The Child Opportunity Index 2.0: A New Index of Neighborhood Opportunity for All US Neighborhoods

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BARI Spring Meeting, June 19, 2020 | Panel: Leveraging the 2020 Census Equitably

diversitydatakids.org
data for a diverse and equitable future
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Neighborhoods matter for children’s healthy development
Neighborhoods influence children’s health and education

Green space and playgrounds
Early childhood education
Schools
Neighborhoods influence children’s health and education

- Air quality
- Access to healthy food
- Walkability
- School quality
Neighborhoods influence children’s norms and expectations for the future

High school graduation
College aspirations
Employment prospects
COI 2.0: A metric of child opportunity for all U.S. neighborhoods

- Multi-sectoral: 29 indicators capturing three domains of opportunity
- Focus on neighborhood features that matter for children today
- Captures important social determinants of health
- Granular data on nearly all U.S. neighborhoods (72,000 census tracts)
- Data comparable across neighborhoods and over time (2010, 2015)
- Good predictive validity compared to similar metrics
- Users from academia, media, health, housing, and early childhood education sectors
COI 2.0: What is included

And how did we build it
### Education

<table>
<thead>
<tr>
<th>Category</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early childhood education (ECE)</td>
<td>ECE centers within five miles, High quality ECE centers within five miles, ECE enrollment</td>
</tr>
<tr>
<td>Primary school</td>
<td>Third grade reading proficiency, Third grade math proficiency</td>
</tr>
<tr>
<td>Secondary and post-secondary</td>
<td>High school graduation rates, AP enrollment, College access/enrollment</td>
</tr>
<tr>
<td>Resources</td>
<td>School poverty, Teacher experience, Adult educational attainment</td>
</tr>
</tbody>
</table>

### Health and Environment

<table>
<thead>
<tr>
<th>Category</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy environments</td>
<td>Access to healthy food, Access to green space, Walkability, Housing vacancy rates</td>
</tr>
<tr>
<td>Toxic exposures</td>
<td>Superfund sites, Industrial pollutants, Microparticles, Ozone, Heat</td>
</tr>
<tr>
<td>Health care access</td>
<td>Health insurance coverage</td>
</tr>
</tbody>
</table>

### Social and Economic

<table>
<thead>
<tr>
<th>Category</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic opportunities</td>
<td>Employment rate, Commute duration</td>
</tr>
<tr>
<td>Economic resource index</td>
<td>Poverty rate, public assistance rate, high skill employment, median household income, home ownership</td>
</tr>
<tr>
<td>Family structure</td>
<td>Single parenthood</td>
</tr>
</tbody>
</table>
How we built the index

Indicators standardized (converted to z-scores) so that they are on a common scale

Standardized indicators averaged into three domain scores

  Weights capture how strongly each indicator predicts four different health and socio-economic outcomes

Domain scores averaged into one overall score

Scores converted into two easily interpretable metrics
COI 2.0 metrics

Child Opportunity Scores

Vary from 1 to 100

To construct them,

we ranked all neighborhoods on domain and overall scores,

grouped neighborhoods into 100 groups containing 1% of the child population each,

and assigned each group a score from 1 (lowest) to 100 (highest)
COI 2.0 metrics

Child Opportunity Levels

5 categories: very low, low, moderate, high, very high

To construct them,

we ranked all neighborhoods on domain average or overall average z-scores
and grouped neighborhoods into 5 categories containing 20% of the child population each

[Image of a scale with categories]
COI 2.0 metrics

Metro-, state- and nationally normed opportunity scores and levels

To compare neighborhoods within one metro area, use metro normed metrics
To compare neighborhoods within one state, use state normed metrics
For all other use cases, use nationally normed metrics
COI 2.0 data stories

More data stories at diversitydatakids.org/child-opportunity-index
Child Opportunity Levels

Metro normed

Source: diversitydatakids.org. Child Opportunity Index 2.0 Database.
Black children’s access to neighborhood opportunity

Child Opportunity Levels (metro normed)

1 Dot = 20 children aged 0-17 years

White children’s access to neighborhood opportunity

Child Opportunity Levels (metro normed)

1 Dot = 20 children aged 0-17 years

BOSTON-CAMBRIDGE-NEWTON METRO AREA

Percent of children by Child Opportunity Level

Child Opportunity Levels (metro normed)
Children aged 0-17 years

BOSTON-CAMBRIDGE-NEWTON METRO AREA

Percent of children by Child Opportunity Level

Child Opportunity Levels (metro normed)
Children aged 0-17 years

Percent of children by Child Opportunity Level

Child Opportunity Levels (metro normed)
Children aged 0-17 years

Life expectancy by Child Opportunity Level

The average number of years a person can be expected to live at birth

Child Opportunity Levels (metro normed)

Sources: diversitydatakids.org, Child Opportunity Index 2.0 Database; National Center for Health Statistics, United States Small-area Life Expectancy Estimates Project (USALEEP).
Life expectancy by Child Opportunity Level

The average number of years a person can be expected to live at birth

Child Opportunity Levels (metro normed)

