**Displacement Risk Index**

**Puget Sound Region**

**2022**

**Methodology**

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# Indicators

## Indicator 01 - People of color

From ACS table B03002, we can estimate the percentage of population that is a race other than non-Hispanic White (per\_minority) by tract. The table has estimates and margin of errors for the following indicators:

* Total number of people by tract (pop)
* Total number of Hispanic White people by tract (hw)
* Total number of non-Hispanic White people by tact (nhw)
* Total number of Hispanic people by tract (h)
* Total number of non-Hispanic people by tract (nh)

With these values, the percentage of people that is a race other than non-Hispanic White (per\_minority) by tract is estimated as:

|  |  |  |
| --- | --- | --- |
| **Summary - Indicator 01** | | |
| **Description** |  | Percent of population that is a race other than non-Hispanic White by tract |
| **Source** |  | American Community Survey/Tidycensus |
| **Table** |  | B03002 |
| **Year** |  | 2014-2019 |
| **Quintiles** | 0% | 4% |
|  | 20% | 19% |
|  | 40% | 27% |
|  | 60% | 38% |
|  | 80% | 5% |
|  | 100% | 91% |
| **Classification** | 0 | >20% |
|  | 1 | 20 - 30% |
|  | 2 | 30 - 40% |
|  | 3 | 40 - 50% |
|  | 4 | >50% |

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Chart, histogram

Description automatically generated

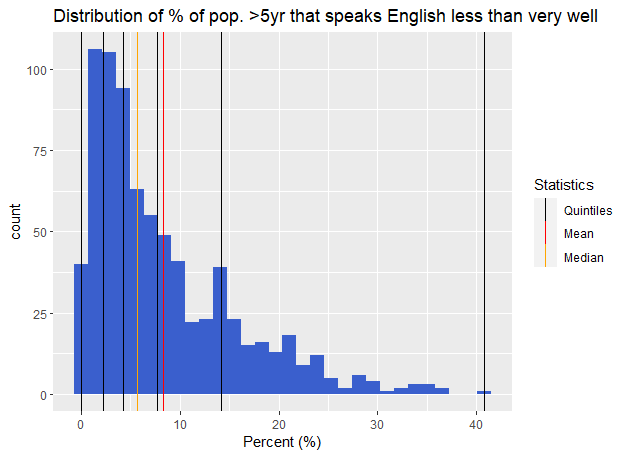
## Indicator 02 – Linguistic Isolation

From ACS table C16001, we can estimate the percent of population 5+ that speak English less than very well by tract (per\_noeng). The table has estimates and margin of errors for the following indicators:

* Total number of people >= 5 years old by tract (pop5)
* People that speak Spanish and English less than very well (spn)
* People that speak French, Haitian or Cajun, and English less than very well (frn)
* People that speak German or other West Germanic Language, and English less than very well (ger)
* People that speak Russian, Polish or other Slavic language, and English less than very well (rus)
* People that speak other Indo-European languages, and English less than very well (eur)
* People that speak Korean and English less than very well (kor)
* People that speak Mandarin or Cantonese, and English less than very well (chn)
* People that speak Vietnamese and English less than very well (vnm)
* People that speak Tagalog and English less than very well (tag)
* People that speak Other Asian and Pacific Island languages, and English less than very well (asn)
* People that speak Arabic and English less than very well (arb)
* People that speak other and unspecified languages, and English less than very well (oth)

With these values, the population 5+ that speak English less than very well by tract (per\_noeng) is simply estimated as the number of people that speak other languages than English, and English less than very well:

|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 02** | | |
| **Description** |  | Percent of population 5+ that speak English less than very well by tract |
| **Source** |  | American Community Survey/Tidycensus |
| **Table** |  | C16001 |
| **Year** |  | 2014-2019 |
| **Quintiles** | 0% | 0% |
|  | 20% | 2% |
|  | 40% | 4% |
|  | 60% | 8% |
|  | 80% | 14% |
|  | 100% | 41% |
| **Classification** | 0 | <4% |
|  | 1 | 4 – 8% |
|  | 2 | 8 – 12% |
|  | 3 | 12 – 16% |
|  | 4 | >16% |

.

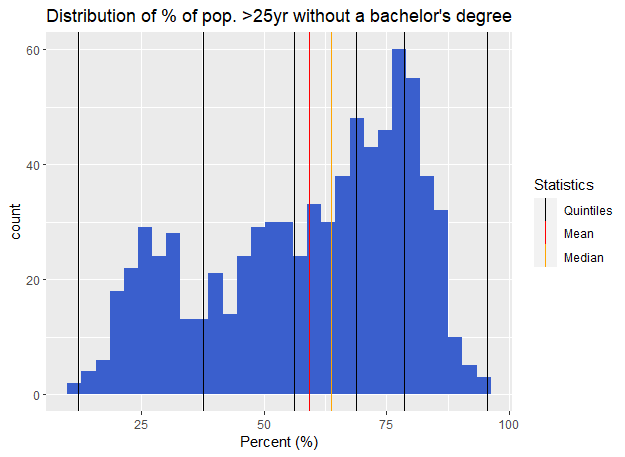
## Indicator 03 – Educational attainment

From ACS table B15003, we can estimate the percent of population 25+ who lack a bachelor’s degree by tract (per\_nobac). The table has estimates and margin of errors for the following indicators:

* Total number of people by tract (pop)
* People 25+ that hold a bachelor’s degree (bac)
* People 25+ that hold a master’s degree (mas)
* People 25+ that hold a Professional school degree (pro)
* People 25+ that hold a Doctorate degree (phd)

With these values, the percent of population 25+ who lack a bachelor’s degree by tract (per\_nobac) is estimated as the difference between the population and the population that hold a bachelor’s degree or higher:

|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 03** | | |
| **Description** |  | Percent of population 25+ who lack a bachelor’s degree |
| **Source** |  | American Community Survey/Tidycensus |
| **Table** |  | B15003 |
| **Year** |  | 2014-2019 |
| **Quintiles** | 0% | 12% |
|  | 20% | 38% |
|  | 40% | 56% |
|  | 60% | 69% |
|  | 80% | 79% |
|  | 100% | 95% |
| **Classification** | 0 | <15% |
|  | 1 | 35 - 50% |
|  | 2 | 50 - 65% |
|  | 3 | 65 - 80% |
|  | 4 | >80% |



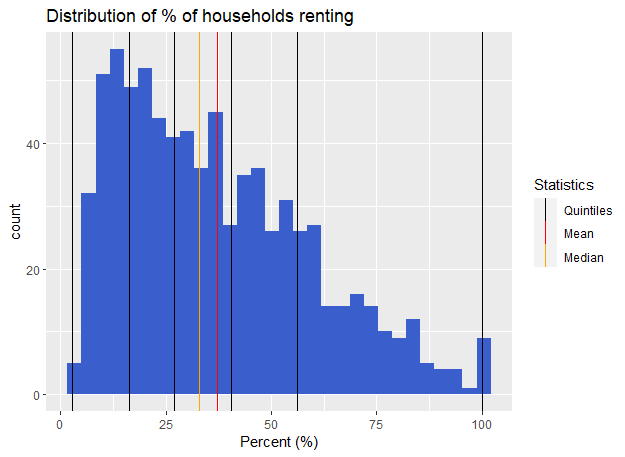
## Indicator 04 – Housing Tenancy

To estimate the percent of households that are renters by tract (per\_rent), the calculation is straightforward since the ACS table B25003 already contains the information needed:

