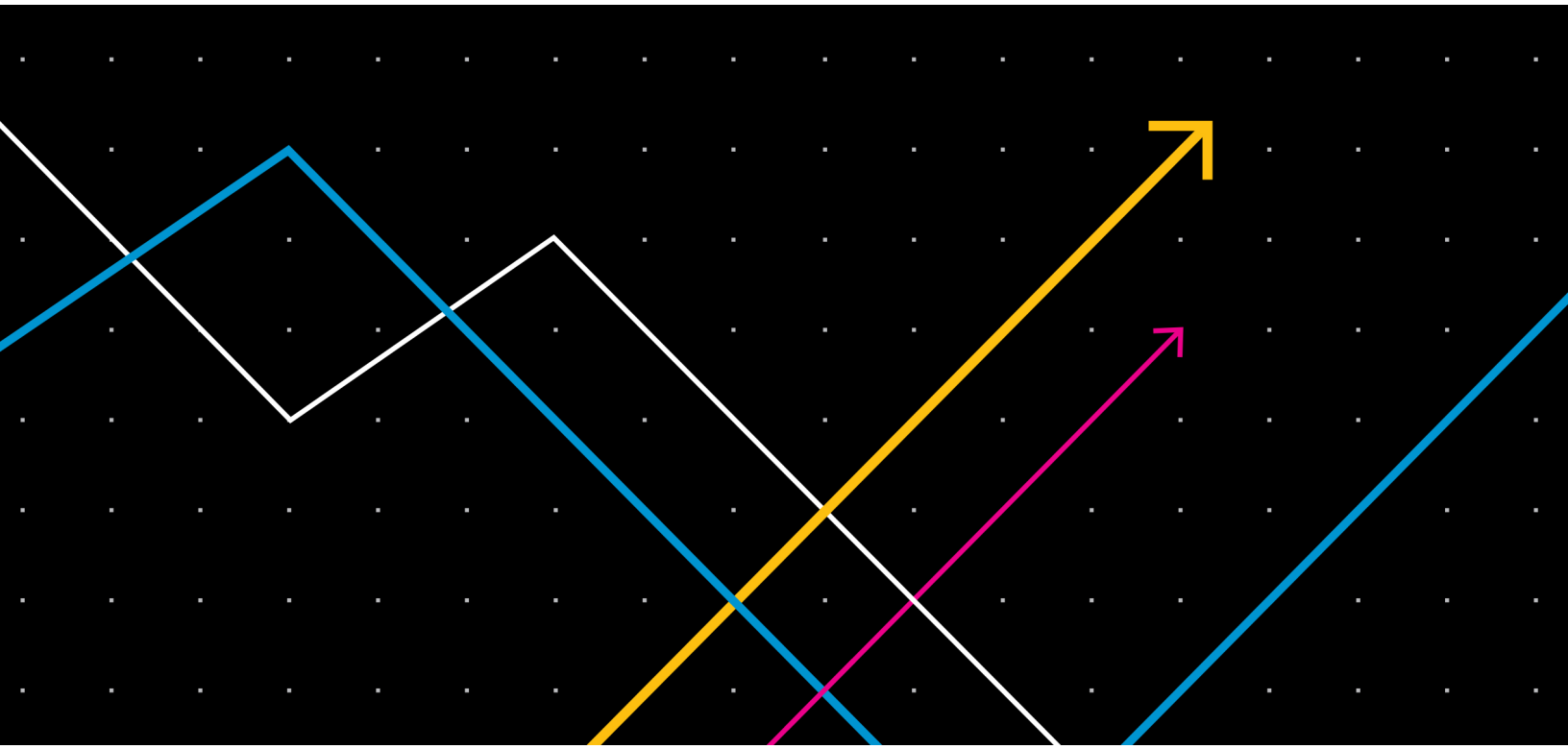

TECHNICAL DOCUMENTATION

Indices for Ohio Qualified Allocation Plans

Data source and methodology

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Introduction

The Ohio Opportunity Index represents a multi-dimensional approach to understanding community opportunity that moves beyond traditional deficit-based measures to capture the assets and strengths that enable residents to thrive. Drawing on established frameworks for measuring community capital and opportunity, the index integrates data across four key domains: Opportunity-Rich and Inclusive Neighborhoods, High-Quality Education, Rewarding Work, and Healthy Environment and Access to Good Health Care. This approach recognizes that true opportunity emerges from the intersection of multiple community characteristics rather than any single factor.

In collaboration with Ohio Housing Finance Agency (OHFA), the Urban Institute created four distinct but related indices that capture different aspects of community opportunity and housing market conditions:

- Neighborhood Opportunity – General Occupancy Index: The primary index measuring community opportunity across four dimensions using 20 variables that capture neighborhood economic conditions, educational access and quality, employment opportunities, and health and environmental factors
- Neighborhood Opportunity – Senior Index: A specialized version of the general index adapted to reflect three dimensions particularly relevant to older adults, including age-specific employment measures and modified rationales for certain opportunity dimensions
- Housing Needs Index: Measures housing supply constraints, affordability challenges, and subsidized housing availability across four dimensions
- Neighborhood Change Index: Captures recent trends across five dimensions—Opportunity Change, Growth, Housing Value, Economic Base, and Early Signs of Change—using longitudinal data to identify areas experiencing change in opportunity and housing need over both five-year and one-year time periods

The methodology emphasizes data transparency, geographic comprehensiveness, and analytical rigor while acknowledging the inherent limitations of any quantitative approach to measuring complex community dynamics. This technical documentation provides a comprehensive account of the data sources, analytical methods, and methodological decisions underlying the Ohio Opportunity Index and its related indices. The following sections detail the study methodology, including data sources and cleaning procedures, variable construction, and index calculation methods.

