465 loop or bike ride down the Monon Trail.¹ That report opened many eyes to the disparities in our own backyard and set in motion a number of efforts to tackle these disparities.

The main purpose of the current report is to update residents of central Indiana on place-based differences in life expectancy and reinforce the importance of a sustained commitment to collective work toward health equity for all. In this report, we will:

- Take a fresh look at life expectancy among communities of the Indianapolis metro area as it was in “normal” times, prior to COVID-19 (2014-2018);
- Compare these more recent life expectancy results with prior results (2009-2013) to see what change occurred and which places experienced gains or losses;
- Explore patterns of life expectancy (remaining years of life) at other ages across the life span besides birth;
- Identify community-level social factors that are linked with life expectancy and which best predict life expectancy at the ZIP Code level in metro Indianapolis;
- Present strategies for action to close the life expectancy gap.

HOW WIDE IS THE GAP IN LIFE EXPECTANCY?

Life expectancy is an important measure of health compared across cities, states, and countries around the world. As humans, we have a similar biological capacity to live as long in one place as another, so comparing life expectancy from place to place allows us to identify where the conditions of life are maximizing or cutting short that innate capacity. In this way, life expectancy is also a reflection on the conditions of everyday life in a given place and the supports that are available to everyone for the community's overall wellbeing.

Life expectancy is a prediction of how long people of a certain age living in a specific time and place can expect to live, on average, based on the past record of deaths in that community. Most often, we report life expectancy at birth – or the average lifespan a baby born can expect to live. Because it is a prediction of the average length of life for all residents of a particular place, some individuals will die much sooner, and some will live much longer. The lost years of life are spread across people of all ages who die too soon. In fact, this average lifespan in years is lowered more by deaths among the very young (infants or teens) residents of a community than among older adults.

How has life expectancy between communities of the Indianapolis metro area changed over the decade, comparing life expectancy for the 5-year period 2009-2013 to the 5-year period 2014-2018?

Between the first 5-year period and the second,

the average life expectancy for all metro area residents combined changed very little, decreasing slightly from 77.7 to 77.5 years (0.2) similar to the US. Likewise, the gap among the eleven counties remained largely unchanged at 6.0 and 6.1 years respectively (Appendix A). However, when comparing life expectancies at the smaller area of ZIP Codes, place-based disparities emerge. **There was a clear widening of the gap between the longest- and shortest-living ZIP Codes of the metro from 13.6 years to 16.8 years - an increase of 3.2 years (23.5%) in the gap over the 2013 level.** The gap increased both because the highest life expectancy in an area ZIP Code increased above the prior high and the lowest life expectancy in an area ZIP Code decreased below the prior low.

Next, let's place the Indianapolis metro into context with the state, the country, and the world. Life expectancy for residents of the Indy metro overall, at 77.5 years (2014-2018), is higher than life expectancy for the state of Indiana overall (76.8 years), but lower than for the U.S. overall (78.6 years). Our home state of Indiana ranks poorly among U.S. states for life expectancy; in 2018, Indiana ranked 39th among the states with a range of 75.1 – 81.0 years. Life expectancy in the U.S. has not kept pace with other wealthy, developed countries, among whom the 2018 average was 80.8 years, and the top wealthy country had a life expectancy of 85 years.¹⁰ The gap between the lowest and highest metro ZIP Code is substantially wider than the gap between

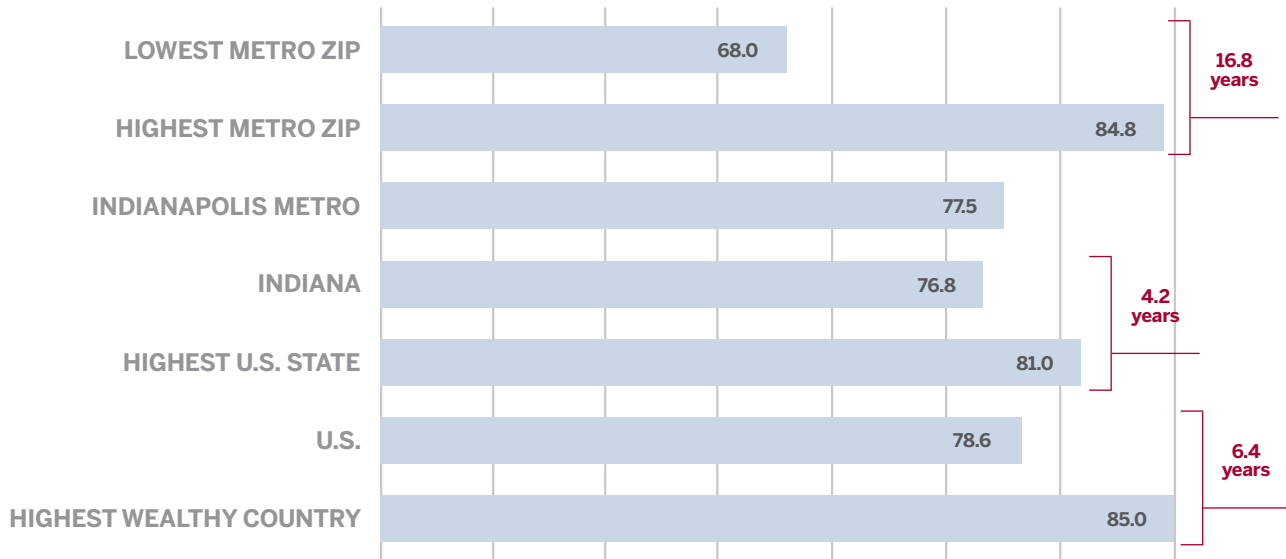
Life expectancy at birth	2009-2013 ^a	2014-2018	Change between periods
...For all people of the United States*	78.8 years ⁹	78.6 years ¹⁰	-0.2 years
...For residents of the state of Indiana*	77.6 years ¹¹	76.8 years ¹²	-0.8 years
...For metro area residents across all ZIP Codes	77.7 years	77.5 years	-0.2 years
...For residents in the shortest-living ZIP Code	70.4 years	68.0 years	-2.4 years
...For residents in the longest-living ZIP Code	84.0 years	84.8 years	+0.8 years
THE GAP – INDIANAPOLIS METRO	13.6 years	16.8 years	+3.2 years

*U.S. and IN - for 2013 and 2018 respectively, not based on 5-year period

^aDue to an update in methods for comparability to 2014-2018, some 2009-13 values differ from those reported in earlier report (2015).

HOW WIDE IS THE GAP IN LIFE EXPECTANCY?

Life Expectancy in Geographic Context (2018*)



*For ZIP Codes, life expectancy is based on 2014-2018, for states and countries, it is the year 2018.

Indiana and the best U.S. state or between the U.S. and the highest peer country. The highest metro ZIP Code is living as long as the highest wealthy country in the world, demonstrating what is possible for all people within our region. It is time to shift societal attention away from increasing human longevity to increasing equity across people in length of life¹³

Life expectancy at birth for the 104 ZIP Codes is shown for 2014-2018 on the map that follows. Mapping allows us to see the patterns in life expectancy based on where you live in the metro area. The color coding represents quintiles where all ZIP Codes are ranked from highest to lowest by life expectancy, then separated into 5 equal groups of 20% each. Red shading represents the 20% of ZIP Codes where residents have the shortest predicted length of life. The deepest green represents the 20% of ZIP Codes where residents have the longest predicted lifespan. (For a listing of each ZIP Code's life expectancy in years for the two time periods, and the change between them, see Appendices B and C.)

Consistent with patterns noted in other large U.S. cities, there is cluster of low life expectancy in the ZIP Codes of the urban core, while areas of high life expectancy form a ring around that core along the suburban transitions from the city. On the periphery of the metro, in what are more rural areas, there are several pockets of low life expectancy. This is the same pattern observed for prior period 2009-2013. (See comparative maps by period in Appendix D.)

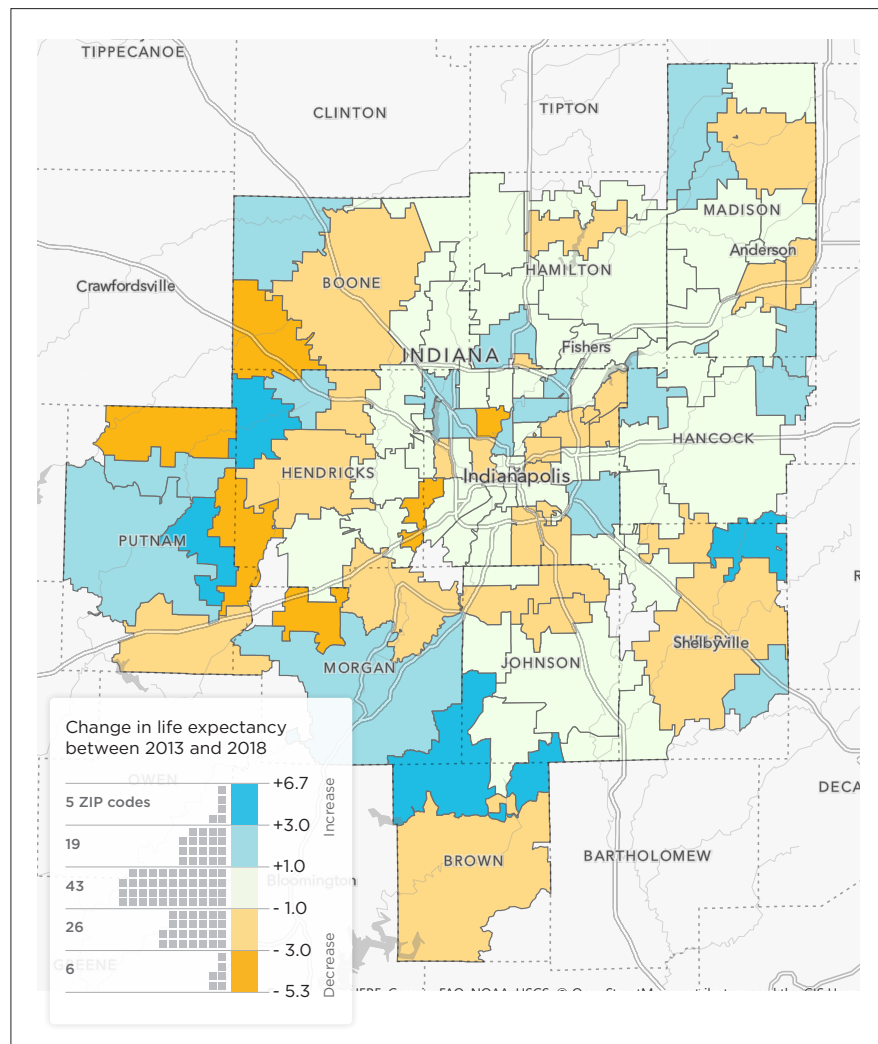
WHAT PLACES GAINED AND LOST LIFE EXPECTANCY?

Between the earlier period (2009-2013) and the later period (2014-2018) of the decade, there were more ZIP Codes who lost versus gained lifespan. The average change in life expectancy among the ZIP Codes was -0.24 years (88 days or roughly 3 months). As an average, this is the loss of predicted lifespan when the loss is spread evenly across all people of the metro area. However, that loss of potential life is not shared evenly across ZIP Codes – rather residents of 41 ZIP Codes gained lifespan (up to 6.7 years), while 60 lost (up to 5.3 years). (Three ZIP Codes were not reported in both years, so change could not be assessed.)

The particulars of each community that contributed to a loss or gain are likely quite variable,

though there are now extensive public data resources to help in investigating these further. There are some measures of neighborhood change that have been used to pick up on gentrification and/or displacement, but we were not able to calculate these due to lack of necessary data for our ZIP Codes.

The map below shows the ZIP Codes shaded by the degree of change between the earlier period (2009-2013) and the later period (2014-2018). The largest changes, both gains (blue) and losses (orange) appear mostly west of the metro center. Little change was observed in many ZIP Codes, with 43 changing by one year or less (+ or -).