* Total number of households by tract (hh)
* Total number of households that are renters by tract (rent)

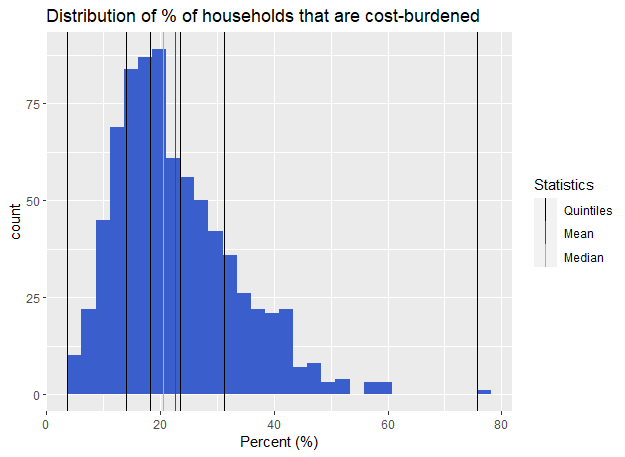
The percent of households that are renters by tract (per\_rent) is estimated as:

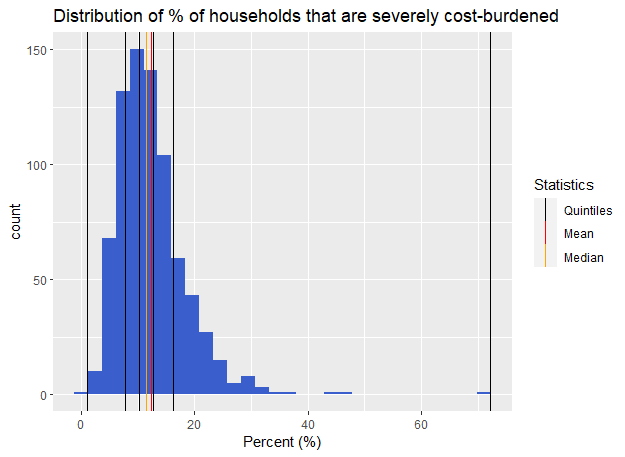
|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 04** | | |
| **Description** |  | Percent of households that are renters |
| **Source** |  | American Community Survey/Tidycensus |
| **Table** |  | B25003 |
| **Year** |  | 2012-2016 |
| **Quintiles** | 0% | 3% |
|  | 20% | 16% |
|  | 40% | 27% |
|  | 60% | 41% |
|  | 80% | 56% |
|  | 100% | 100% |
| **Classification** | 0 | <15% |
|  | 1 | 15 - 30% |
|  | 2 | 30 - 45% |
|  | 3 | 45 - 60% |
|  | 4 | >60% |



## Indicator 05 – Cost-burdened households (cost-burdened and severely cost-burdened households)

|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 05** | | |
| **Description** |  | Cost-burdened households: Percent of households with income <80% of area median income (AMI) paying >30% of income on housing.  Severely Cost-burdened households: Percent of households with income <80% of AMI paying >50% of income on housing. |
| **Source** |  | Comprehensive Household Affordability Strategy data (CHAS) |
| **Link to download** |  | https://www.huduser.gov/portal/datasets/cp/2014thru2018-140-csv.zip |
| **Year** |  | 2014-2018 |
| **Cost-burdened households** | | |
| **Quintiles** | 0% | 4% |
|  | 20% | 14% |
|  | 40% | 18% |
|  | 60% | 23% |
|  | 80% | 31% |
|  | 100% | 76% |
| **Classification** | 0 | <10% |
|  | 1 | 10 – 15% |
|  | 2 | 15 – 20% |
|  | 3 | 20 – 25% |
|  | 4 | >25% |
| **Severely cost-burdened households** | | |
| **Quintiles** | 0% | 1% |
|  | 20% | 8% |
|  | 40% | 10% |
|  | 60% | 13% |
|  | 80% | 16% |
|  | 100% | 72% |
| **Classification** | 0 | <10% |
|  | 1 | 10 – 15% |
|  | 2 | 15 – 20% |
|  | 3 | 20 – 25% |
|  | 4 | >25% |





Data on cost-burdened household can be downloaded from the CHAS database. This database can be downloaded from the U.S. Department of Housing and Urban Development [website](https://www.huduser.gov/portal/datasets/cp.html#2006-2015_data). The data can be downloaded by using the R script (DataGen\_05\_CostBurden.R) or it can be done manually as followed[[1]](#footnote-1):

Graphical user interface, text, application, email

Description automatically generated

The CHAS database contains several files, but we only need two:

* **CHAS data dictionary 14-18.xlsx**

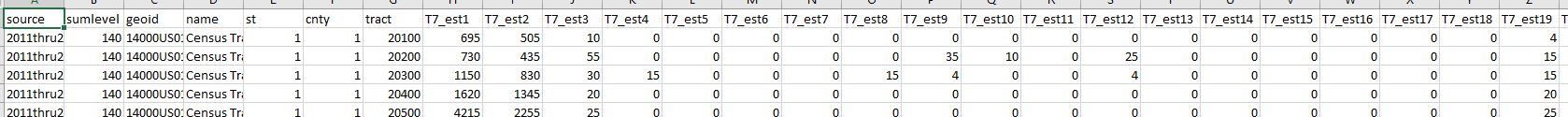
This file contains the data dictionary. This database is useful to read the data and choose the right variables/column names.

A picture containing calendar

Description automatically generated

* **Table7.csv**

We are only interested in Table 7, since it contains the information related to Cost Burden and Household income.

 The columns in Table 7 are named with codes that include a T7\_est(#) label. In order to choose the right columns, we identified the labels from the CHAS data dictionary as followed.

* **Cost-burdened households:**

Such households have a housing cost burden that is greater than 30% and a household income that is less than or equal to 80% of Housing Urban Development Area Median Family Income (HAMFI). The Table 7 column labels for these households are:

* T7\_est6, T7\_est7, T7\_est11, T7\_est12, T7\_est16, T7\_est17, T7\_est21,

T7\_est22, T7\_est26, T7\_est27, T7\_est32, T7\_est33, T7\_est37, T7\_est38,

T7\_est42, T7\_est43, T7\_est47, T7\_est48, T7\_est52, T7\_est53, T7\_est58,

T7\_est59, T7\_est63, T7\_est64, T7\_est68, T7\_est69, T7\_est73, T7\_est74,

T7\_est78, T7\_est79, T7\_est137, T7\_est138, T7\_est142, T7\_est143,

T7\_est147, T7\_est148, T7\_est152, T7\_est153, T7\_est157, T7\_est158,

T7\_est163, T7\_est164, T7\_est168, T7\_est169, T7\_est173, T7\_est174,

T7\_est178, T7\_est179, T7\_est183, T7\_est184, T7\_est189, T7\_est190,

T7\_est194, T7\_est195, T7\_est199, T7\_est200, T7\_est204, T7\_est205,

T7\_est209, T7\_est210

Summing these columns will result in the number of cost-burdened households by

tract (cb).

