HEALTHY CHICAGO

CHICAGO DEPARTMENT OF PUBLIC HEALTH

Air Quality and Health Index Data Pack

Office of Epidemiology

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What is the purpose of the index and this data pack?

The **Air Quality and Health Index** is a tool that uses local data on air quality, health, and social factors to help prioritize locations within the city for air pollution reductions or other actions that will reduce the impact of air pollution exposure on residents' health.

This **Data Pack** provides a deeper background on the rationale for our chosen methodology and data sources, along with the full tables of underlying data.

Background

- Air quality in Chicago is generally worse than the rest of the state and country.
- Air pollution is more harmful to people with chronic diseases like asthma, heart disease, and chronic obstructive pulmonary disease (COPD).
- Chicago is a racially and economically segregated city and some communities are more vulnerable to the effects of air pollution than others based on health and social factors.
- A place-based approach is necessary to prioritize interventions in impacted areas to mitigate the potential impacts and ensure health equity.

Choosing a model index

CDPH reviewed a variety of indices for guidance on developing our own Air Quality + Health Index. We chose to model our index after the California Environmental Protection Agency's CalEnviroScreen because it includes health factors along with other indicators of the combined – or cumulative – impacts of different kinds of pollution and was developed with robust community input.

Method	Data Source(s)	Cumulative Impacts	Health Indicators	Community Input
EJScreen	EPA + Census			
NRDC Cumulative Impacts	EJ Screen	✓		✓
Illinois Solar for All	EJ Screen	✓		✓
CalEnviroScreen	EPA, State Sources & Census	✓	✓	✓

Adjustments to model index

We modified the CalEnviroScreen to develop the Chicago Air Quality + Health Index in a few ways:

- Focused on air quality exclusively as a starting point. The CalEnviroScreen also considered environmental quality in other media like water and soil.
- Added important demographic indicators (i.e. race/ethnicity and young/old age) for a more comprehensive picture of community conditions.
- Used disease prevalence of air pollution-sensitive diseases (asthma, COPD, heart disease) rather than emergency department visit data.

Indicator criteria

How did we determine what indicators to include?

We used indicators that:

- Help us understand community conditions
- Are available at a local scale (e.g., census block group)
- Are collected and analyzed using an established methodology
- Are refreshed regularly to allow for future updates and assure timeliness
- Are widely accepted as good data

Indicator category and component definitions

Pollution Burden

Air pollution: Estimated concentrations or proxies for concentrations, health risks, or hazard indices for outdoor air pollutants

Polluted sites: adverse environmental conditions caused by pollutants

Population Characteristics

Health factors: biological characteristics of populations that render them more sensitive to adverse health impacts of air pollution

Social factors: social characteristics of populations that reduce their power and result in increased vulnerability to air pollution

Which indicators did we choose?

Pollution Burden

Air Pollution

PM 2.5
Ozone
Diesel PM
Air Toxics Cancer Risk
Air Toxics Respiratory Hazard Index
Traffic Volume and Proximity

Polluted Sites

Proximity to Risk Management Plan sites
Proximity to Hazardous Waste Treatment, Storage, and Disposal Facilities
Proximity to National Priorities List, Superfund program sites

