

Ohio Children's Opportunity Index

Final Report



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Ohio Colleges of Medicine Government Resource Center

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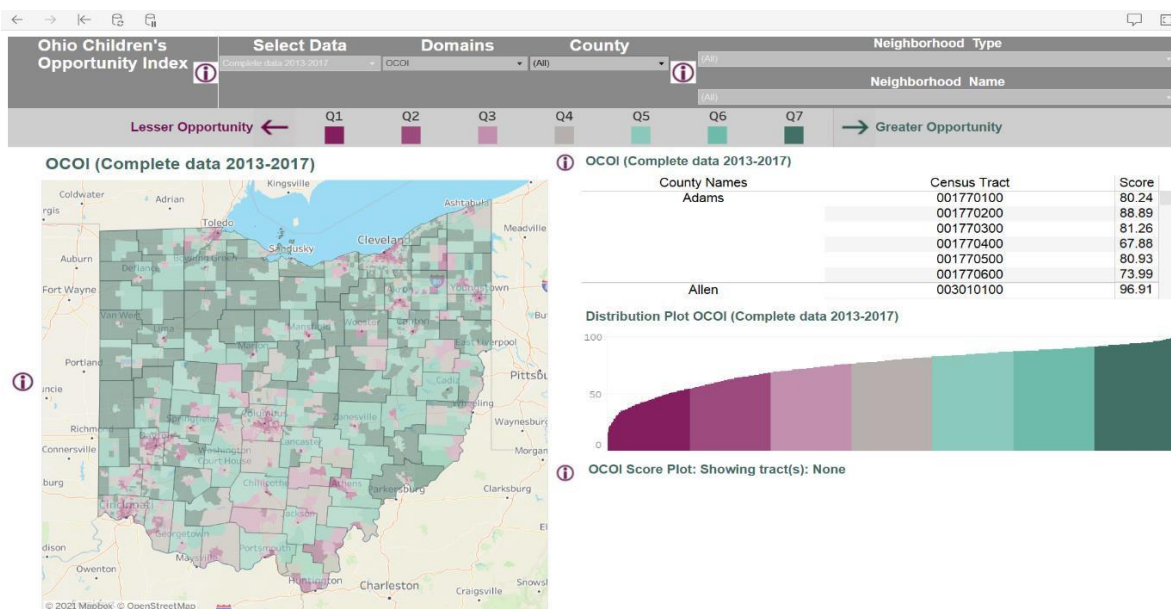
1. Introduction

The Ohio Opportunity Index (OOI) was created in 2019 as a component of the Infant Mortality Research Partnership (IMRP), a project sponsored by the Ohio Departments of Medicaid, Higher Education, and Health that focused on creating tools to reduce infant mortality in Ohio. As part of the work of the IMRP, the OOI was created to allow the Ohio Department of Medicaid (ODM) and other population-based health agencies and organizations to use geospatial modeling to analyze social determinants of infant mortality and preterm birth. In 2020, sponsored by the ODM, this work was expanded with the launch of the Ohio Opportunity Index project and the development of the Ohio Children’s Opportunity Index (OCOI) that focuses specifically on the social determinants of health and health outcomes of children. The OCOI was developed in collaboration with the ODM by the Ohio Colleges of Medicine Government Resource Center and The Ohio State University (OSU) Department of Geography and included a thorough literature review on “Kids Count” indices and identification of appropriate domains and indicators. Along with the OOI, the goal of the OCOI is to improve children’s health and well-being while supporting a mission of quality, equity, and population health. The Index will provide population-based health agencies and organizations with a tool to target assessments, interventions, and evaluations and allow synthesis of the social determinants of health in an interpretable, actionable way. The purpose of this report is to describe the methods used to create the OCOI and provide evidence of its validity.

1.1 OCOI dashboard

In collaboration with the OSU Department of Biomedical Informatics, an interactive Tableau dashboard was created as a tool for agencies and organizations to interact with the OCOI data and observe the Index geospatially. As seen in Diagram 1, the dashboard contains a color-coded, interactive map indicating the OCOI score for each census tract in Ohio as well as tables indicating OCOI scores for each census tract, a color-coded distribution plot broken down into septiles, and a score plot that populates the domain scores for selected census tracts.