* **Severely Cost-burdened households:**

Such households have a housing cost burden that is greater than 50% and a household income that is less than or equal to 80% of HAMFI. The Table 7 column labels for this households are:

* + - T7\_est7, T7\_est12, T7\_est17, T7\_est22, T7\_est27, T7\_est33, T7\_est38,

T7\_est43, T7\_est48, T7\_est53, T7\_est59, T7\_est64, T7\_est69, T7\_est74,

T7\_est79, T7\_est138, T7\_est143, T7\_est148, T7\_est153, T7\_est158,

T7\_est164, T7\_est169, T7\_est174, T7\_est179, T7\_est184, T7\_est190,

T7\_est195, T7\_est200, T7\_est205, T7\_est210.

Summing these columns will result in the number of severely cost-burdened

households by tract (scb).

* + **Other labels:**

The last value that we used for this analysis contains the number of households by tract (hh). The column label for this value is T7-est1.

With these values, the percent of percent of cost-burdened households and severely cost-burdened households is:

Percent of Cost-burdened households by tract:

Percent of Severely Cost-burdened households by tract:

## Indicator 06 – Household income

Table S1701 is not available in the tidycensus R library, for this reason it was directly downloaded from the ACS [website](https://data.census.gov/cedsci/). We entered the table id into the search field, then specified the year as “2019: ACS 5-Year Estimates Subject Tables” (see image below)

A screenshot of a computer

Description automatically generated

and geography as Geography > Summary Levels > 140 Census Tract (see image below) > Washington > All Census Tracts within Washington.

Graphical user interface, text, application

Description automatically generated

After applying these filters and downloading the data, the ACS website provides a folder with several files; however, we only need the one named ACSST5Y2019.S1701\_data\_with\_overlays\_2022-05-03T014840.csv (renamed to ACS\_19\_5YR\_S1701.csv in the 06-HouseholdIncome data folder).

From this .csv file we need the values labeled as:

* **S1701\_C01\_042E**

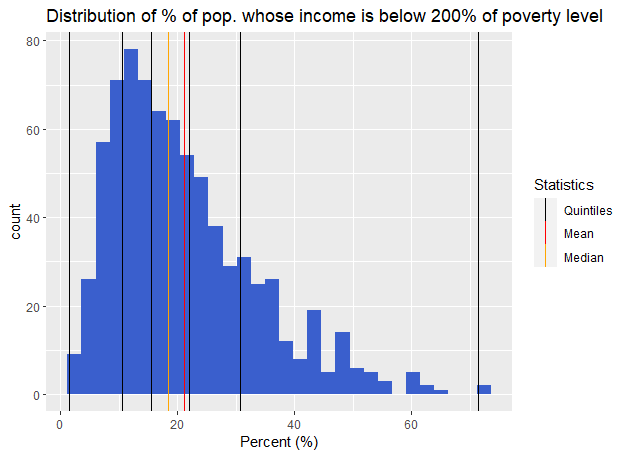
This value contains the population for whom poverty status is determined by tract (pop\_pov)

* **S1701\_C01\_001E**

This value contains the number of individuals with income below the 200 percent of poverty level (pov200)

With these values, the percent of population whose income is below 200% (per\_pov200) of poverty level) is:

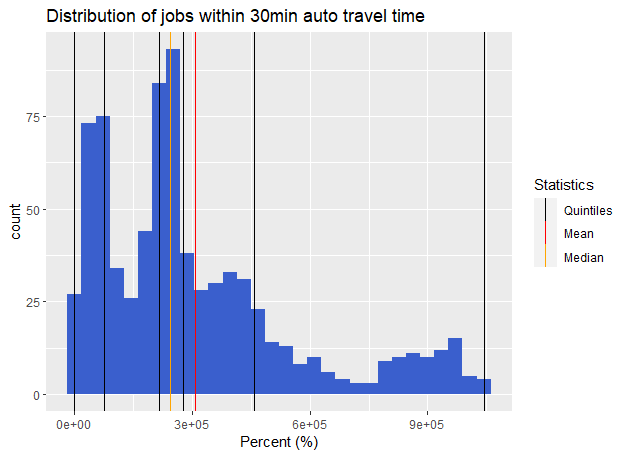
|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 06** | | |
| **Description** |  | Percent of population whose income is below 200% of poverty level |
| **Source** |  | American Community Survey |
| **Table** |  | S1701 |
| **Year** |  | 2014-2019 |
| **Quintiles** | 0% | 1% |
|  | 20% | 11% |
|  | 40% | 16% |
|  | 60% | 22% |
|  | 80% | 31% |
|  | 100% | 71% |
| **Classification** | 0 | <8% |
|  | 1 | 8 – 16% |
|  | 2 | 16 – 24% |
|  | 3 | 24 – 32% |
|  | 4 | >32% |

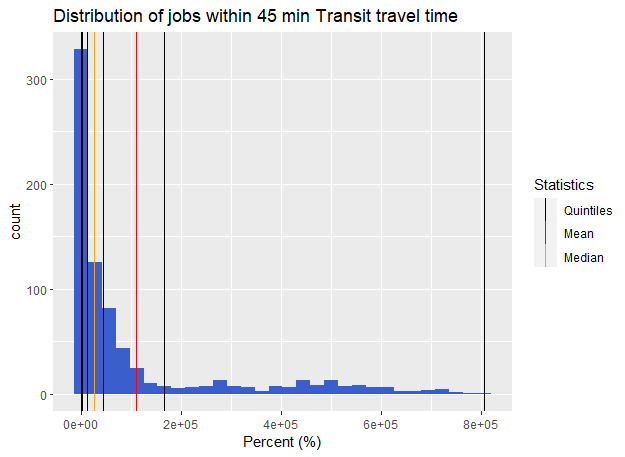


## Indicator 07 – Proximity to job center

This indicator was created internally by PSRC using SoundCast modeling. Contact SoundCast developers to generate this dataset for the most recent base year.

|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 07** | | |
| **Description** |  | Proximity to jobs by auto: Number of jobs within 30 min travel time by auto  Proximity to jobs by transit: Number of jobs within 45 min travel time by transit (includes walking and waiting time) |
| **Source** |  | PSRC |
| **Year** |  | 2018 base year |
| **Jobs by Auto** | | |
| **Quintiles** | 0% | 0 |
|  | 20% | 75,642 |
|  | 40% | 215,139 |
|  | 60% | 276,182 |
|  | 80% | 458,013 |
|  | 100% | 1,043,309 |
| **Classification** | 0 | <75K |
|  | 1 | 75 – 200K |
|  | 2 | 200 – 325K |
|  | 3 | 325 – 450K |
|  | 4 | >450K |
| **Jobs by Transit** | | |
| **Quintiles** | 0% | 0 |
|  | 20% | 1,119 |
|  | 40% | 12,030 |
|  | 60% | 43,562 |
|  | 80% | 167,010 |
|  | 100% | 806,537 |
| **Classification** | 0 | <1K |
|  | 1 | 1 – 13K |
|  | 2 | 13 – 43K |
|  | 3 | 43 – 200K |
|  | 4 | >200K |

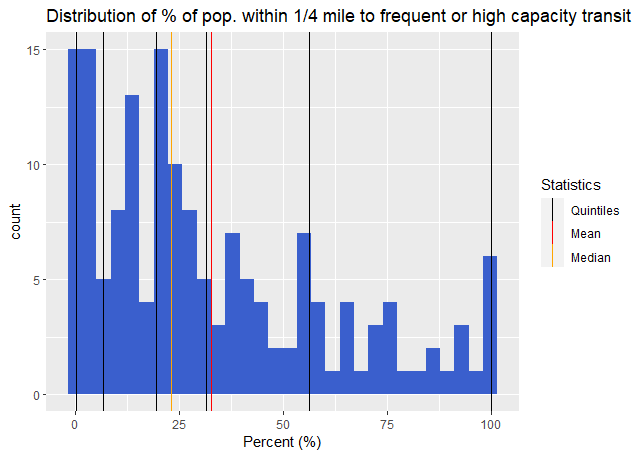
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## Indicator 08 – Proximity to transit

This indicator was created internally by PSRC using SoundCast modeling. Contact SoundCast developers to generate this dataset for the most recent base year.

