National Estimates

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State Variation in Low-Dose CT Scanning for Lung Cancer Screening in the United States

Stacey Fedewa, PhD

NLCRT Annual Meeting

December, 2020

Collaborators

- Gerard A Silvestri, MD, MS
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Background

- Annual lung cancer screening (LCS) with low dose chest computed tomography in older current and former smokers (i.e. eligible adults) has been recommended since 2013
- In 2015, with less than 4% of eligible adults reporting past-year LCS with LDCT
- In 2017, among 10 states collecting LCS data in the 2017 Behavioral Risk Factor Surveillance System survey showed 13-14% of USPSTF eligible adults reported screening with LDCT in the past year

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Objectives

- Develop a method to examine lung cancer screening rates in all 50 states
- Determine if lung cancer screening rates are associated with sociodemographic factors, burden, capacity, and access

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How did we do this?

LDCT Rate= LDCT Scans/Eligible Population

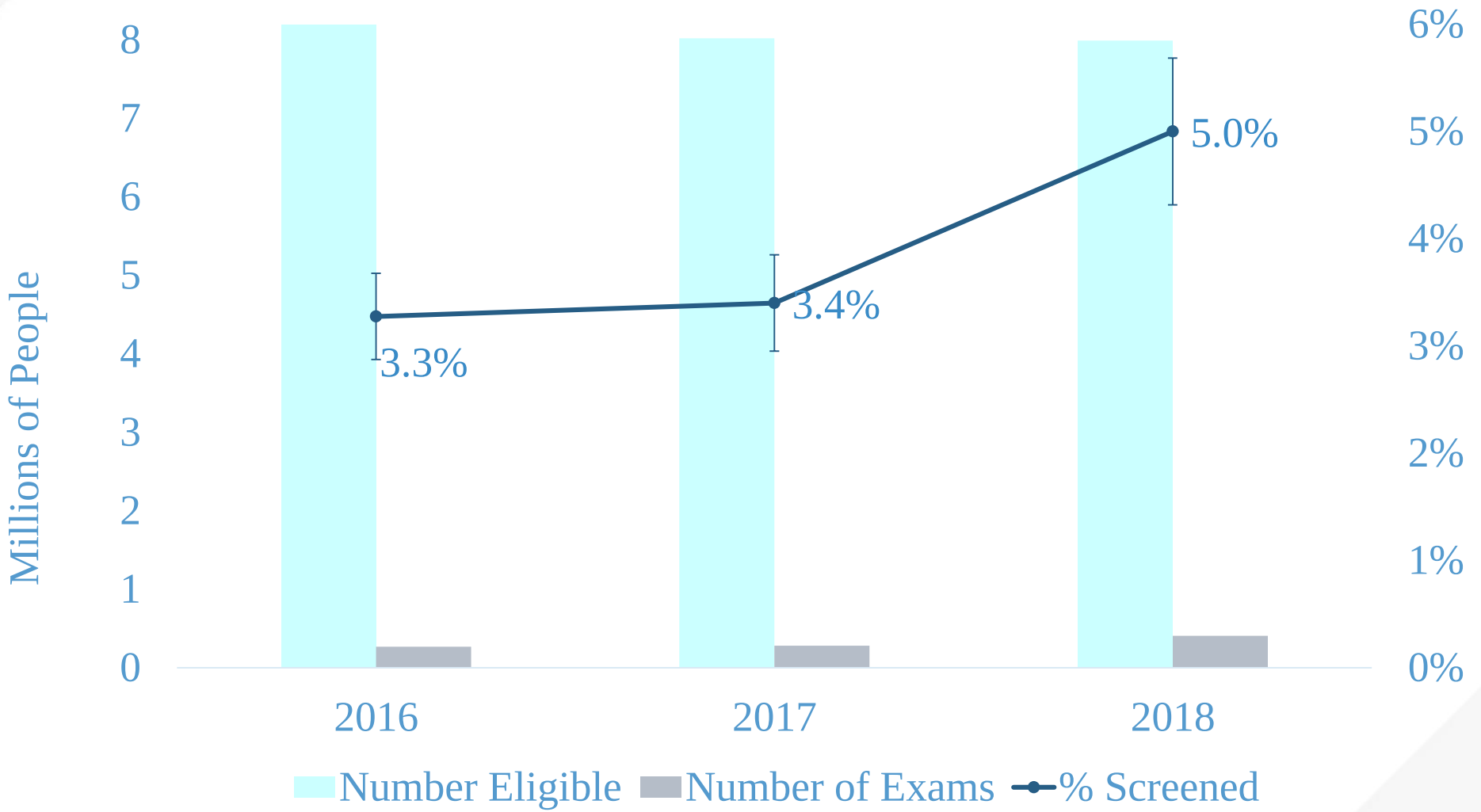
ACR Lung Cancer Screening Registry Reports

