Community Air Tool (CAT) Version 3

Metadata

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Overview:

The Community Air Tool (CAT) is an index used to identify census block group areas within the Puget Sound region (King, Kitsap, Pierce, and Snohomish Counties) characterized by degraded air quality, whose residents face economic or historic barriers to participation in clean air decisions and solutions. The CAT value is based on 13 categories of environmental and demographic data. Data from each category is divided into quartiles and each quartile is assigned a value from 0 to 3. The overall CAT score is the sum of quartile values across all 13 categories, with a range from 0-36. The higher the indicator score, the greater the anticipated burden on the community.

Acknowledgement: Kishore Madhipatla, who helped geocode registered sources.

Version History:

- 2012: Community Air Tool (CAT) Version 1 created.
- August 2018: CAT Version 2 update completed. Data and methodology were both updated (Tables 1-2).
- April 2020: CAT Version 2.1 update completed. Data and methodology were not changed, but the metadata and web interface were updated.
- March 2025: CAT Version 3 update completed. No significant methodology changes from version 2.

Methodology:

Data Sources

Identified which Census Summary categories were to be included (and downloaded from the Census Bureau) in the calculation. These data were from the US Census Bureau's American Community Survey (ACS) 2019-2023. Reference codes below are Table IDs from the ACS.[1]

Percentages were calculated by dividing category population by total population (census reference code B00001001) for each census block group or, the percentage is on a per-household basis, dividing category households by total households (reference code B00002001). For example, if a block group has a "linguistically isolated" population of 50 out of a total population of 500, the "linguistically isolated" percentage would be 10%.

Indicators included in CAT Score

Percent minority

"Race", reference code B02001

The sum of reference codes B02001003 through B02001008. **Divided by** population (reference code B00001001).

Federal Poverty Level

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

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).

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[1] https://www.census.gov/content/dam/Census/library/publications/2019/acs/acs_summary-file_handbook_2019_ch03.pdf

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 of households that use wood 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 analysis to better capture the increased risk from diesel exhaust. Version 3 is the same as version 2, except using the 2023 WSDOT Freight shapefile.

The methodology is described in detail here on page 73 of the Agency's Near-Road Air Toxics Study in the Chinatown-International District report.[2]

This was the methodology from version 1:

Downloaded 2010 Traffic Segment GIS Shapefiles from the Washington State Department of Transportation (WS DOT).[3] 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 2024). 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.

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[2]http://www.pscleanair.org/DocumentCenter/View/3398/Air-Toxics-Study-in-the-Chinatown-International-District-Full-Report
[3]http://www.wsdot.wa.gov/mapsdata/geodatacatalog/default.htm

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 March 2025). Sources without air operating permits and 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 2016-2023 (8 years) via the Community Health Assessment Tool.[4] 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 **8 years were averaged**. Since some ZIP codes were recently adopted, only the available years were used in the average. The result is an annual rate of hospitalizations per 100,000 persons for each ZIP code. That figure is **divided by ten** to give a result of annual cardiac hospitalizations per million people for each ZIP code.

To divide the ZIP code result into census block group units, first, the ZIP code layer was joined into a block level shapefile (even smaller than census block groups) and the attributes were "averaged". Then, the block level data were joined into the census block group level shapefile using the "average" again for the attributes. This approach of converting first to the block level geography and then to block groups produces more accurate results along ZIP code boundaries than converting directly from ZIP code to block group.

Rate of COPD hospitalizations

We used the Washington State Department of Health's Comprehensive Hospital Abstract Reporting System (CHARS) data from 2016-2023 (8 years) via the Community Health Assessment Tool.[4] 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 **8 years were averaged**. Since some ZIP codes were recently adopted, only the available years were used in the average. The result is an annual rate of hospitalizations per 100,000 persons for each ZIP code. That figure is **divided by ten** to give a result of annual cardiac hospitalizations per million people for each ZIP code.

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[4] https://www.doh.wa.gov/DataandStatisticalReports/HealthcareinWashington/HospitalandPatientData/Hospital Dis

Rate of asthma hospitalizations

We used the Washington State Department of Health's Comprehensive Hospital Abstract Reporting System (CHARS) data from 2016-2023 (8 years) via the Community Health Assessment Tool.[4] 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 **8 years were averaged**. Since some ZIP codes were recently adopted, only the available years were used in the average. The result is an annual rate of hospitalizations per 100,000 persons for each ZIP code. That figure is **divided by ten** to give a result of annual cardiac hospitalizations per million people for each ZIP code.

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Indicators used as background information

Number of households

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

Total population

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

Analysis

Each indicator included in the CAT score was divided into quartiles, which were assigned scores of 0, 1, 2, and 3. There are 2,924 block groups within the four-county Puget Sound region, meaning that there are roughly 700 in each quartile. If more than 25% of the block groups had a zero value or percentage for any indicator, those were all assigned a score of 0 and the remainder of the block groups were distributed equally into quantiles and given scores of 1, 2, and 3, respectively. Once every block group had been scored for every indicator, the CAT score was calculated as the sum of the 13 indicator scores.

Example:

Percent minority value = 2
Percent households below federal poverty level 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

Total (CAT Score) = 23

Field Glossary:

countyfp20	Census County ID
intptlat20	Latitude
intptlon20	Longitude
land_acres	Area in acres
GeoIDtext	Census block group ID as text
GeoIDNum	Census block group ID as a number
Population	Population in block group
Households	Household count in block group
U18Perc	Percent under 18 years old
U18Qtile	The quartile of percent under 18 years old
O64Perc	Percent over 64 years old
O64Qtile	The quartile of percent over 64 years old
LessHSPerc	Percent with no high school diploma (not used in the final CAT score)
LessHSQtil	The quartile of no high school diploma
FPLPerc	Percent of households below the federal poverty level
FPLQtile	The quartile of percent below the federal poverty level
LangPerc	Percent limited English proficiency
LangQtile	The quartile of percent limited English proficiency
MinorPerc	Percent minority race
MinorQtile	The quartile of percent minority race
WoodPerc	Percent that use wood as a primary source of heat
WoodQtile	The quartile of percent that use wood as a primary source of heat
TonnQtle	The quartile of diesel vehicle weighted distance
RegCount	The count of registered sources in the block group
RegCoQtle	The quartile of the count
AOPQtle	The quartile of the distance to the nearest AOP source
AsthmaRate	Asthma-related hospitalization rate per million per year
AsthmaQtle	The quartile of asthma-related hospitalization rate
COPDRate	Chronic obstructive pulmonary disease related hospitalization rate per million per year
COPDQtle	The quartile of COPD-related hospitalization rate
CardRate	Cardiac-related hospitalization rate per million per year
CardQtle	The quartile of cardiac-related hospitalization rate
SumAll	Sum of all the quartiles (the official CAT score)

Other details for the shapefile CATv3:

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