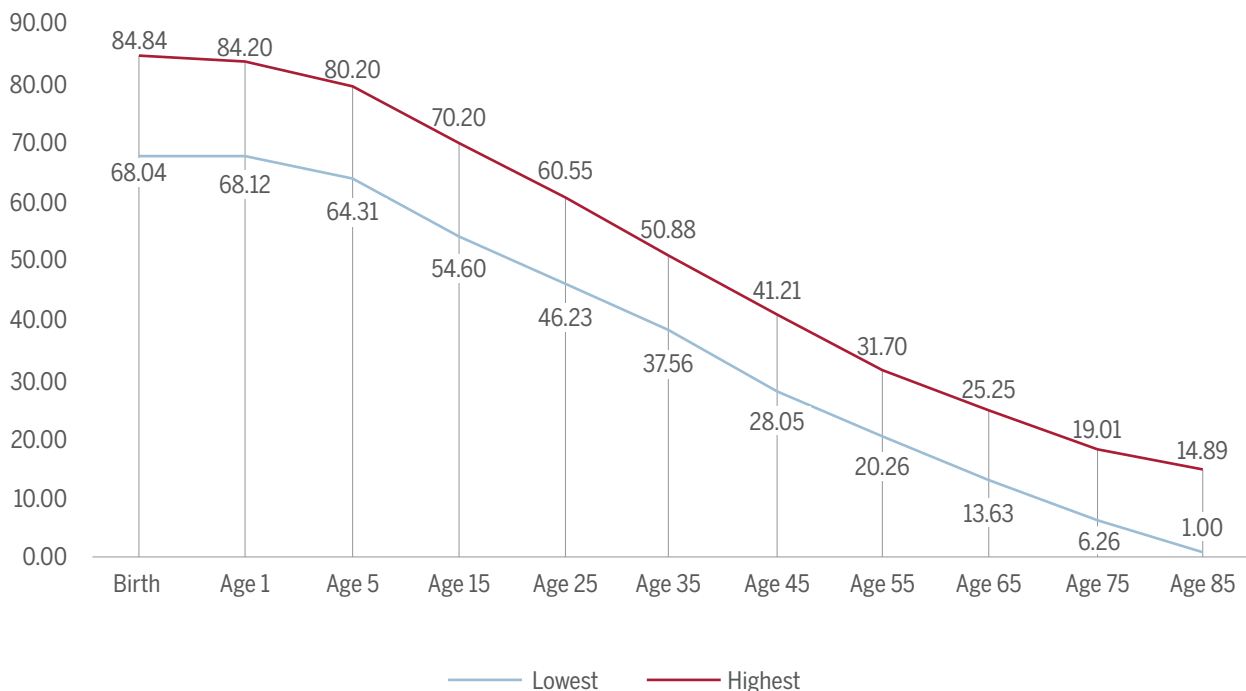
HOW DOES THE GAP CHANGE BY AGE GROUP?

Life expectancy is most often reported at birth, so that it predicts the average length of life from birth to death. However, sometimes it is useful to compare life expectancy at other ages – that is the remaining years of life expected among people who have reached another age point in life. How does the gap change with age between ZIP Codes? For example, if the overall gap in life expectancy between communities primarily resulted from infant deaths, we would expect the gap to narrow substantially by the time people reach childhood.

What we see, however, is a remarkable persistence in the gap across the age spectrum. In terms of the absolute number of years that makes up the gap between shortest and longest life expectancy of ZIPs in the metro, this remains somewhat stable over the life course. The gap is widest at birth (16.8 years), declines with age to its smallest difference at age 55 (11.44 years), and then rebounds to increase through age 85 (13.89 years).

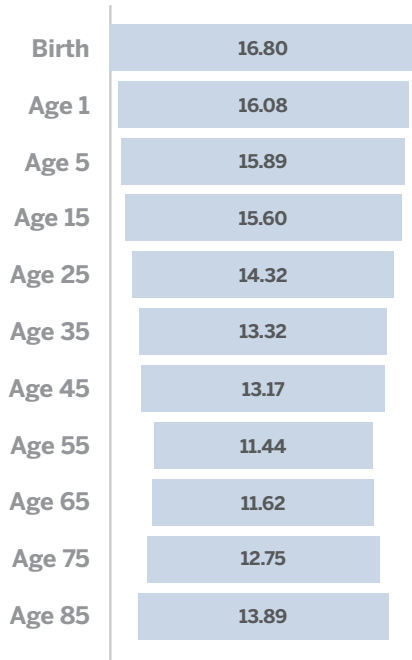
While the gap counted in absolute years remains somewhat stable overall across the age spectrum, these years represent an ever-increasing proportion of possible life remaining as we age. For example, the gap is highest at birth at 16.8 years. At birth, babies living in the shortest-living community can expect to live 80% of the life span of babies living in the longest-living community ($68.04/84.84 \times 100 = 80\%$). On the other end of the age spectrum (age 85) the absolute gap is lower than at birth at 13.89 years, but relative to the amount of possible life remaining, it is far more substantial. At age 85, residents of the shortest-living community can expect to live only 7% of the remaining life expected by residents of the longest-living community ($1.00/14.89 \times 100 = 7\%$). At age 55, the gap represents a much bigger portion of potential life remaining. (See Appendix E for a summary table of these data across the age spectrum.)

Highest and Lowest Life Expectancy among Metro ZIP Codes by Age (2014-2018)

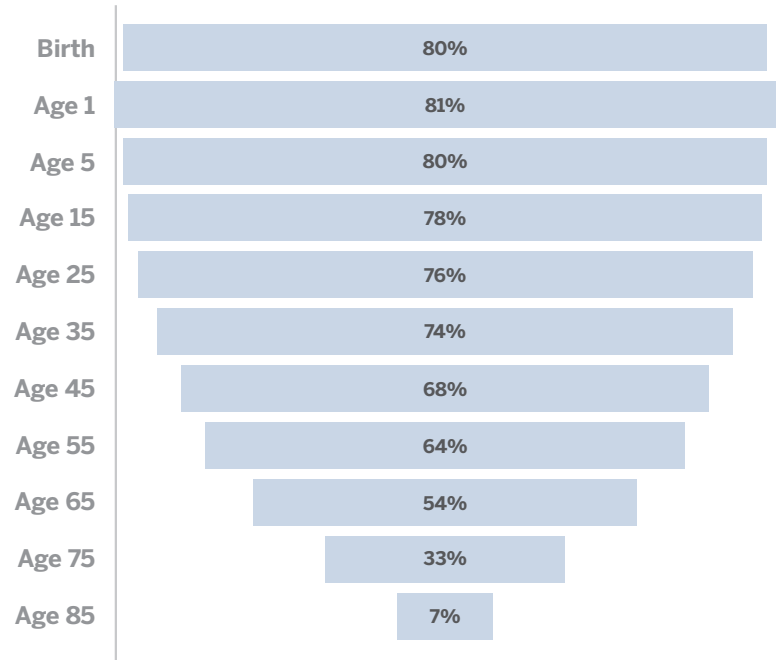


HOW DOES THE GAP CHANGE BY AGE GROUP?

Gap in Life Expectancy Based on Age Reached (Years), 2014-2018



Remaining life expected in shortest-living ZIP as a percentage of remaining life expected in the longest-living ZIP by age (2014-2018)



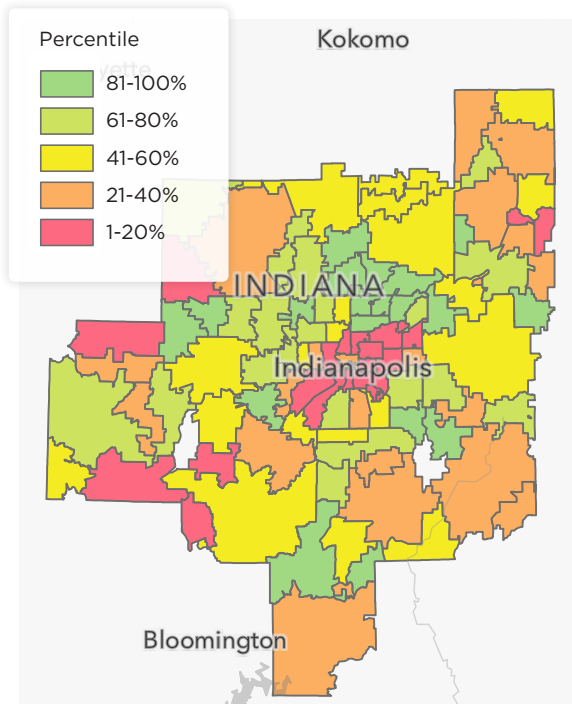
Do the spatial patterns in life expectancy – that is the particular places that are high or low, remain consistent at different ages of the life span? We chose to map four age groups that represent different life stages: Birth (Map 1), Age 25 (Map 3), Age 45 (Map 4), and Age 65 (Map 5).

Between birth and age 25, there is a high degree of geographic consistency. Improvements from birth to age 25 between areas might be related to infant mortality. Once you have survived to age 25, childhood causes of death are no longer reflected in remaining life expectancy and instead accidents (which include drug & alcohol related deaths as well as homicides and motor vehicle accidents) tend to play a stronger role. More geographic changes are noted at age 45, where chronic disease begin to take root in surviving residents. The greatest pattern changes occur geographically at age

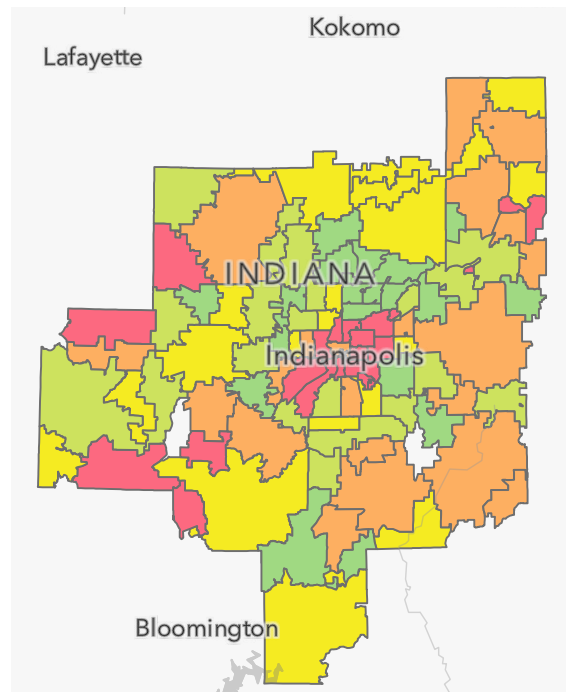
65. If you have survived the perils of life to this point, deaths from chronic diseases and natural aging begin to show. A deeper exploration within individual communities would help inform places that support healthy aging.

The striking pattern, however, is the remarkable consistency in these geographic patterns of high and low life expectancy across ages of the life course. The persistent effect of “place” appears to hold.

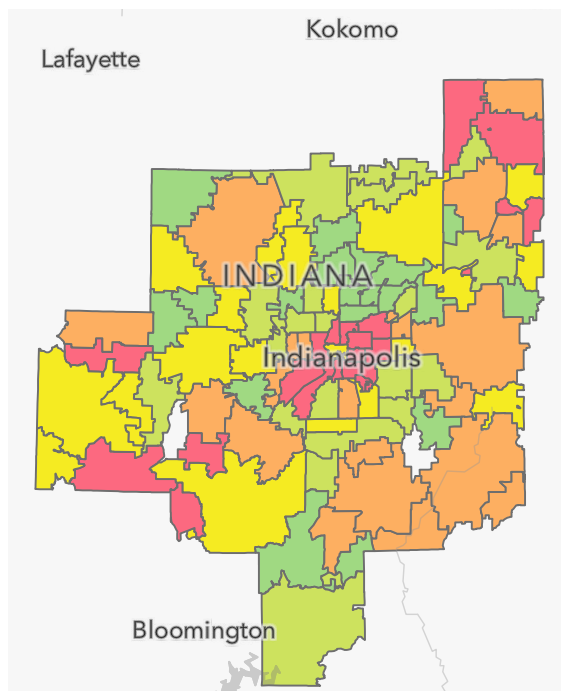
Life Expectancy at Birth, Age 25, Age 45, and Age 65 (2014-2018)



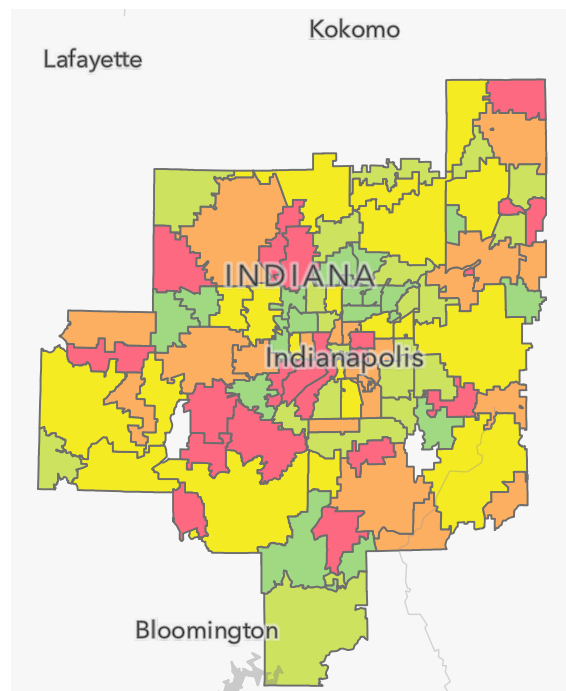
Life expectancy at birth



Life expectancy at age 25



Life expectancy at age 45



Life expectancy at age 65

WHAT ARE THE UPSTREAM SOCIAL DRIVERS OF THE LIFE EXPECTANCY GAP?