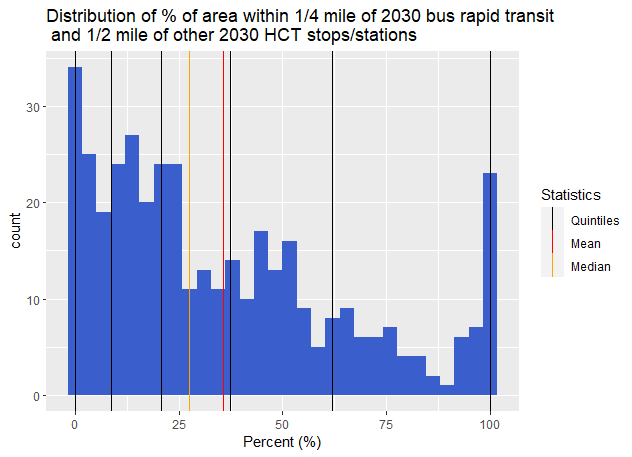
|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 08** | | |
| **Description** |  | Percent of population within ¼ mile to frequent or high-capacity transit |
| **Source** |  | PSRC |
| **Year** |  | 2018 base year |
| **Quintiles** | 0% | 0% |
|  | 20% | 7% |
|  | 40% | 20% |
|  | 60% | 32% |
|  | 80% | 56% |
|  | 100% | 100% |
| **Classification** | 0 | <6% |
|  | 1 | 6%-24% |
|  | 2 | 24%-42% |
|  | 3 | 42%-60% |
|  | 4 | >60% |

*****Note: Tracts with 0% of the population within ¼ mi. to frequent or high-capacity transit have been excluded in the figure above.*

## Indicator 09 – Proximity to current or future link light rail & streetcar

This indicator was created internally by PSRC using SoundCast modeling. Contact SoundCast developers to generate this dataset for the most recent base year.

|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 09** | | |
| **Description** |  | Percent of area within ¼ mile of 2030 bus rapid transit (BRT) and ½ mile of other 2030 high-capacity transit (HCT) stops/stations |
| **Source** |  | PSRC |
| **Year** |  | 2030 |
| **Quintiles** | 0% | 1% |
|  | 20% | 9% |
|  | 40% | 21% |
|  | 60% | 37% |
|  | 80% | 56% |
|  | 100% | 100% |
| **Classification** | 0 | <6% |
|  | 1 | 6%-24% |
|  | 2 | 24%-42% |
|  | 3 | 42%-60% |
|  | 4 | >60% |

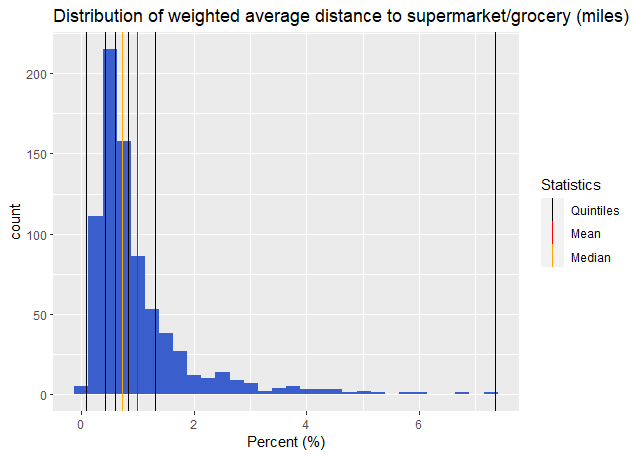
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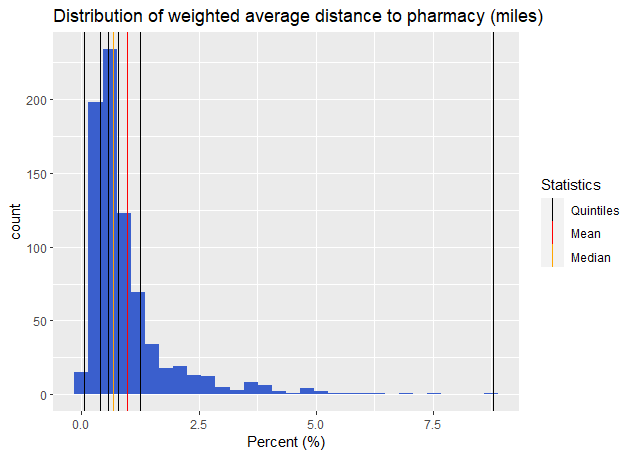
*Note: Tracts with 0% of area within ¼ mi. to 2030 BRT and ½ mi. to 2030 HCT have been excluded in the figure above.*

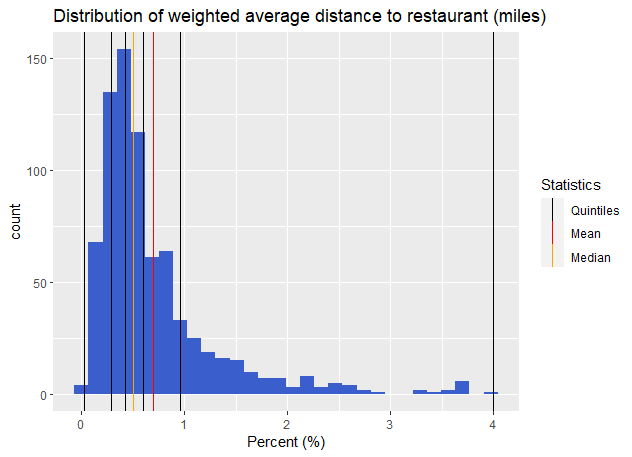
## Indicator 10 – Proximity to core business

This indicator was created internally by PSRC.