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Life expectancy by Child Opportunity Score

The average number of years a person can be expected to live at birth

Child Opportunity Scores (metro-normed)

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Life expectancy by Child Opportunity Score

The average number of years a person can be expected to live at birth

Child Opportunity Scores (metro-normed)

BOSTON-CAMBRIDGE-NEWTON METRO AREA

Gap = 8.7 years
Life expectancy by Child Opportunity Score

The average number of years a person can be expected to live at birth

Child Opportunity Scores (metro-normed)

Sources: diversitydatakids.org, Child Opportunity Index 2.0 Database; National Center for Health Statistics, United States Small-area Life Expectancy Estimates Project (USALEEP), World Bank.
### Percent variance explained across adult outcomes

$R^2$ statistics from regressions of 14 health and socio-economic adult outcomes on COI 2.0 overall average z-score

<table>
<thead>
<tr>
<th>Outcome</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall mental health</td>
<td>85%</td>
</tr>
<tr>
<td>Limited physical activity</td>
<td>80%</td>
</tr>
<tr>
<td>Overall physical health</td>
<td>78%</td>
</tr>
<tr>
<td>Smoking</td>
<td>77%</td>
</tr>
<tr>
<td>Obesity</td>
<td>73%</td>
</tr>
<tr>
<td>Asthma</td>
<td>71%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>67%</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>32%</td>
</tr>
<tr>
<td>Binge drinking</td>
<td>27%</td>
</tr>
<tr>
<td>Cancer</td>
<td>23%</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>33%</td>
</tr>
<tr>
<td>Residing in low poverty tract</td>
<td>58%</td>
</tr>
<tr>
<td>Top 20% of income distribution</td>
<td>50%</td>
</tr>
<tr>
<td>Adult household income</td>
<td>47%</td>
</tr>
</tbody>
</table>

**Sources:** diversitydatakids.org, Child Opportunity Index 2.0 Database, Chetty et al., Opportunity Atlas, NCHS, 500 Cities and USALEEP.
COI 2.0: Actionable neighborhood data

- Multi-sectoral, child-focused, granular, contemporary
- Data for all US neighborhoods
- Strongly correlated with adult outcomes
- Clear and compelling visualization of spatial and racial/ethnic inequities in access to opportunity
- Users from academia, media, health, housing, and early childhood education sectors
Appendix

Learn more about our work on diversitydatakids.org
Current focus of our work

Better understand COI users and uses
Better understand what helps COI users achieve impacts
Facilitate more impactful uses
Develop and disseminate exemplary stories
Focus on health, early childhood education, and housing sectors

Questions? diversitydatakids.org/contact-us
Email us info@diversitydatakids.org
Further details on COI 2.0 methodology

Even more details in our technical documentation at http://diversitydatakids.org/research-library/research-brief/how-we-built-it
Outcomes used for constructing weights

Socio-economic outcomes from Opportunity Atlas (Chetty et al.)

Mean household income rank in adulthood (parents at median of parent income distribution)

Probability of living in a low poverty census tract in adulthood (parents at median of parent income distribution)

Summary health outcomes from 500 Cities Project (CDC, RWJF)

Mental health not good for 14 or more days among adults

Physical health not good for 14 or more days among adults
Combining empirical and constant weights

Empirical weights reflect how well indicators predict outcomes

Need: Average causal effect for all indicators
Have: Estimated (conditional/unconditional) association between each indicator and tract-level SES and health outcomes in representative/recent data

Constant weights: Each indicator counts equally

Least worst solution in the absence of any information on what weights should be

For COI 2.0, we combined both approaches

We average empirical and constant weights to guard against bias in the empirical weights
Averaging empirical and constant weights shrinks large empirical weights and inflates small empirical weights towards a domain specific constant
Combining empirical and constant weights

How we calculate weights

- Estimate bivariate correlation (Pearson’s rho) between indicator z-scores (2010) and each of the four outcomes
- Average rho’s for each indicator j across outcomes (= \( \rho_{oj} \))
- Rescale \( \rho_{oj} \) to sum up to number of indicators in each domain
- Calculate weight for indicator j as \( w_j = (\rho_{oj} + 1) / 2 \)
- Rescale \( w_j \) to sum up to one in each domain

Sensitivity analyses

- Re-estimate correlations with county fixed effects and controlling for economic resources and population density
Indicator weights by domain

Weights sum to one in each domain

COI 2.0 PREDICTIVE VALIDITY

**Education**

- Adult educational attainment: 0.14
- School poverty: 0.14
- Reading proficiency: 0.12
- Math proficiency: 0.12
- High school graduation rate: 0.09
- AP course enrolment: 0.08
- ECE enrolment: 0.08
- College access and enrolment: 0.08
- Teacher experience: 0.06
- ECE centers: 0.05
- High-quality ECE centers: 0.05

**Health & Environment**

- Health insurance coverage: 0.19
- Housing vacancy rate: 0.18
- Access to healthy food: 0.15
- Access to green space: 0.10
- Heat exposure: 0.08
- Microparticle concentration: 0.08
- Ozone concentration: 0.06
- Walkability: 0.05
- Superfund sites: 0.05
- Industrial pollutants: 0.05