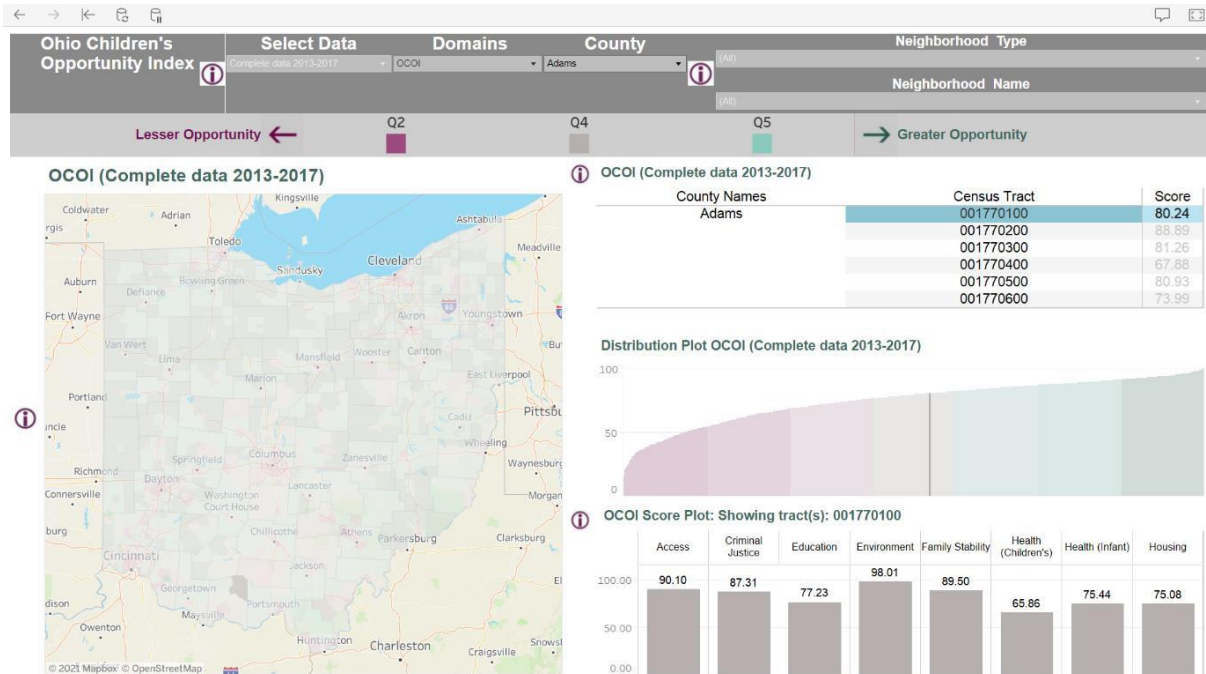
Diagram 1. The OCOI dashboard



Users are able to filter results by selecting census tracts on the map or by using drop-downs for county and neighborhood, including filters by city or village, township, or zip code.

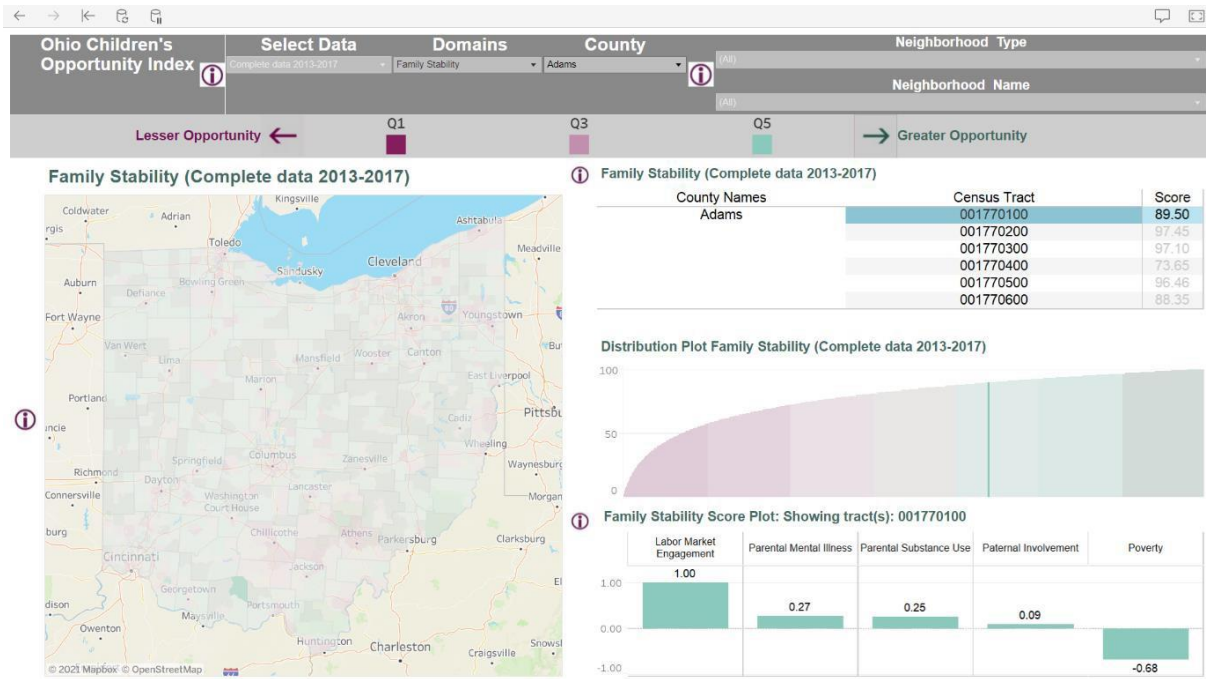
In Diagram 2, the user is able to measure the opportunity of the selected census tract in Adams county by looking at its score in the table (80.24), how its score compares to those across the state in the Distribution Plot (ranked in the fourth septile), and measure the tracts domain scores by looking at the Score Plot (all domain scores are above average).