|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 10** | | |
| **Description** |  | Proximity to supermarket/grocery: Location within ½ miles of supermarket/grocery  Proximity to pharmacy Location within ¼ miles of pharmacy  Proximity to restaurant/café/dinner: Location within ¼ miles of restaurant/café/dinner |
| **Source** |  | Google maps, PSRC |
| **Year** |  | 2018 |
| **Proximity to supermarket/grocery** | | |
| **Quintiles** | 0% | 0.07 |
|  | 20% | 0.42 |
|  | 40% | 0.59 |
|  | 60% | 0.82 |
|  | 80% | 1.31 |
|  | 100% | 7.35 |
| **Classification** | 0 | >1.20 mi |
|  | 1 | 0.80 – 1.20 mi |
|  | 2 | 0.60 – 0.80 mi |
|  | 3 | 0.40 – 0.60 mi |
|  | 4 | <0.40 mi |
| **Proximity to pharmacy** | | |
| **Quintiles** | 0% | 0.05 |
|  | 20% | 0.40 |
|  | 40% | 0.56 |
|  | 60% | 0.78 |
|  | 80% | 1.25 |
|  | 100% | 8.78 |
| **Classification** | 0 | >1.20 mi |
|  | 1 | 0.80 – 1.20 mi |
|  | 2 | 0.60 – 0.80 mi |
|  | 3 | 0.40 – 0.60 mi |
|  | 4 | <0.40 mi |
| **Proximity to restaurants** | | |
| **Quintiles** | 0% | 0.03 |
|  | 20% | 0.28 |
|  | 40% | 0.42 |
|  | 60% | 0.60 |
|  | 80% | 0.95 |
|  | 100% | 4.00 |
| **Classification** | 0 | >1.00 mi |
|  | 1 | 0.75 – 1.00 mi |
|  | 2 | 0.50 – 0.75 mi |
|  | 3 | 0.25 – 0.50 mi |
|  | 4 | <0.25 mi |

****

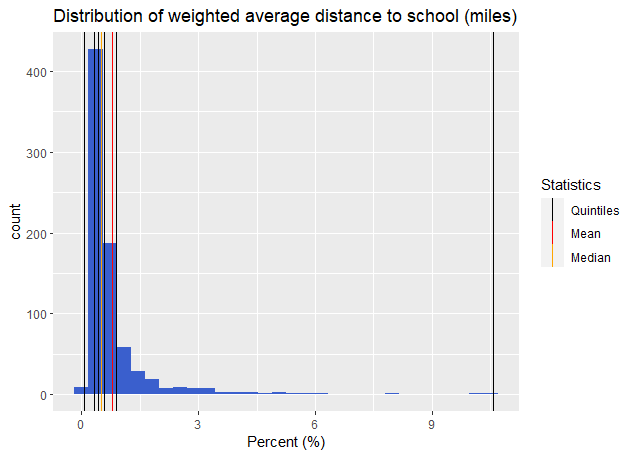
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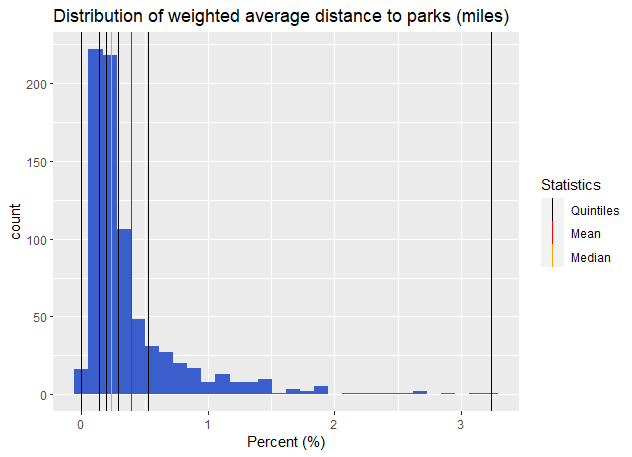
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## Indicator 11 – Proximity to civic infrastructure

This indicator was created internally by PSRC. See Y:\VISION 2050\Data\Displacement\Displacement Index 2021\docs\ByIndicator\11-Proximity to Civic Infrastructure for documentation. Note that for the 2021 update, only the “schools” portion was updated – the “parks” numbers were kept the same. Additionally, note that the scripts to process the proximity to schools indicator are the only scripts done in Python.

|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 11** | | |
| **Description** |  | Proximity to schools: Weighted average distance to nearest public school  Proximity to parks: Weighted average distance to nearest park |
| **Source** |  | PSRC |
| **Year** |  | 2018 |
| **Proximity to Schools** | | |
| **Quintiles** | 0% | 0.07 |
|  | 20% | 0.33 |
|  | 40% | 0.44 |
|  | 60% | 0.57 |
|  | 80% | 0.89 |
|  | 100% | 10.6 |
| **Classification** | 0 | >1.00 mi |
|  | 1 | 0.80 – 1.00 mi |
|  | 2 | 0.60 – 0.80 mi |
|  | 3 | 0.40 – 0.60 mi |
|  | 4 | < 0.40 mi |
| **Proximity to parks** | | |
| **Quintiles** | 0% | 0 |
|  | 20% | 0.14 |
|  | 40% | 0.20 |
|  | 60% | 0.29 |
|  | 80% | 0.53 |
|  | 100% | 3.23 |
| **Classification** | 0 | >0.60 mi |
|  | 1 | 0.45 – 0.60 mi |
|  | 2 | 0.30 – 0.45 mi |
|  | 3 | 0.15 – 0.30 mi |
|  | 4 | <0.15 mi |





## Indicator 12 – Proximity to high-income neighborhood

|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 12** | | |
| **Description** |  | Census tracts that have a median household income <80% of AMI and abut a tract where median household is >120% of AMI |
| **Source** |  | American Community Survey/Tidycensus |
|  | Table | B19113 |
| **Year** |  | 2014-2019 |
| **Quintiles** |  | Do not apply, 0 and 1 only values |
| **Classification** | 0 | Other tracts |
|  | 4 | Census tract has a median household income <80% of AMI and abut a tract where median household is >120% of AMI |

ACS table B19113 contains the median family income. This estimate was used instead of median household income because it takes into consideration household size. Additionally, CHAS uses the same value for their cost burden analysis. From table B19113 we can estimate the ratio of median household income by tract, to the median household income by county. The table has estimates and margin of errors for the following indicators:

* Median family income by county (inc\_cty)
* Median family income by tract (inc\_trc)

With these values, we estimated the income ratio and then classified the results by three different levels:

|  |  |
| --- | --- |
| **Classification** | **Description** |
|  | Census tract that have a median household income <= 80% of AMI |
|  | Census tract that have a median household income between 80% to 120% of AMI |
|  | Census tract that have a median household income >= 120% of AMI |

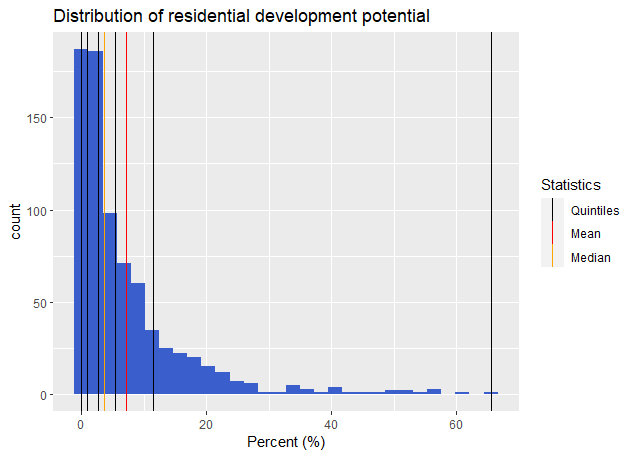
Finally, we identified tracts with an income ratio under 80% of AMI that are neighbors of tracts with an income ratio over 120% of AMI using the function st\_touches() in the sf packages in R.

|  |  |
| --- | --- |
| **Classification** | **Number of tracts** |
| Census tracts that have a median household income <80% of AMI and abut a tract where median household is >120% of AMI | 59 |
| Other tracts | 714 |

