

Using Small Area Estimation to Create New Tools for Community Resilience

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In March of 2020, the COVID-19 pandemic struck the world and highlighted a need for high quality data on the vulnerability of our communities.

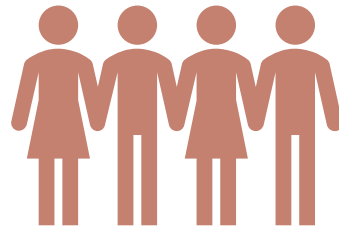
The Census Bureau's **Community Resilience Estimates (CRE)** provide a precise, understandable, and easy to use measure of social vulnerability.

What are you going to learn today?

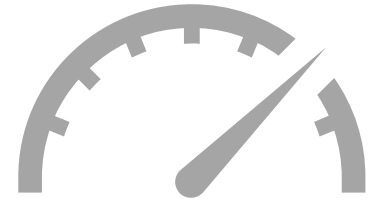
The Census Bureau and COVID-19



COVID-19 pandemic reiterated the need for usable information about the population.



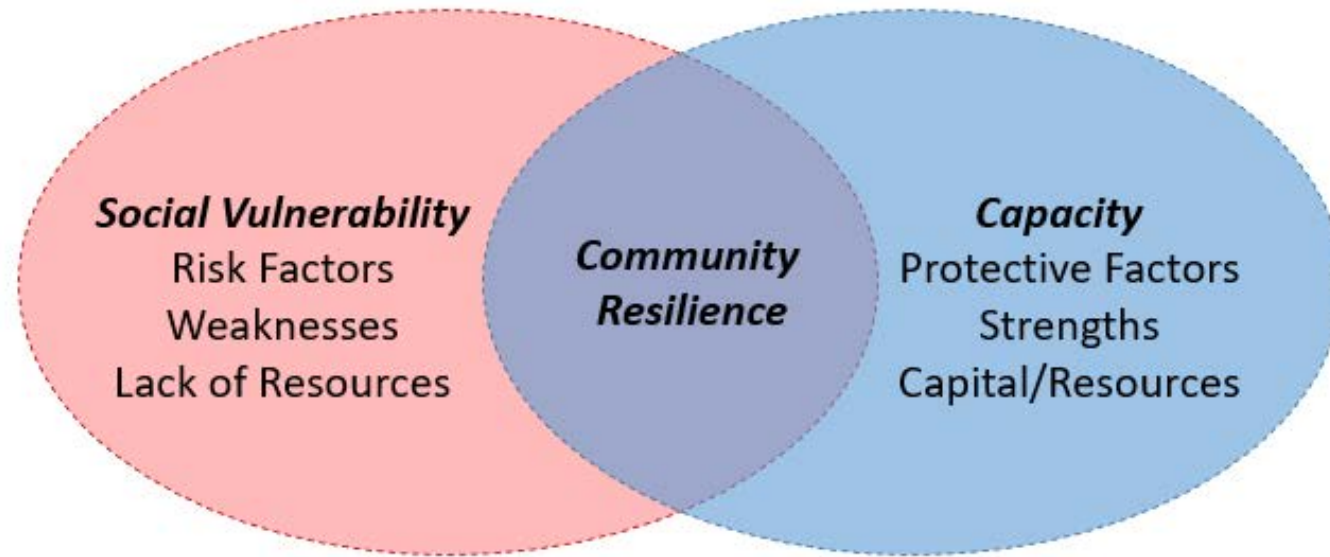
Many groups reached out to the Census Bureau for data.



Overwhelming need for a single, easy to understand metric.