Population based surveys: NHIS + BRFSS

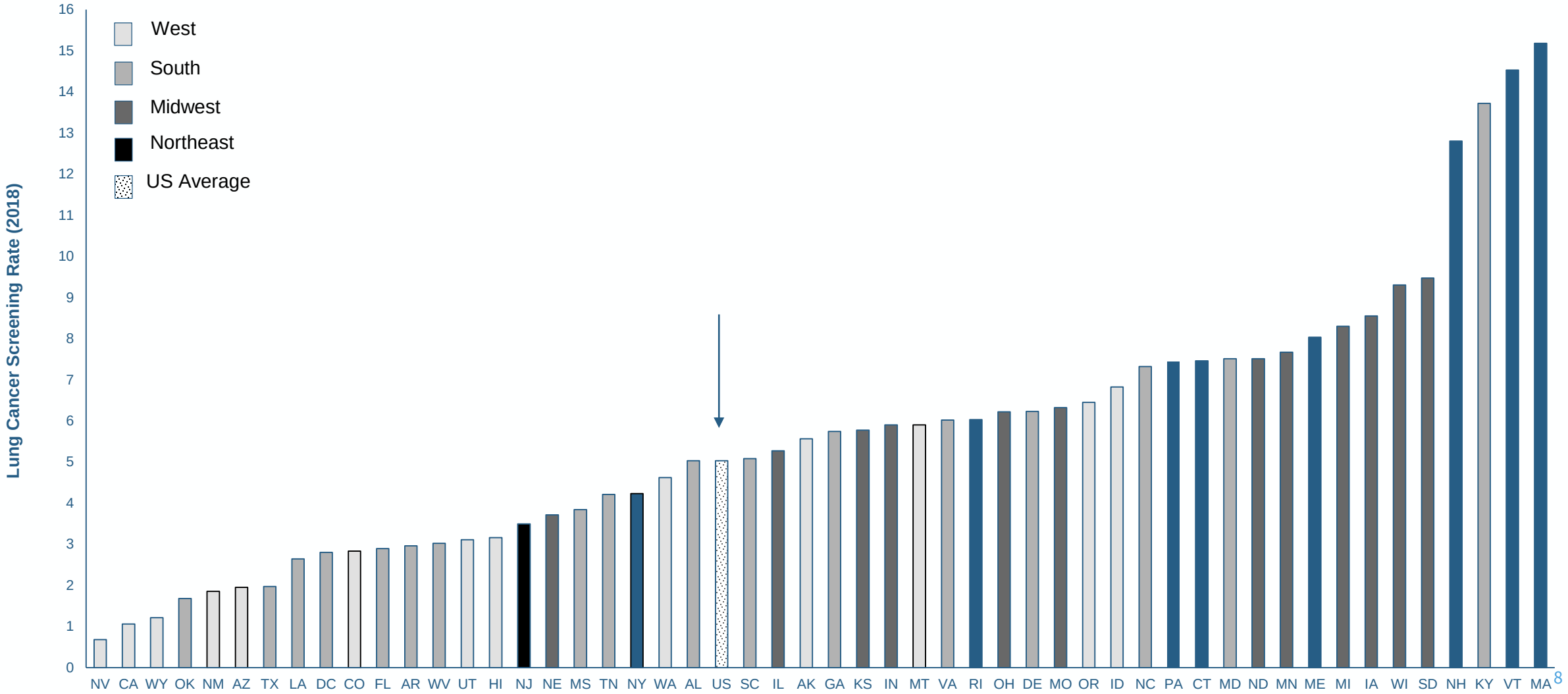
Population counts: census data

State	LDCT Rates	Lung cancer mortality (Vital Statistics)	Screening capacity	% of people who smoked who were uninsured (BRFSS)
Alabama				
..				
Wyoming				