## Indicator 13 – Development capacity

This indicator was created internally by PSRC. See Y:\VISION 2050\Data\Displacement\Displacement Index 2021\docs\ByIndicator\DevelopmentCapacity\_BY2018-2021-11-29.pdf for documentation.

|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 13** | | |
| **Description** |  | Residential development potential based on the difference (and percentage) between existing and zoned capacity |
| **Source** |  | PSRC |
| **Year** |  | 2018 base year |
| **Quintiles** | 0% | 0% |
|  | 20% | 1% |
|  | 40% | 3% |
|  | 60% | 5% |
|  | 80% | 11% |
|  | 100% | 65% |
| **Classification** | 0 | <1% |
|  | 1 | 1 – 4% |
|  | 2 | 4 – 7% |
|  | 3 | 7 – 10% |
|  | 4 | >10% |



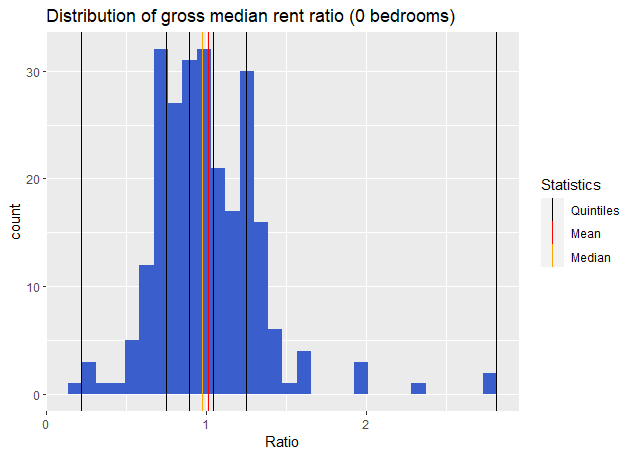
## Indicator 14 – Median rent

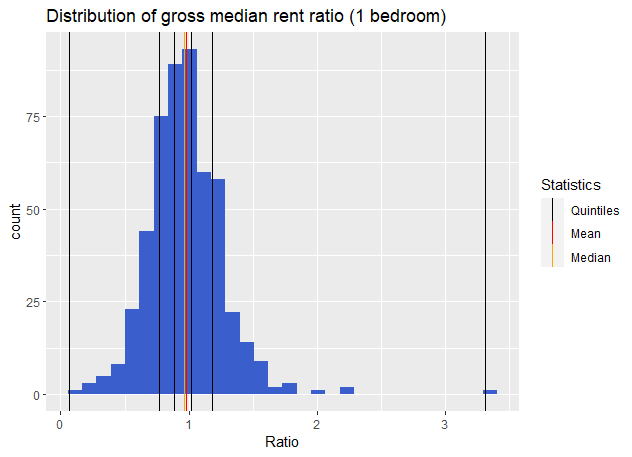
From ACS table B25031, we can estimate the ratio of gross median rent by tract, to the gross median rent by county. This estimation is made for different house sizes (from 0 bedrooms to 5 and more). The table has estimates and margin of errors for the following indicators:

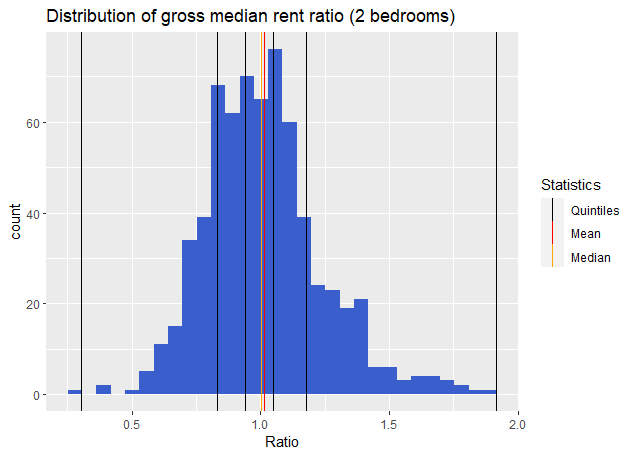
* Gross Median Rent (GMR) – 0 bedrooms (by tract and by county)
* Gross Median Rent (GMR) – 1 bedroom (by tract and by county)
* Gross Median Rent (GMR) – 2 bedrooms (by tract and by county)
* Gross Median Rent (GMR) – 3 bedrooms (by tract and by county)
* Gross Median Rent (GMR) – 4 bedrooms (by tract and by county)
* Gross Median Rent (GMR) – +5 bedrooms (by tract and by county)

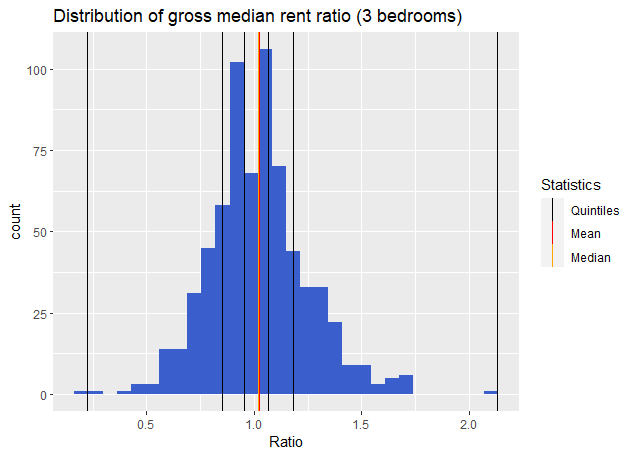
With these values, the gross median rent ratio is estimated as