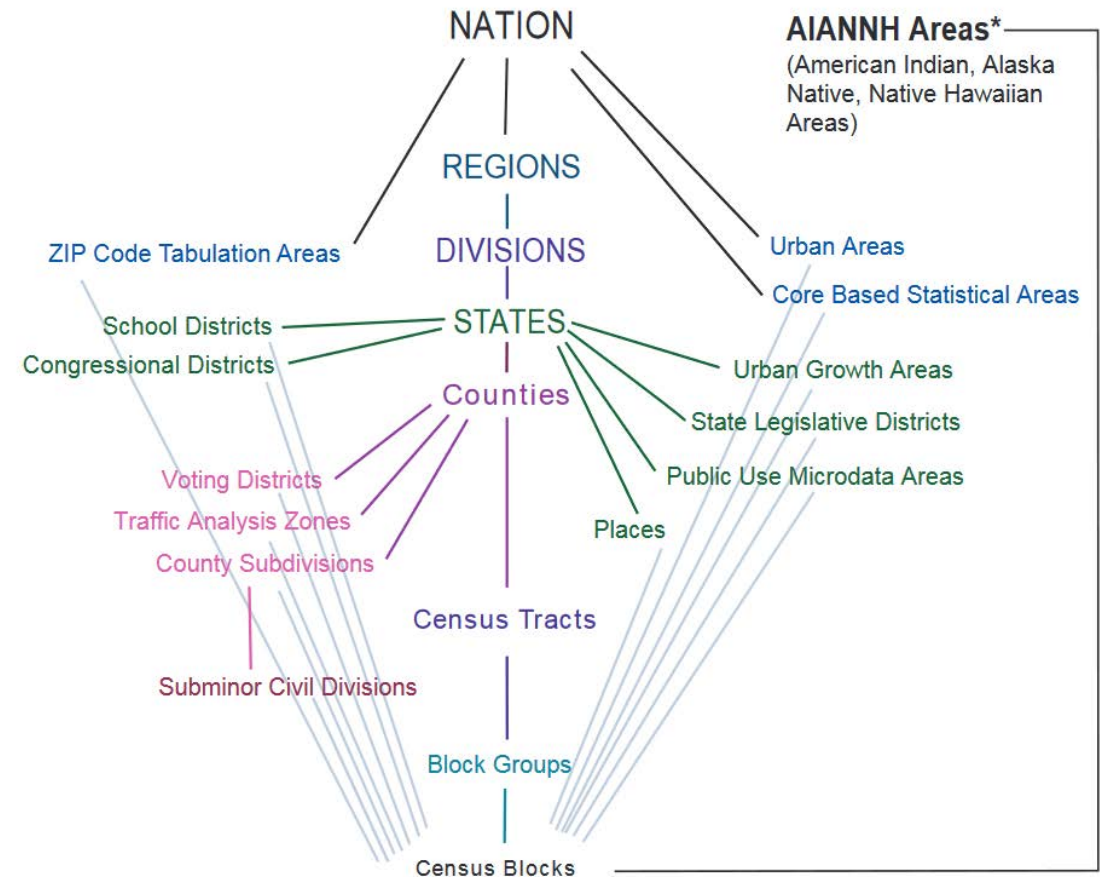
What is resilience?

Community resilience is a measure of the ability of individuals and households within a community to cope with the external stresses of the impacts of a disaster.



What is the CRE's social vulnerability measure?

- Number and percentage of population that are at low, moderate, and high risk of being unable to absorb, endure, and recover from impacts of a disaster or emergency
- Annual estimates for all states, counties, and tracts
- Uses survey data from the nation's largest and most comprehensive survey, the American Community Survey (ACS), along with decennial census data and population estimates



CRE Low, Moderate, and High-Risk Metric

- Defined by the concentration of population with risk factors that increase vulnerability
- CRE provides the number and percent of population in social vulnerability risk factor groups for each geography
 - Low: 0 risk factors
 - Moderate: 1-2 risk factors
 - High: 3-10 risk factors

CRE Social Vulnerability Risk Factors

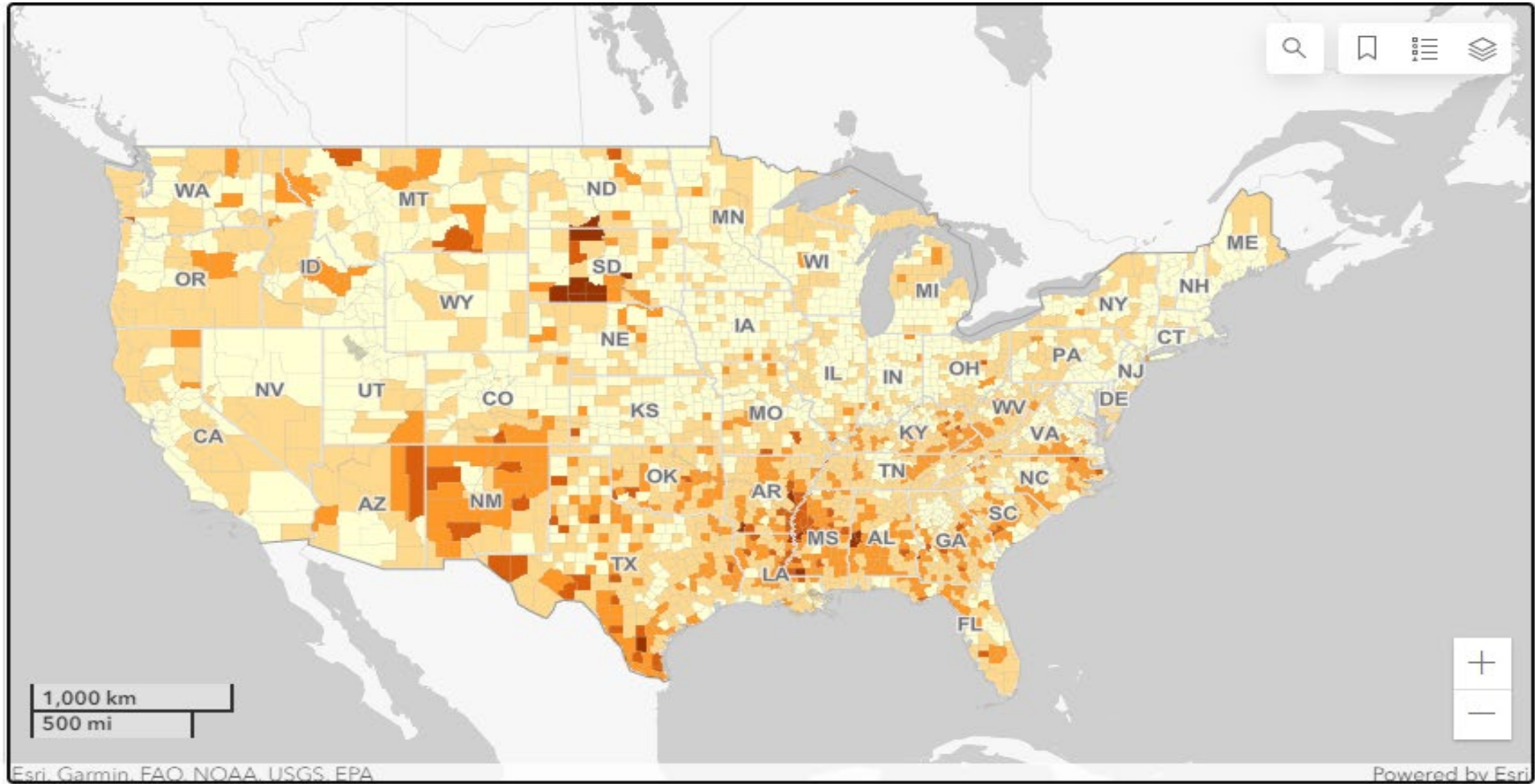
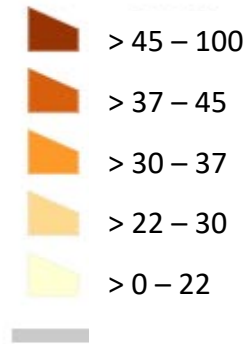
1. Income-to-Poverty Ratio less than 130 percent
2. Single or Zero Caregiver Household (only one or no individuals who are 18-64)
3. Crowding (more than 0.75 persons per room)
4. Communication Barrier (limited English-speaking households or no one over the age of 16 with high school diploma)
5. Households without Full-time, Year-round Employment
6. Disability
7. No Health Insurance
8. Age 65+
9. No Vehicle Access
10. No Broadband Internet Access