Population Characteristics

Health Factors

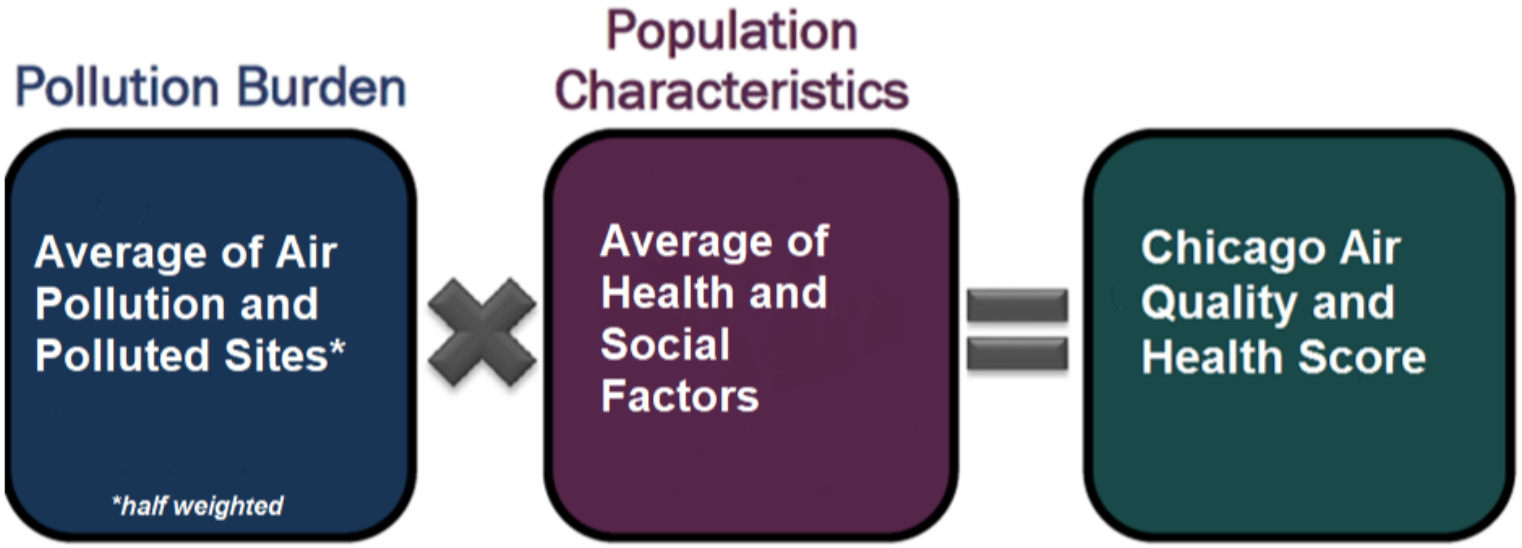
Asthma prevalence
COPD prevalence
Coronary Heart Disease prevalence
Low birth weight
Young age
Old age

Social Factors

Percent Low income
Percent Minority
Percent less than high school education
Linguistic isolation
Unemployment
Housing burdened low income households

How did we calculate index scores?

1. Determined a value for each indicator for each census block group.
2. Assigned a percentile for each indicator for each census block group, based on rank-order related to other block groups in the city.
3. Calculated scores for pollution burden and population characteristics components.
    1. Polluted sites component is half-weighted to reflect a less direct effect on health outcomes
4. Calculated Air Quality + Health Index score by combining the component scores (see below).