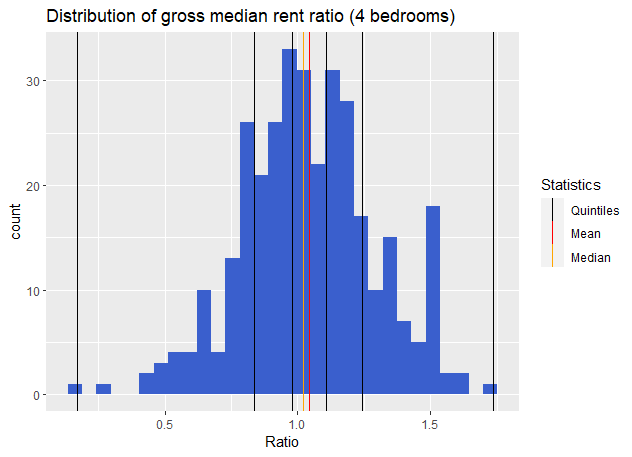
|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 14** | | |
| **Description** |  | Ratio of tract median gross rent to county median gross rent, by # of bedrooms |
| **Source** |  | American Community Survey/Tidycensus |
| **Year** |  | 2014-2019 |
| **Gross median rent no bedrooms** | | |
| **Quintiles** | 0% | 0.22 |
|  | 20% | 0.75 |
|  | 40% | 0.89 |
|  | 60% | 1.04 |
|  | 80% | 1.25 |
|  | 100% | 2.81 |
| **Classification** | 0 | <0.75 |
|  | 1 | 0.75-0.80 |
|  | 2 | 0.80-0.85 |
|  | 3 | 0.85-0.90 |
|  | 4 | >0.90 |
| **Gross median rent 1 bedroom** | | |
| **Quintiles** | 0% | 0.07 |
|  | 20% | 0.77 |
|  | 40% | 0.89 |
|  | 60% | 1.02 |
|  | 80% | 1.19 |
|  | 100% | 3.31 |
| **Classification** | 0 | <0.75 |
|  | 1 | 0.75-0.80 |
|  | 2 | 0.80-0.85 |
|  | 3 | 0.85-0.90 |
|  | 4 | >0.90 |
| **Gross median rent 2 bedrooms** | | |
| **Quintiles** | 0% | 0.30 |
|  | 20% | 0.83 |
|  | 40% | 0.94 |
|  | 60% | 1.05 |
|  | 80% | 1.18 |
|  | 100% | 1.92 |
| **Classification** | 0 | <0.75 |
|  | 1 | 0.75-0.80 |
|  | 2 | 0.80-0.85 |
|  | 3 | 0.85-0.90 |
|  | 4 | >0.90 |
| **Gross median rent 3 bedrooms** | | |
| **Quintiles** | 0% | 0.23 |
|  | 20% | 0.85 |
|  | 40% | 0.95 |
|  | 60% | 1.07 |
|  | 80% | 1.18 |
|  | 100% | 2.13 |
| **Classification** | 0 | <0.75 |
|  | 1 | 0.75-0.80 |
|  | 2 | 0.80-0.85 |
|  | 3 | 0.85-0.90 |
|  | 4 | >0.90 |
| **Gross median rent 4 bedrooms** | | |
| **Quintiles** | 0% | 0.17 |
|  | 20% | 0.84 |
|  | 40% | 0.98 |
|  | 60% | 1.11 |
|  | 80% | 1.24 |
|  | 100% | 1.73 |
| **Classification** | 0 | <0.75 |
|  | 1 | 0.75-0.80 |
|  | 2 | 0.80-0.85 |
|  | 3 | 0.85-0.90 |
|  | 4 | >0.90 |
| **Gross median rent +5 bedrooms** | | |
| **Quintiles** | 0% | 0.41 |
|  | 20% | 0.89 |
|  | 40% | 1.02 |
|  | 60% | 1.16 |
|  | 80% | 1.34 |
|  | 100% | 1.53 |
| **Classification** | 0 | <0.75 |
|  | 1 | 0.75-0.80 |
|  | 2 | 0.80-0.85 |
|  | 3 | 0.85-0.90 |
|  | 4 | >0.90 |

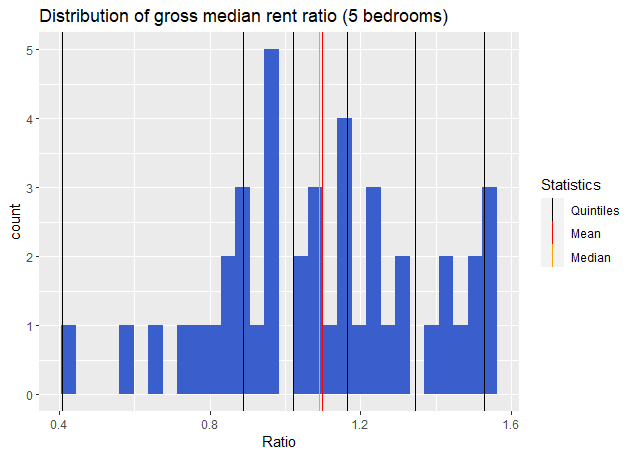












## Indicator 15 – Voter turnout

### Calculation:

This indicator reflects the percent of all people in the tract, regardless of age or citizenship status, who voted. We use this percentage in the index to approximate civic engagement. Calculating this figure by tract requires aggregation from the precinct to the tract level using a weighted scheme.

We collect data on the number of votes cast for the 2020 Presidential election by precinct, *Vprecinct*. We also use 2018 UrbanSim baseyear data to calculate the population in each precinct, *popprecinct*. Then, for each precinct, we can calculate the precinct voter turnout, *Tprecinct*, as

.

From here, for each tract we identify the precincts intersecting it and calculate the tract’s turnout, *Ttract*, as a weighted sum of those precincts’ turnouts. The weight for each precinct, *Wi,* is the percent of the tract’s residential units that fall in that precinct. Thus, where *i* represents one of the intersecting precincts, we have

The steps for these calculations are

1. Download election data (.csv) and total votes cast in Presidential election by precinct, *Vprecinct*
2. Download precinct shapefile (.shp) and join it to election data by precinct
3. Connect to the 2018\_parcel\_baseyear\_rtp database and download “households,” “buildings,” and “parcels” (containing parcel centroids) datasets. Join households and buildings datasets to calculate the total population and residential units by parcel id. Join these values to parcels dataset by parcel\_id.
4. Intersect parcel centroids with precinct spatial feature, then calculate the total population in the precinct, *popprecinct*
5. Calculate *Tprecinct*
6. Download tract shapefile
7. Extract the precinct features that overlay the Census tracts polygons (clip feature)

Graphical user interface

Description automatically generated

1. Intersect parcel centroids with these clipped precincts to calculate total residential units per clipped precinct, *RCP*
2. Intersect parcel centroids with tract polygons to calculate total residential units by tract, *Rtract*
3. Calculate weight per clipped precinct,
4. Calculate *Ttract*

### Data:

* **Population and residential units data** was downloaded from the PSRC AWS MySQL database called “2018\_parcel\_baseyear\_rtp” using the following line in R (see R script):

dbConnect(

MySQL(), user='psrcurbansim', password='psrc\_urbansim', dbname='2018\_parcel\_baseyear\_rtp', host='aws-modelmysql'

)

* **Elections data** was found on the Washington Secretary of State (WA SOS) [data and statistics page](https://www.sos.wa.gov/elections/research/data-and-statistics.aspx).

Graphical user interface, text, application, email

Description automatically generated

Navigate to “Data from past elections” > “2020 General Election Summary”

Graphical user interface, text, application, email

Description automatically generated

Click on “[2020 General Election Data](https://www.sos.wa.gov/elections/research/2020-general-election.aspx)” then “GIS Precinct Results” under “Other Files” at the bottom of the page.

Text, application

Description automatically generated

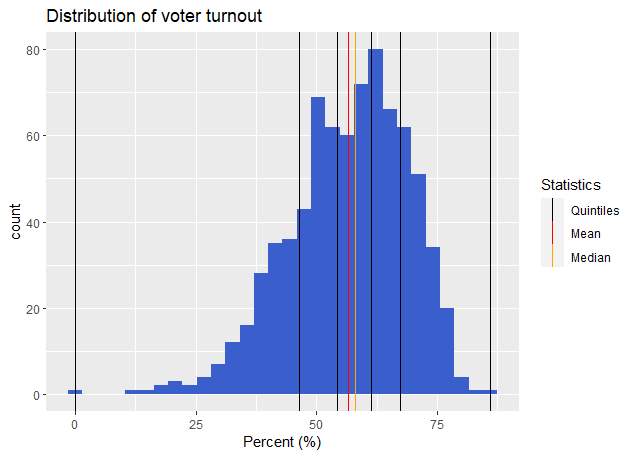
Election data is in Sheet 1 of this Excel file. Follow R script to calculate Presidential election votes by precinct.

* **Precinct shapefiles** were found at the WA SOS data and statistics page under “Other data files and resources” > “[Precinct shapefiles (2004 – 2021)](https://www.sos.wa.gov/elections/research/precinct-shapefiles.aspx)”, [Statewide\_Precincts\_2020General.zip](https://www.sos.wa.gov/_assets/elections/research/Statewide_Precincts_2020General.zip).