National 2021 CRE Estimates

0 Risk Factors <i>Low Risk</i>	1-2 Risk Factors <i>Moderate Risk</i>	3+ Risk Factors <i>High Risk</i>
112,885,613 (+/-1,618,652)	144,981,486 (+/-1,772,974)	69,111,026 (+/-1,470,280)
34.5% (+/-0.5%)	44.3% (+/-0.5%)	21.1% (+/-0.5%)

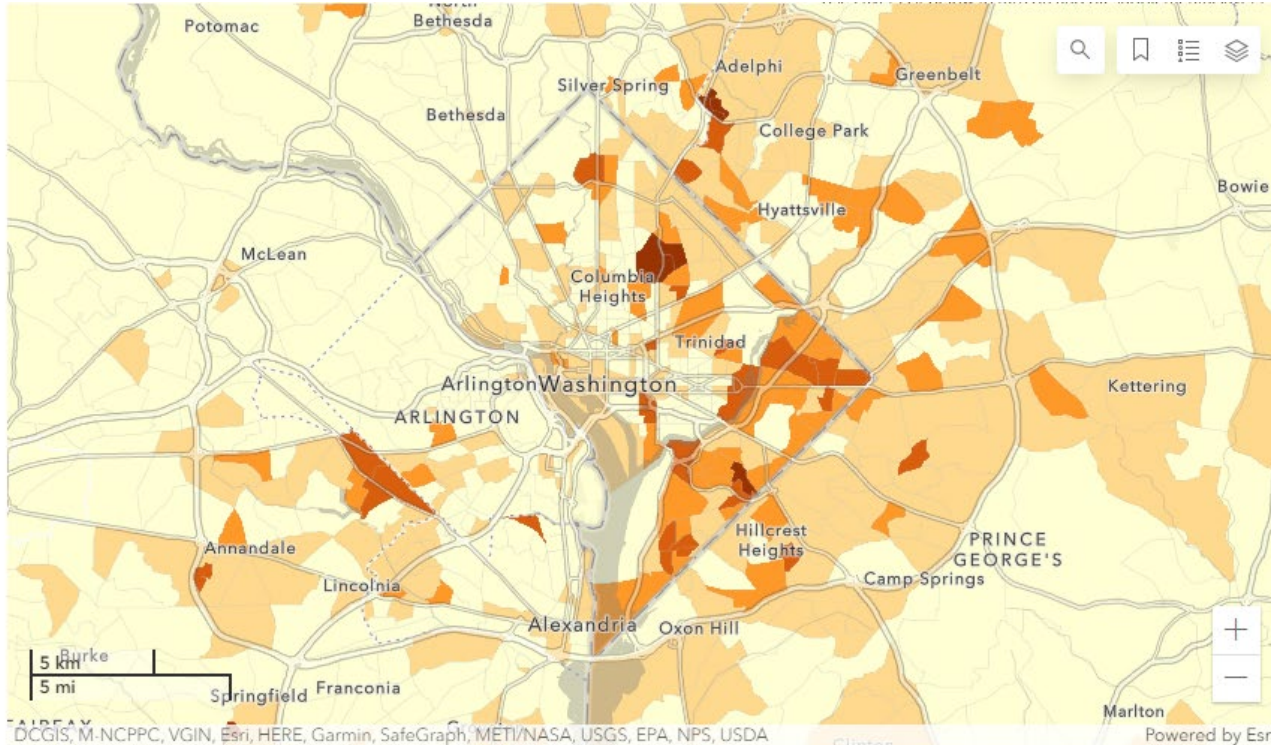
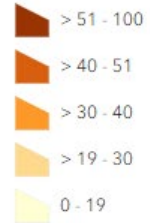
2021 CRE: Percent of County Population at “High Risk”

Percent of population with 3+ risk factors



2021 CRE: Percent of Census Tract Population at “High Risk” in Washington, DC

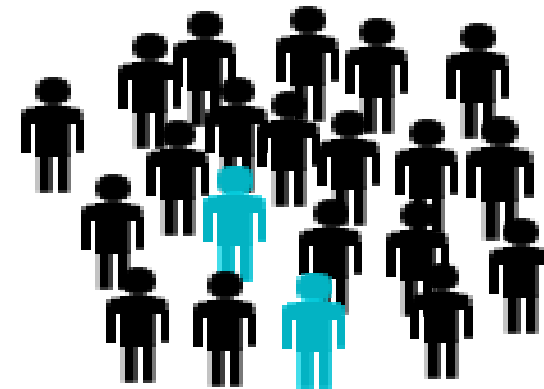
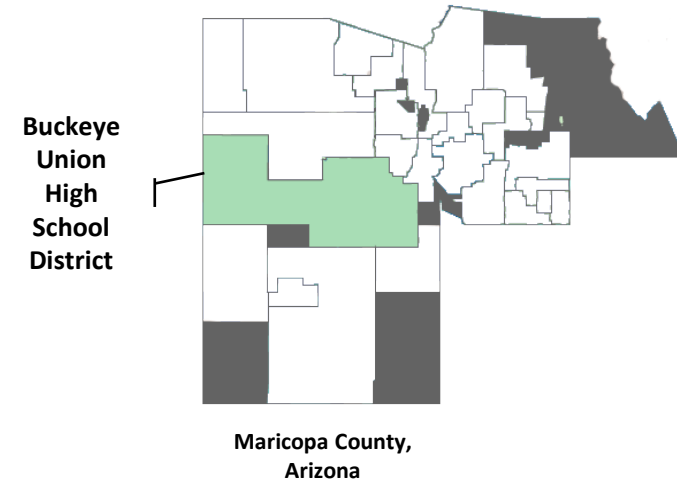
Percent of population with 3+ risk factors



- CRE estimates of social vulnerability provide granular data at the Census tract level
- Tracts are small areas within counties with limited survey data available
- How is this level of geographic detail possible in the CRE?

What is a “Small Area”?

- Small Geographic Area
 - County
 - Municipality
 - School District
- Small Domain
 - Specific socio-demographic group
 - Ex. Low-income Hispanic women aged 40 to 64 in Indiana

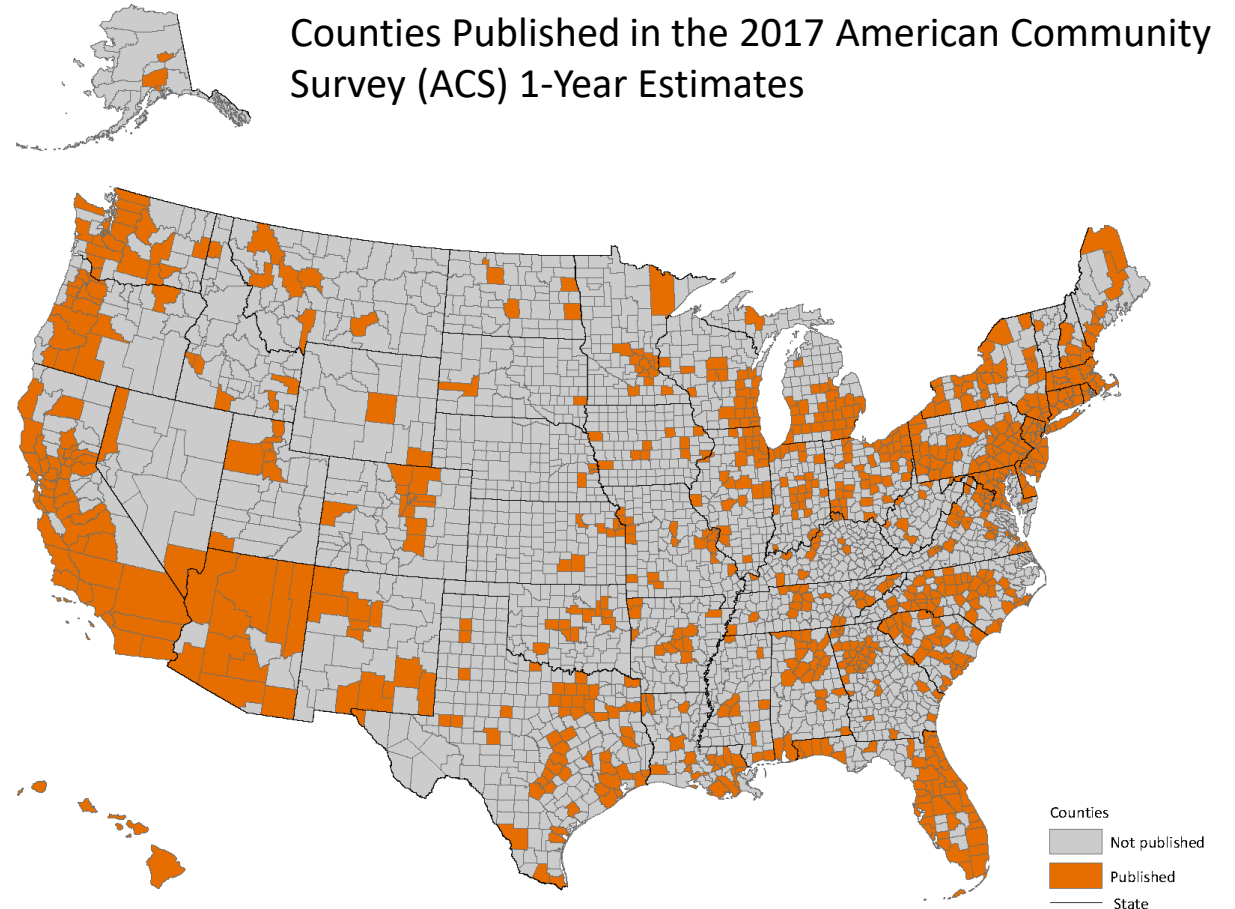


Why Small Area Estimation?

- Censuses have limited scope.
- Sample surveys provide reliable statistics for **large** areas or populations.
- Growing demand for reliable **small area** statistics, but sample sizes are too small to provide survey (or area specific) estimators with acceptable accuracy.

Why Small Area Estimation?

- Estimates can be released for **all counties**, regardless of population size, and for many detailed domains
- Reduction in year-to-year volatility relative to the survey estimates
- Improvement in precision (margins of error) relative to the survey estimates
- Timely release of annual estimates not possible by using survey data alone

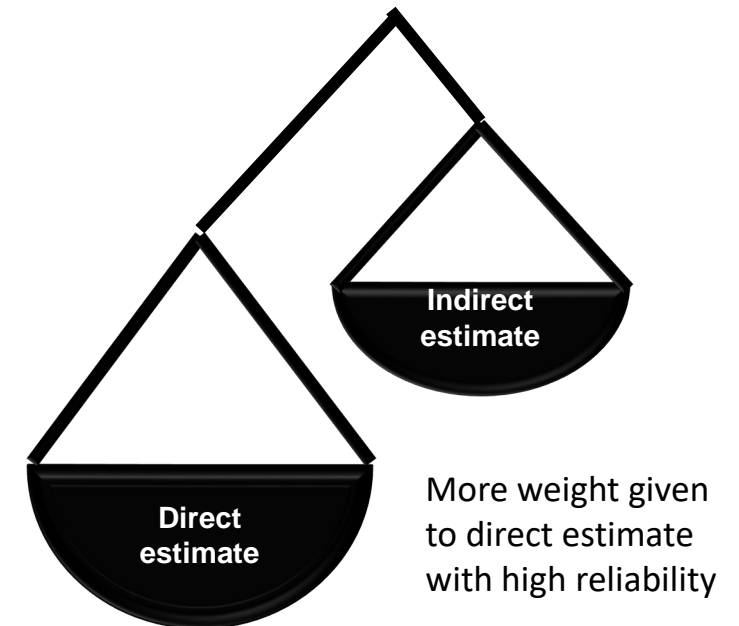


Source: U.S. Census Bureau American Community Survey Office, 2018.

Small Area Estimation in CRE

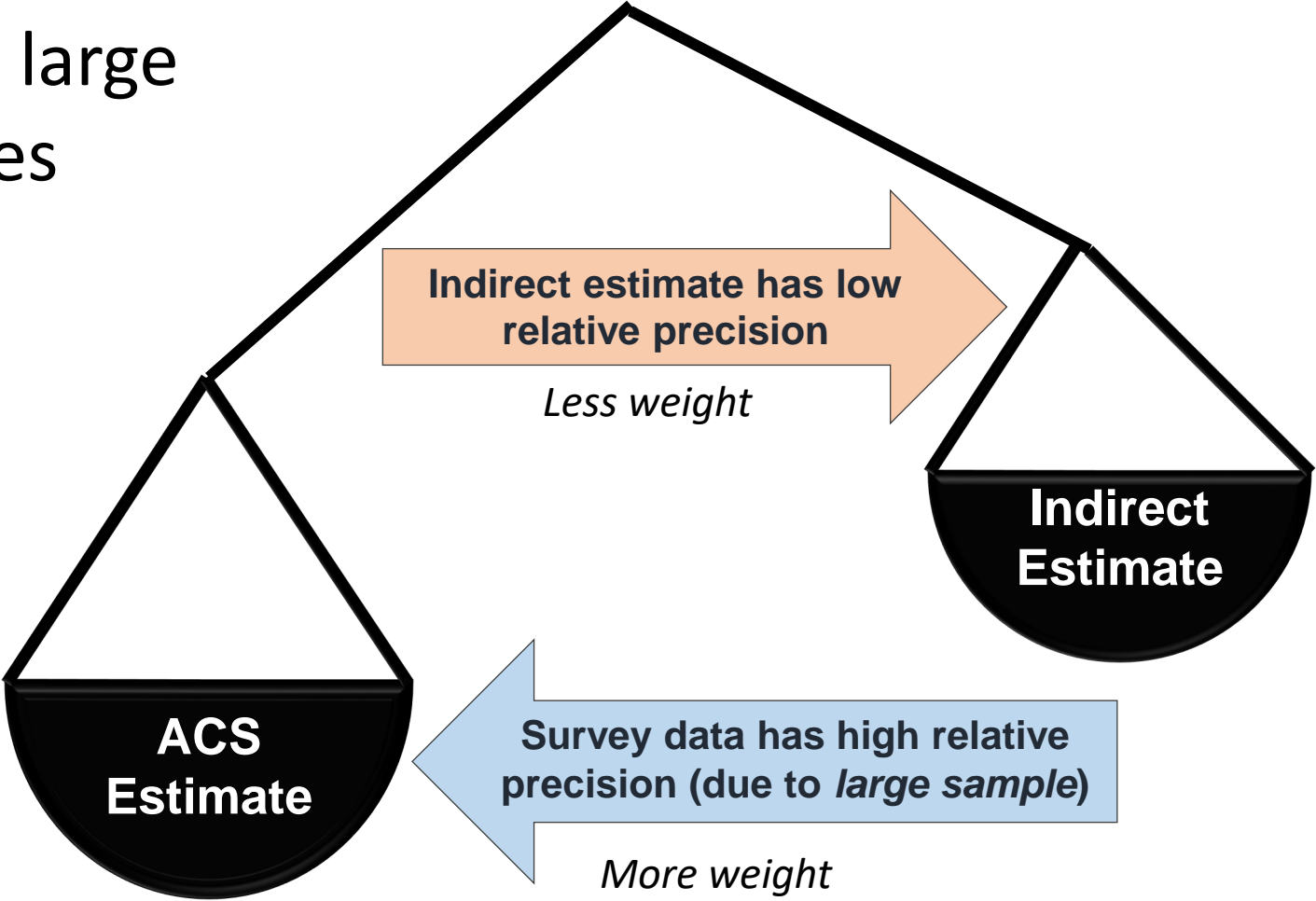
- Blend ACS direct survey estimates with related information from external data sources (auxiliary data)
- Use information from related geographies, times, and/or groups to increase the precision of “small area” estimates

The CRE small area model is a weighted average of the direct survey estimate and an indirect estimate derived from pulling in additional related data called auxiliary data



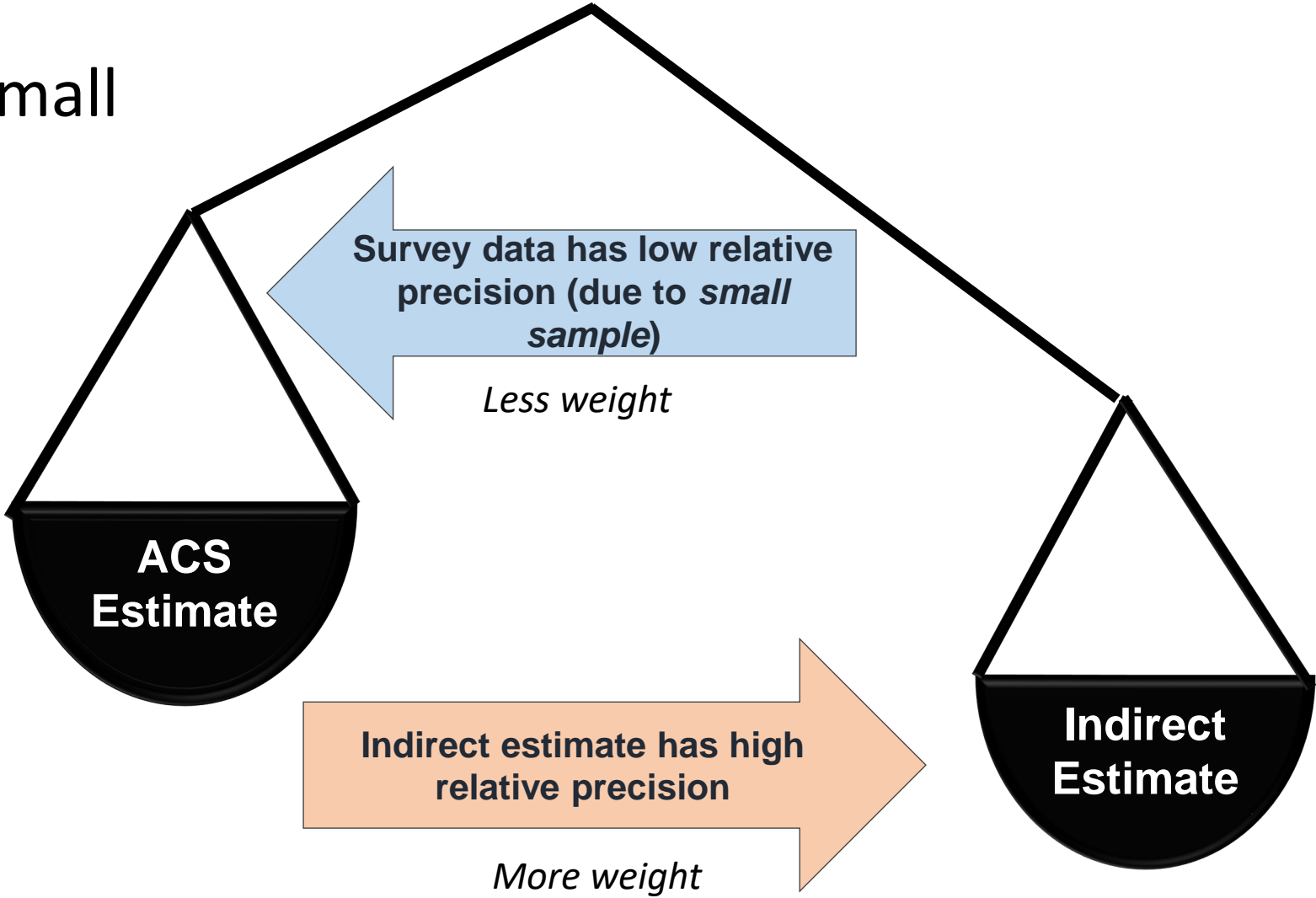
Small Area Estimation in CRE

Areas with large sample sizes



Small Area Estimation in CRE

Areas with small sample sizes



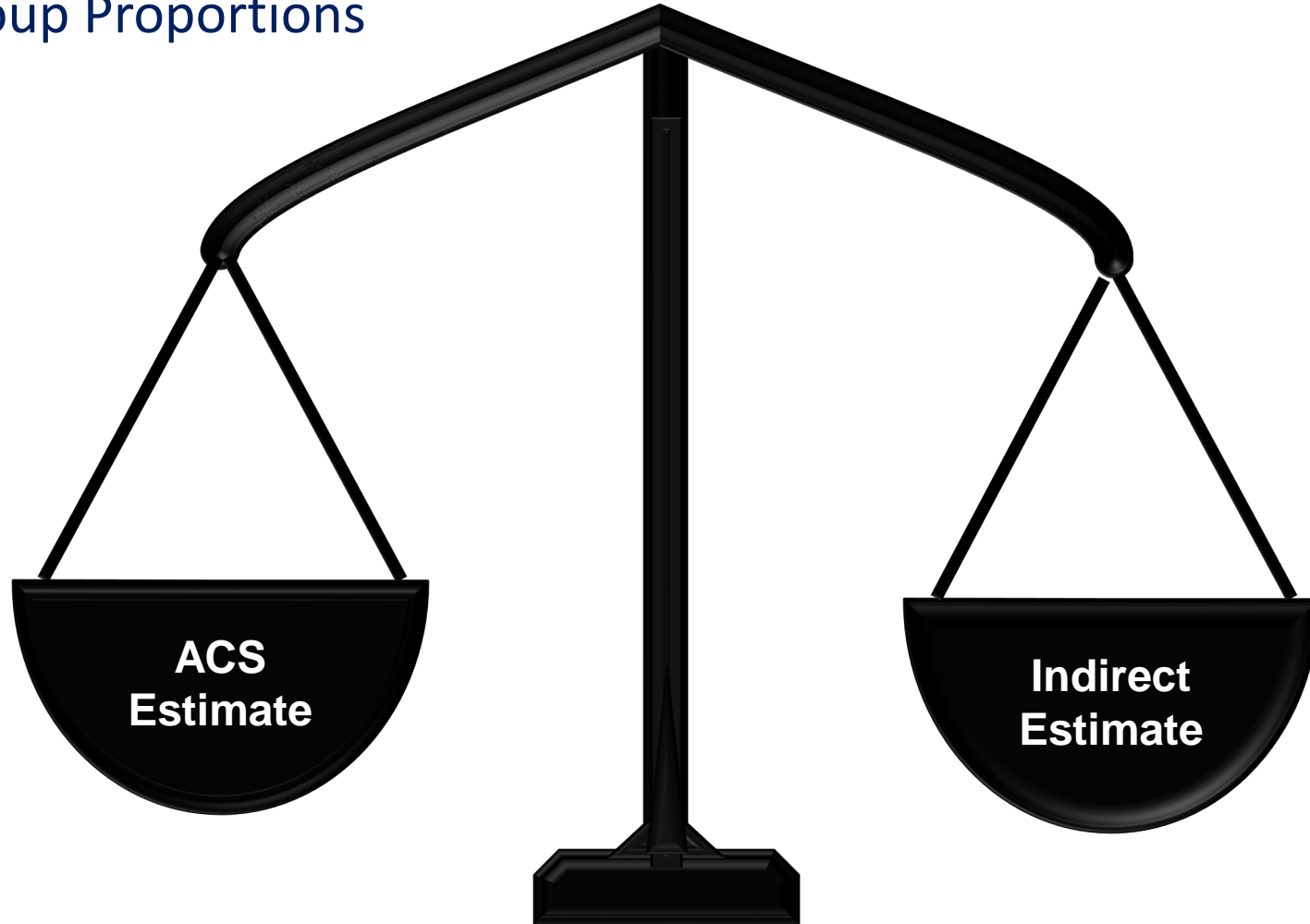
Small Area Estimation in 2021 CRE: Auxiliary Data Sources

- 2020 decennial census counts at the tract level by age group, race, and Hispanic origin and living arrangement (households, group quarters like college dorms or nursing homes)
- 2021 official county population estimates from the Census Bureau by same demographic groups and living arrangements
- Census and population estimates are combined to produce synthetic population counts in 2021 for all tracts by same detail

Small Area Estimation in CRE

Weighted average between survey estimate and indirect estimate:
Risk Factor Group Proportions

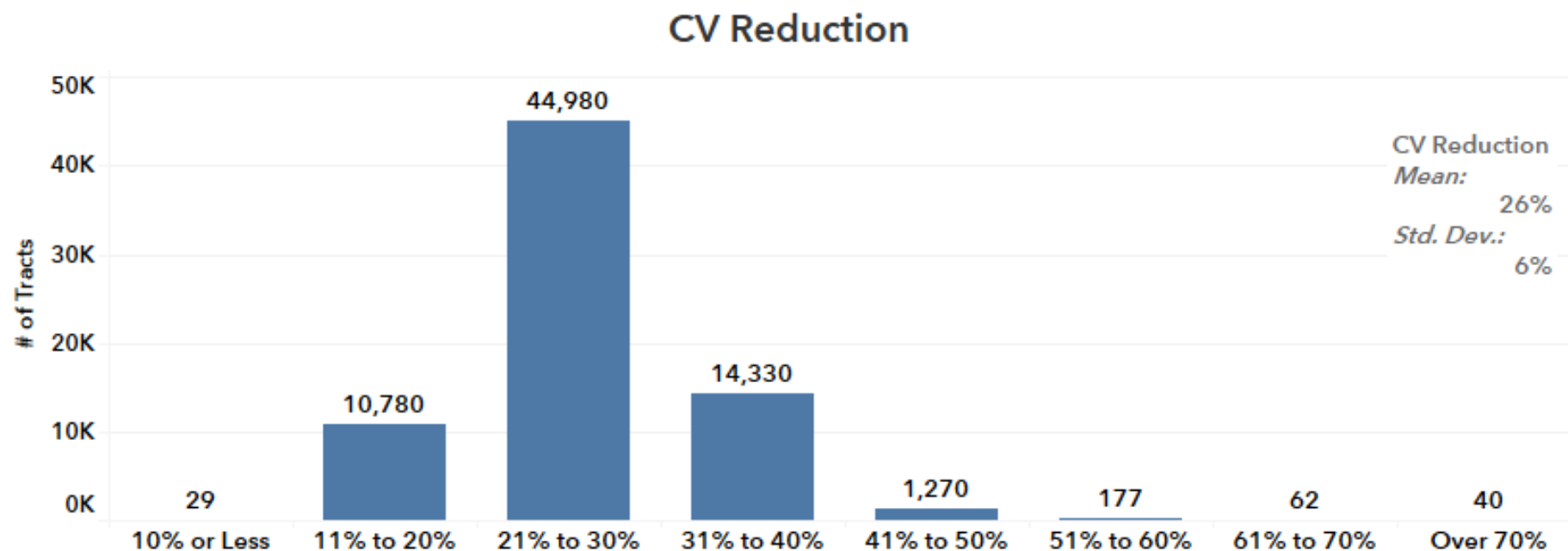
Proportion of population with 0 risk factors, 1-2 risk factors, and 3-10 risk factors tabulated from ACS at geography of interest



- Risk factor group proportions from poststratification
- Joint distribution of risk factor prevalence estimated at higher levels of geography (Census division by increasing levels of urbanicity) and by demographic groups (Age, race, and Hispanic origin) applied to tract population estimates

CRE Reduces Error, Improves Data Quality

Percent Reduction in the Coefficient of Variation
for High-Risk Population in Populated Census Tracts:
CRE vs Direct ACS Estimate



CRE Data Products

Published

- 2018, 2019, & 2021 CRE on Social Vulnerability
- 2019 CRE for Equity Supplement (2019 CRE on Social Vulnerability + 2019 5-Year ACS Estimates for social context)
- 2019 CRE for Puerto Rico
- 2019 CRE for Heat

Coming soon (within 1 year)

- 2022 CRE
- 2021 CRE for Puerto Rico
- 2021 CRE for Heat
- 2021 CRE on Capacity

Recap

CRE provides the following benefits

- **Timeliness** (1-year ACS)
- **Accuracy & reliability** (small area estimation → reduces sampling error)
- **Granularity** (outputs estimates down to census tracts)
- **Accessibility** (interactive tools)
- **Adaptability/Growth** (geographic coverage, research topic, indicators, additional data sources)

Thank You!

Contacts

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