Data

Example of index calculation for a census block group

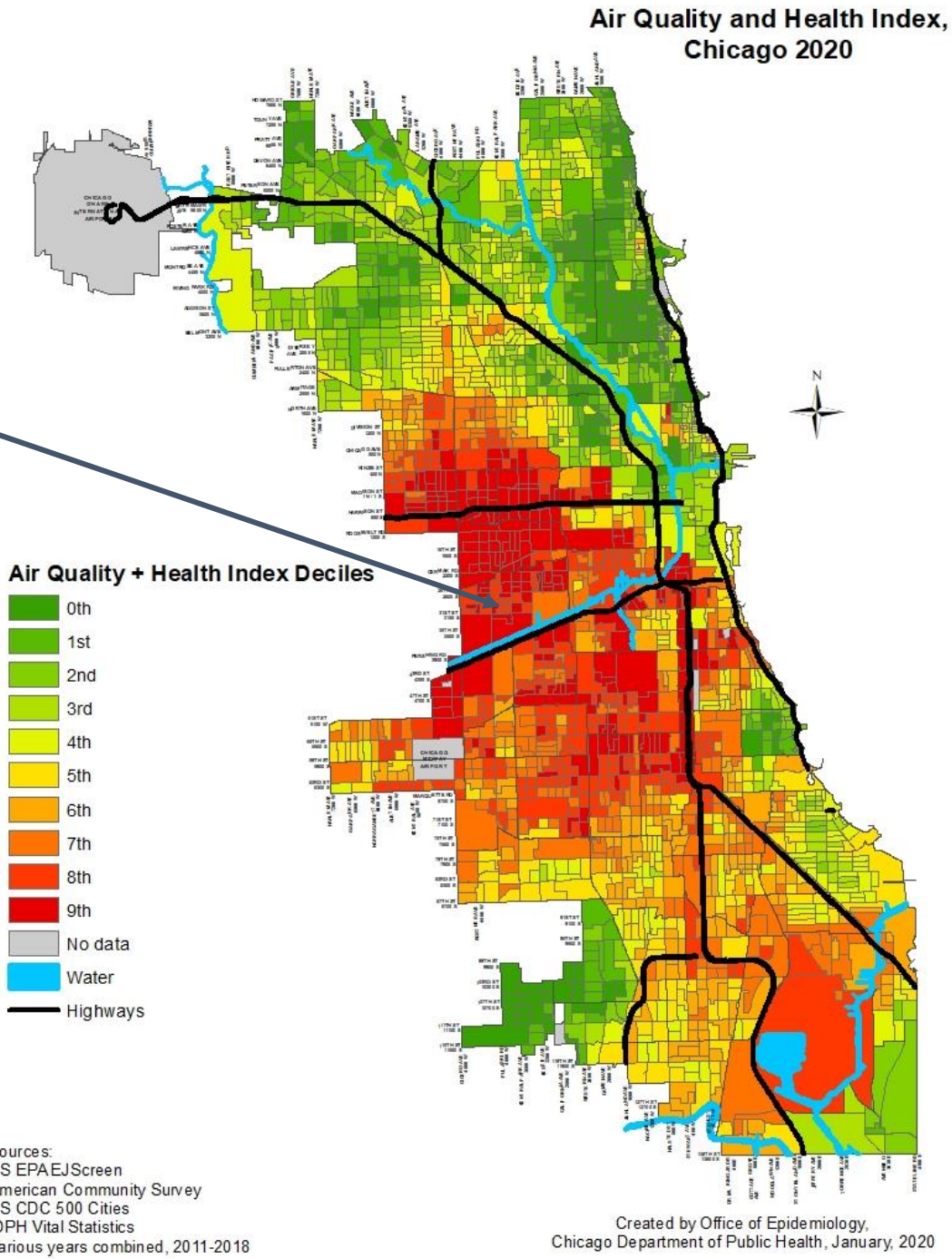
Example address and census block group

Address: 2844 S Millard Ave

Census block group: 170313017023

Census block group

170313017023



Data

How did we calculate index scores for pollution burden?

Pollution Burden components calculation for census block group 170313017023

Air Pollution Indicators		
Indicator	**Raw Value**	**Percentile**
PM 2.5 (concentration)	9.99575136612	93.87
Ozone (concentration)	45.1077346405	22.64
Diesel PM (emissions)	1.104631667	65.49
Cancer risk (per million person-years)	39.7003233803	71.03
Respiratory Hazard Index (no units)	0.625279961811	85.42
Traffic (volume and proximity)	123.406690276	20.4
AVERAGE COMPONENT SCORE	_	59.81

Polluted Sites Indicators		
Indicator	**Raw Value**	**Percentile**
Risk Management Plan sites (proximity)	3.23442897082	81.7
Hazardous Waste Teatment, Storage, Transfer Facilities (proximity)	8.38520752202	88.55
National Priority List Sites (proximity)	0.046407107144	55.46
AVERAGE COMPONENT SCORE	_	75.24

Data

How did we calculate index scores for population characteristics?

Population Characteristics components calculation for census block group 170313017023

Health Factor Indicators		
Indicator	**Raw Value**	**Percentile**
Asthma prevalence (%)	8.4	47.84
Chronic Obstructive prevalence (%)	5.7	38.18
Coronary Heart Disease prevalence (%)	5.1	42.41
Low Birth Weight (percent)	2.875399361	4.12
Under age 5 (percent)	11.9212962963	89.88
Over Age 64 (percent)	3.125	7.21
AVERAGE COMPONENT SCORE	_	38.27

Social Factor Indicators		
Indicator	**Raw Value**	**Percentile**
Poverty (percent)	69.212962963	87.77
Racial/Ethnic Minority (percent)	99.1319444444	80.97
Educational Attainment (percent)	48.5685071575	97.38
Linguistic Isolation (percent)	26.6666666667	92.14
Unemployment (percent)	9.6	57.43
Low Income Housing Burdened (percent)	35.3211009	82.13
AVERAGE COMPONENT SCORE	_	82.94