Methodology

Overview

Creation of each of the four indices followed a similar methodology:

- **Dimension and metric identification:** For each index, we consulted the relevant literature and with OHFA staff to identify a set of dimensions within the index that best capture the neighborhood characteristics relevant to the index that . For each dimension, we then identified one or more metrics that effectively measure that dimension based on our literature review and data availability. The dimensions and measures are outlined in the sections below.
- **Data collection and cleaning:** We collected, cleaned and standardized raw data as needed to calculate each metric. We cleaned the calculated metrics to prepare for analysis including performing geographic crosswalks to convert all measures to 2020 census tract-level metrics and adjusting all neighborhood change metrics measured in nominal dollars for inflation. For more information, see the "Data Sources and Measures" section below.
- **Handle outliers and normalize:** We addressed extreme outliers through top and bottom coding at three standard deviations above or below the mean. For example, an observation with a value 5 standard deviations above the metric mean would be replaced with the value 3 standard deviations above the mean. This process prevents extreme outliers causing highly-skewed z-scores and index scores. Some measures are more dispersed than others and the highest share of outliers we coded is 2.77 percent of the total observation.
- **Convert measures to Z-**score. After adjusting for extreme values, we put all measures on the same scale so we could compare them fairly. We converted each measure to z-scores by subtracting the mean value and dividing by the standard deviation. Normalized measures have a mean of 0 and standard deviation of 1. For metrics that involve measuring distance to a resource, we split tracts into urban, suburban, and rural subgroups using the RUCA codes prior to normalization to compare tracts against the average for tracts in their geographic subgroup. See "Approach to Incorporating Geography" below for more details. For measures where higher numbers indicate worse conditions (such as poverty rates), we flipped the scale by multiplying the normalized measure by -1 so that better conditions always get higher scores, making the results easier to interpret and combine.

- **Calculate sub-indices**: Subindices correspond to the dimensions within each index. We calculated each sub-index by taking the average of all non-missing metrics in in the same dimension. This gives all non-missing metrics within the sub-index the same weight. For example, if there are four metrics in a sub-index and all are non-missing, each has an effective weight of .25 in the final sub-index score. If one metric is missing, the remaining three non-missing metrics have an effective weight of .33.

- **Calculate and scale final index:** We calculated the final index by averaging the sub-index scores together. This gives all sub-indices the same weight in calculating the final index. Except for one tract in the neighborhood change index[1], all tracts have non-missing sub-index values across all sub-indices for each index. We then performed min-max scaling to convert each index to a 0-100 scale, where 0 represents the lowest index score across all tracts and 100 represents the highest index score across all tracts. All other scores are distributed between 0 and 100 based on their share of the maximum value (e.g. an index score of 75 is 75% as large as the highest index score across all tracts).

Approach to Incorporating Geography

Acknowledging the geographic differences between rural, suburban, and urban areas and how these differences might potentially concentrate investment, we implemented a geography-sensitive approach to our opportunity index methodology. Our approach aims to balance accounting for geography where relevant while enabling valid comparisons of opportunity across tracts in different geographic areas. Accordingly, we applied geography-based comparison only to measures involving distance to amenities, since resource density varies systematically across rural, suburban, and urban areas. For the set of distance-based measures included in the indices (proximity to parks, libraries, healthcare centers, childcare centers, farmer's markets and grocery stores) we created z-scores only within comparable geographic groups (urban, suburban, rural) rather than across all tracts. This approach ensures that rural areas are not unfairly penalized for naturally longer distances to amenities compared to their urban counterparts.

We defined urban, suburban, and rural classifications based on rural-urban commuting area (RUCA) codes, which classify US census tracts using measures of population density, urbanization, and daily commuting patterns.[2] Created by the US Department of Agriculture (USDA) Economic Research Service and used by the Federal Office of Rural Health Policy within the US Department of Health and Human Services, RUCA codes build on the US Census Bureau's definitions of "urbanized areas" and

"urban clusters." The RUCA codes provide nuance beyond county-based classification systems (e.g., the US Office of Management and Budget's metropolitan and nonmetropolitan areas and USDA's rural-urban continuum codes), allowing users to categorize tracts based on the functional relationships between places rather than relying solely on population density.

The most recent version of the RUCA codes was last revised in 2019 using 2010 census tract boundaries, and USDA reports that updated RUCA codes using 2020 updated census tract boundaries have not been released at the time of publication[3]. Since our analysis is based on 2020 Census update of the census tract boundaries, we crosswalked the RUCA code to align with the 2020 tract boundaries for analysis. For each 2020 tract, we identified the share of the tract's population that comes from each 2010 tract. We then assigned the 2020 tract to the RUCA code that represents the largest share of the tract's population. This spatial crosswalk process ensures that our geographic classifications reflect the most current census geography while preserving the analytical power of the RUCA methodology.

Once we crosswalked the RUCA code, we then further aggregated the detailed RUCA codes to urban/suburban/rural categories. Table 1 shows the crosswalk between detailed RUCA code and the corresponding urban/suburban/rural categories. This approach has been validated in previous research[1] and provides a more intuitive framework for understanding geographic differences in opportunity.

TABLE 1. URBAN/SUBURBAN/RURAL CLASSIFICATION BY RUCA CODE

RUCA Code	Description	Category
1	Metro	Urban
1.1	Metro: Secondary flow to larger UA	Urban
2	Metro High Commuting	Suburban
2.1	Secondary flow to larger UA	Suburban
3	Metro Low Commuting	Rural
4	Micro	Suburban
4.1	Secondary flow to a UA	Suburban
5	Micro High Commuting	Rural
5.1	Secondary flow to a UA	Rural
6	Micro Low Commuting	Rural
7	Small town core	Rural

[1] For example, see Paykin, Susan, et al. "Rural, Suburban, Urban Classification for Small Area Analysis." *Healthy regions+ policies lab.—2021.—URL* 10 (2021).

7.1	Secondary flow to a UA	Rural
7.2	Secondary flow to a large UC	Rural
8	Small town high commuting	Rural
8.1	Secondary flow to a UA	Rural
8.2	Secondary flow to a large UC	Rural
9	Small town low commuting	Rural
10	Rural	Rural
10.1	Secondary flow to a UA	Rural
10.2	Secondary flow to a large UC	Rural
10.3	Secondary flow to a small UC	Rural

Note: UA = Urbanized Area, UC = Urban Cluster

We created the z-scores for distance-based measures within urban/suburban/rural tracts based on these geographic classifications so that they are only compared to their comparable peers. For example, a rural tract's proximity to healthcare is evaluated against the average for other rural tracts, not against urban tracts where healthcare facilities are naturally more concentrated. For all other measures in the indices, the z-scores are created across all tracts, comparing the measure value for a given tract to the average of all tracts in the state.

The geography-specific and geography-neutral z-scores then flow into the subindices and final opportunity indices, resulting in a single opportunity measure for all tracts in the state. This approach incorporates the underlying geographic differences across different types of communities for those distance-based measures where it is most relevant, creating a more equitable assessment framework for access to amenities across highly diverse tracts. At the same time, adopting the geography-neutral approach for non-distance-based measures allows for direct comparison of the ultimate indices across tracts.