Diagram 2. OCOI dashboard with Adams county filter and census tract 001770100 selected



Users can further filter by domain and measure opportunity by specific indicators, as shown in Diagram 3. The selected census tract in Adams county scores in the fifth septile in the Family Stability domain, and scores for each of the specific indicators are displayed in the Score Plot, showing this tract is doing above average in four out of the five indicators.

Diagram 3. OCOI dashboard with Adams county and Access filters and census tract 001770100 selected



Diagrams 4 and 5 show how filters can be used to view specific neighborhoods and compare opportunity within each neighborhood and across the state. Diagram 4 shows a specific census tract in the Over the Rhine neighborhood. Diagram 5 shows how multiple census tracts can be selected at one time and illustrates that the Over-the-Rhine neighborhood scores in the first septile for opportunity and how each of the census tracts compare to each other across the domains. Diagram 6 further shows how this neighborhood compares to the rest of the state in the Family Stability domain, with all tracts scoring in the first septile, and how the tracts' indicator scores compare to each other and the rest of the state.

Diagram 4. OCOI dashboard with Over-the-Rhine neighborhood filter and census tract 061026900 selected

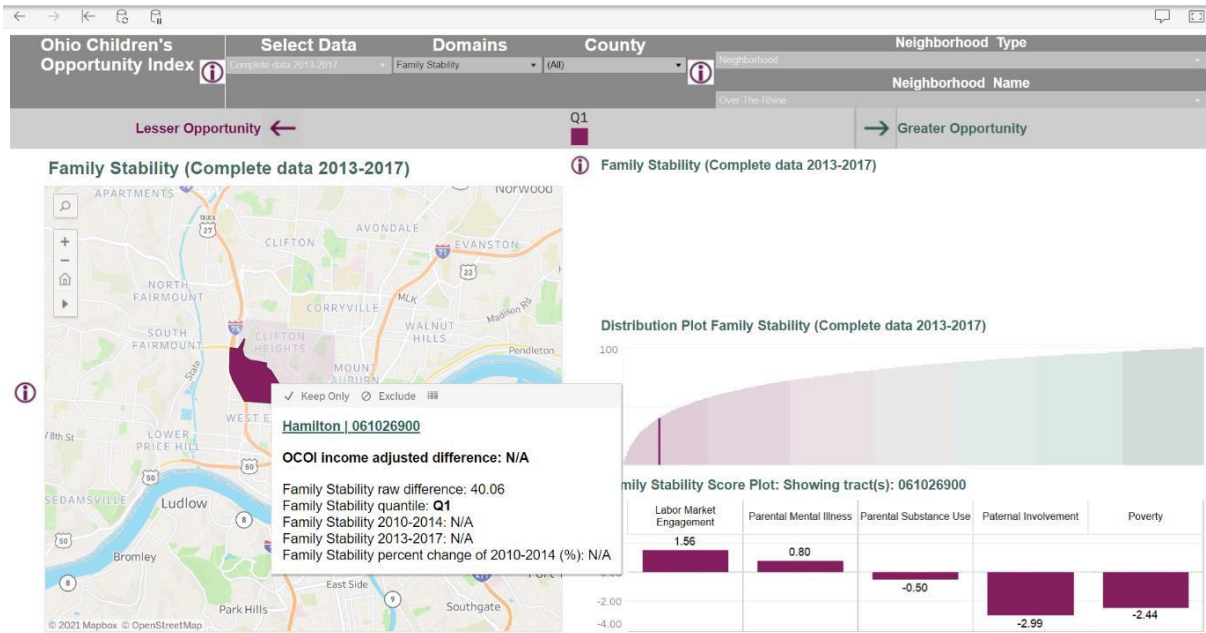


Diagram 5. OCOI dashboard with Over-the-Rhine neighborhood filter and all census tracts within the neighborhood selected