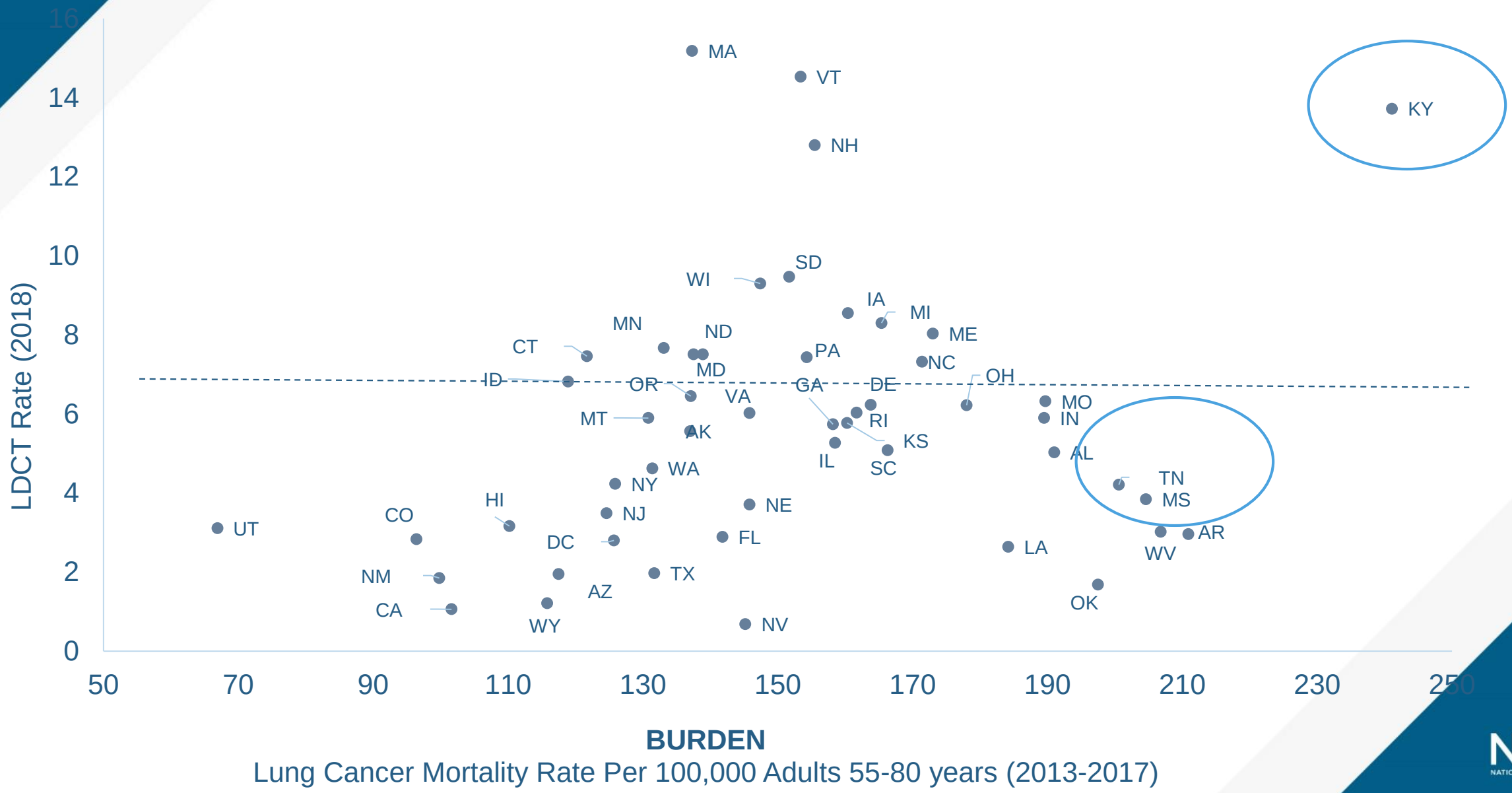
National Lung Cancer Screening Rates 2016-2018



Lung Cancer Screening Rates According to State, 2018



Lung Cancer Screening v Burden



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Correlations between State Level Lung Cancer Screening

- **Not significantly correlated:**
- Lung cancer burden (lung cancer mortality)
- Mean age
- % of adults who smoked and were:
  - Formerly smoked
  - Black persons
  - Had a High School education

Significantly and Negatively Correlated

- Access (% of adults who smoked and were uninsured)
- % of adults who smoked and were Hispanic

- **Significantly and Positively Correlated**
- Screening Capacity (Facility Density per 1,000 eligible adults)
- % of adults who smoked and were female

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Conclusions

- National lung cancer screening rates rose between 2016-2018, the rate still was still low in 2018, with only **5-6%** eligible adults in the US receiving lung cancer LDCT screening.
- Could be an underestimate, as some patients undergoing lung cancer LDCT screening are not covered in this estimate, including patients at DOD facilities
- Lung cancer screening was higher in several Northeastern states that have lower lung cancer burden, and lower rates in several southern states that have high-lung cancer burden
- The one exception to this pattern was Kentucky, which simultaneously holds the nation's highest lung cancer death rates and one of the highest lung cancer screening rates

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Thank you!