Approach to Identify Tracts Excluded from Analysis

To ensure the analysis focused on census tracts representative of residential communities and avoided extreme outlier measures in low population tracts that might distort index scores, we implemented a systematic approach to exclude tracts unsuitable for measuring community opportunity. Our exclusion criteria targeted tracts with minimal residential populations or those dominated by institutional uses that do not reflect typical community characteristics.

We applied two primary filters to identify tracts for exclusion from the opportunity index calculation:

- Zero Population Tracts: We excluded all census tracts with zero population based on 2019-2023 American Community Survey five-year estimates. These tracts typically represent areas covered primarily by water bodies, airports, large industrial facilities, or other non-residential land uses that are not relevant for measuring residential community opportunity.
- High Group Quarters Population: We calculated the share of total population living in group quarters for each tract and excluded those where more than 90 percent of residents live in group quarters facilities. Group quarters include institutional settings such as correctional facilities, nursing homes, college dormitories, military barracks, and other non-household living arrangements.[4] Tracts dominated by group quarters populations do not reflect typical residential community characteristics and would not provide meaningful opportunity scores for development decision-making.

This exclusion process removed 26 census tracts from our initial population of all census tracts in Ohio, resulting in a final analysis universe of 3,142 census tracts across Ohio. This approach provides a systematic and replicable method for identifying tracts that are clearly unsuitable for opportunity measurement. The 90 percent group quarters threshold was selected to capture tracts where institutional populations overwhelmingly dominate while retaining tracts with mixed residential and institutional uses that still reflect community characteristics relevant to household location decisions. We chose high thresholds for exclusion to default to including more tracts in our analysis while excluding only the most extreme examples that would skew the index values.

Data Sources and Measures

Data Collection

We prioritized data sources that provided comprehensive geographic coverage at the census tract level and represented the most current information available. Our selection criteria included:

1. **Geographic Coverage**: Data must be available for all or nearly all census tracts in Ohio.
2. **Temporal Relevance**: Data should represent conditions from 2018 or later, with preference for the most recent available estimates.

3. **Reliability**: Sources must come from established federal agencies, state agencies, or recognized national organizations with documented methodologies.

4. **Tract-Level Granularity**: Data should be available at the census tract level or able to be accurately allocated to census tracts.

Table 2 below provides the full list of data sources, geographic levels, and years used in constructing the four indices.

TABLE 2. DATA SOURCES USED IN OHIO OPPORTUNITY INDEX CONSTRUCTION

Source	Geographic Level	Year(s)
American Community Survey (ACS) 5-Year Estimates	Census tract	2019-2023
Center for Neighborhood Technology Housing + Transportation Index	Block group	2022
Environmental Justice Screening and Mapping Tool (EJ Screen)	Census tract	2023
ESRI	Point/polygon data	2023
Health Resources and Services Administration (HRSA)	Point data	2023
Home Mortgage Disclosure Act (HMDA)	Census tract	2023
Longitudinal Employer-Household Dynamics (LEHD)	Census tract	2018-2022
National Library Survey	Point data	2024
National Neighborhood Data Archive	Census tract	2021
National Housing Preservation Database (NHPD)	Property-level	2023
Ohio Department of Children & Youth	Point data	2025
Ohio School Report Card	School district	2023-2024
US Department of Agriculture (USDA) Economic Research Service	Census tract	2023
US Department of Housing and Urban Development/US Postal Service (USPS)	Census tract	2018-2023
Zillow	ZIP code	2018-2023

Some of our data sources provided point-level information (such as facility locations) that required conversion to tract-level distance-based measures. For these measures, we calculated Euclidean distances from each tract's population-weighted centroid to the nearest facility. We used population-weighted centroids published by National Historical Geographic Information System (NHGIS)[5] rather than geographic centroids to better reflect where residents actually live within each tract, particularly important for tracts with irregular shapes or concentrated development patterns.

For address-level data sources, such as subsidized housing units from National Housing Preservation Database, we geocoded individual addresses and assigned each record to its corresponding census tract

based on geographic location. We then aggregated these address-level observations to create tract-level measures, such as counts of subsidized housing units.

For data sources providing information at geographic levels other than census tracts, we applied the following allocation methods:

- ZIP code-level data: Used population-weighted crosswalks published by the US Department of Housing and Urban Development[6] to allocate ZIP code values to census tracts.
- School district data: Allocated district-level graduation rates to census tracts based on the proportion of each tract's area within district boundaries

We identified extreme values using a three-standard-deviation criterion, flagging observations that fell more than three standard deviations above or below the mean for each variable. Rather than removing these outliers, we applied top and bottom coding by reassigning extreme values to the three-standard-deviation boundaries. Specifically, values exceeding three standard deviations above the mean were set to the upper bound (mean + 3 standard deviations), while values falling more than three standard deviations below the mean were set to the lower bound (mean - 3 standard deviations). This approach retained all observations in the dataset while limiting the influence of extreme outliers that could distort index calculations, ensuring that legitimate but unusual tract characteristics were preserved while preventing data entry errors or truly anomalous cases from skewing results.

Neighborhood Opportunity Measures- General Occupancy Index

Neighborhood Opportunity – General Occupancy Index represents a multidimensional approach to measuring the potential for economic advancement and quality of life across different geographic areas. This index adapts the Urban Institute Upward Mobility Initiative[7] framework, which draws from extensive literature that identifies key factors contributing to individual and community opportunity for economic advancement. The index recognizes that housing location is not merely about shelter, but about access to the broader ecosystem of resources, services, and conditions such as education and employment prospects (Chetty et.al. 2016) that enable residents to improve their economic circumstances and overall well-being over time.

The development of this index involved a systematic review of research-backed dimensions and indicators that have been empirically linked to upward mobility and expanded opportunity. Working in partnership with the Ohio Housing Finance Agency, we identified four core dimensions of opportunity:

- Opportunity-Rich & Inclusive Neighborhoods: Neighborhoods serve as crucial determinants of economic advancement since they influence family stability, overall wellness, and the availability of social and economic prospects (Chantarat et. al, 2012).
- High-Quality Education: Educational opportunities from early childhood through college represent a vital pathway for economic and social advancement (Chetty et al. 2012). Quality schools enhance student performance and improve long-term life outcomes while exposing young people to diverse peer groups and helping shape their personal identity and sense of community belonging.
- Rewarding Work: The primary avenue for income generation and economic stability, with job availability and compensation levels playing crucial roles in determining opportunities for socioeconomic advancement (Brand 2015).
- Healthy Environment & Access to Good Health Care: A clean and safe physical environment with access to healthy food options protects residents from environmental hazards and nutritional challenges that can lead to chronic health problems. Healthcare access within neighborhoods directly impacts residents' ability to maintain good health through preventive care and early intervention (Bindman et.al 1995), reducing both individual suffering and long-term medical costs.