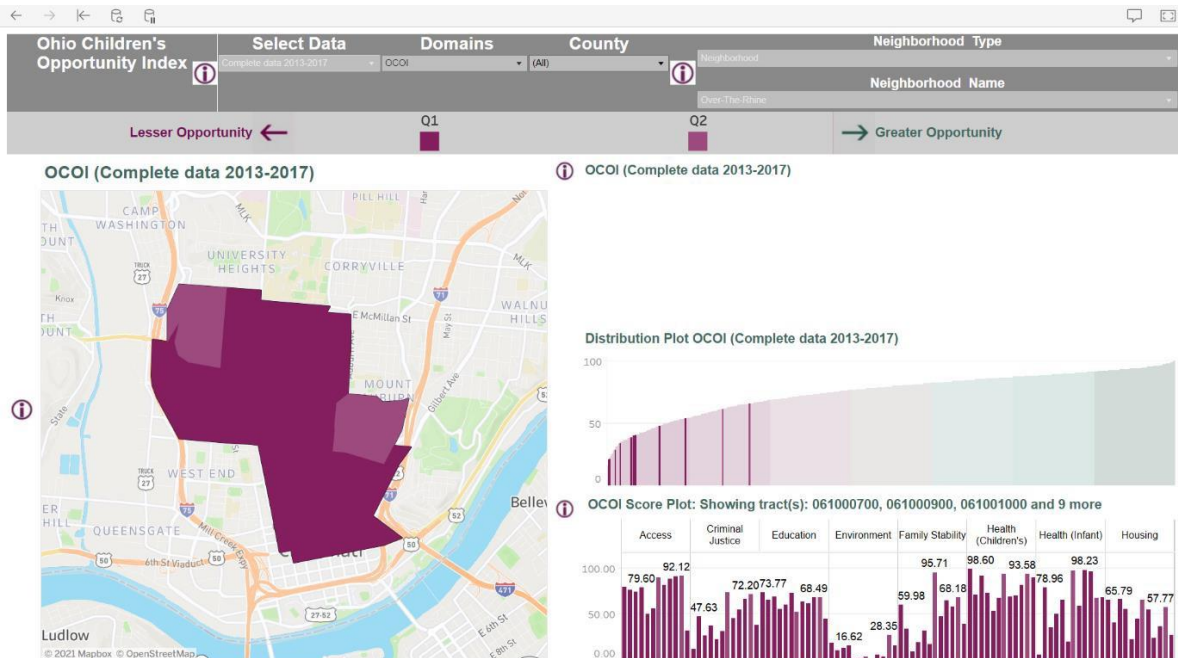
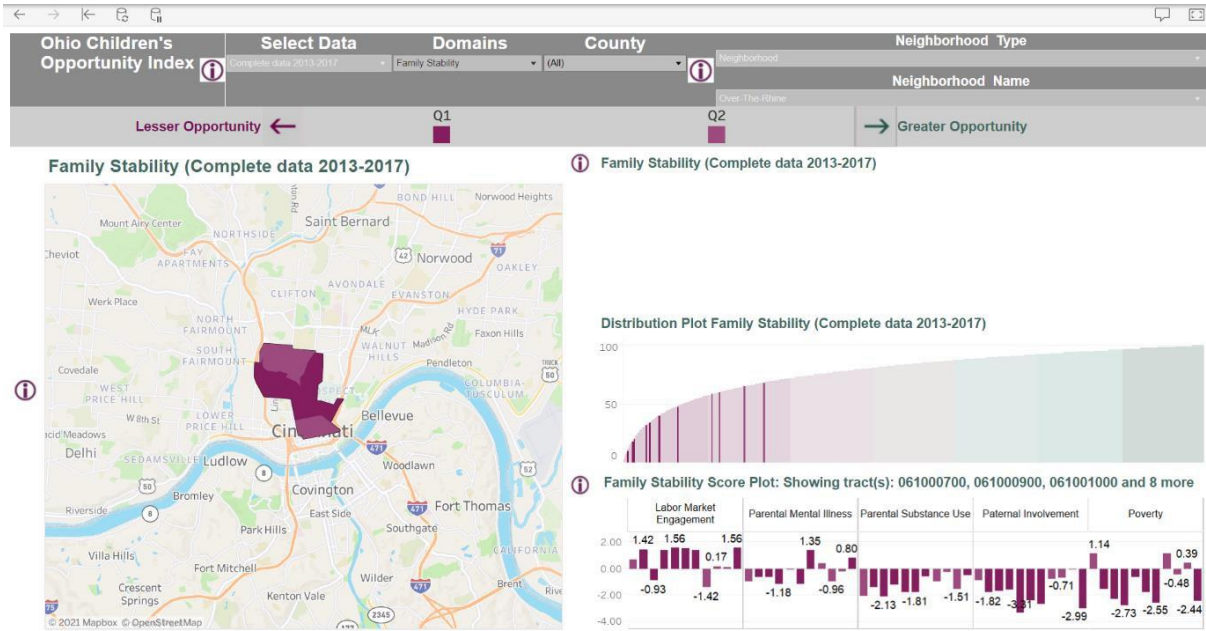
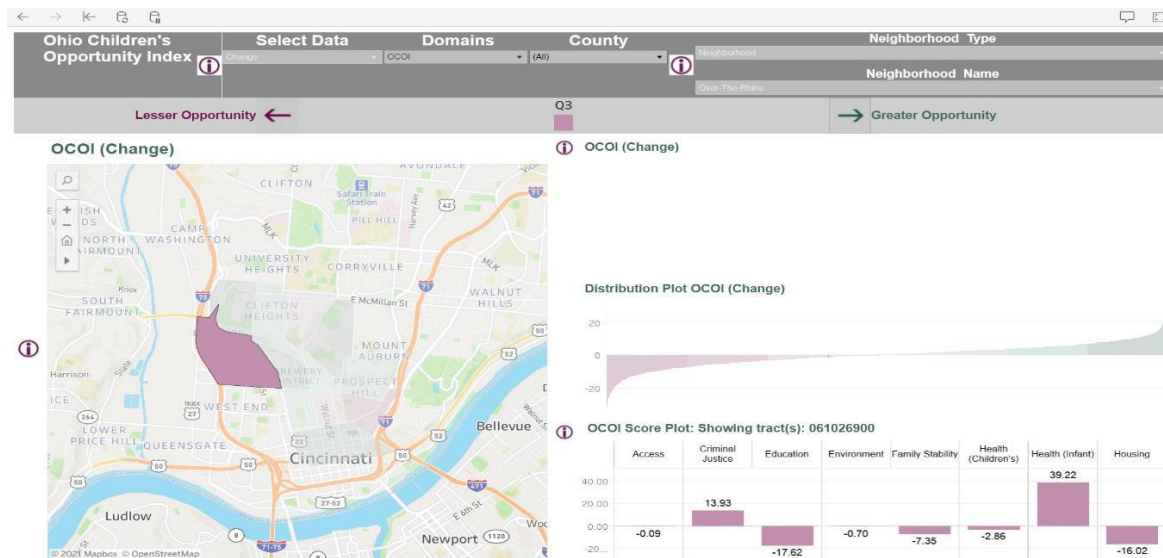