The gap in life expectancy is just the final manifestation of a long chain of gaps: gaps in educational quality and opportunity, gaps in home ownership, gaps in working conditions and livable wages, gaps in wealth, gaps in food and transportation access, gaps in internet access, gaps in healthcare access – and more. In a society that sorts people by class and race (among other things), some groups are living in places where the resources needed for community wellbeing are systematically constrained, and the health gap is perpetuated.

There is a well-known social gradient when it comes to the distribution of health and length of life. It works like a ladder where the higher you are on that ladder, the more likely it is that you will live a long and healthy life, and the lower you are on that ladder, the more likely it is that you will be sicker and die sooner. Every step up the social ladder increases access to health-promoting

environments with safe housing, quality schools, parks and sidewalks to be active, and many other supports for health.¹⁴ Every step down the ladder increases exposures and vulnerabilities to the conditions that harm health.¹⁵ This gradient can be applied to communities. The higher up the ladder a community is the more access residents have to fundamental resources needed for health, and, conversely, the lower on the ladder a community is the more likely its residents are to lack those fundamental health-supporting resources.

Health waxes and wanes, is kept or lost over the years of a lifetime through the accumulation of experiences we have every day – at home, at work, at school, or wherever we interact with our world. That’s why the everyday conditions in the places we live are so crucial. We cannot shift the trajectory toward health equity without taking our work “upstream” to the social inequities that drive the life expectancy gap.

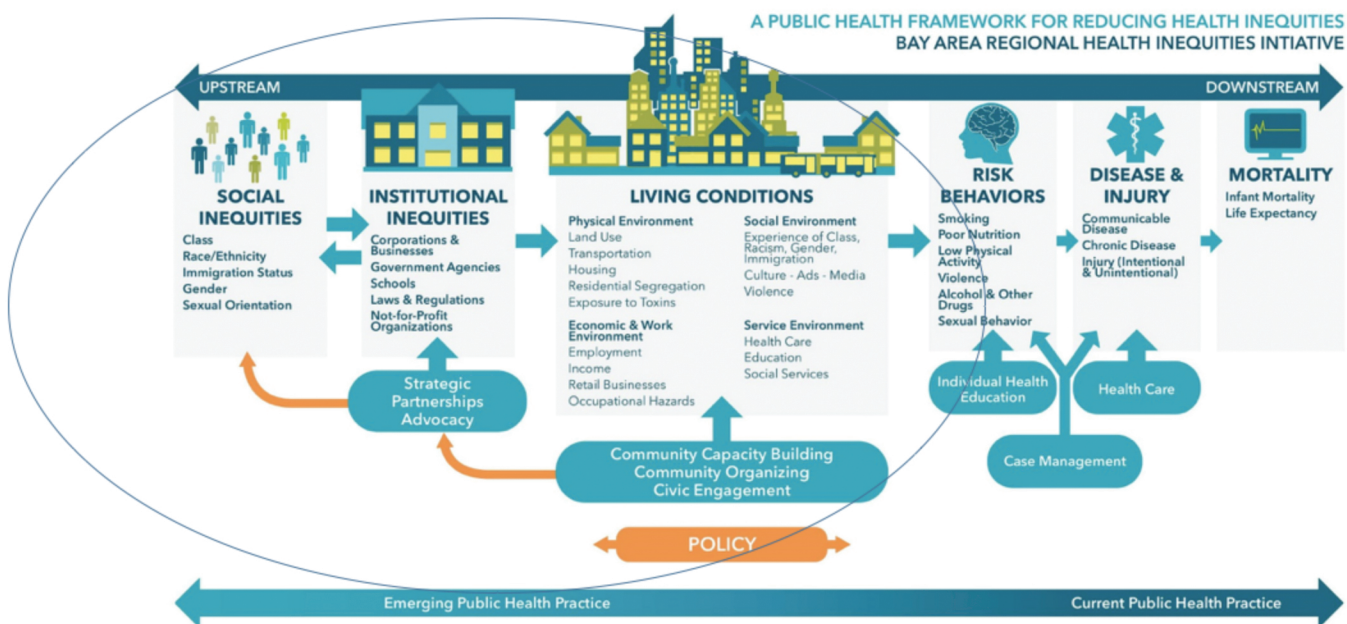


Image Source: Bay Area Regional Health Inequities Initiative, <https://www.barhii.org/enlarged-framework>

In this section, we will take a close look at upstream social inequities in ZIP Codes of metro Indianapolis to examine the strength of their association with life expectancy and to guide upstream action.

We focus our attention on the leading social causes of death identified by Galea and colleagues in a nationally-published study (2011).¹⁶ Combining data from 47 studies, the top social causes they identified were found to account for a similar number of deaths as those in disease-based lists more commonly reported (e.g. heart disease, cancer). The top social causes they identified were:

- Low education
- Racial segregation
- Low social support
- Poverty
- Income inequality

Using ZIP-Code level data available from the U.S. Census Bureau's American Community Survey, we report the strength of the association (i.e. correlation) between several of these and our latest life expectancy results for metro area ZIP Codes.

Additionally, we assessed the strength of the association between life expectancy and the Social Vulnerability Index. This index was developed by the Centers for Disease Control and Prevention as a tool to identify communities likely to need

Health equity means that...

Everyone has a fair and just opportunity to be as healthy as possible. This requires removing obstacles to health such as poverty, discrimination, and their consequences, including powerlessness and lack of access to good jobs with fair pay, quality education and housing, safe environments, and health care.

Braveman, et al, 2017
*Robert Wood Johnson Foundation*⁴⁴

assistance during a natural disaster or other crisis.¹⁷ More recently it has been used to identify places that are vulnerable to other health impacts, such as COVID-19 and diabetes.^{18,19}

Correlation does not establish that one causes the other, but it does establish that when one changes, the other also changes in a predictable way – they are linked in some way. The strength of the association as well as the direction (+/-) tell us about their relationship to each other. Appendix F summarizes the area-level social indicators we tested in a table, showing the average values and range of values observed across the metro ZIP Codes, as well as the strength of each indicator's correlation with life expectancy.

Education

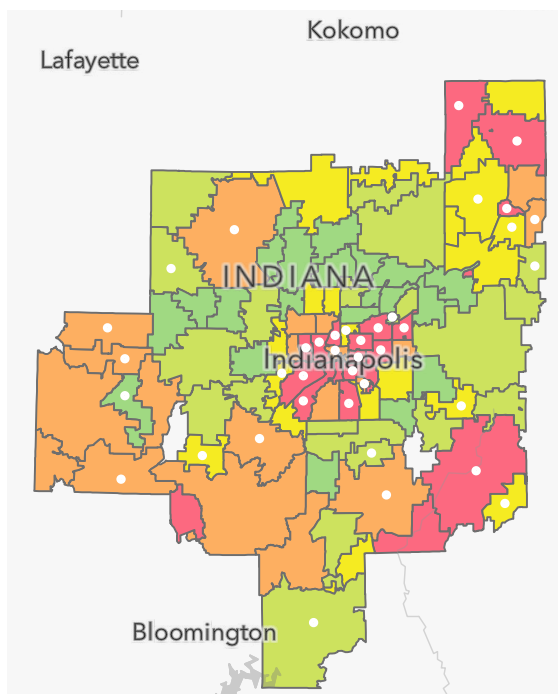
Educational attainment is a key indicator of social class and a powerful predictor of adult health. Across the U.S., the quality of one's health rises in step with education level. Within Indiana, 35.6% of those who have not completed high school are in fair or poor health, compared to just 7.9% of those with college degrees – 4.5 times as many.²⁰ The effects of education compound over a lifetime, impacting health at every life stage.

Opportunities to obtain a quality education are not equitably available to all, as demonstrated by the Child Opportunity Index (Appendix G), and this has lasting, widespread consequences. “Across all metros [of the United States], there is a seven-year difference in life expectancy between residents in very low-opportunity neighborhoods (75 years) and residents in very high-opportunity neighborhoods (82 years).^{21,22} Furthermore, the Indianapolis metro ranks among the ten metro areas, of the 100 largest in

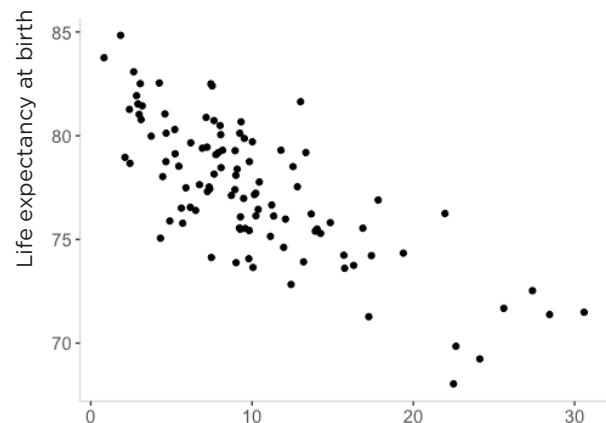
the U.S., with the widest (worst) life expectancy gap between very high and very low opportunity areas.²²

All indicators of education we tested are strongly correlated with 2014-2018 life expectancy. As the percentage of residents with low education increases in a ZIP Code, life expectancy for the area falls. The opposite is true for the percentage of college graduates in a place; as this percentage increases, life expectancy increases. Of three education variables, the one most strongly correlated with life expectancy is the percentage lacking a high school diploma. Across the 104 ZIP Codes, the percentage of residents lacking a high school diploma averages 10%, but varies by ZIP from a low of <1% to as much as 31%. The map demonstrates the spatial overlap between low education and low life expectancy. Wherever you see red and orange areas (worst areas for low education) with a white dot (worst areas for life expectancy), these are co-occurring.

When analyzed as a sole predictor variable, the percentage of adults lacking a high school education explains 57% of the variation in life expectancy across metro Indianapolis ZIP Codes.



Percent of population without high-school diploma or equivalency (2014-2018)



Percent of population without high school diploma or equivalency

Income

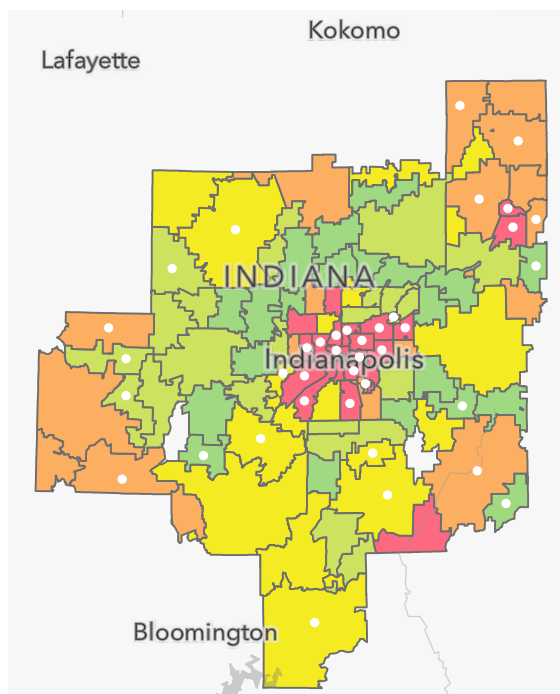
Money is a fundamental resource needed to provide for basic needs and to sustain health. For most, money comes through wages earned on the job as income. Multiple studies show that as income increases the likelihood of disease and premature death decrease.²³ Individually, lower income is easily linked to an inability to afford healthcare/insurance or the basic necessities (e.g. healthy food) to create a healthy lifestyle.²⁴ These effects, however, are not just important to individuals. Area-wide low income can lead to “economic segregation” where a lower tax base results in worse public resources^{25,26} This cascades into having limited access to high quality resources that promote health in your neighborhood like: access to nutritious food, advertising-free spaces, housing, transportation, school system, jobs, and clean air and water.²⁴

A 2016 study compared the life expectancy of poor adults living across the U.S.^{27,28} In a ranking of the 100 largest metro areas of the U.S., Indianapolis ranked among the 10 cities where being poor

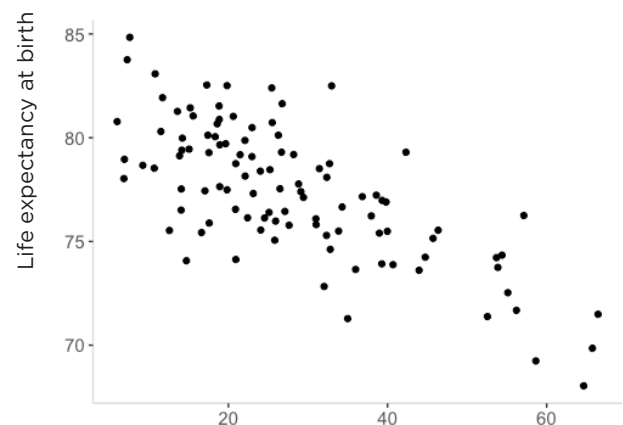
shortens life the most, for both men and women. Poor residents of Indianapolis live shorter lives than residents of New York City, Los Angeles, Chicago, and most of these 100 large metro areas. Why? Most simply stated, these cities differ in the availability of resources that help buffer the effects of poverty on health – resources such as high-quality public schools or robust public transportation.