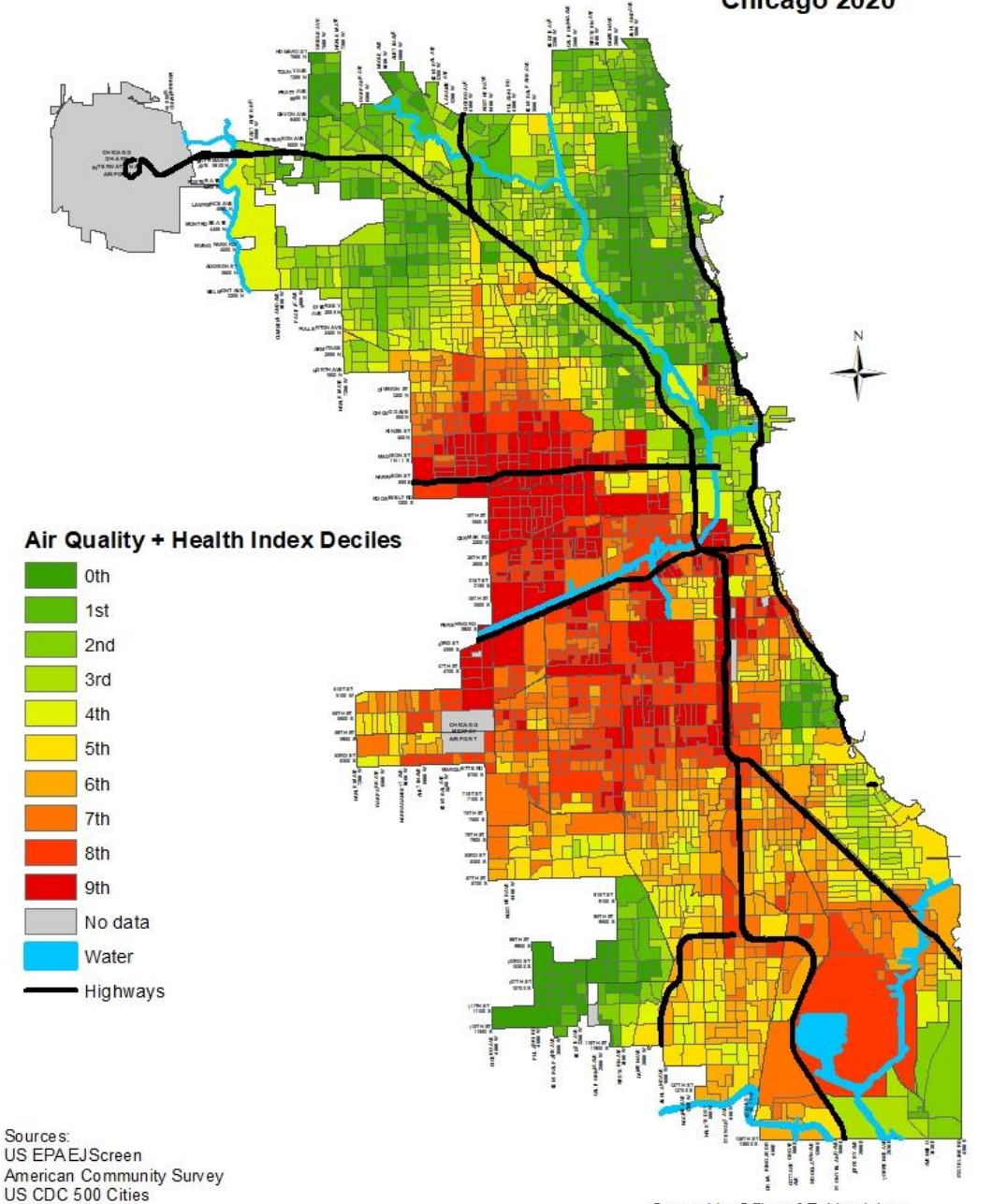
Data

How did we calculate index scores from the components?

Air Quality + Health Index calculations for census block group 170313017023

	Pollution Burden		Population Characteristics	
	Air Pollution Indicators	Polluted Sites Indicators	Health Factor Indicators	Social Factor Indicators
Component Score	59.81	(0.5 x 75.24)=37.62	38.27	82.94
Average of Component Score	(59.81 +37.62)/2=48.71 *Pollution Burden is calculated as the average of its two component scores, with the Polluted Site component half-weighted*		(38.27+ 82.94)/2=60.65 *Population Characteristics is calculated as the average of its two component scores*	
Scaled Component Scores (Range 0-10)	(42.46/61.18) x 10 = 7.96 *The Pollution Burden percentile is scaled by the citywide maximum Pollution Burden Score*		(60.59/90.62) x 10 = 6.69 *The Population Characteristics percentile is scaled by the citywide maximum Population Characteristics Score*	
Air Quality + Health Index Score	7.96 x 6.69 = 53.24 *An Index score of 47.01 puts this census block group in the 86th percentile of scores for Chicago*			

Air Quality and Health Index, Chicago 2020



Sources:
US EPA EJScreen
American Community Survey
US CDC 500 Cities
IDPH Vital Statistics
Various years combined, 2011-2018

Created by Office of Epidemiology,
Chicago Department of Public Health, January, 2020

Data

How did data quality inform exclusions of census block groups?

Six census block groups are flagged because they are missing four of the six health component indicators. Since their Index scores ranged from 33 to 77, they were not excluded.