Diagram 6. OCOI dashboard with Over-the-Rhine neighborhood filter, all census tracts within the neighborhood selected, and Family Stability Filter selected



Lastly, users are able to select specific time periods. Complete data for the OCOI is available between 2014 and 2017, and reduced data between 2010 and 2013 and 2014 and 2017 is available to be used for comparison between the two time periods. As seen in Diagram 7, a filter is available that allows the user to see how the overall OCOI, domain, and indicator scores have changed over the course of time (2010-2013 compared to 2014-2017). The selected census tract in the Over-the-Rhine neighborhood, for example, shows an improvement in Criminal Justice and Infant Health but a decline in all other domain scores.

Diagram 7. OCOI dashboard with Change time filter, Over-the-Rhine neighborhood filter, and census tract 061026900 selected



1.2 Brief literature review of neighborhood effects on health

There is a veritable wealth of information that establishes the fact that neighborhood socioeconomic and structural conditions are associated with a wide variety of health, social, and economic outcomes. Of the thousands of peer reviewed journal articles on the topic, 101 were identified across three reviews that spanned more than 20 years as examples of work that researches the connections between neighborhood conditions and individual outcomes.^{1,2,3} A common theme that emerged from these reviews, and one that is reinforced by other researchers, is that while there is a definitive connection between neighborhood constructs and a variety of health, social, and economic outcomes, the exact pathways through which neighborhood factors affect health is unknown.^{4,5,6}

Historically, income inequality and basic demographics have been the most commonly used measures of neighborhood constructs employed to assess outcomes². But as more research has been compiled on the relationship between neighborhoods and various outcomes of their inhabitants, what constitutes a neighborhood construct has evolved to include several domains of measurement, including physical access to resources, children's health, criminal justice, education, environment, family stability, housing, and infant health.^{1,5,7,2,3} The OCOI uses measures in all of these domains as a means of capturing a comprehensive perspective of neighborhood characteristics that are likely to influence children's health.

2. Methods

The objective of this project was to create an OCOI that spans two time periods—the period between 2010 and 2014 and the period between 2013 and 2017, which we refer to as the 2014 and 2017 versions of the OCOI, respectively.

2.1 Data

Prior to gathering data for the OCOI, we decided on eight broad *domains* in which individual measures would exclusively fit. The domains include: (1) infant health; (2) non-infant child health; (3) family stability; (4) housing; (5) education; (6) access; (7) crime; (8) environment.

¹ Minh, A., Muhajarine, N., Janus, M., Brownell, M., & Guhn, M. (2017). A review of neighborhood effects and early child development: How, where, and for whom, do neighborhoods matter? *Health & Place*, 46, 155–174. <https://doi.org/10.1016/j.healthplace.2017.04.012>

² Sampson, R. J., Morenoff, J. D., & Gannon-Rowley, T. (2002). Assessing “Neighborhood Effects”: Social Processes and New Directions in Research. *Annual Review of Sociology*, 28(1), 443–478. <https://doi.org/10.1146/annurev.soc.28.110601.141114>