Graphical user interface, text, application

Description automatically generated

|  |  |  |
| --- | --- | --- |
| **Summary – Indicator 15** | | |
| **Description** |  | Percent of all population who voted in the 2020 Presidential elections |
| **Source** |  | American Community Survey/Tidycensus |
| **Table** |  | B15003 |
| **Year** |  | 2020, 2018 baseyear |
| **Quintiles** | 0% | 11% |
|  | 20% | 47% |
|  | 40% | 54% |
|  | 60% | 61% |
|  | 80% | 67% |
|  | 100% | 86% |
| **Classification** | 0 | >68% |
|  | 1 | 61 – 68% |
|  | 2 | 54 – 61% |
|  | 3 | 47– 54% |
|  | 4 | <47% |



# Displacement risk index analysis

The displacement risk index analysis has four main components: Classifying each indicator, merging the indicators into one dataset, estimating the displacement risk index, and assigning final categories through breakpoints. The final results for this stage are found in docs\displacement-risk-data-2021.xlsx.

Map

Description automatically generated

## Classification

After estimating the quintiles (0%, 20%, 40%, 60%, 80%, 100%) for each indicator’s distribution, we classified the data into 4 risk levels (0, 1, 2 ,3 4), 0 being the lowest displacement risk and 4 the highest. The breakpoints are shown in the next table.

Table

Description automatically generated

The breakpoints were set by considering the exact quintiles, then finding evenly spaced breakpoints that most closely matched those quintiles. This was done for easier interpretation by users. The table above is found on Sheet 1 of the final results file.

## Merging

The second step in the analysis is merging the different indicator datasets into one. This master dataset is organized with the following columns:

|  |  |
| --- | --- |
| Census tract ID (GEOID) | Proximity to core business (supermarket/grocery) – classification |
| People of color –classification | Proximity to core business (pharmacy) – classification |
| Linguistic Isolation – classification | Proximity to core business (restaurant) – classification |
| Educational attainment – classification | Proximity to civic infrastructure (park) – classification |
| Housing tenancy – classification | Proximity to civic infrastructure (school) – classification |
| Cost-burdened households – classification | Proximity to high income neighborhood - classification |
| Severely cost-burdened households – classification | Development Capacity – classification |
| Household income – classification | Gross median rent (0 bedrooms) – classification |
| Proximity to job center by auto – classification | Gross median rent (1 bedroom) - classification |
| Proximity to job center by transit – classification | Gross median rent (2 bedrooms) - classification |
| Proximity to transit – classification | Gross median rent (3+ bedrooms) - classification\* |
| Proximity to current or future link light rail and streetcar | Voter turnout – classification |

\* Note that due to the scarcity of homes with more than three rooms, these categories were collapsed to only retain a category containing all homes with 3+ rooms.

In the 2021 update, much of this work was done manually in Excel. However, some files from the 2018 update automate the process. Y:\VISION 2050\Data\Displacement\Displacement\_Risk\_Script\src\ Results\_DisplacementRisk\_polygon.R is a script to merge all indicator values into one, and likely includes code to create classification columns. Updating this 2018 script would be more efficient for summarizing, as little has to be done manually in Excel.

For the 2021 update, the first lines of the file scripts\consolidateFinalValues.R merge all indicator values into one dataset and save it as data\FinalIndicators.xlsx. However, this script does not create the classification columns. One must copy this new FinalIndicators.xlsx dataset into Sheet 2 of the final results file and reformat the columns. Additionally, classification columns must be created for each indicator by creating Excel formulas encoding the breakpoints and referencing the raw values for each indicator.

The remaining lines in consolidateFinalValues.R create various plots for all indicators in one pass and can be ignored at this time.

## Estimation

Once the final displacement risk database is compiled, we can estimate the risk index. The weights for each indicator are shown in the previous table. Weights are 100% for each indicator having only one level. If an indicator has more than one level, we split the weight evenly across levels. For the indicator 14 (median rent), the weight is not fixed, as not all tracts have gross median rent for all housing types (0-bedroom, 1-bedroom, etc.) This prevents us from having a constant weighting scheme across all tracts. Instead, we used a weight based on the information available in each tract. For example, if tract X has gross median rent for housing with 0, 1 and 2 bedrooms, the weight for each median rent score in that tract is 1/3. On the other hand, if tract Y has gross median rent for housing with 0 and 1 bedroom, the weight is 1/2 for each median rent score. Like “Merging,” the 2021 work on this step was done manually in Excel. However, the script

Y:\VISION 2050\Data\Displacement\Displacement\_Risk\_Script\Results\_Classification.R could be updated to automate this process.

Finally, the displacement risk index for each census tract is estimated as:

The index ranges from 0 to 53, being 0 a census tract with no displacement risk and 53 a tract with the highest risk.

## Assignment to final categories using breakpoints

We classify the displacement risk scores into three levels: Highest risk, moderate risk, and lower risk. Whereas in the 2018 displacement risk project these groups were based on percentile cutoffs, in the 2021 update we instead retained the same cutoff values as in the previous project iteration, regardless of percentile. This choice was made so users could compare displacement risk scores across years, knowing they were based on the same rating scale. The cutoffs are:

|  |  |
| --- | --- |
| Highest risk | > 38.6 |
| Moderate risk | < 38.6, > 24.8 |
| Lower risk | < 24.8 |

# Appendix

The data, scripts, and results are in the Y:\VISION 2050\Data\Displacement\Displacement Index 2021 folder. The files are organized into four main folders: data, docs, export, and scripts.

Graphical user interface, application

Description automatically generated

1. Data

This folder contains raw data collected from several sources along with the clean data. Each indicator has a separate folder containing the relevant datasets.

Table

Description automatically generated with medium confidence

Within each indicator folder, clean data either follows the pattern

[indicator number]\_[IndicatorName].csv (values) or starts with “tract” (values including tract shapefiles). Raw data, when available (some indicators download data using R packages and no raw dataset is explicitly generated), follows name patterns other than the two just mentioned.

1. docs

This folder contains general documentation (such as this methodology document), documentation pertaining to specific indicators (ByIndicator folder), and figures generated throughout the 2021 update process (Figures). The final index values for all tracts are found in

displacement-risk-data-2021.xlsx.

Graphical user interface, text, application, email

Description automatically generated

1. export

This folder was generated to send externally when users request the displacement risk index data. It contains every indicator’s clean data file along with the published 2018 final index calculation spreadsheet and the DRAFT 2021 final index calculation spreadsheet.

Table

Description automatically generated

1. scripts

This folder contains all scripts used throughout the 2021 update. Each indicator has a separate folder containing relevant scripts, and there are a few unfiled scripts that are more general. In general, each indicator has a file following the pattern

“DataGen\_[indicator number]\_[IndicatorName].R”

which generates the values for the given indicator and another following the pattern

“Vis\_[indicator number]\_[IndicatorName].R”

which generates various visualizations for that indicator, and which vary by indicator and the questions the team asked at that stage of the update process.

Table

Description automatically generated with medium confidence

1. One problem with the CHAS database is its size (it contains all U.S. counties). The R script contains functions to subset the data by King, Kitsap, Pierce and Snohomish counties. [↑](#footnote-ref-1)