**Social & Economic**

- Economic resource index: 0.32
- Single parenthood: 0.28
- Employment rate: 0.27
- Commute duration: 0.13

Sources: diversitydatakids.org
COI 2.0 can be used to compare neighborhoods across the US

More data stories at diversitydatakids.org/child-opportunity-index
Child Opportunity Scores

Median child opportunity scores (nationally-normed) for the 100 largest metro areas

Sources: diversitydatakids.org, Child Opportunity Index 2.0 Database.
Additional slides on COI 2.0 predictive validity

See our technical documentation at
http://diversitydatakids.org/research-library/research-brief/how-we-built-it
## COI 2.0 Predictive Validity

### Percent variance explained across different outcomes

$R^2$ statistics from regressions of 14 health and socio-economic adult outcomes on COI 2.0 overall average z-score

Data for all US census tracts

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Percent Variance Explained</th>
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<tbody>
<tr>
<td>Overall mental health</td>
<td>78%</td>
</tr>
<tr>
<td>Overall physical health</td>
<td>75%</td>
</tr>
<tr>
<td>Limited physical activity</td>
<td>72%</td>
</tr>
<tr>
<td>Smoking</td>
<td>63%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>60%</td>
</tr>
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<td>59%</td>
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<td>Binge drinking</td>
<td>29%</td>
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<tr>
<td>Cancer</td>
<td>11%</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>43%</td>
</tr>
<tr>
<td>Residing in low poverty tract</td>
<td>52%</td>
</tr>
<tr>
<td>Adult household income</td>
<td>49%</td>
</tr>
<tr>
<td>Top 20% of income distribution</td>
<td>41%</td>
</tr>
</tbody>
</table>

Sources: diversitydatakids.org, Child Opportunity Index 2.0 Database. Chetty et al., Opportunity Atlas. NCHS, 500 Cities and USALEEP.
Median pediatric asthma hospitalizations
in very low opportunity tracts = 9.1 per 1000 children
in very high opportunity tracts = 1.8 per 1000 children
Neighborhood Child Opportunity and Individual-Level Pediatric Acute Care Use and Diagnoses

Ellen E. Kersten, PhD, a Nancy E. Adler, PhD, a,b,c Laura Gottlieb, MD, MPH, c,d Douglas P. Jutte, MD, MPH, e,f Sarah Robinson, BS, f Katrina Roundfield, PhD, a Kaja Z. LeWinn, ScD a,c

Adjusted odd ratios of having 4 or more acute care visits within one year, relative to children in very high opportunity neighborhoods
Children in low (very low) opportunity neighborhoods had 40% (30%) greater odds of acute care admissions than children in very high opportunity neighborhoods

* 1.4
** 1.3
1.2
1.0
0.9
1.0

Very low
Low
Moderate
High
Very high

Children’s cortisol levels (AUC$_g$)
Lower family SES was associated with higher daily cortisol output only at lower levels but not at higher levels of neighborhood opportunity.
Child Opportunity Index (COI) vs. Opportunity Atlas

**Child Opportunity Index**

Composite index based on 29 indicators covering three domains

Focus on contemporary features of neighborhoods linked to healthy child development by previous research

Incorporates OA (and 500 Cities data) to improve predictive validity

**Opportunity Atlas (Chetty et al. 2018)**

Estimates of long-term effects of growing up in different neighborhoods on, e.g., household income rank, marital status, and incarceration in adulthood

Effects of neighborhoods as they were 15-20 years ago

No information about features of neighborhoods generating these effects
Using the COI to increase equity

Consider sharing your story with us at

[link]
diversitydatakids.org/impact-stories
In Nearly Every U.S. Metro Area, New Data Show Opportunity Lags For Kids Of Color

December 18, 2019 · 3:18 PM ET

How healthy is your neighborhood for your child? Take a look by Sandee LaMotte, CNN

Opportunity Knocks Across the Nation

California cities rank among country’s best and worst places to raise kids, study says

We Tried to Find the Most Equal Place in America. It Got Complicated

Childhood Opportunity Varies Dramatically by Neighborhood

A new report shows stark inequities in neighborhood conditions for children across the country, holding serious implications for later in life.

What shapes a kid’s opportunities? Researchers say look to the neighborhood.

A Brandeis University study finds stark divides along racial and ethnic lines, and glaring ‘opportunity gaps’
Moving Data to Action in Chicago

Department of Public Health published community health improvement plan in 2015

Subsequent collaboration around and uses of the COI

- “Hyper-local” view of neighborhood context and inequality
- Award of community seed grants
- Targeting for place-based interventions
- Community health needs assessments

[Links to relevant resources]
diversitydatakids.org/research-library/impact-story/moving-data-action-chicago
Brittney Lange-Maia (Rush University Medical Center) says the influence of the COI data is reflected in the questions her team members now ask:

“What neighborhoods should we focus our community services on? Where are we sending our volunteers? Are they servicing the right neighborhoods, based on what we know?”