The full set of indicator values (including missing values) can be found in the accompanying reference table "All AQH indicator values."

To find a count of missing values by each indicator, see the accompanying reference table "Indicator value distribution."

Appendix A. Indicator changes from Calenviroscreen to Chicago Air Quality + Health Index

1. Indicators added
2. Indicators modified
3. Indicators not included
4. Indicators using a modified methodology

Indicators added

The following indicators were not included in the CalEnviroScreen index and were included in ours.

Health factors	Rationale
Young age	Important indicator of sensitivity to air pollution.
Old age	Important indicator of sensitivity to air pollution.

Social factors	
Percent Minority	Important indicator of vulnerability to air pollution.

Indicators modified

The following indicators were modified from similar indicators in the CalEnviroScreen.

Health factors	Reason
Asthma prevalence	Availability for cities, census tract level geography, perhaps better reflection of sensitivity to air pollution than hospitalization
COPD prevalence	Availability for cities and census tract level geography
Coronary Heart Disease prevalence	Availability for cities, census tract level geography, perhaps better reflection of sensitivity to air pollution than hospitalization

Indicators not included

These indicators were present in the CalEnviroScreen but *not* included in the Chicago Index.

Air pollution	Reason
Drinking water contaminants	Unrelated to Air Quality
Agricultural pesticide use	Unrelated to Air Quality in Chicago

Polluted sites	
Groundwater threats	Unrelated to Air Quality
Impaired water bodies	Unrelated to Air Quality

Indicators using a modified methodology

These indicators were present in the CalEnviroScreen and included in the Chicago Index using a similar but slightly different methodology.

Air Pollution	Reason
PM 2.5	Data availability and census block group level geography
Ozone	Data availability and census block group level geography
Diesel PM	Data availability and census block group level geography
Air Toxics Cancer Risk	Data availability and census block group level geography
Air Toxics Respiratory Hazard Index	Data availability and census block group level geography
Traffic Volume and Proximity	Data availability and census block group level geography
Polluted Sites	
Proximity to Risk Management Plan sites	Data availability and census block group level geography
Proximity to Hazardous Waste Treatment, Storage, and Disposal Facilities	Data availability and census block group level geography
Proximity to National Priorities List, Superfund program sites	Data availability and census block group level geography
Social factors	
Percent Low income	Data availability and census block group level geography
Percent less than high school education	Data availability and census block group level geography
Linguistic isolation	Data availability and census block group level geography

Appendix B. Accompanying reference tables

1. **Air Quality and Health Index Scores by Census Block Group:** Provides index score and rank for each census block group.

2. **All Air Quality and Health Index Indicator Values:** Complete list of all indicator values, geographic levels, index score and rank, intermediate calculated variables and ranks.

3. **Air Quality and Health Index Indicator Description:** For each indicator, lists year of estimate, references for data sources and methods, and exclusion criteria.

4. **Air Quality and Health Index Indicator Value Distribution:** Describes distribution of values and summary statistics for each indicator.

5. **Chicago Air Quality and Health Index Map Layer:** Map layer with index values for census block groups.

Appendix C. Selected bibliography

Key websites

1. EJScreen https://www.epa.gov/ejscreen
2. Calenviroscreen https://oehha.ca.gov/calenviroscreen
3. 500 Cities https://www.cdc.gov/500cities/
4. IL Solar for All https://www.illinoissfa.com/environmental-justice-communities/
5. NRDC cumulative impacts summary

Key reference documents

1. EJScreen
2. CalEnviroScreen
3. NRDC cumulative impacts
4. Illinois Solar for All

Key source data locations

1. EJScreen ftp://newftp.epa.gov/EJSCREEN/2018/
2. 500 Cities https://chronicdata.cdc.gov/500-Cities/500-Cities-Local-Data-for-Better-Health-2018-relea/6vp6-wxuq
3. HUD housing burdened low income https://www.huduser.gov/portal/datasets/cp.html

Acknowledgements

The debt to the dedicated and skilled scientists at the California Office of Environmental Hazard Health Assessment (CalEnviroScreen) and the US Environmental Protection Agency (EJScreen) can hardly be expressed. Like all science, this effort, too, has proceeded by standing on the shoulders of the aforementioned giants. It is the authors' humble wish that our imitation will be interpreted as flattery.

From the non-governmental sector, the Natural Resources Defense Council (NRDC) and Elevate Energy provided inspiration and examples with their indices.

Finally, we consulted with subject matter experts and community-based environmental justice organizations who have been dedicated and effective advocates for their neighbors for many years.