All but one of the indicators of income distribution we tested are strongly correlated with life expectancy. As average income in an area rises, so does life expectancy. Likewise, as the percentage of those living in/near poverty increases in a ZIP, life expectancy falls. Our measure of how income is distributed or income inequality, the GINI Index, was only weakly correlated with life expectancy. Of the income variables, the percentage living at <200% poverty level is most strongly correlated with life expectancy. Across ZIP Codes, the percentage of residents living at <200% poverty averages 28%, but varies widely from 6% to 66%. The map demonstrates the spatial overlap between low income and low life expectancy. Wherever you see red and orange areas (worst areas for low income) with a white dot (worst areas for life expectancy), these are co-occurring.

When analyzed as a sole predictor variable, the percentage of residents living at <200% poverty explains 53% of the variation in life expectancy across metro Indianapolis ZIP Codes.



Percent of population below 200% of federal poverty level (2014-2018)



Percent of population below 200% of federal poverty level

Social vulnerability

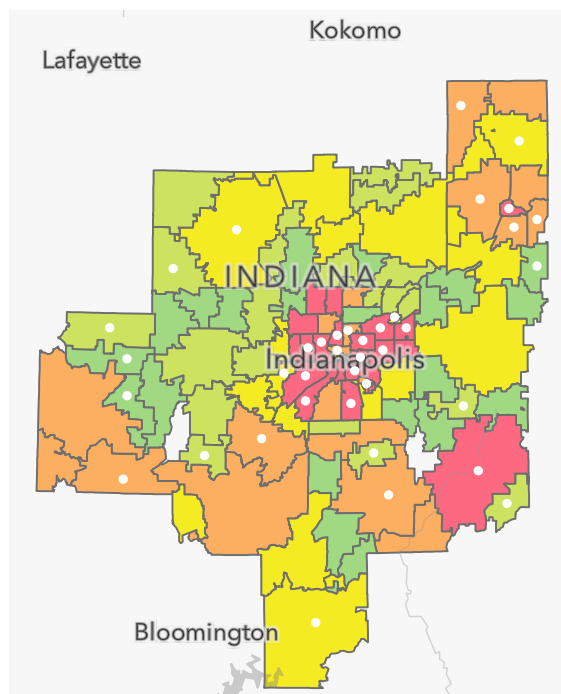
The Social Vulnerability Index (SVI), calculated with 15 different social indicators, attempts to capture in an overall score a more complete picture of a community's social vulnerability in 4 different categories: Socioeconomic, Household Composition, Minority & Language, and Housing & Transportation (Appendix I). Of note, both poverty and income are included in the index.

Overall SVI values, as well as two of the four category values (Socioeconomic, Household Composition) are strongly correlated with life expectancy. As social vulnerability increases, life expectancy decreases. The Socioeconomic category value is the most strongly correlated with life expectancy in metro area ZIP Codes – stronger than correlation with the overall SVI. The Transportation and Housing category was moderately correlated, while the Minority & Language category was not significantly correlated. We note, however that the index uses

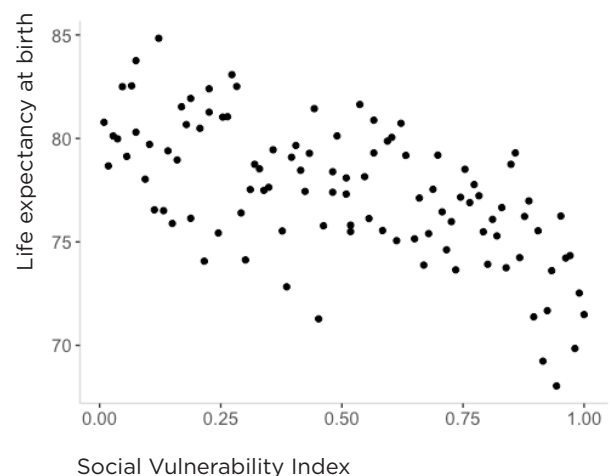
the percentage of all minorities combined. Since ZIP Codes with higher Asian population have higher life expectancy in metro Indianapolis, while areas with higher Black and Hispanic populations have lower life expectancy, using a measure of all minorities combined may have caused these differing effects to counter-balance each other in this particular category, thus lowering the correlation for this category and the overall SVI score.

The map demonstrates the spatial overlap between overall social vulnerability and low life expectancy. Wherever you see red and orange areas (worst areas for SVI) with a white dot (worst areas for life expectancy), these are co-occurring.

When analyzed as a sole predictor variable, the SVI Socioeconomic Score explains 49.6% of the variation in life expectancy across metro Indianapolis ZIP Codes. While the SVI is more comprehensive in capturing a range of possible social vulnerabilities in a community, it did not predict ZIP-Code level life expectancy in the metro quite as well as did the education and income variables shown earlier.



Social Vulnerability Index (2014-2018)

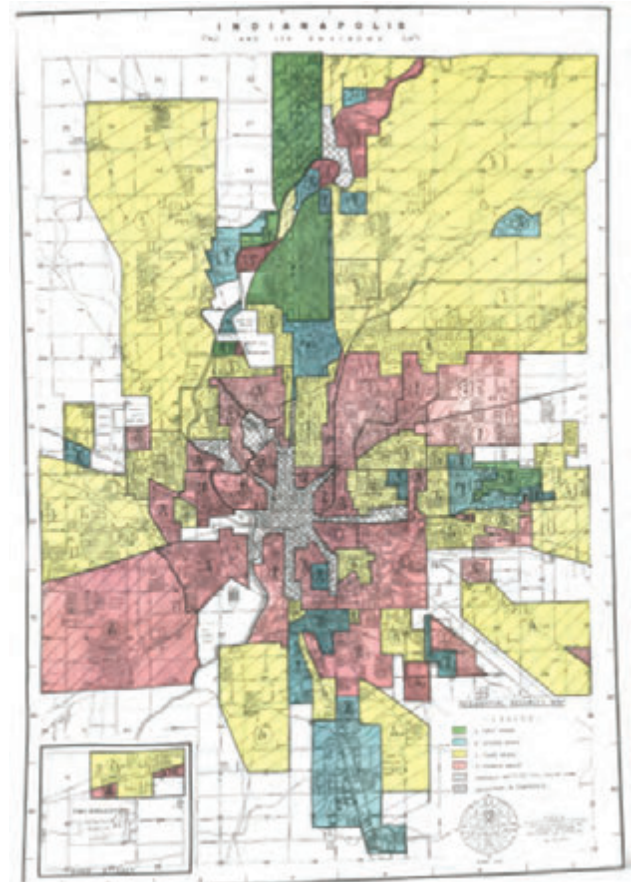


Racism and segregation

Racism affects health through many mechanisms.²⁹ A particularly formidable one when it comes to metro area neighborhoods is the history of redlining and the continuing impact of residential racial segregation.^{30,31} During the late 1930s, diverse neighborhoods were often “red-lined” by the Homeowner’s Loan Corporation (HOLC) when noting “an infiltration”³² of Black and foreign-born residents in the area.^{33,34} This made it difficult for residents to buy homes, build wealth, and maintain a thriving life in the community. [Historical map of Indianapolis from *Mapping Inequality*.³⁴]

Studies have shown a strong link between a place’s HOLC grade in the 1930s-40s and their present-day life expectancy, with residents of former red-lined areas having shorter life spans than those of green-lined areas.³⁵ This demonstrates how racist policies of the past continue to perpetuate disparities in communities today. [Explore the connection between past HOLC grades and present day Indianapolis at this interactive website: <https://dsl.richmond.edu/socialvulnerability/>.³⁶]

Dr. David Williams, a world-class scholar on the connections between racism and health, says that the legacy of “racial residential segregation is the number one factor driving the poor health outcomes of African Americans today.”³⁷ He reports that “Every 7 minutes, a Black person dies



prematurely. That’s more than 200 Black people a day who would not die if the health of blacks and whites were equal.”³⁷

“De facto segregation, we tell ourselves, has various causes. [...] Real estate agents steered whites away from black neighborhoods, and blacks away from white ones. Banks discriminated with “redlining,” refusing to give mortgages to African Americans or extracting unusually severe terms from them with subprime loans. African Americans haven’t generally gotten the educations that would enable them to earn sufficient incomes to live in white suburbs, and, as a result, many remain concentrated in urban neighborhoods. Besides, black families prefer to live with one another.

All this has some truth, but it remains a small part of the truth, submerged by a far more important one: until the last quarter of the twentieth century, racially explicit policies of federal, state, and local governments defined where whites and African Americans should live. [...] Segregation by intentional government action is not de facto. Rather, it is what courts call de jure: segregation by law and public policy.”

— Richard Rothstein, *The Color of Law: A Forgotten History of How Our Government Segregated America*

Across the United States, life expectancy is higher in areas where there is greater racial/ethnic diversity. Large life expectancy gaps occur most frequently in cities that have higher levels of racial/ethnic segregation.^{38,39} In an analysis of the 500 largest cities of the U.S., gaps as high as 30 years (Chicago) were found among the most segregated 56 cities. In this study, Indianapolis was among that group of 56 highly-segregated cities, with a gap of approximately 23 years based on census tracts. On the other end of the spectrum, this analysis identified Fishers (the location of our longest-living ZIP Code) as the city with the smallest life expectancy gap between census tracts and low segregation. Here again, we see places within the metro area that are worlds apart.^{38,39}

Measuring racial segregation is complex, as there are a number of dimensions of the construct to attempt to capture.⁴⁰ Evenness of racial distribution within the metro area and exposure of one racial group to another are the most frequent dimensions studied in the health literature.⁴¹ Levels of black-white exposure in particular are thought to best capture the separation of African Americans from health-promoting resources. Due to the sensitivity of segregation measures to the geography used, it may also be that ZIP Codes are too large to reveal neighborhood-level segregation in the Indy metro area. The Isolation Index, for example, was originally designed to measure segregation at the census tract rather than the ZIP Code level.⁴⁰ Spatial measures that are tailored to city-specific layouts using GIS continue to be refined and could provide a more detailed look at Indianapolis segregation in future studies.⁴²

Despite these limitations, we tested three common measures of Black/White segregation used in the health literature - the Isolation Index, the Dissimilarity Index, and the Entropy Index - to attempt to identify the continuing impact of redlining in communities of the Indianapolis metro area. We excluded ZIP Codes with 0% Black population from the analyses. Two of three segregation indices we tested are moderately correlated with life expectancy. The strongest association was found with the Black/White Isolation Index, designed to capture the possibility of interaction

between Black and White residents in a given place (in this case ZIP Code). Lower segregation is associated with higher life expectancy in the metro Indianapolis area.

Black representation is too low in many ZIP Codes of the metro to reliably calculate ZIP-Code level life expectancy of residents by race, as we have done for all residents combined. Therefore, we took another approach to assess whether ZIP-Code level life expectancy is significantly different based on the relative segregation of one's ZIP.

Using the Black/White Isolation Index, we identified the one-fourth of metro ZIP Codes with the highest segregation (i.e. 75th percentile).

- 8 ZIP Codes of the Indianapolis metro area with zero Black residents of record were excluded from these analyses.
- Of the remaining 86 ZIP Codes with some percentage of Black residents –
 - 77.2% of Black, non-Hispanic residents live in the 21 most segregated ZIP Codes of the metro
 - 22.8% of Black, non-Hispanic residents live in the remaining 65 ZIP Codes of the metro

We then compared the life expectancy of these 21 ZIP Codes to the remaining, less-segregated ZIP Codes. The average life expectancy at birth among residents of the highest segregated ZIP Codes was 3.9 years less than the lesser-segregated ZIP Code areas.

WHAT ARE THE UPSTREAM SOCIAL DRIVERS OF THE LIFE EXPECTANCY GAP?



There were substantial differences in social measures between the groups as well, with much

higher poverty, much higher prevalence of low education, and much lower per capita income.

	Most segregated ZIP Codes (75th percentile) (n=21)	Lesser-segregated ZIP Codes (<75th percentile) (n=65)	Difference for Segregated ZIP Codes
Average life expectancy at birth	74.5 years	78.4 years	3.9 years less*
Average percent population living <200% poverty	46.4%	8.3%	5.6 X higher
Average percent without high school diploma	16.5%	8.3%	2 x Higher
Average per capita income	\$24,609	\$34,272	\$9,663 less per person

*Significant at $p < .001$

What social factors best explain the life expectancy gap in metro Indy?

As demonstrated, low income & poverty, low education, and segregation often intersect in the same geographic locations, constraining access to resources and perpetuating cycles of disadvantage. These are social toxins just as deadly and far more entrenched than COVID.

How much of the gap in life expectancy can be explained by these factors? We tested variables one at a time for their ability to predict life expectancy. Given the high correlation between significant socioeconomic status predictors, we did not enter them simultaneously into a model (Appendix H, Correlation Matrix).