ACCEPTED MANUSCRIPT

State Variation in Low-Dose CT Scanning for Lung Cancer Screening in the United States

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Link to the paper:

- https://academic.oup.com/jnci/advance-article/doi/10.1093/jnci/djaa170/5970481

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GEOGRAPHIC ACCESS TO LUNG CANCER SCREENING

Nationwide and in rural and urban areas

Liora Sahar, PhD, GISP

GRACE
Geospatial Research and Analytics Center of Excellence

Agenda

- Paper 1: "Using Geospatial Analysis to Evaluate Access to Lung Cancer Screening in the United States"
  - Published in Chest, Sep 01,2020

CHEST
Available online 1 September 2020
In Press, Uncorrected Proof

Thoracic Oncology: Original Research

Using Geospatial Analysis to Evaluate Access to Lung Cancer Screening in the United States

Preliminary findings of this study were presented at the American Association of Geographers' annual meeting, Washington, DC, April 3-7, 2019, and at the Centers for Disease Control and Prevention Place and Health Conference, November 2019, Atlanta, GA.

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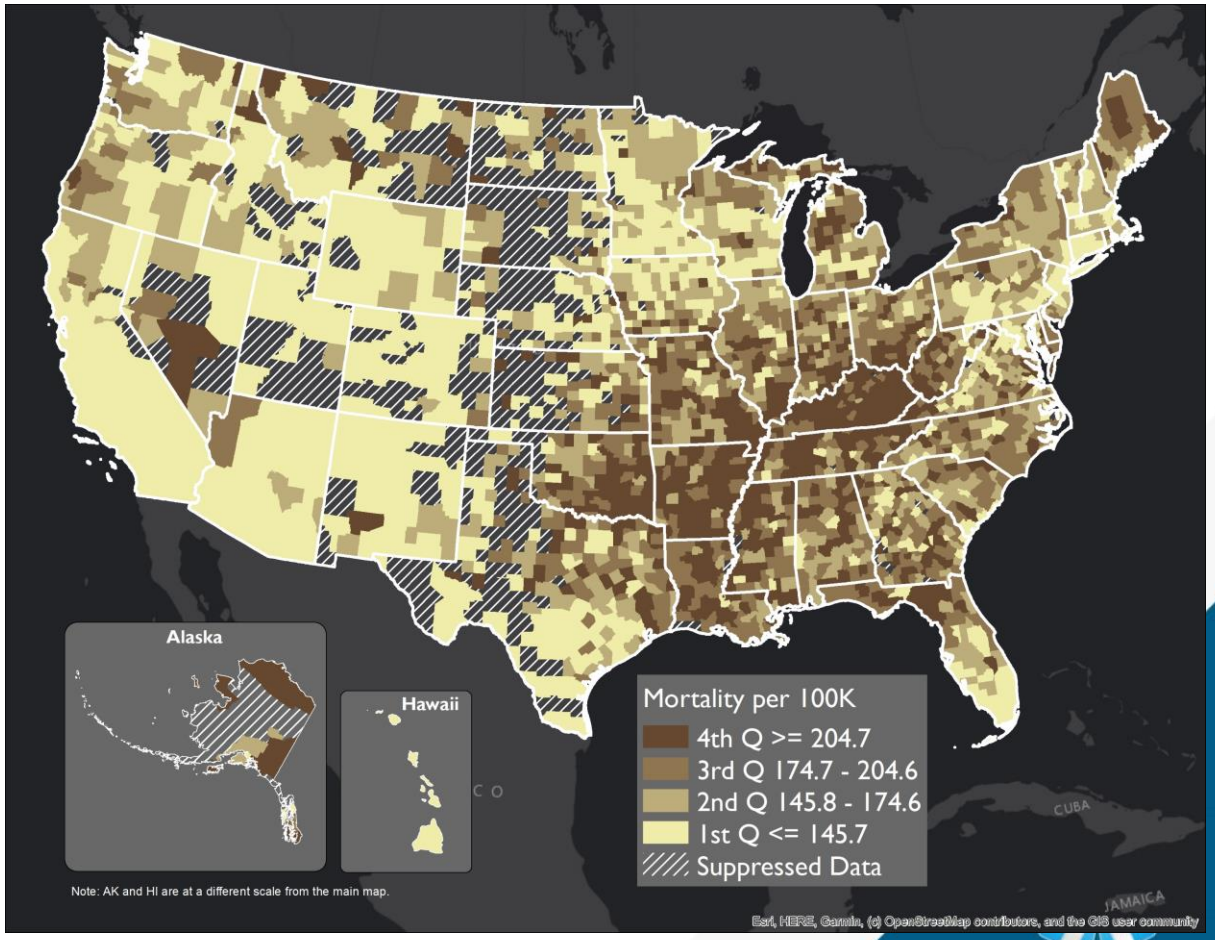
- Paper 2: in preparation. Preliminary results. "Access to lung cancer screening by rural and urban populations in the US"
  - In progress