³ van Vuuren, C. L., Reijneveld, S. A., van der Wal, M. F., & Verhoeff, A. P. (2014). Neighborhood socioeconomic deprivation characteristics in child (0-18 years) health studies: A review. *Health & Place*, 29, 34–42. <https://doi.org/10.1016/j.healthplace.2014.05.010>

⁴ Ellen, I. G., Mijanovich, T., & Dillman, K.-N. (2001). Neighborhood Effects on Health: Exploring the Links and Assessing the Evidence. *Journal of Urban Affairs*, 23(3–4), 391–408. <https://doi.org/10.1111/0735-2166.00096>

⁵ Leventhal, T., & Brooks-Gunn, J. (2000). The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes. *Psychological Bulletin*, 126(2), 309–337. <https://doi.org/10.1037/0033-2909.126.2.309>

⁶ Sharkey, P., & Faber, J. W. (2014). Where, When, Why, and For Whom Do Residential Contexts Matter? Moving Away from the Dichotomous Understanding of Neighborhood Effects. *Annual Review of Sociology*, 40(1), 559–579. <https://doi.org/10.1146/annurev-soc-071913-043350>

⁷ Rajaratnam, J. K., Burke, J. G., & O'Campo, P. (2006). Maternal and child health and neighborhood context: The selection and construction of area-level variables. *Health & Place*, 12(4), 547–556. <https://doi.org/10.1016/j.healthplace.2005.08.008>

The data collected for the construction of the OCOI consist of 53 measures (termed *constituent measures*, hereafter), each representing a theoretical aspect of opportunity and each placed within one of the eight domains. The sources for measures ranged from publicly accessible data from surveys and interest group products to restricted access vital statistics and Medicaid claims data. Some constituent measures were not available at the earlier time period. We therefore developed two versions of the OCOI, one *time-varying OCOI* that included only the 37 constituent measures that were available for both time periods, and one *time-fixed OCOI* representing only the 2013-2017 period but inclusive of all 53 measures. Appendix A contains a list of all 53 measures, a reference to their source, and the time-period availability of each.

2.2 Procedures

The OCOI was constructed in two main steps that are detailed in paragraphs that follow. In the first step, we combined the constituent measures within each domain into one variable to form eight unique *domain scores* with one value per tract. In the second step we transformed the domain scores and used a simple method to combine them into one single value that we refer to as the Ohio Children's Opportunity Index (OCOI).

The first step of combining constituent measures into domain scores was to standardize each individual measure by dividing it by its own standard deviation (i.e., we calculated z-scores). We then redirected all of the measures such that higher values represented more *deprivation* (as opposed to *opportunity*).⁸ Next, we calculated the mean all of the standardized measures within each domain resulting in one mean score per domain—still with higher values representing more deprivation. The mean score is an intermediate score provided in the deliverable and sharable data files (domain scores in the publicly available sharable files are reversed so that higher values represent more *opportunity*). Next, values of each mean score were ranked (from 1 to 2952) where a rank of one represents the lowest value. This rank was rescaled to range from zero to one such that zero represented the lowest value and one represented the highest value. This rescaled rank variable is the second intermediate transformation provided in the deliverable (not the publicly available “sharable” file). Finally, the rescaled rank, which is distributed approximately uniformly, was transformed to an exponential distribution as described in Noble (2006), which we refer to as the transformed domain scores.⁸ The exponential distribution of the transformed domain scores is positively skewed in such a way that when multiple transformed domain scores are averaged together (as we did when constructing the OCOI), a high level of deprivation with respect to one domain cannot be completely cancelled out by a correspondingly high level of opportunity on just one other domain. It will require more than one high-opportunity domain to counter-balance the depriving effect of a single high-deprivation domain.

Following a precedent set by Child Trends and the Forum for Youth Investment (2019), we combined the domain scores using a uniform weighting scheme—we averaged the domain scores to produce a single value representative of deprivation, which was reversed and scaled to range between 0 and 100. The result is the children's opportunity.⁹

⁸ Noble, M., Wright, G., Smith, G., & Dibben, C. (2006). Measuring Multiple Deprivation at the Small-Area Level. *Environment and Planning A: Economy and Space*, 38(1), 169–185. <https://doi.org/10.1068/a37168>

⁹ Data & Scoring. (2021, April 16). OPPORTUNITY INDEX HOW OPPORTUNITY MEASURES UP IN YOUR COMMUNITY. <https://opportunityindex.org/methods-sources/>

2.3 Validation

The analysis included two steps to provide evidence for the validity of the OCOI. The first focused on validity of the overall OCOI measure. The second focused on the validity of the collection of domain scores underpinning the OCOI. Both examined five outcome variables measured at the Census tract level: (1) life expectancy, (2) all-cause death rate, (3) proportion of Medicaid enrolled children age 6-17 with a diagnosis of asthma or (4) severe mental illness, and (5) proportion of births that were pre-term. The latter three variables were included as constituent measures in the OCOI and so can only provide weak evidence of validity. The first two were not included in the index in any way, but do have the potential to provide good evidence of validity.