Each dimension encompasses multiple evidence-based measures selected for their documented relationship to economic mobility and community prosperity. The selection process prioritized indicators with strong theoretical foundations in mobility research, reliable data availability, and practical relevance to housing policy decisions.

Each metric is given equal weight in calculating the dimension sub-index score, and each dimension score is given equal weight in calculating the overall index. See the methodology overview for more detail. Table 3 lists the indicators and respective rationales for each dimension within the General Occupancy Housing Opportunity Index.

TABLE 3. DEFINITION AND RATIONALE FOR NEIGHBORHOOD OPPORTUNITY – GENERAL OCCUPANCY INDEX

Opportunity Dimension	Measure (Source)	Definition, Rationale, and Usage	Direction of Impact

Opportunity-Rich & Inclusive Neighborhoods	Median income compared to state average (American Community Survey (ACS))	**Definition:** Ratio of local median household income to the state median household income **Rationale:** Areas with higher relative incomes have greater consumer spending power, supporting more diverse businesses and creating a cycle of economic growth and opportunity. Higher values of this measure **increase** the opportunity index score.	
	Poverty rate (ACS)	**Definition:** Percentage of population with income below the federal poverty threshold. **Rationale:** Higher poverty rates indicate structural barriers to economic mobility and fewer resources available for community investment. Higher values of this measure **decrease** the opportunity index score.	
	Commute time (ACS)	**Definition:** Share of workers aged 16 years and older who commute to work with travel time less than 30 minutes. **Rationale:** Shorter commutes increase quality of life, reduce transportation costs, and allow more time for education, family, and community engagement. Higher values of this measure **decrease** the opportunity index score.	
	Transportation cost as a share of income (Center for Neighborhood Technology Housing + Transportation Index)	**Definition:** Transportation cost as a share of income for the typical household in the region. The typical household is defined as having the median household income, the average household size, and the average commuters per household for the region. The region is defined as the OMB Core Based Statistical Areas (CBSAs). **Rationale:** Neighborhoods with affordable transportation options relative to local incomes enable greater economic mobility by reducing a significant household expense burden. Higherr values of this measure **decrease** the opportunity index score.	

	Number of jobs accessed through transit (Center for Neighborhood Technology Housing + Transportation Index)	**Definition:** Employment Access Index calculated using an inverse-square law to model total access to jobs in the area by using the sum of the number of jobs divided by the square of the distance to those jobs. **Rationale:** Access to greater numbers of jobs via transit increases economic opportunity for households without vehicles. Higher values of this measure **increase** the opportunity index score.	
	Proximity to closest park (ESRI)	**Definition:** Distance to the nearest public park or recreational area. **Rationale:** Areas with nearby parks attract more residents, increase property values, and provide venues for community cohesion and local economic activity. Higher values of this measure (larger distances) **decrease** the opportunity index score. Z-scores for this measure are calculated **within geographic groups**.	
	Proximity to closest library (National Library Survey)	**Definition:** Distance to nearest public library. **Rationale:** Libraries provide resources for skill development, job searching, and provide venues for community cohesion and local economic activity. Higher values of this measure (larger distances) **decrease** the opportunity index score. Z-scores for this measure are calculated **within geographic groups**.	
High-Quality Education	Percentage of 3–4-year-olds enrolled in school (ACS)	**Definition:** Share of children ages 3-4 participating in formal early education programs. **Rationale:** Early education builds foundational skills for future academic success and enables parental workforce participation, generating immediate and long-term economic benefits. Higher values of this measure **increase** the opportunity index score.	
	High school graduation rate (Ohio School Report Card)	**Definition:** Percentage of students who complete high school within the expected timeframe (4 years).	

		Rationale: Higher graduation rates indicate stronger education systems that produce more qualified workers, attracting employers and supporting higher local wages. Higher values of this measure **increase** the opportunity index score.	
	Share of households with broadband subscription (ACS)	**Definition:** Percentage of households with a broadband internet subscription. **Rationale:** Broadband enables access to online learning resources, virtual classrooms, and educational applications, creating pathways to quality education regardless of geographic location**.** Additionally, broadband enables remote work, entrepreneurship, and skills development, creating pathways to higher-wage jobs and new business formation. Higher values of this measure **increase** the opportunity index score.	
Rewarding Work	Share of 18- to 64-year-olds in the labor force (ACS)	**Definition:** Percentage of working-age adults (18-64) either employed or actively seeking employment. **Rationale:** Higher labor force participation indicates fewer barriers to employment and greater economic vitality, supporting business growth and tax revenue. Higher values of this measure **increase** the opportunity index score.	
	Ratio of entry level jobs to total persons unemployed within a census tract (ACS, Longitudinal Employer-Household Dynamics (LEHD))	**Definition:** Number of entry-level positions divided by number of unemployed residents. **Rationale:** A higher ratio of entry-level jobs to unemployed people indicates greater job availability and more accessible pathways to economic advancement, particularly for disadvantaged populations. Higher values of this measure **increase** the opportunity index score.	
	Median earnings in the past 12 months (ACS)	**Definition:** Median earnings for workers aged 16 and over during the previous 12-month period. **Rationale:** Higher earnings indicate stronger local labor markets with	

		better wages, attracting and retaining skilled workers while supporting higher living standards. Higher values of this measure **increase** the opportunity index score.	
	Proximity to closest childcare centers (Ohio Department of Children & Youth)	**Definition:** Distance to the nearest childcare centers. **Rationale:** Greater childcare accessibility enables parent workforce participation and career advancement, particularly benefiting women's economic opportunity. Higher values of this measure (larger distances) **decrease** the opportunity index score. Z-scores for this measure are calculated **within geographic groups**.	
Healthy Environment & Access to Good Health Care	Index of environmental burden (pm2.5) (Environmental Justice Screening and Mapping Tool (EJ Screen))	**Definition:** Potential exposure to inhalable particles 2.5 microns or smaller (about 30 times smaller than the width of human hair) in terms of annual average concentration. **Rationale:** Exposure to fine particulate matter (PM2.5) is linked to respiratory and cardiovascular diseases that can affect overall community health. Higher values of this measure **decrease** the opportunity index score.	
	Index of environmental burden (drinking water non-compliance) (EJ Screen)	**Definition:** Populations served by community water systems that have challenges complying with Safe Drinking Water Act requirements. **Rationale:** Safe drinking water is fundamental to health, with violations indicating potential exposure to contaminants that can cause acute and chronic health effects for residents of all ages, placing strain on healthcare systems and reducing productivity through preventable illness. Higher values of this measure **decrease** the opportunity index score.	
	Proximity to closest primary health care centers (Health Resources and Services Administration)	**Definition:** Distance to nearest primary healthcare facility. **Rationale:** Closer healthcare access supports a healthier workforce with fewer sick days and lower healthcare costs, creating a more productive local	

		economy. Higher values of this measure (larger distances) **decrease** the opportunity index score. Z-scores for this measure are calculated **within geographic groups**.	
	Physician office employees per capita (National Neighborhood Data Archive)	**Definition:** Number of employees in offices or clinics of physicians per 1,000 population. **Rationale:** Higher ratio indicates stronger healthcare infrastructure that supports population health, worker productivity, and healthcare sector jobs. Higher values of this measure **increase** the opportunity index score.	
	Share of households who don't have access to grocery store (United States Department of Agriculture (USDA) Economic Research Service)	**Definition:** Share of the population without access to a grocery store within 1 mile for urban areas or 10 miles for rural areas**.** **Rationale:** Limited access to grocery stores reduces consumption of fresh foods and increases reliance on processed options, leading to poorer health outcomes, higher healthcare costs, and reduced community vitality and productivity. Higher values of this measure **decrease** the opportunity index score.	
	Proximity to closet farmer's market (USDA)	**Definition:** Distance to the nearest farmer's market. **Rationale:** Closer farmer's markets increase access to fresh, nutritious foods that support community health, while also serving as social hubs that strengthen neighborhood cohesion and resident wellbeing. Higher values of this measure (larger distances) **decrease** the opportunity index score. Z-scores for this measure are calculated **within geographic groups**.	

Neighborhood Opportunity Measures – Senior Index

The Neighborhood Opportunity – Senior Index builds upon the same foundational framework as the Neighborhood Opportunity General Occupancy Index, recognizing that housing location remains a critical determinant of quality of life and economic well-being for older adults. However, this index acknowledges that seniors have distinct needs and priorities that require a refined approach to measuring opportunity. Drawing from the same literature-based methodology that emphasizes upward mobility and community prosperity, the senior-focused index adapts key dimensions and measures to better reflect the unique circumstances and aspirations of older adult populations. Most notably, the High-Quality Education dimension was removed, as formal educational access is typically less relevant for this demographic. Instead, the index concentrates on three core dimensions that most directly impact senior well-being and opportunity: Opportunity-Rich & Inclusive Neighborhoods, Rewarding Work, and Healthy Environment & Access to Good Health Care. Within the Rewarding Work dimension, measures were specifically refined to capture employment opportunity for seniors, focusing on labor force participation rates for adults 55 and older and unemployment patterns within this age group. This approach recognizes that while many seniors may be transitioning toward or already in retirement, those who wish to remain economically active face unique challenges and opportunities that differ significantly from younger working populations.

Each metric is given equal weight in calculating the dimension score, and each dimension score is given equal weight in calculating the overall index. See the methodology overview for more detail. Table 4 lists the indicators and respective rationales for each dimension within the Neighborhood Opportunity – Senior Index.

TABLE 4. DEFINITION AND RATIONALE FOR NEIGHBORHOOD OPPORTUNITY – SENIOR INDEX

Opportunity Dimension	Measure (Source)	Definition, Rationale, and Usage	Direction of Impact

Opportunity-Rich & Inclusive Neighborhoods	Median income compared to state average (ACS)	**Definition:** Ratio of local median household income to the state median household income. **Rationale:** Areas with higher relative incomes have greater consumer spending power, supporting more diverse businesses and creating a cycle of economic growth and opportunity. Higher values of this measure **increase** the opportunity index score.	
	Poverty rate (ACS)	**Definition:** Percentage of population with income below the federal poverty threshold. **Rationale:** Higher poverty rates indicate structural barriers to economic mobility and fewer resources available for community investment. Higher values of this measure **decrease** the opportunity index score.	
	Transportation cost as a share of income (Center for Neighborhood Technology Housing + Transportation Index)	**Definition:** Transportation cost as a share of income for the typical household in the region. The typical household is defined as having the median household income, the average household size, and the average commuters per household for the region. The region is defined as the OMB Core Based Statistical Areas (CBSAs). **Rationale:** Neighborhoods with affordable transportation options relative to local incomes enable greater economic mobility by reducing a significant household expense burden. Higher values of this measure **decrease** the opportunity index score.	

	Number of jobs accessed through transit (Center for Neighborhood Technology Housing + Transportation Index)	**Definition:** Employment Access Index is calculated using an inverse-square law to model total access to jobs in the area by using the sum of the number of jobs divided by the square of the distance to those jobs. **Rationale:** Access to greater numbers of jobs via transit increases economic opportunity for households without vehicles Higher values of this measure **increase** the opportunity index score.	
	Proximity to closest park (ESRI)	**Definition:** Distance to the nearest public park or recreational area. **Rationale:** Areas with nearby parks attract more residents, increase property values, and provide venues for community cohesion and local economic activity. Higher values of this measure (larger distances) **decrease** the opportunity index score. Z-scores for this measure are calculated **within geographic groups**.	
	Proximity to closest library (National Library Survey)	**Definition:** Distance to the nearest public library. **Rationale:** Libraries provide resources for skill development, job searching, and provide venues for community cohesion and local economic activity. Higher values of this measure (larger distances) **decrease** the opportunity index score. Z-scores for this measure are calculated **within geographic groups**.	

Rewarding Work	Share of 55 and older adults in the labor force (ACS)	**Definition:** Percentage of senior adults (55 and over) either employed or actively seeking employment. **Rationale:** Higher labor force participation indicates fewer barriers to employment and greater economic vitality, supporting business growth and tax revenue. Higher values of this measure **increase** the opportunity index score.	
	Share of households with broadband subscription (ACS)	**Definition:** Percentage of households with a broadband internet subscription. **Rationale:** Broadband enables access to remote work, entrepreneurship, and skills development, creating pathways to higher-wage jobs and new business formation. Higher values of this measure **increase** the opportunity index score.	
	Share of 55 and older in labor force and unemployed (ACS)	**Definition:** Percentage of senior adults (55 and over) in labor force and unemployed. **Rationale:** Unemployment rate for seniors indicates the ability of seniors to maintain financial stability through continued employment when desired or necessary. Higher values of this measure **decrease** the opportunity index score.	

Healthy Environment & Access to Good Health Care	Index of environmental burden (pm2.5) (Environmental Justice Screening and Mapping Tool (EJ Screen))	**Definition:** Potential exposure to inhalable particles 2.5 microns or smaller (about 30 times smaller than the width of human hair) in terms of annual average concentration. **Rationale:** Exposure to fine particulate matter (PM2.5) is linked to respiratory and cardiovascular diseases that can affect overall community health. Higher values of this measure **decrease** the opportunity index score.	
	Index of environmental burden (drinking water non-compliance) (EJ Screen)	Definition: Populations served by community water systems that have challenges complying with Safe Drinking Water Act requirements. Rationale: Safe drinking water is fundamental to health, with violations indicating potential exposure to contaminants that can cause acute and chronic health effects for residents of all ages, placing strain on healthcare systems and reducing productivity through preventable illness. Higher values of this measure **decrease** the opportunity index score.	
	Proximity to closest primary health care centers (Health Resources and Services Administration)	**Definition:** Distance to nearest primary healthcare facility. **Rationale:** Closer healthcare access supports a healthier workforce with fewer sick days and lower healthcare costs, creating a more productive local economy. Higher values of this measure (larger distances) **decrease** the opportunity index score. Z-scores for this measure are calculated **within geographic groups**.	

	Physician office employees per capita (National Neighborhood Data Archive)	**Definition:** Number of employees in offices or clinics of physicians per 1,000 population. **Rationale:** Higher ratio indicates stronger healthcare infrastructure that supports population health, worker productivity, and healthcare sector jobs. Higher values of this measure **increase** the opportunity index score.	
	Share of households who don't have access to grocery store (USDA ERS)	**Definition:** Share of the population without access to a grocery store within 1 mile for urban areas or 10 miles for rural areas. **Rationale:** Limited access to grocery stores reduces consumption of fresh foods and increases reliance on processed options, leading to poorer health outcomes, higher healthcare costs, and reduced community vitality and productivity. Higher values of this measure **decrease** the opportunity index score.	
	Proximity to closet farmer's market (USDA)	**Definition:** Distance to the nearest farmer's market. **Rationale:** Closer farmer's markets increase access to fresh, nutritious foods that support community health, while also serving as social hubs that strengthen neighborhood cohesion and resident wellbeing. Higher values of this measure (larger distances) **decrease** the opportunity index score. Z-scores for this measure are calculated within geographic groups.	

Housing Needs Index Measures

The Housing Needs Index measures housing market conditions, shifting focus from opportunity access across places to how well the existing housing stock and conditions serve current and prospective residents who wish to locate in these areas. While the Neighborhood Opportunity Indices assess the factors that contribute to upward mobility and quality of life, the Housing Needs Index examines housing availability, affordability, and accessibility within those same communities, recognizing that affordable housing options reduce financial strain on families while supporting their physical, mental, and economic well-being, ultimately enhancing both their financial prospects and community connection (Pew Charitable Trusts 2018). This dual-lens approach recognizes that true housing opportunity requires both access to community assets and resources as well as adequate housing options that residents can realistically afford and access, enabling more nuanced decision-making that considers both the quality of opportunities available in a location and the need for increased affordable housing supply to enable residents to access and maintain housing in the community.

Each dimension score is given equal weight in calculating the overall index. See the methodology overview for more detail. Table 5 lists the indicators and respective rationales for each dimension within the Housing Needs Index.

TABLE 5. DEFINITION AND RATIONALE FOR HOUSING NEEDS INDEX

Housing Needs Dimension	Measure (Source)	Definition, Rationale, and Usage	Direction of Impact
Housing Supply	Residential vacancy rate (United States Department of Housing and Urban Development (HUD), United States Postal Service (USPS) Data)	**Definition:** Percentage of residential addresses that are vacant. **Rationale:** Very low vacancy rates signal housing shortages. Higher values of this measure **decrease** the housing needs index score.	⇩
Affordable Housing Stock	Share of housing stock receiving federal housing subsidy (NHPD)	**Definition:** Percentage of housing units supported by federal subsidy programs. **Rationale:** Areas with low subsidized housing stock may lack housing options for lower-income residents. Higher values of this measure **decrease** the housing needs index score.	⇩
Affordability	Share of renters who are cost burdened (ACS)	**Definition:** Percentage of renter households spending more than 30% of income on housing costs **Rationale:** High housing cost burden reduces household spending on other needs and	⇧

		indicates insufficient housing supply at appropriate price points for local income levels. Higher values of this measure **increase** the housing needs index score.	
Affordability	Number of affordable housing units per number of VLI households (NHPD)	**Definition:** Ratio of affordable units to very low-income (VLI) households, defined as households earning less than 50 percent of state area median income (AMI) for 2-person households. **Rationale:** A low ratio reveals housing supply gaps where VLI households face extreme cost burdens or displacement risk, highlighting areas with significant housing needs. Higher values of this measure **decrease** the housing needs index score.	

Neighborhood Change Index Measures

The Neighborhood Change Index seeks to measure the trajectory of opportunity change in a census tract relative to other census tracts. The index is comprised of five dimensions that the neighborhood change literature suggests are predictive of future neighborhood change characterized by increasing incomes, rising home prices, concentration of amenities, and growth in economic opportunities. It is important to note that the literature also highlights potential negative impact of such neighborhood change on incumbent residents who risk being priced out of changing communities through processes of gentrification and displacement. By bringing together the neighborhood change index with the housing needs index and opportunity indices discussed above, the neighborhood change index can help target new affordable housing investment to help low-income households benefit from neighborhood change. The five neighborhood change dimensions that make up the index are:

- **Opportunity Change**: Measures change in the neighborhood opportunity - general occupancy index in the 5-year period leading up to the index year. Tracts with positive trajectories of past opportunity growth are likelier to continue to experience positive opportunity growth. For the first year of the neighborhood change index and neighborhood opportunity – general occupancy index, we calculated the value of the neighborhood opportunity – general occupancy index for five years prior so we could calculate change in the index score over the previous 5 years. For each metric, included in the neighborhood opportunity – general occupancy index, we used data published five years prior to the year of data included in the

most recent index. Some metrics did not have available data from five years prior. In such cases, we either sought to include a close substitute measure that had data availability or dropped the metric from the calculation of the prior index. For more information, see Appendix I. **Growth**: Measures growth in population, housing, businesses, and jobs in a tract in the 5-year period leading up to the index year. Collectively, these factors are engines of opportunity. Tracts experiencing positive growth trajectories are likelier to experience future opportunity growth (Chapple 2016, Cohen and Pettit 2019, Stancil 2019).

- **Housing Value**: Measures the change in housing value in a tract in the 5-year period leading up to the index year. Greater increases in housing value in a tract relative to other tracts are correlated with increasing demand for living in the tract, which is correlated with growing opportunity (Bates 2013, Chapple 2016, Steif et al 2016).
- **Economic Base:** Measures changes in the economic base of a tract through changes in household incomes and vacancy rates in the 5-year period leading up to the index year. Growth in the economic base of a tract supports future opportunity growth in the tract (Data Driven Detroit 2012, Cohen and Pettit 2019, Stern 2021).
- **Early Signs of Change**: This measure focuses on early signs of neighborhood change in the one year prior to the index year. The other dimensions focus on a five-year period of change to measure a more stable trajectory over a longer period and to allow for the use of non-overlapping 5-year ACS estimates to measure change. We recognize that this approach may overlook some tracts where the opportunity trajectory is just beginning to change. We incorporate this dimension to account for that early change in the overall index (Cohen and Pettit 2019, Stern 2021).

Each dimension is measured by one or more metrics, outlined in table 6. Each metric is given equal weight in calculating the dimension sub-index score, and each dimension score is given equal weight in calculating the overall index[8]. See the methodology overview for more detail.

TABLE 6. DEFINITION AND RATIONALE FOR NEIGHBORHOOD CHANGE INDEX

Neighborhood Change Dimension	Measure (Source)	Definition, Rationale, and Usage	Direction of Impact

Opportunity Change (5-year period of change)	Change in Neighborhood Opportunity - General Occupancy Index (Urban Institute)	**Definition:** Difference in the neighborhood opportunity – general occupancy index. **Rationale:** Provides overall measure of whether opportunity is increasing or decreasing in a tract relative to other tracts in the geography subgroup. Positive change indicates **increasing** opportunity.	
Growth (5-year period of change)	Population Change (ACS)	**Definition:** Difference in total tract population calculated by taking difference between non-overlapping ACS 5-year survey estimates. **Rationale:** Population growth suggests dynamic neighborhoods while population loss may indicate decline. Positive change indicates **increasing** opportunity.	
	Residential Address Growth (USPS)	**Definition:** Difference in the total residential addresses. We first calculate the average residential addresses in the tract for the comparison years by averaging the quarterly USPS address counts for each year, then take the difference between the two averages. **Rationale:** An increase in the number of residential addresses suggests population growth and dynamism in a tract. Positive change indicates **increasing** opportunity.	
	Business Address Growth (USPS)	**Definition:** Difference in the total business addresses. We first calculate the average business addresses in the tract for the comparison years by averaging the quarterly USPS address counts for each year, then take the difference between the two averages. **Rationale:** An increase in the number of business addresses suggests economic growth and dynamism in a tract. Positive change indicates **increasing** opportunity.	
	Job Growth (LEHD)	**Definition:** Difference in the total jobs in a tract, calculated by taking the difference between estimates in the comparison years. **Rationale:** An increase in the number of jobs in a tract suggests economic growth and dynamism in a tract. Positive change indicates **increasing** opportunity.	

Housing Value (5-year period of change)	Change in median home loan amount (Home Mortgage Disclosure Act)	**Definition:** Difference in the median home loan amount for a given tract as measured by the Home Mortgage Disclosure Act (HMDA) data[9]. Home loan values are adjusted to the later comparison year's dollar values to adjust for inflation prior to comparison. **Rationale:** An increase in the median home loan amount indicates an increase in home values in a given tract, which indicates growing opportunity. Positive change indicates **increasing** opportunity.	⇧
	Change in share of housing units built before 1960 (ACS)	**Definition:** Difference in the share of all housing units in a given tract that were built before 1960. **Rationale:** A decrease in the share of housing units built before 1960 suggests redevelopment of housing or new housing construction, both of which indicate opportunity growth. Positive change indicates **decreasing** opportunity.	⇩
	Change in median housing cost (ACS)	**Definition:** Difference in the median monthly housing cost in a given tract as measured by the ACS. Median monthly cost is calculated from occupied housing units with monthly housing costs, including mortgages or other property debts, rent, real estate taxes, property insurance, utilities, fuels, mobile home costs or condominium fees.[10] The ACS reports data adjusted to the latest survey year's dollar values.[11] We will adjust the earlier comparison year to the latter year by applying an inflation multiplier. **Rationale:** An increase in median housing costs indicates an increase in housing value in a given tract, which indicates growing opportunity. We include median housing cost and home loan amount because they capture different segments of the housing market. Median housing cost includes all costs for renters and owners. Home loans capture new home purchases, which could be more sensitive to price change than housing as a whole. Positive change indicates **increasing** opportunity.	⇧
Economic Base (5-year period of change)	Change in median household income (ACS)	**Definition:** Difference in median household income in a given tract as measured by the ACS. We adjust the earlier comparison year to the latter year by applying an inflation multiplier. **Rationale:** An increase in median household income suggests a growth in the economic base of a tract, which indicates growing opportunity. Positive change indicates **increasing** opportunity.	⇧
	Change in residential vacancy rate (USPS)	**Definition:** Change in the share of total residential addresses that are vacant as measured by the USPS. We first calculate the average vacancy rate in the tract for the comparison years by averaging the quarterly USPS	⇩

		vacancy rate for each year, then take the difference between the two averages. **Rationale:** An increase in the residential vacancy rate indicates a contracting economic base in a tract. Positive change indicates **decreasing** opportunity.	
	Change in business vacancy rate (USPS)	**Definition:** Change in the share of total business addresses that are vacant as measured by the USPS. We first calculate the average vacancy rate in the tract for the comparison years by averaging the quarterly USPS vacancy rate for each year, then take the difference between the two averages. **Rationale:** An increase in the business vacancy rate indicates a contracting economic base in a tract. Positive change indicates **decreasing** opportunity.	
Early Signs of Change (1-year period of change)	Change in short-term residential vacancy (USPS)	**Definition:** Count of residential addresses identified as vacant 6-months or less as measured by the USPS. We first calculate the average short-term vacant residential addresses in the tract for the comparison years by averaging the quarterly USPS short-term vacant residential address counts for each year, then take the difference between the two averages. **Rationale:** An increase in short-term vacancies suggests a rise in residential addresses that have newly become vacant. This suggests that opportunity may begin to decline in the tract. Positive change indicates **decreasing** opportunity.	
	Change in short-term business vacancy (USPS)	**Definition:** Count of business addresses identified as vacant for 6-months or less as measured by the USPS. We first calculate the average short-term vacant business addresses in the tract for comparison years by averaging the quarterly USPS short-term vacant business address counts for each year, then take the difference between the two averages. **Rationale:** An increase in short-term vacancies suggests a rise in business addresses that have newly become vacant. This suggests that opportunity may begin to decline in the tract. Positive change indicates **decreasing** opportunity.	
	Residential Address Growth (USPS)	**Definition:** Difference in the total residential addresses. We first calculate the average residential addresses in the tract for the comparison years by averaging the quarterly USPS address counts for each year, then take the difference between the two averages.	

		Rationale: An increase in the number of residential addresses suggests population growth and dynamism in a tract. Positive change indicates **increasing** opportunity.	
	Business Address Growth (USPS)	**Definition:** Difference in the total business addresses. We first calculate the average business addresses in the tract for the comparison years by averaging the quarterly USPS address counts for each year, then take the difference between the two averages. **Rationale:** An increase in the number of business addresses suggests economic growth and dynamism in a tract. Positive change indicates **increasing** opportunity.	⇧
	Zillow Home Value Index (Zillow)	**Definition:** Change in the Zillow Home Value Index (ZHVI), which aims to measure the "typical" home value in a Zip Code. We use the ZHVI for all home types (including single-family residences, condos, and co-ops).[12] We recognize that the composition of home types varies significantly across zip codes. Because we are comparing each geography to itself, we avoid issues of comparability across geographies. ZHVI is reported monthly. We first average the months in the comparison years for each zip code. We then crosswalk zip codes to census tracts, imputing missing values with the corresponding ZHVI for the county. We then take the difference of the two tract-level values. **Rationale:** An increase in home values suggests increasing opportunity and increasing affordable housing need in a tract. Positive change indicates **increasing** opportunity.	⇧

Notes

[1] Census tract 39025041304 has a missing value for the housing value subindex due to having missing values for all component metrics, all of which are calculated from ACS data. This tract is located within the Cincinnati Nature Center. Accordingly, the housing value subindex is given zero weight for this tract in calculating the final neighborhood change index, and each of the other four subindices comprise a quarter of the final score.

[2] See more at https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.

[3] USDA reports that 2020 RUCA codes will be released "no earlier than 2025" per https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.

[4] See the Census glossary definition of group quarters for more detail: https://www.census.gov/glossary/?term=Group+Quarters+%28GQ%29

[5] See https://www.nhgis.org/geographic-crosswalks for more information.

[6] See https://www.huduser.gov/apps/public/uspscrosswalk/login for crosswalk files. Access to these files requires registration and login.

[7] See more at https://upward-mobility.urban.org/mobility-metrics

[8] See endnote 1 above.

[9] HMDA data is pulled from the Urban Institute Data Catalog's tract-level aggregates. https://datacatalog.urban.org/dataset/home-mortgage-disclosure-act-neighborhood-summary-files-census-tract-level

[10] https://www.neighborhoodexplorer.org/sources/80ZRMpWm/

[11] https://www2.census.gov/programs-surveys/acs/tech_docs/subject_definitions/2022_ACSSubjectDefinitions.pdf

[12] We select ZHVI All Homes (SFR, Condo/Co-op) Time Series, Smoothed, Seasonally Adjusted from https://www.zillow.com/research/data/

Appendix I: Calculating Previous Neighborhood Change Index

For each measure included in the neighborhood opportunity – general occupancy index, we sought to find the same measure from 5 years prior to the data year for the 2025 index to best calculate the index value from 5 years prior to calculate change. For some measures, this data was not available, and we provide an explanation in the Notes column.

	Measure	Data year for 2025 Index	Data year for prior index	Notes
Opportunity-Rich & Inclusive Neighborhoods	Median income compared to state average (ACS)	2023	2018	
	Poverty rate (ACS)	2023	2018	
	Commute time (ACS)	2023	2018	
	Transportation cost as a share of income (CNT H+T Index)	2022	2015	
	Number of jobs accessed through transit (CNT H+T Index)	2022	2015	CNT published 2019 and 2015 data. We chose to use 2015 data.
	Proximity to closest park (ESRI)	2024	2024	Data is periodically updated, point-in-time historical snapshots are not available.
	Proximity to closest library (National Library Survey)	2022	2017	
High-Quality Education	Percentage of 3–4-year-olds enrolled in school (ACS)	2023	2018	
	High school graduation rate (Ohio School Report Card)	2023-2024	2018-2019	
	Share of households with broadband subscription (ACS)	2023	2018	
Rewarding Work	Share of 18- to 64-year-olds in the labor force (ACS)	2023	2018	
	Ratio of entry level jobs to total persons unemployed within a census tract (ACS, LEHD)	2023, 2022	2018, 2017	
	Median earnings in the past 12 months (ACS)	2023	2018	
	Proximity to closest childcare centers (Ohio Department of Children & Youth)	2025	2025	Data is periodically updated, point-in-time historical snapshots are not available.

Healthy Environment & Access to Good Health Care	Index of environmental burden (pm2.5) (EJ Screen)	2024	2019	
	Index of environmental burden (drinking water non-compliance) (EJ Screen)	2024	2019	
	Proximity to closest primary health care centers (HRSA)	2024	2024	Data is periodically updated, point-in-time historical snapshots are not available.
	Physician office employees per capita (National Neighborhood Data Archive)	2021	2016	
	Share of households who don't have access to grocery store (USDA)	2019	2019	USDA did not have 2014 data but published data for 2015. We chose 2019 data over the available 2015 dataset due to variable inconsistencies between the 2015 and 2019 data.
	Proximity to closet farmer's market (USDA)	2025	2025	Data is periodically updated, point-in-time historical snapshots are not available.

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