"USING GEOSPATIAL ANALYSIS TO EVALUATE ACCESS TO LUNG CANCER SCREENING IN THE UNITED STATES"

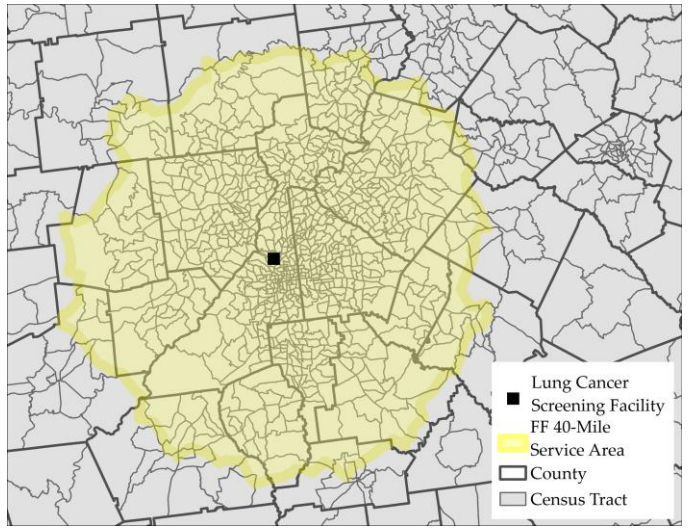
- DATA
  - American College of Radiology's lung cancer screening registry (ACR-LCSR) participants (3,592 locations)
  - American Community Survey 2016 5-year 55-79 population at county (3,142) and census tract (73,056) levels
  - 2016 BRFSS adult smoking prevalence (Robert Wood Johnson Foundation, County Health Rankings)
  - 2015 5-year county level age-adjusted lung cancer death rates (per 100K) for both males and females aged 50+



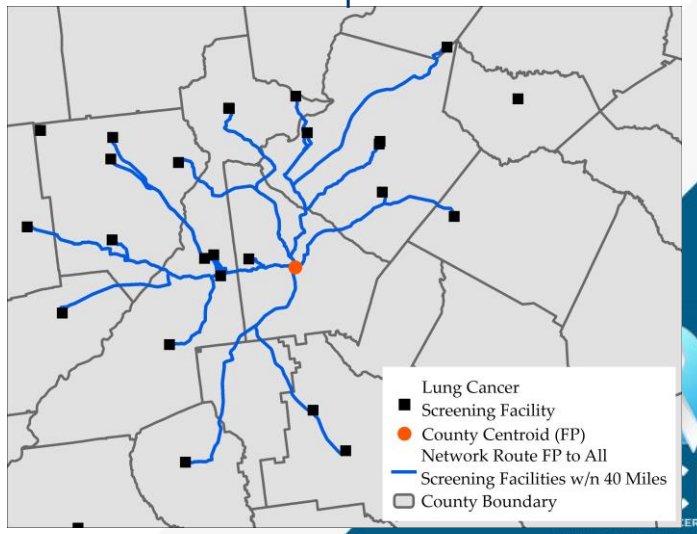
"USING GEOSPATIAL ANALYSIS TO EVALUATE ACCESS TO LUNG CANCER SCREENING IN THE UNITED STATES"

- METHOD
  - Geocode and QA/QC locations of screening facilities
  - