Community Air Tool (CAT) Version 2 Metadata

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Overview:

The Community Air Tool (CAT) is an index used to identify census block group areas of high disproportionate impacts in Puget Sound (King, Kitsap, Pierce, and Snohomish Counties). The CAT takes into account 13 different census categories, scores each category into quartiles, and then evenly weights all 13 categories scores by totaling them. The higher the indicator score (Min of 0, Max of 35) the more disproportionate impacts and vulnerability or "cumulative disparities" the community illustrates.

The version 2 update was completed in August 2018. Version 1 was originally created in 2012.

Procedure used:

Step 1.

Identified which Census Summary categories were to be included (and downloaded from the Census Bureau) in the calculation. The data was from the US Census Bureau's American Community Survey 2012-2016.

Percent's were calculated dividing category population by total population (census reference code B00001001) in the census block group or households (reference code B00002001) where indicated. For example, of 500 total population, if 50 were "linguistically isolated", then the result would be 10% (or 10% of that census block group).

Percent minority

> "Race", reference code B02001
>
> **The sum of** reference codes B02001003 through B02001008. **Divided by** population (reference code B00001001).

Median income

> "Median household income in the past 12 months (in 2010 inflation-adjusted dollars)", reference code B19013.
>
> This was included in analysis since it was the metric for version 1 of the CAT tool, but for version 2 was not used in the final sum to estimate the total CAT score.

Federal Poverty Level

> "Income in the past 12 months below poverty level – family households" (reference code B17012002**), divided by** the total households (B17012001).

This measure was not in CAT version 1, but replaces median income as the main metric used for the final sum to estimate the total CAT score.

Percent population <18

"Sex by age", reference code B01001.
The sum of reference codes B01001003 through B0100106 **and** reference codes B01001027 through B01001030. **Divided by** population (reference code B00001001).

Percent population >64

"Sex by age", reference code B01001

The sum of reference codes B01001020 through B01001025 **and** reference codes B01001044 through B01001049. **Divided by** population (reference code B00001001).

Percent population without high school diploma

"Sex by educational attainment for the population 25 years and over", reference code B15002

The sum of B15002003 through B15002010 **added to** B15002020 through B15002027. **Divided by** population (reference code B00001001).

Percent households with linguistic isolation

"Limited English Speaking Households" reference code C16002.

The sum of reference codes C16002004, C16002007, C16002010, and C16002013. **Divided by** total households (reference code C00002001).

Percent single female head of household

This was NOT included in version 2 after this metric demonstrated no correlation to any of the air pollution measures. In summary, this measure just adds noise to a data set and dilutes the value of other more correlated measures that do show correlations.

The description below was used in version 1 of CAT:

"Own children under 18 years by family type and age", reference code B09002

B09002015, "Female householder, no husband present", **divided by** total households (reference code B00002001).

Percent that use heat as their primary heating fuel

The reference code B25040007, "Wood".

Impact from diesel vehicles

This was a change from version 1, which was for all vehicles. We decided to prioritize diesel exhaust specifically and opted to not include cars in the emissions to capture the increased risk from diesel exhaust. We did not want to include both as it would potentially be double

counting.

The methodology is described in detail here on page 73 of the pdf:
http://www.pscleanair.org/DocumentCenter/View/3398/Air-Toxics-Study-in-the-Chinatown-International-District-Full-Report

This was the methodology from version 1:

Using 2010 Traffic Segment GIS Shapefiles from WS DOT:
http://www.wsdot.wa.gov/mapsdata/geodatacatalog/default.htm
Used ArcGIS 9 to join with the 2010 Block Groups. Clicked on census block group shapefile and selected "Join…" then selected "Join data from another layer based on spatial location" and chose the WS DOT shapefile to join. The block group then was associated with the value of the traffic nearest the block group.

Count of registered sources

We used the "v_RegListActive" query in the Puget Sound Clean Air Agency's "Compliance" database to get the addresses of each active registered source (as of July 2018). Sources with air operating permits or gas stations were filtered out. Each address was then geocoded to latitudinal and longitudinal coordinates and mapped. The new point layer was then joined with the census block groups and the "Count" field was used in the joined shapefile.

Impact from sources with air operating permits

We used the "v_RegListActive" query in the Puget Sound Clean Air Agency's "Compliance" database to get the addresses of each active source with air operating permits (as of July 2018). Sources without air operating permits or gas stations were filtered out. Each address was then geocoded to latitudinal and longitudinal coordinates and mapped. The new point layer was then joined with the census block groups and the "Distance" field was used in the joined shapefile.

Rate of cardiac hospitalizations

We used the Washington State Department of Health's Comprehensive Hospital Abstract Reporting System (CHARS) data from 2005-2014 (10 years) via the Community Health Assessment Tool.[1] Age-adjusted rates were selected. Counts of diagnosis related group (DRG) codes 215 through 316 were added for each year by Zip code. Then, the **10 years were averaged**. Since some Zip codes were recently adopted, only the available years were used in the average. The Zip codes cardiac hospitalizations were then **divided by the population** estimate provided from the Washington State Office of Financial Management.[2] The result is a rate of hospitalizations per person. This figure is **multiplied by one million** to give a result that is per million people per year for each Zip code.

To merge the Zip code result into a census block group, first, the Zip code data was joined into a block level shapefile (even smaller than census block groups) and the attributes were "averaged". Then, the block level data was joined into the final census block group level shapefile using the "average" again for the attributes. The advantage of going to block level data first is that census block groups on the boundaries can have the average of the blocks within them, creating a more representative result on Zip code boundaries.

Rate of COPD hospitalizations

We used the Washington State Department of Health's Comprehensive Hospital Abstract Reporting System (CHARS) data from 2005-2014 (10 years).[1] Age-adjusted rates were selected. Counts of diagnosis related group (DRG) codes 190 through 192 were added for each year by Zip code. Then, the **10 years were averaged**. Since some Zip codes were recently adopted, only the available years were used in the average. The Zip codes COPD hospitalizations were then **divided by the population** estimate provided from the Washington State Office of Financial Management.[2] The result is a rate of hospitalizations per person. This figure is **multiplied by one million** to give a result that is per million people per year for each Zip code.

To merge the Zip code result into a census block group, first, the Zip code data was joined into a block level shapefile (even smaller than census block groups) and the attributes were "averaged". Then, the block level data was joined into the final census block group level shapefile using the "average" again for the attributes. The advantage of going to block level data first is that census block groups on the boundaries can have the average of the blocks within them, creating a more representative result on Zip code boundaries.

Rate of asthma hospitalizations

We used the Washington State Department of Health's Comprehensive Hospital Abstract Reporting System (CHARS) data from 2001-2010 (10 years).[1] Age-adjusted rates were selected. Counts of diagnosis related group (DRG) codes 202 through 203 were added for each year by Zip code. Then, the **10 years were averaged**. Since some Zip codes were recently adopted, only the available years were used in the average. The Zip codes asthma hospitalizations were then **divided by the population** estimate provided from the Washington State Office of Financial Management.[2] The result is a rate of hospitalizations per person. This figure is **multiplied by one million** to give a result that is per million people per year for each Zip code.

To merge the Zip code result into a census block group, first, the Zip code data was joined into a block level shapefile (even smaller than census block groups) and the attributes were "averaged". Then, the block level data was joined into the final census block group level shapefile using the "average" again for the attributes. The advantage of going to block level data first is that census block groups on the boundaries can have the average of the blocks within them, creating a more representative result on Zip code boundaries.

Count of the population

B00001001 (used for calculating percentages of total population in sample)

Number of households

B00002001 (used for calculating percentages of total households in sample)

Step 2.

In this step, we assigned quartile classification (equal distribution) with values 0, 1, 2 or 3 for each of the indicator percentages. ¼ of the total data falls into each of the 4 categories' equally. Of the 2775 values, roughly 700 fall into each value category. If a category had more than 25% with "zero" percent, these were assigned a value of "0" and the remainder of the block groups were distributed equally into values 1, 2, and 3.

Example:

Percent minority value = 2
Per capita income value = 2
Percent population <18 value = 1
Percent population >64 value = 0
Percent population without high school diploma value = 1
Percent households with linguistic isolation value = 1
Percent that use wood as their primary heating fuel = 3
Impact from diesel vehicles = 2
Count of registered sources = 3
Impact from sources with air operating permits = 2
Rate of cardiac hospitalizations = 3
Rate of asthma hospitalizations = 2
Rate of COPD hospitalizations = 1

By totaling the 13 values to a final score, the result (in this case) would be "23" for that particular census block group.

Changes from version 1 to version 2:

The table below summarizes the updated years:

Measure	CAT 1.0	CAT 2.0
Census data	ACS 5-yr 2006-2010	ACS 5-yr 2012-2016
Health data	WA DOH CHARS Hospitalizations 2001-2010	WA DOH CHARS Hospitalizations 2005-2014
Industrial sources	Registered sources in 2012	Registered sources in 2018
Vehicle counts	WSDOT 2010	WSDOT 2016

The table below shows all the changes for each measure and the rationale:

Measure	CAT 1.0	CAT 2.0	Rationale
Health measures	Not age-adjusted	Age-adjusted	May have been double counting, since age was also measure by itself
Impact from vehicles	Total vehicle counts, single-road distance weighted (nearest road)	Truck (freight) volume, and multi-road distance weighted	Diesel exhaust has more risk, and was lost on some major truck routes (e.g. SR-99). Also, in old CAT, nearer small roads would overshadow largest
Income	Used median income	Uses percent below Federal Poverty Level	Median may still miss areas with large dichotomies of rich and lower income (e.g. some waterfront properties)
Language	Used percent where household spoke English “less than very well”	Used “Limited-English” as defined by Census	No longer an option to see in the census data

Field cross-walk:

GEOID10:	Census block group ID as text
GeoNum	Census block group ID as a number
RegCount_1	The count of registered sources in the block group
QRegCount	The quartile of the count
AOPDstMile	The distance in miles to the nearest Air Operating Permit source
QAOPDist	The quartile of the distance to the nearest AOP source
Asthma	Asthma-related hospitalization rate per million per year
Cardiac	Cardiac-related hospitalization rate per million per year
COPD	Chronic obstructive pulmonary disease related hospitalization rate per million per year
QAsthma	The quartile of asthma-related hospitalization rate
QCardiac	The quartile of cardiac-related hospitalization rate
QCOPD	The quartile of COPD-related hospitalization rate
FreightDis	Weighted distance to diesel vehicles
QFreightDi	The quartile of diesel vehicle weighted distance
Pop	Population in block group
Households	Household count in block group
PerMinor	Percent minority race
QPerMinori	The quartile of percent minority race
PerUnd18	Percent under 18 years old
QPerUnd18	The quartile of percent under 18 years old
PerOver64	Percent over 64 years old
QPerOver64	The quartile of percent over 64 years old
WoodPerc	Percent that use wood as a primary source of heat
QWoodPer	The quartile of percent that use wood as a primary source of heat
NoHSPer	Percent with no high school diploma (not used in the final CAT score)
QNoHSPer	The quartile of no high school diploma
LEPPerc	Percent limited English proficiency
QLEPPerc	The quartile of percent limited English proficiency
MedIncome	Median Income
QMedIncome	The quartile of median income
FPLPer	Percent of households below the federal poverty level
QFPLPer	The quartile of percent below the federal poverty level
Sum	Sum of all the quartiles (the official CAT score)

Other details for the shapefile CATv2:

PROJCS["NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet",
GEOGCS["GCS_North_American_1983",DATUM["D_North_American_1983",
SPHEROID["GRS_1980",6378137.0,298.257222101]],
PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433]],
PROJECTION["Lambert_Conformal_Conic"],
PARAMETER["False_Easting",1640416.666666667],
PARAMETER["False_Northing",0.0],PARAMETER["Central_Meridian",-120.8333333333333],
PARAMETER["Standard_Parallel_1",47.5],
PARAMETER["Standard_Parallel_2",48.73333333333333],
PARAMETER["Latitude_Of_Origin",47.0],UNIT["Foot_US",0.3048006096012192]]

References:

[1] http://www.doh.wa.gov/DataandStatisticalReports/HealthcareinWashington/HospitalandPatientData/HospitalDischargeDataCHARS.aspx

[2] http://www.ofm.wa.gov/pop/smallarea/