2.3.1 Validity of the OCOI

To assess the validity of the overall OCOI scores, we examined correlations between the OCOI and each of the five selected outcomes. We also provided significance tests for those correlations.

2.3.2 Validity of the collection of OCOI domain scores

To assess the validity of the collection of domain scores comprising the OCOI, we calculated a regression analysis of each of the five outcome variables (dependent variables) on all eight domain scores (independent variables). We reported the multiple R-squared statistic that indicates the variance in the outcome variables that is explained by the model including all eight domain scores as predictors.

3. Results

The results of the data collection and procedures are largely presented in Appendix A and B, and are also available in HTML files. They include a portion of the R code used to construct the domain scores and the OCOI as well as numerical and graphical representations of procedural and analysis results.

3.1 Description of constituent measures

Appendix A contains details about the 53 constituent measures used to construct the eight domains and is organized by domain. The appendix includes nominal descriptions of each variable, univariate numerical descriptions, bivariate relationships among all variables in a domain, the geographic distribution, and the source for each measure.

3.2 Validation results

Validation results are presented in tables 1 and 2. These results are also available in Appendices B and C, which contain the OCOI construction details for the time-fixed (Appendix B) and time-varying (Appendix C) OCOIs. These appendices also include choropleth maps of each domain score and the time-fixed and time-varying OCOIs, which can be used to assess the face validity of the domains and OCOIs.

Table 1. Results of correlation and multiple regression analyses of 5 outcome variables and the time-fixed OCOI and the time-fixed OCOI domain scores.

Outcome	Correlation with OCOI	Multiple Regression
	(p-value)	R-squared
Death rate	-0.12 (0.00)	0.05
Asthma	-0.56 (0.00)	0.35
Life expectancy	0.70 (0.00)	0.54
Child severe mental illness	-0.32 (0.00)	0.41
Pre-term birth	-0.52 (0.00)	0.41

Table 2. Results of correlation and multiple regression analyses of 5 outcome variables and the time-varying OCOI and time-varying OCOI domain scores.

Outcome	2014		2017	
	Correlation with OCOI	Multiple Regression	Correlation with OCOI	Multiple Regression
	(p-value)	R-squared	(p-value)	R-squared
Death rate	-0.15 (0.00)	0.05	-0.15 (0.00)	0.05
Asthma	-0.52 (0.00)	0.35	-0.46 (0.00)	0.31
Life expectancy	0.65 (0.00)	0.56	0.65 (0.00)	0.57
Child severe mental illness	-0.26 (0.00)	0.32	-0.27 (0.00)	0.42
Pre-term birth	-0.48 (0.00)	0.40	-0.45 (0.00)	0.41

3.2.1 Validity of the OCOI

Tables 1 and 2 present the results of correlation analyses between the OCOI and each of the five outcome variables for both versions of the OCOI. All three of the OCOI scores (one time-fixed and two time-varying OCOIs) have statistically significant ($p < .01$) correlations with all five of the outcome variables and the direction of the correlations align with our expectations that more opportunity is associated with better health outcomes. These findings are consistent for all versions of the OCOI. These results provide evidence that the OCOI is measuring the construct of opportunity since opportunity is known to be associated with better health outcomes.

3.2.2 Validity of the collection of OCOI domain scores

Tables 1 and 2 also present a variance-explained metric from multiple regression analyses of the 5 outcomes regressed on all domain scores of each of the three OCOIs (one time-fixed and two time-varying). The results suggest that the domain scores explain a considerable amount of variance in each outcome with the exception of the death rate, for which no OCOI explained more than 5%. However, all three versions of the OCOI domains explained over half of the variance in life expectancy and

approximately one-third or more of the variance in asthma, child severe mental illness, and pre-term births. These results provide evidence that the domain scores have considerable explanatory power with regard to some key health outcomes.

4. Discussion

4.1 Correlation Discussion

As mentioned, there were five key outcome measures this study analyzed, all of which correlate to the OI scores. Exhibited in Tables 1 and 2, as well as described in section 3.2.1 and 3.2.2, the three OCOI scores are significantly associated with all five of the outcome measures: death rate, asthma, life expectancy, child severe mental illness, and pre-term birth. This means that our expectations of more opportunity are directly correlated with better health outcomes. As policy makers, this can be further evaluated and analyzed to ensure proper actions are taken in areas that have less opportunity to ensure better health outcomes. Because our data has explicitly shown that opportunity is related to health outcomes, it is essential for local leadership to take a deeper look into their communities and their areas of opportunity for further development and hopefully better overall health outcomes.

The five outcome measures discussed have all been deemed as good indicators of outcomes of children's health at different points in time. To ensure that the data was all-encompassing, we chose measures on a broad spectrum that would further correlate with levels of opportunity and overall health outcomes. Although we have identified two different types of OCOI (single period and two-period), it would be even more useful to look further into an entire children's lifespan, typically 0-17 years old. In addition, this study shows several domains that correlate highly on their own across the different outcome measures. This is seen in section 2.3 of Appendices A, B, and C.

4.2 OI and outcome measures

The data that was used in this study is comprised from numerous sources: publicly accessible data from surveys, interest group products and other sources, as well as restricted access vital statistics and Medicaid claims data. Because there are some limitations to the data collection, obtaining data from other agencies would be beneficial to further examine the correlation between opportunity and health outcomes. For example, taking a deeper look into outcome measures such as entry into foster care, early childhood health outcomes, mental health diagnosis, obesity, et cetera would allow us to have even more information about the correlation to overall opportunity and health outcomes.

Additionally, these outcome measures can be further used in predictive modeling for long-term social success outcomes. As mentioned above, different outcome measures could potentially be found if we were to obtain data from additional agencies. These outcome measures, specifically looking at success, would further allow local government agencies and policy makers to take further action on their own opportunity measures. More specifically, this analysis could be used to predict factors such as foster care entry, employment, or college matriculation rates and allow communities to potentially improve their score and overall opportunity and health outcomes.

On a macro level, the OCOI could be used to improve the lives of Ohioans by improving scores across all domains within the Index. Policy makers and local organizations could use the Index to create public programming, provide education, and target resources and interventions based on scores within each of their domains. For example, if an area has a low OCOI score in the crime domain (indicating high crime), community organizations could be funded to provide rehabilitation, addiction and social services, local job and family services agencies could extend their outreach, and local law enforcement could increase their community programs. On the opposite end, an area with a high OCOI score in the crime domain (indicating low crime) could be researched and used as a model for struggling areas with similar

characteristics. On a micro level, further work could also be done to educate people about the opportunity within their area and how they, as individuals, can improve their and their children's health outcomes by understanding the OCOI score for their area. Parents who are informed about low scores in the education domain and its impact on long term health outcomes for children and adults, could not only be provided with additional resources about early education for their children but also about high school or GED programs and college or trade programs for adults.

4.3 Bright Spots

Neighborhoods are frequently characterized by numerous indicators of opportunity that are known to bear on a range of socioeconomic and ultimately, health outcomes. While on average the residents of a relatively deprived neighborhood are expected to have relatively poor health outcomes, outliers do exist. By comparative examination of the OCOI and infant and child health outcome variables, we can identify and study such outliers to inform policy decisions, resource allocation, and help communities learn from each other.

The 2020 Children's Health Bright Spots: Defying Opportunity Deficits in Ohio report uses regression model residuals and the idea of positive deviance to identify outlier "Bright Spots" where neighborhoods have better than predicted child and infant health outcomes, given the level of opportunity as captured by the OCOI. Qualitative interviews with community members of the Bright Spots reveal cross-collaboration of multiple parties, access to health care and other resources, and availability of educational and recreational enrichment for children. Alternatively, residual analysis can also be used to identify "Dark Spots," or communities that have worse than expected outcomes, where they may benefit from additional resources and community involvement.

Using the OCOI and residual analyses can provide an opportunity for local governments, school systems, and voluntary organizations to reflect on their needs and priorities. It also provides an opportunity for state agencies responsible for financing and delivering health, education, and social services to develop micro-system targeting strategies to incentivize providers and practitioners to work closely with one another to address these issues.

4.4 Impact of the COVID-19 pandemic

Though the OCOI contains numerous socio-economic and health indicators from various domains, there may be a need to re-examine these domains and their weight in the future, particularly due to the COVID-19 pandemic. The pandemic has claimed hundreds of thousands of lives in the U.S. while many more have been infected. To curb the transmission of the virus, people were encouraged to stay home and socially distance. Unemployment increased as numerous businesses were forced to close down or operate in a limited capacity. Many schools transitioned to online learning and the reduced human interaction (among both children and adults) has led many to raise concerns about mental health. It is essential to re-assess and make changes to the OCOI post-pandemic, as the pandemic has profoundly changed the ways in which individuals interact with each other and how they access health care and other services.

One source to consider is Medicaid treatment data for COVID-19 at the local level. We could study COVID-19 infection rates and its correlation with children's outcomes. Additionally, looking at infection rates and the severity of COVID-19 symptoms could help identify need for future treatment, care, and resources at the neighborhood level. There is also a need to evaluate the effect of reduced (or lack of) socialization, physical exercise, and other factors on outcome measures. Other potential long term

effects of the pandemic, such as on education, health, and the economy, must also be considered when re-examining and updating the OCOI in the future.

Appendices

[Appendix A: Ohio Children's Opportunity Index \(OCOI\) – Constituent Measures Description](#)

[Appendix B: Ohio Children's Opportunity Index \(OCOI\) – Index Construction \(2017 Complete\)](#)

[Appendix C: Ohio Children's Opportunity Index \(2014 – 2017\) - Reduced Version](#)