When single predictors were tested alone, the one that explains the greatest percentage of the variation in life expectancy – best predicts

life expectancy at the ZIP Code level – is the percentage of the ZIP Code’s population without a high school diploma. This variable alone explains 57% of the variation in life expectancy across metro Indianapolis ZIP Codes. The Black/White Isolation Index was not a significant predictor when added to the education measure in a model.

The index variables we tested for segregation, social vulnerability, and income inequality, while designed to better capture the nuances of these complex social conditions, did not turn out to be quite as good at predicting ZIP-Code level life expectancy as the single area-level predictors. (The GINI Index of income inequality was weakly correlated with life expectancy and not tested in a model.)

Models: Single Predictor	n	Percentage of Variation Life Expectancy this Predictor Alone Explains (%)
Percentage without H.S. diploma	104	57.0%
Percentage living <200% poverty level	104	53.0%
SVI-Socioeconomic Category	104	49.6%
Average per capita income	104	45.9%
Black/White Isolation Index, excluding ZIPs with 0% Black	86	12.9%

A key goal of this report is to provide data that inspires action. The inequities in life expectancy seen in the Indianapolis metro area are not unique to this region, and there is evidence from countries and cities around the world that the gap in life expectancy in the Indianapolis metro area can be narrowed.

In 2008, the World Health Organization's Commission on Social Determinants of Health put out a pivotal report focused on the life expectancy gap that exists between and within countries of the world, issuing a call to "clos[e] the gap in a generation" through action on the social determinants of health.⁴³ Their overarching recommendations address the "causes of the causes" – the upstream drivers that affect quality and length of life no matter where you live.

- 1. Improve daily living conditions.**
- 2. Tackle the inequitable distribution of power, money, and resources.**
- 3. Measure and understand the problem, and assess the impact of action.**

A parallel call to action was issued for the United States in 2017, emphasizing the need to "**Change and implement policies, laws, systems, environments, and practices to reduce inequities in the opportunities and resources needed to be as healthy as possible,**" giving more attention to groups that have been historically marginalized.⁴⁴

These are short statements yet big tasks.

There is a vast array of potential policies and programs, covering virtually all sectors of life. We call on people from all sectors to consider how their work can build health equity, and to partner with residents of communities who have much to contribute in this work through the wisdom of lived experience and dedication to their communities. Here we highlight just a few examples of national approaches and active local initiatives aimed at improving living conditions and equity in neighborhoods.

**Effective national approaches
ADDRESSING AREA-LEVEL POVERTY**

A particular past randomized long-term research demonstration that focused on area-level poverty is the Moving to Opportunity for Fair Housing (MTO) program implemented through the Department of Housing and Urban Development (HUD).⁴⁵ In this program, HUD randomly assigned public housing residents in participating cities to receive a housing voucher to move from an area of high poverty (>40%) to an area of low poverty (<10%) with pre-move counseling, a traditional unrestricted voucher with pre-move counseling, or no voucher. After 10-15 years of follow-up, the adults who moved to lower poverty areas had significantly lower rates of extreme obesity and diabetes than those in other groups. The more time spent living in the lower-poverty tracts, the better these health measures were.⁴⁶ Benefits to mental health and wellbeing were also demonstrated.⁴⁷ But the program also had intergenerational impacts. Children in families who moved to lower-poverty tracts when they were < 13 years old had higher rates of college attendance and higher income as adults.⁴⁸ As we have established, increases in education and income are linked with better health and longer life. This is an example of how policy approaches can effectively narrow the life expectancy gap.

The U.S. Community Preventive Services Task Force conducted a systematic review of several studies of tenant-based housing voucher programs, including MTO, and recommends these as effective for advancing health equity (2021).⁴⁹ The review found that participants in these programs had several improved outcomes over those who were eligible but did not receive a voucher, including better housing quality, decreased poverty and food insecurity, lower prevalence of chronic health conditions and fewer unmet medical needs, more children attending college, and more children employed as adults.

ADDRESSING EDUCATIONAL QUALITY AND OPPORTUNITY

The value of high-quality preschool education in closing educational and health gaps was proven through a key study known as the Perry Preschool Project that began back in 1962 and continued to follow these children into their adult lives. At age 40, the Perry preschool students compared to other children more often completed high school, earned higher income, were more likely to own a home, and had fewer arrests. The return on investment was \$12.90 for every \$1 invested.⁵⁰

The U.S. Community Preventive Services Task Force also recommends center-based early childhood education as effective for advancing health equity on the basis of a meta-analysis of 49 studies of such programs in low-income children ages 3-4 (2015).⁵¹ They concluded that these programs improve educational, social, and health outcomes.

The U.S. Community Preventive Services Task Force additionally recommends a variety of high school completion programs for at-risk students, including mentoring and counseling, social-emotional skills training, vocational training, college-oriented programming and more (2013).⁵² These programs are recommended on the basis of strong evidence to address disparities in educational achievement, which have long term consequences to health and length of life. Lifetime economic benefits to society for each additional high school graduate ranged from \$347,000 to \$718,000.

ADDRESSING RESIDENTIAL SEGREGATION

There are many housing-related pathways to address residential segregation, including: Increasing Black homeownership, providing broader access to affordable housing options in more neighborhoods, and increasing opportunities for families with vouchers to secure housing in lower-poverty neighborhoods (such as in MTO).^{53,54} Reinvesting in neighborhoods is another approach to increase access to resources and housing in divested areas. “The Land Trust model, where land is owned by the community but housing is provided

to individuals and families, can provide stability by mitigating against foreclosure and gentrification-related displacement pressures.”⁵⁴

Of course, the specific means by which to realize these aims require a great deal of policy and systems change. This points out the crucial need for people working in all sectors of society to address these fundamental drivers of health inequity. However, the community development sector plays a particularly crucial role. Their long-standing work to improve the daily living conditions and physical resources in communities directly addresses the “social determinants of health” around which public health has built momentum. In the past decade, there has been a push to increase collaborations between community development and public health as natural allies in the quest for health equity.^{21,55} Yet there is still much greater potential in these partnerships than has been realized.

Active local initiatives

Prior to the analyses of life expectancy in the Indianapolis metro area, we could claim ignorance of the patterns and the systemic conditions contributing to them. Knowledge of these non-random patterns of life expectancy should provide an incentive to act. We will discuss three examples of local initiatives that are addressing health and health equity in central Indiana neighborhoods.

DIABETES IMPACT PROJECT – INDIANAPOLIS NEIGHBORHOODS (DIP-IN)

Partially inspired by the initial Worlds Apart report, the project was designed to address the statement: Where you live shouldn't determine how long you live. With funding from the Lilly Global Health Partnership (LGHP), DIP-IN is designed as a multi-level, multi-partner, collective impact initiative targeting diabetes and overall quality of life in three Indianapolis communities that are home to roughly 43,000 people. The communities include six ZIP Codes (at least in part), all of which have life expectancy in the lowest 20% (red) of the metro area. Diabetes is the 6th leading cause of death for residents of Marion County, and among

the top causes of lost years of potential life due to premature death.⁵⁶ Thus, diabetes is surely contributing to the low life expectancy in these communities.

The project utilizes a collective impact model that emphasizes multiple stakeholders working toward a common agenda through mutually reinforcing activities.⁵⁷ By coordinating activities and identifying common goals across multiple organizational partners, the potential impact on reducing health inequities is amplified. The project is led by the IU Richard M. Fairbanks School of Public Health at IUPUI, along with resident steering committees in the Near West, Northeast, and Near Northwest. In addition, there are multiple actively engaged organizational partners, including the Marion County Public Health Department (MCPHD), Eskenazi Health, Local Initiatives Support Corporation (LISC), The Polis Center at IUPUI, Regenstrief Institute, Alliance for Northeast Unification (ANU/UNEC), Flanner House, and Christamore House. One of the project's three primary goals is to foster an environment (physical and social) that supports greater health and wellbeing for all residents. Residents of these communities serve on steering committees are the primary drivers of work on this aim. They are tasked with the selection and implementation of evidence-based strategies to benefit the health and well-being of all residents around their chosen focus areas of stress (Near West), healthy food access and healthy eating (Northeast), and physical activity access and opportunities (Near Northwest). These strategies include partnerships that integrate education, housing, and economic development, the key upstream drivers identified in this report. (For more information about DIP-IN, visit diabetes.iupui.edu).

CONCORD-IU COMMUNITY HEALTH PARTNERSHIP

As a result of the initial Worlds Apart study (2015), a community-university partnership was formed between the Concord Neighborhood Center and the IU Fairbanks School of Public Health at IUPUI. Concord serves neighborhoods on the

Indianapolis Southside, including the ZIP Code that had the lowest life expectancy in 2009-2013. The partnership has completed a comprehensive review of data about health and social context in the Concord service area, and has been learning from residents of all ages and other stakeholders about the community's assets and challenges to health using interviews, photography, and other means. Next, they plan to convene a group of resident change-makers to consider these inputs and guide development of a community health action plan. The Old Southside, where Concord is located, was once described as a flourishing and working-class community where African Americans, Appalachian Americans, German, and Jewish immigrant families moved for work and lived as friends and neighbors.⁵⁸⁻⁶⁰ The community itself formed a buffer against some of the harshness of life visited upon people through discrimination and poverty, but was disrupted by industrial growth and construction of the interstate system. The vision for this community today is to reclaim its identity as a vibrant place with vibrant people surrounded by the environments and opportunities people need to thrive. (This work was supported by the Indiana CTSI Community Health Partnership Program and the Central Indiana Community Foundation.)

COALITION OF CONGREGATIONS AS HEALTH CONNECTORS

Senior clergypersons and health advocates from ten Indianapolis churches formed a congregational health partnership in 2020, convened as the #HealthyMe Learning Community. These congregations serve the neighborhoods of Old Northside, Martindale-Brightwood, Near Northwest, Mapleton Fall Creek, Meridian Kessler, and Crown Hill. Facilitated by Professor David Craig of IUPUI and Reverend Shonda Nicole Gladden of Good for the Soul, the overall goals of this learning community are to share ongoing congregational programs and neighborhood outreach, gather and steward information and resources out to members and neighbors, collaborate in identifying and acting on community health priorities, and challenge status quo operations in health care and social services. This coalition demonstrates how sectors

WHAT ARE STRATEGIES TO CLOSE THE GAP?

of a community beyond health/healthcare can be key contributors to improving health and equity in neighborhoods. The participating congregations include First Baptist North Indianapolis, Mt. Zion Baptist, Allen Chapel AME, St. John AME, Crossroads AME, Bethel Cathedral AME, Purpose of Life, Witherspoon Presbyterian, and Broadway United Methodist. (The learning community is organized by the Monon Collaborative, an initiative of the Indiana CTSI with support from the Indiana University Health Values Fund.)

MULTISECTOR COLLABORATIONS NEEDED

The data presented in this report clearly show that life expectancy in the Indianapolis metro area is not distributed by chance. Where you live has a strong influence on how long you live. There is not one simple solution that will immediately eliminate these inequities in health and close the gaps in life expectancy. This issue is not one that can be fixed by the healthcare system or by any one organization. It will take a collaborative effort of most if not all sectors of society to drive change that is not focused on the downstream symptoms (such as disease patterns) but on the upstream drivers of these health inequities. Collectively, we can lessen the gap between communities of metropolitan Indianapolis through specific actions and policies.

EVERYONE DESERVES A FAIR OPPORTUNITY FOR A LONG AND HEALTHY LIFE. YET, STARK DIFFERENCES IN LIFE EXPECTANCY BETWEEN COMMUNITIES OF METRO INDIANAPOLIS HIGHLIGHT A LACK OF EQUITY IN LENGTH AND QUALITY OF LIFE.

Our prior analysis of life expectancy among communities of the Indianapolis metro area by ZIP Code for the period 2009-2013 brought to light substantial differences in length of life between communities separated only by a short drive around the I-465 loop or bike ride down the Monon Trail. That report opened many eyes to the disparities in our own backyard and set in motion a number of efforts to tackle these disparities. The main purpose of the current report is to update residents of central Indiana on place-based differences in life expectancy and call for strengthened and sustained work toward health equity for all, from all sectors of our society. While this follow-up study was planned before COVID began, it has taken on more significance in the current social context. The same underlying social vulnerabilities that produced disparities in deaths from COVID-19 were already shortening lives in the decades before COVID, and they will continue to shorten lives in the decades to come unless we interrupt these processes with changes to policy, systems, and the environments of daily life.

THE GAP IN LIFE EXPECTANCY IN THE INDIANAPOLIS METRO HAS WIDENED. TWO COMMUNITIES SEPARATED BY JUST A FEW MILES OF DISTANCE ARE WORLDS APART.

Similar to our earlier findings, residents of the longest-living community are living years longer than the U.S. average with a life expectancy comparable to the top high-income countries of the world. Residents of the shortest living community are living only as long as U.S. residents lived on average more than six decades ago. There was a clear widening of the gap between the longest- and shortest-living ZIP Codes of the metro from 13.6 years to 16.8 years - an increase of 3.2 years (23.5%) in the gap over the 2013 level. Though only 17 miles

of distance separate the shortest- and longest-living communities in the metro, their life expectancy is worlds apart.

Following the winding path of the White River which crosses the entire metro area, we see a pattern in life expectancy that also plays out throughout the metro area. Life expectancy is lowest in places within the urban core of the Indianapolis and also on the outer periphery of the 11-county metro, while highest life expectancy is found in the suburban transitions from the city.

MORE PLACES IN THE INDIANAPOLIS METRO AREA LOST LIFE EXPECTANCY THAN GAINED IT.

Between the earlier period (2009-2013) and the later period (2014-2018) of the decade, there were more ZIP Codes who lost time of predicted lifespan than who gained time. ZIP Codes that experienced the most change in life expectancy, both gains and losses, tended to be located outside the urban center in the western counties of the metro. Little change was observed in many ZIP Codes, with 43 changing by one year or less (+ or -).

THE GAP IN LIFE EXPECTANCY IS REMARKABLY PERSISTENT ACROSS THE AGE SPECTRUM.

The life expectancy gap between ZIP Codes of metro Indy persists across different ages of the life course, never falling below an 11-year difference. As communities, we do not outgrow or outlive disparities in life expectancy. The gap is widest at birth (16.8 years), declines with age to its smallest difference at age 55 (11.4 years), and then rebounds to increase through age 85 (13.9 years). When comparing spatial patterns of life expectancy at birth, age 25, age 45, and age 65, some changes do emerge over time, particularly by age 65. However, the most striking pattern is the remarkable consistency in these geographic patterns of high and low life expectancy across ages of the life course. The persistent effect of “place” appears to hold.

WHAT ARE THE KEY TAKEAWAYS?

Education, income, and racial residential segregation are all significant drivers of the life expectancy gap in metropolitan Indianapolis. These factors often intersect in the same geographic locations, constraining access to resources and perpetuating cycles of disadvantage. These are social toxins just as deadly and far more entrenched than COVID.

The gap in life expectancy is just the final manifestation of a long chain of gaps: gaps in educational quality and opportunity, gaps in home ownership, gaps in working conditions and livable wages, gaps in wealth, gaps in food and transportation access, gaps in internet access, gaps in healthcare access – and more. In a society that sorts people by class and race (among other things), some groups are living in places where the resources needed for community wellbeing are systematically constrained, and the health gap is perpetuated.

- Educational opportunities and attainment are crucial and strongly linked with life expectancy. As an area's overall educational attainment increases, so does life expectancy. The proportion of residents in a ZIP Code without a high school education varies greatly across the metro, and this measure alone accounts for 57% of the life expectancy gap.
- Money is a fundamental resource needed to provide for basic needs and to sustain health. As average income in an area rises, so does life expectancy. Likewise, as the percentage of those living in/near poverty increases in a ZIP, life expectancy falls. The proportion of residents in a ZIP Code experiencing financial hardship (living below 200% poverty level) is strongly linked with the area's life expectancy, explaining 53% of the variation in life expectancy across metro Indianapolis ZIP Codes
- As an area's overall level of social vulnerability increases, life expectancy falls. Using an index of 15 different social factors known as the Social Vulnerability Index (SVI), we found that this index explains 49.5% of the variation in life expectancy in the Indy metro. While the index is more

comprehensive in capturing a range of possible social vulnerabilities in a community, it did not predict ZIP-Code level life expectancy in the metro quite as well as low education or low income.

- Racism specifically as it set in place a system of residential segregation continues to affect health in communities of metro Indianapolis. Studies have shown that residents of former red-lined areas have shorter life spans than those of green-lined areas. Across the United States, life expectancy is higher in areas where there is greater racial/ethnic diversity. Large life expectancy gaps occur most frequently in cities that have higher levels of racial/ethnic segregation, and Indianapolis is among the most highly segregated large cities of the U.S. (Spoer, 2019). Due to the enduring legacy of racial residential segregation in the Indy metro, 77% of all Black residents live in just 21 highly-segregated ZIP Codes – and the average life expectancy in these ZIP Codes is 3.9 years shorter than lesser-segregated ZIP Codes.

STRATEGIES TO NARROW THE GAP MUST TAKE AIM AT THE UPSTREAM DRIVERS WITH SUSTAINED AND COLLECTIVE ACTION FOCUSED ON EQUITY.

A key goal of this report is to provide data that inspires action. There is evidence from countries and cities around the world that we can lessen this life expectancy gap by 1) improving the daily conditions of life 2) tackling the inequitable distribution of power, money, and resources; and 3) measuring and understanding the problem, and assessing the impact of action. These are short statements, yet big tasks. We provide a few examples of effective approaches and active local initiatives to increase health equity.

Effective national approaches include tenant-based housing voucher programs, center-based early childhood education, and high school completion programs for at-risk kids. A variety of policy and systems changes have been identified to address residential segregation by increasing homeownership among Black residents, providing broader access to

affordable housing in all areas, increasing options for families with housing vouchers, and reinvesting in divested neighborhoods to increase access to housing and other resources.

Active neighborhood-based initiatives to improve health equity locally include a community-university partnership with a neighborhood center to develop a community health action plan, a multi-partner collective impact initiative working with 3 communities (>40,000 people) to reduce the burden of diabetes, and an interfaith health network of congregations.

THIS WORK TAKES ALL OF US.

There is no one, simple solution that will immediately eliminate these inequities in health and close the gaps in life expectancy. This issue is not one that can be fixed by the healthcare system or by any one organization. It will take a collaborative effort of most if not all sectors of society to drive change that is not focused on the symptoms (such as disease patterns) but on the drivers of these health inequities. Collectively, we can lessen the gap between communities of metropolitan Indianapolis through specific actions and policies.

LET'S BUILD COMMUNITIES WHERE WE ALL CAN THRIVE.

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Appendix A. Life Expectancy at Birth for Counties of the Indianapolis Metro Area

County	2014-2018	2009-2013*	Change Between Periods
Boone	78.2	78.8	-0.6
Brown	79.1	78.0	1.1
Hamilton	81.9	82.0	-0.1
Hancock	78.3	78.2	0.1
Hendricks	79.6	80.0	-0.4
Johnson	78.0	78.5	-0.5
Madison	75.9	75.9	0.0
Marion	75.9	76.4	-0.5
Morgan	76.8	76.7	0.1
Putnam	77.6	77.1	0.5
Shelby	76.5	77.3	-0.8
THE GAP BY COUNTY	6.0 years	6.1 years	-0.1
Indianapolis Metropolitan Area	77.5	77.7	-0.2

* Due to an update in methods for comparability to 2014-2018 calculations, some 2009-2013 values differ from those reported in earlier report (2015).

Appendix B. Life Expectancy at Birth in Order of ZIP Code, Indianapolis Metro Area

ZIP Code	2014 2018	2009-2013*	Change Between Periods
46001	75.5	77.5	-2.0
46011	76.1	75.6	0.5
46012	77.2	76.8	0.4
46013	75.5	76.9	-1.4
46016	69.9	70.4	-0.5
46017	73.7	74.7	-1.0
46030	78.5	78.9	-0.4
46032	83.1	82.0	1.1
46033	83.8	83.8	0.0
46034	77.4	80.4	-3.0
46036	75.4	73.8	1.6
46037	84.8	81.7	3.1
46038	81.3	80.5	0.8
46040	78.0	78.0	0.0
46044	79.3	77.4	1.9
46048	75.8	74.4	1.4
46051	80.1	79.3	0.8
46052	76.1	77.7	-1.6
46055	80.8	77.9	2.9
46056	76.5	73.9	2.6
46060	78.2	78.2	0.0
46062	81.0	83.7	-2.7
46064	79.3	79.4	-0.1
46069	78.1	79.0	-0.9
46070	77.1	78.1	-1.0
46071	79.1	77.4	1.7
46074	81.4	82.4	-1.0
46075	78.7	78.1	0.6
46077	79.0	79.6	-0.6
46105	76.1	75.1	1.0
46106	79.1	79.7	-0.6
46107	73.9	75.0	-1.1
46112	79.4	79.3	0.1
46113	78.4	Not reported	N/A
46118	77.5	76.8	0.7
46120	74.6	77.5	-2.9
46121	79.7	84.0	-4.3
46122	77.6	80.2	-2.6

ZIP Code	2014 2018	2009-2013*	Change Between Periods
46123	78.5	79.3	-0.8
46124	76.9	76.2	0.7
46126	80.5	80.8	-0.3
46128	75.9	72.7	3.2
46130	75.5	77.9	-2.4
46131	76.5	76.1	0.4
46135	78.5	77.0	1.5
46140	77.3	77.4	-0.1
46142	77.5	78.1	-0.6
46143	79.2	81.2	-2.0
46147	74.1	78.7	-4.6
46149	82.5	79.9	2.6
46151	77.5	76.0	1.5
46157	74.1	79.4	-5.3
46158	76.0	78.0	-2.0
46160	81.6	74.9	6.7
46161	79.4	76.3	3.1
46163	80.0	80.9	-0.9
46164	80.7	77.0	3.7
46165	80.1	74.0	6.1
46166	71.3	Not reported	N/A
46167	78.7	81.4	-2.7
46168	80.9	80.2	0.7
46171	77.2	Not reported	N/A
46172	72.8	76.1	-3.3
46176	75.3	76.7	-1.4
46181	76.5	76.7	-0.2
46182	75.4	72.6	2.8
46184	76.4	78.2	-1.8
46186	82.5	80.9	1.6
46201	69.2	70.8	-1.6
46202	75.1	75.6	-0.5
46203	71.7	71.6	0.1
46205	73.9	74.5	-0.6
46208	73.7	72.5	1.2
46214	76.7	78.7	-2.0
46216	75.1	77.5	-2.4
46217	79.2	79.5	-0.3

ZIP Code	2014 2018	2009-2013*	Change Between Periods
46218	68.0	70.5	-2.5
46219	73.6	74.1	-0.5
46220	81.5	80.0	1.5
46221	74.2	74.1	0.1
46222	71.5	73.1	-1.6
46224	76.3	76.8	-0.5
46225	71.4	70.4	1.0
46226	74.3	76.2	-1.9
46227	75.5	76.6	-1.1
46228	77.8	81.6	-3.8
46229	76.2	77.1	-0.9
46231	75.5	79.4	-3.9
46234	80.0	79.5	0.5
46235	74.2	75.7	-1.5
46236	79.7	81.1	-1.4
46237	77.4	79.0	-1.6
46239	79.9	78.2	1.7
46240	80.7	81.3	-0.6
46241	72.5	73.5	-1.0
46250	81.0	79.8	1.2
46254	79.3	78.1	1.2
46256	82.5	81.7	0.8
46259	80.3	81.0	-0.7
46260	77.0	77.8	-0.8
46268	78.7	79.7	-1.0
46278	81.9	80.0	1.9
46280	82.4	83.6	-1.2
47448	75.8	77.2	-1.4

Appendix C. Life Expectancy at Birth for ZIP Codes, High to Low, 2014-2018

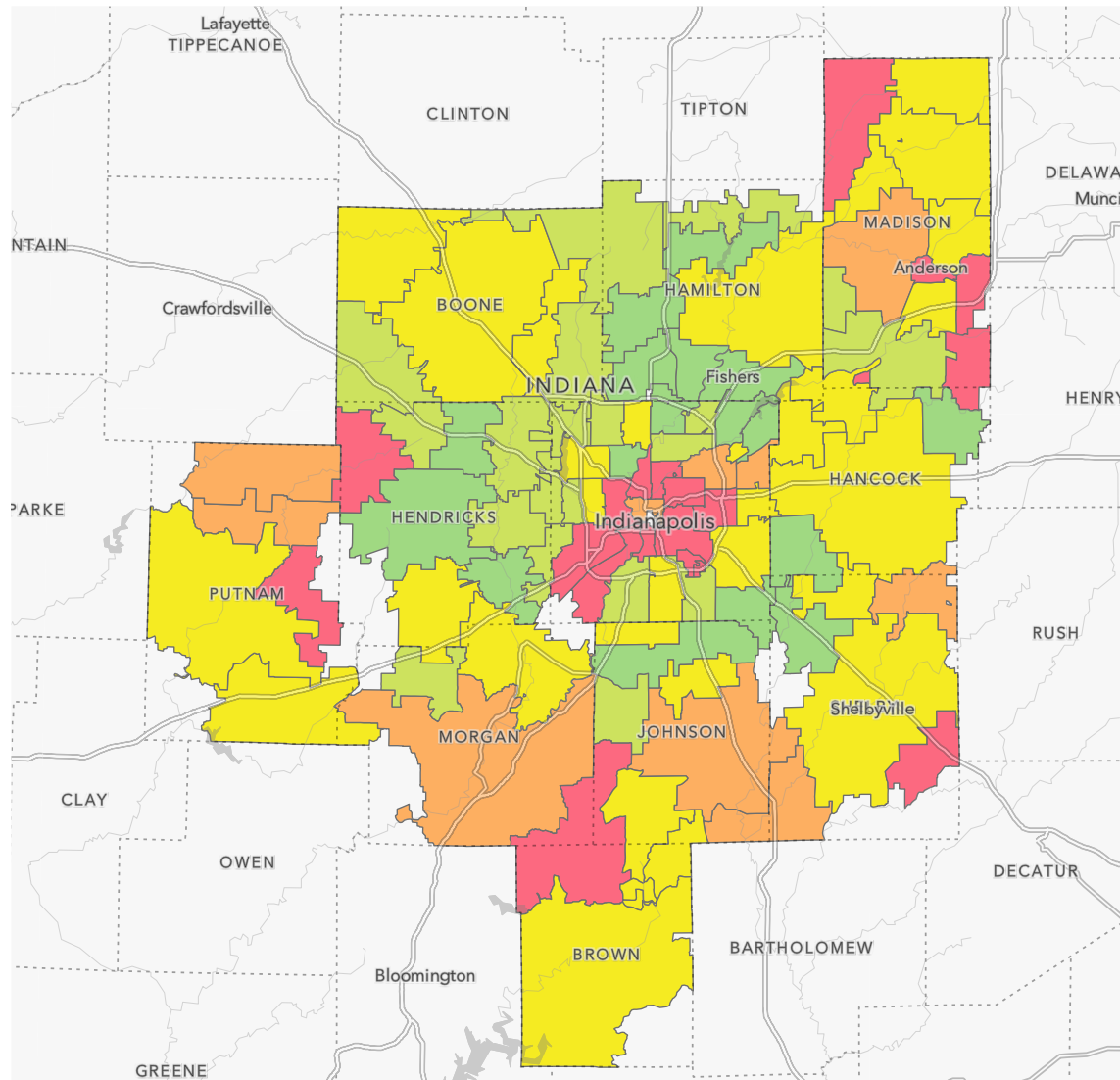
2014-2018 Life Expectancy, High to Low	Quintile	ZIP Code
84.8		46037
83.8		46033
83.1		46032
82.5		46149
82.5		46256
82.5		46186
82.4		46280
81.9		46278
81.6		46160
81.5		46220
81.4		46074
81.3		46038
81.0		46062
81.0		46250
80.9		46168
80.8		46055
80.7		46240
80.7		46164
80.5		46126
80.3		46259
80.1		46051
80.1		46165
80.0		46234
80.0		46163
79.9		46239
79.7		46121
79.7		46236
79.4		46112
79.4		46161
79.3		46254
79.3		46044
79.3		46064
79.2		46217
79.2		46143
79.1		46106
79.1		46071
79.0		46077

2014-2018 Life Expectancy, High to Low	Quintile	ZIP Code
78.7		46075
78.7		46268
78.7		46167
78.5		46123
78.5		46135
78.5		46030
78.4		46113
78.2		46060
78.1		46069
78.0		46040
77.8		46228
77.6		46122
77.5		46151
77.5		46118
77.5		46142
77.4		46034
77.4		46237
77.3		46140
77.2		46012
77.2		46171
77.1		46070
77.0		46260
76.9		46124
76.7		46214
76.5		46181
76.5		46056
76.5		46131
76.4		46184
76.3		46224
76.2		46229
76.1		46105
76.1		46052
76.1		46011
76.0		46158
75.9		46128
75.8		46048
75.8		47448

2014-2018 Life Expectancy, High to Low	Quintile	ZIP Code
75.5		46231
75.5		46227
75.5		46130
75.5		46001
75.5		46013
75.4		46182
75.4		46036
75.3		46176
75.1		46202
75.1		46216
74.6		46120
74.3		46226
74.2		46221
74.2		46235
74.1		46147
74.1		46157
73.9		46107
73.9		46205
73.7		46208
73.7		46017
73.6		46219
72.8		46172
72.5		46241
71.7		46203
71.5		46222
71.4		46225
71.3		46166
69.9		46016
69.2		46201
68.0		46218

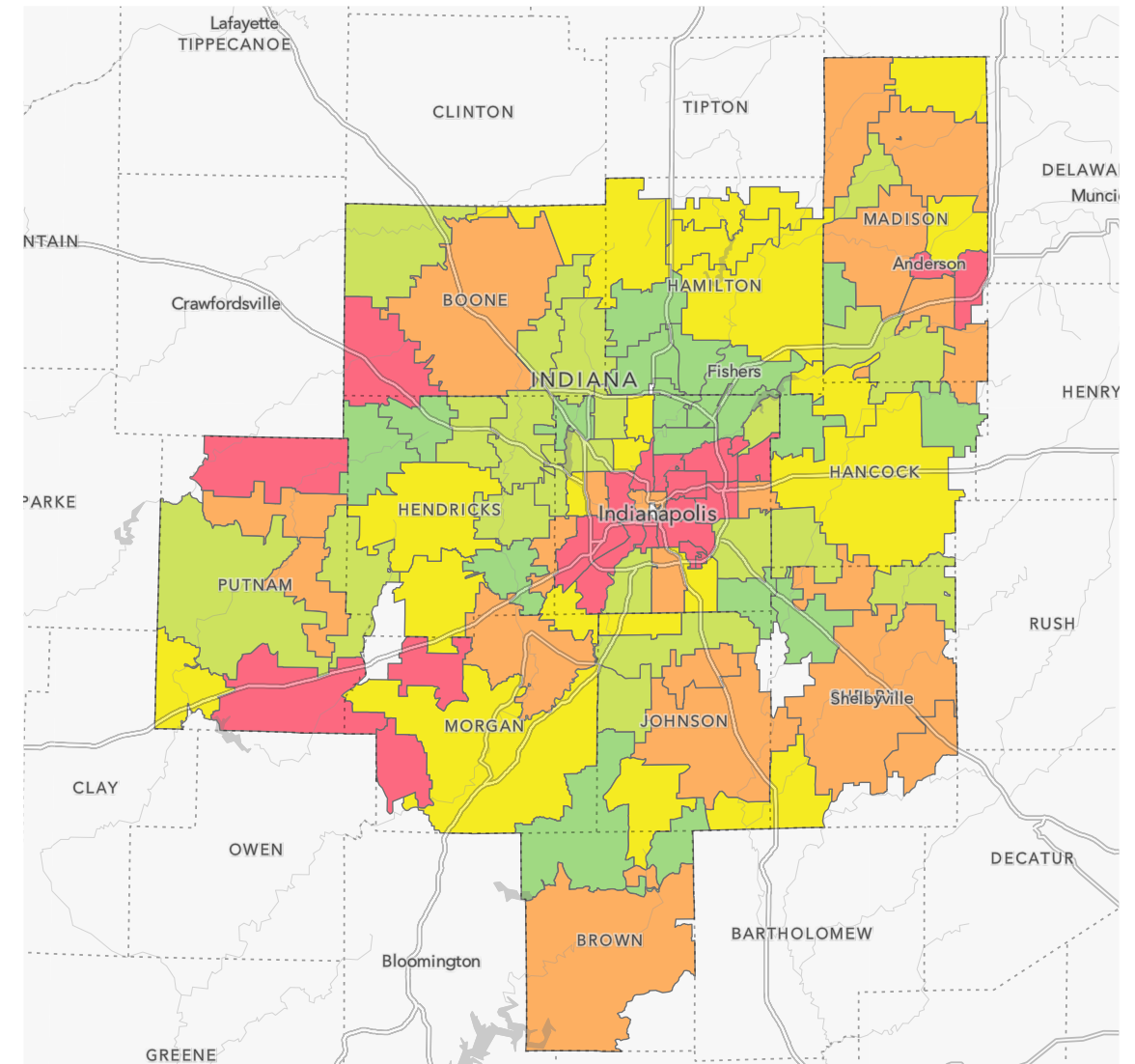
Quintile Legend	
Red	68.0 – 75.1
Orange	75.2 – 76.5
Yellow	76.6 – 78.5
Light Green	78.6 – 80.1
Dark Green	80.2 – 84.8

Appendix D. Maps of Life Expectancy at Birth by ZIP Codes of Indianapolis Metro Area for 2009-2013 and 2014-2018



In 2013, a child born in these ZIP Codes could expect to live...

- 75.1 years or lower
- 75.2-76.5
- 76.6-78.5
- 78.6-80.1
- 80.2 or higher



In 2018, a child born in these ZIP Codes could expect to live...

- 75.1 years or lower
- 75.2-76.5
- 76.6-78.5
- 78.6-80.1
- 80.2 or higher

Appendix E: Life Expectancy Across the Age Spectrum, 2014-2018

	Birth	Age 1	Age 5	Age 15	Age 25	Age 35	Age 45	Age 55	Age 65	Age 75	Age 85
Average	77.41	76.89	72.96	63.06	53.64	44.46	35.30	26.67	18.77	11.88	6.41
Lowest	68.04	68.12	64.31	54.60	46.23	37.56	28.05	20.26	13.63	6.26	1.00
Highest	84.84	84.20	80.20	70.20	60.55	50.88	41.21	31.70	25.25	19.01	14.89
THE GAP	16.80	16.08	15.89	15.60	14.32	13.32	13.17	11.44	11.62	12.75	13.89
Ratio of Low to High (as %)	80%	81%	80%	78%	76%	74%	68%	64%	54%	33%	7%

Appendix F. Descriptive Statistics and Correlation of Area-Level Social Factors with Life Expectancy at Birth, 2014-2018

ZIP-Code Level Social Factors	Average (Percent of ZIP's Population)	Range (Low-High)	Pearson's Correlation with Life Expectancy at Birth	Strength of Effect
Population Size	19,129	(1,433 – 56,614)	.050	None
EDUCATION				
No High School Diploma	10.00 %	(0.82% - 30.59%)	-.755**	Strong
High School Diploma	31.66%	(6.95% - 50.17%)	-.510**	Strong
College Degree or more	29.66%	(5.97% - 73.19%)	.622**	Strong
INCOME DISTRIBUTION				
Per Capita Income	\$31,593	(\$15,368-\$61,118)	.678**	Strong
Population in Poverty	11.93%	(1.61% - 36.61%)	-.709**	Strong
Population below 200% Poverty Level	27.93%	(6.01% - 66.46%)	-.728**	Strong
GINI Index of Income Inequality	0.413	(0.280 – 0.600)	-.197*	Weak
SOCIAL VULNERABILITY INDEX (SVI)				
SVI – indicator based	0.5040	(0.0000 – 1.0000)	-.643**	Strong
SVI – category based	0.5040	(0.0090 – 1.0000)	-.623**	Strong
SVI – Socioeconomic Category	0.5018	(0.0000 – 1.0000)	-.704**	Strong
SVI – Household Composition Category	0.5063	(0.0000 – 1.0000)	-.610**	Strong
SVI – Minority & Language Category	0.5034	(0.0090 – 1.0000)	-.190	Weak
SVI – Housing & Transportation Category	0.4991	(0.0000 – 1.0000)	-.468**	Moderate
RACIAL DISTRIBUTION				
People of Color	19.92%	(0.28 % - 80.9%	-.314**	Moderate
Black, Non-Hispanic	10.64%	(0.00% - 71.64%)	-.338**	Moderate
Hispanic	4.95%	(0.00% - 28.56%)	-.351**	Moderate
Asian	1.95%	(0.00% - 13.48%)	.314**	Moderate
White, Non-Hispanic	80.08%	(19.06% - 99.72%)	.321**	Moderate
RACIAL SEGREGATION				
Dissimilarity Index, adjusted	0.0128	(0.0001 – 0.0743)	-.208	Weak
Entropy Index	0.0032	(-0.0053 – 0.0178)	.348**	Moderate
Black/White Isolation Index, adjusted	0.0041	(0.0000 – 0.0465)	-.359**	Moderate

Excludes 18 ZIP codes with 0% Black population

** Correlation is significant at the 0.01 level

* Correlation is significant at the 0.05 level

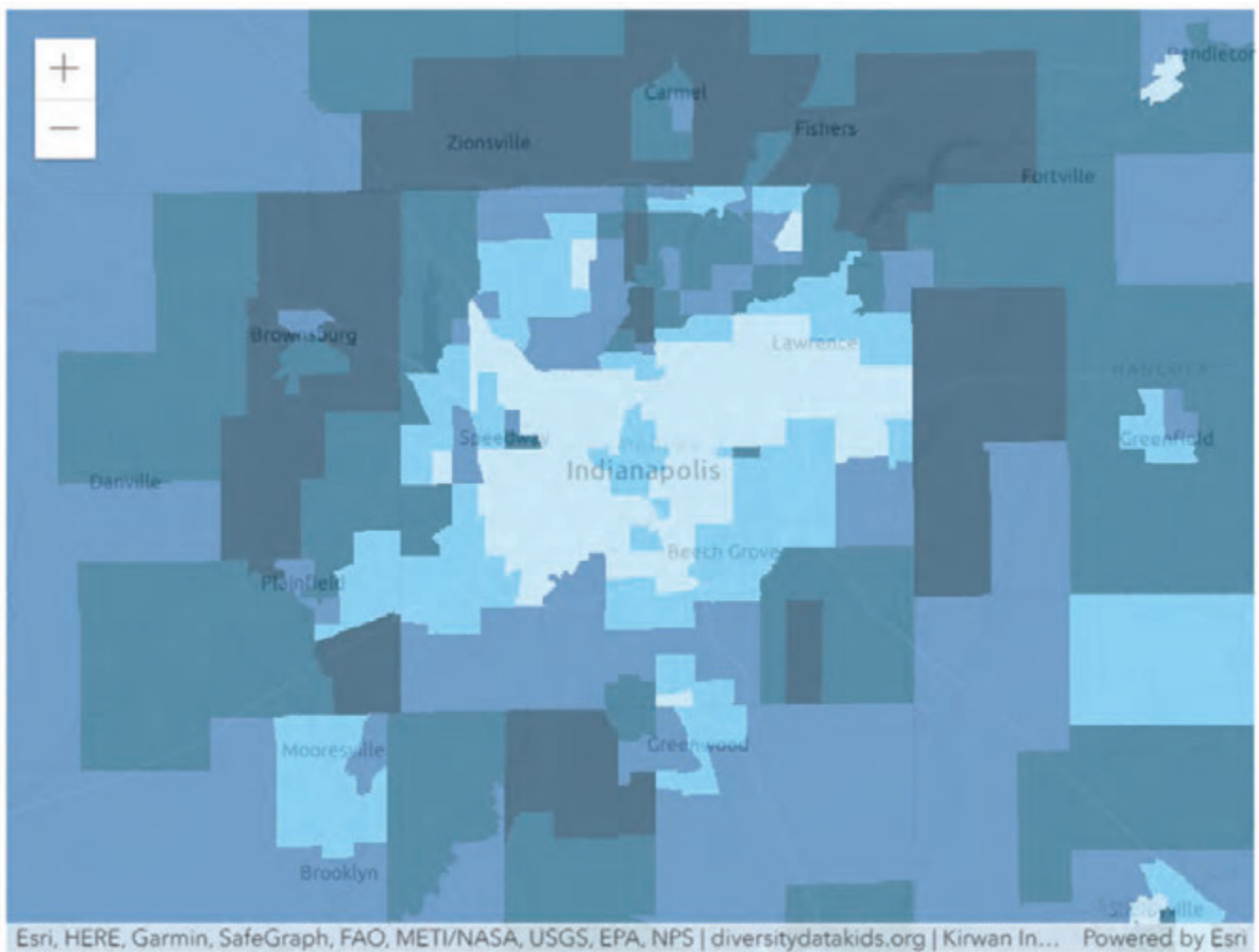
Two overall SVI scores can be calculated. In the indicator-based score, each of the 15 indicators contributes to the score equally. In the category-based score, each of the 4 categories (which are each developed from a different number of related indicators) contribute to the score equally.

Appendix G: Map of the Child Opportunity Index 2.0 for Indianapolis Metro Area, 2015

The degree of opportunity presented to children in our communities today is associated with their life expectancy. “Across all metros [of the United States], there is a seven-year difference in life expectancy between residents in very low-opportunity neighborhoods (75 years) and residents in very high-opportunity neighborhoods (82 years).²² Furthermore, the Indianapolis metro ranks among the ten metro areas, of the 100 largest in the U.S., with the widest (worst) life expectancy gap between very high and

very low opportunity areas (Acevedo-Garcia, et al, page 43).²² Neighborhoods affect a child’s quality of education and wellbeing, as well as their expectations for the future. Their chances of moving up the social ladder themselves as adults are decreased when living in a low-opportunity area.

The Child Opportunity Index 2.0 is a score that compares and ranks each census tract in the U.S.



Neighborhood opportunity levels

- Very low
- Low
- Moderate
- High
- Very high

compared to all others on 29 different measures affecting the opportunity for children living there to thrive. The current release of the index is based upon 2015 data. As defined on page 10 of their report, Acevedo-Garcia and colleagues describe the dimensions of neighborhood opportunity captured in the index:

- Availability and quality of neighborhood institutions (e.g., early childhood education centers and schools)
- Peer and adult influences that help shape children's norms and expectations (e.g. high school graduation rate and adults with high-skill jobs)
- Neighborhood social structure and economic resources (e.g., neighborhood poverty and employment)
- Environmental quality (e.g., air pollution)
- Resources for healthy living (e.g. green space, healthy food outlets, walkability)

Their map of the Child Opportunity index across census tracts (not ZIP Codes) of the Indianapolis metro area is shaded to indicate which of the five opportunity levels the census tract falls, from very low (lightest color) to very high (darkest color). The pattern for the Indianapolis metro is similar to maps of life expectancy for the Indy metro, where the lowest opportunity areas are concentrated near the urban core, while the highest opportunity areas form a ring in the suburbs just outside the I-465 loop. Without improving opportunity for children in low opportunity areas, cycles of poor health and shortened lives are likely to continue from one generation to another.

The Child Opportunity Index 2.0 is a score that compares and ranks each census tract in the U.S. compared to all others on 29 different measures affecting the opportunity for children living there to thrive. The current release of the index is based upon 2015 data. As defined on page 10 of their report, Acevedo-Garcia and colleagues describe the dimensions of neighborhood opportunity captured in the index:

- Availability and quality of neighborhood institutions (e.g., early childhood education centers and schools)
- Peer and adult influences that help shape children's norms and expectations (e.g. high school graduation rate and adults with high-skill jobs)
- Neighborhood social structure and economic resources (e.g., neighborhood poverty and employment)
- Environmental quality (e.g., air pollution)
- Resources for healthy living (e.g. green space, healthy food outlets, walkability)

Their map of the Child Opportunity index across census tracts (not ZIP Codes) of the Indianapolis metro area is shaded to indicate which of the five opportunity levels the census tract falls, from very low (lightest color) to very high (darkest color). The pattern for the Indianapolis metro is similar to maps of life expectancy for the Indy metro, where the lowest opportunity areas are concentrated near the urban core, while the highest opportunity areas form a ring in the suburbs just outside the I-465 loop. Without improving opportunity for children in low opportunity areas, cycles of poor health and shortened lives are likely to continue from one generation to another.

Appendix H: Correlation Matrix between Main Social Factors

CORRELATION MATRIX BETWEEN KEY SOCIAL PREDICTORS OF LIFE EXPECTANCY

Variable	1	2	3	4
1. Percentage without H.S. diploma	--			
2. Percentage living <200% poverty level	.885**	--		
3. Black/White Isolation Index	.402**	.551**	--	
4. SVI-Socioeconomic Category	.849**	.889**	.459**	--

**Significant at $p < .01$

Appendix I: Methods

LIFE EXPECTANCY

Life expectancy at birth is a prediction of the number of years babies born in a certain place today will live based upon the death rates of those who lived in the area during the time period studied, should all things remain the same. Likewise, life expectancy at any other age, such as age 45, is an estimate of remaining years of life persons who have reached a specific age, on average, can expect to live.

In our analysis, life expectancy at birth was derived for 11 counties and 104 Zip Code Tabulation Areas (ZCTA)¹ in the Indianapolis-Carmel-Anderson Metropolitan Statistical Area (MSA) through the calculation of abridged life tables for the years 2009-2013 (pooled) and 2014-2018 (pooled). In this update, we employed a widely-used method developed by Chiang, and adjusted by Silcocks. Specifically, we utilized a Life Table Template from Public Health England to automate calculations of abridged life tables with 95% confidence intervals for life expectancy at each age band in Excel, following input of age-specific population estimates and deaths. For further information on the methods applied in this template, please see the Technical Notes and References that it contains.

Using multiple years of death data is recommended for small geographies such as ZIP Codes to improve accuracy of the estimates, thus our selection of the five-year periods 2009-2013 and 2014-2018. In this

update, we also switched to 10-year age groups from five-year age groups to limit the possibility of age groups with zero deaths. For small areas like ZIP Codes, it is common to have zero deaths among childhood age groups. With the Silcocks adjustment, the age-specific death rate is not imputed for age bands with zero deaths, except for the final age band (85+).

In this analysis, the age groups in the Life Table Template were adjusted from 5-year to 10-year bands between ages 5-84, and the final age group was kept at 85+, not 90+. Therefore, our abridged life tables use death and population data that are aggregated by the following age groups: less than 1 year, 1-4 years, 5-14 years, 15-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, 65-74 years, 75-84 years, and 85+ years.

- The count of deaths occurring by age group in the two five-year periods, by county and ZIP Code, were obtained from the Indiana Department of Health.
- Five-year population estimates by county and ZCTA, also for the periods of 2009-2013 and 2014-2018, were drawn from the American Community Survey's 5-year estimates, and provided by The Polis Center at IUPUI. The population of those age <1 and 1-5 were attributed at 20% and 80% of the total population 0-5, given that population estimates are not available for <1 and 1-5.

¹ ZIP Code Tabulation Areas, unlike ZIP Codes, do not usually include areas that are unpopulated or only business locations. In most cases a residential address has the same ZCTA and ZIP Code. To learn more, visit <https://help.healthycities.org/hc/en-us/articles/115006016767-What-is-the-difference-between-ZIP-Codes-and-ZCTAs->

There were four criteria which precluded us from calculating and/or reporting life expectancy results for any given ZCTA. Results are not reported for any ZIP Codes/ZCTAs with 1) fewer than 1,000 residents (5,000 person-years when combining 5 years of death data) or 2) fewer than 10 deaths annually (50 pooled over 5 years). Areas with too few deaths or too small a total population can result in unstable age-specific death rates and life expectancy estimates. These criteria meet established recommendations from the National Center for Health Statistics. Also, life expectancy was not reported for any ZIP Code/ZCTA where 3) the number of deaths exceeded the population estimate for an age group, which occurred in a few instances among those age 85+. Finally, we did not report for one ZIP Code where 4) the 95% confidence interval was exceptionally wide (>20 years) despite having met all other criteria.

Due to updates in methodology, we recalculated life expectancy for 2009-2013 to enable comparison between the two periods. For this reason, life expectancy for 2009-2013 reported here (2021) may differ for some ZIP Codes from the life expectancy that we originally reported in 2015. Change in life expectancy from recalculations ranged from -0.3 years to +1.6 years. In 78/104 ZIP Codes (75%) the recalculated 2009-2013 life expectancy changed by +0.5 years or less.

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RACIAL RESIDENTIAL SEGREGATION

Three different indices of racial residential segregation were utilized in these analyses: the isolation index, the dissimilarity index, and the entropy index. Calculations for these indices utilized methods described by Massey and Denton (1988). Each formula involves a comparison of black-white segregation within ZIP Codes to black-white segregation in the Indianapolis metro area overall. Eighteen ZIP Codes with zero black residents on record were excluded.

Massey DS, Denton NA. The Dimensions of Residential Segregation. *Social Forces*. 1988;67(2):281. doi:10.2307/2579183

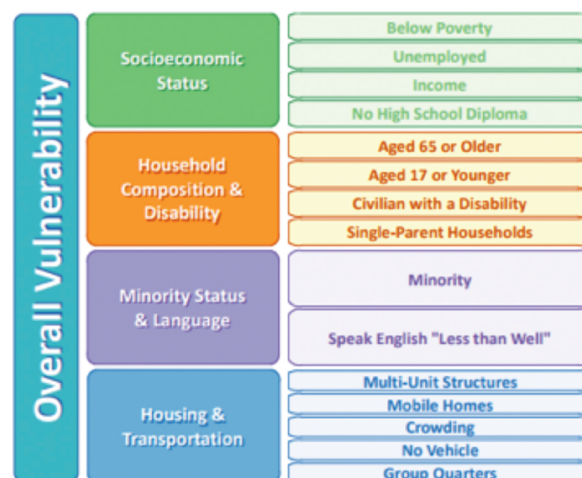


Image Source: Centers for Disease Control and Prevention (CDC), 2018 SVI Documentation Guide.

SOCIAL VULNERABILITY INDEX

The Social Vulnerability Index (SVI) was calculated using 15 area-level census measures for ZIP Code Tabulation Areas (ZCTAs) (American Community Survey, 2014-2018) within four categories: Socioeconomic, Household Composition/Disability, Minority Status/Language, and Housing Type/Transportation, as shown below. Methods are described in the Centers for Disease Control and Prevention's documentation.

Centers for Disease Control and Prevention. CDC SVI Documentation 2018. ASTDR | Place and Health. Published 2018. Accessed August 9, 2021. https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/SVI_documentation_2018.html

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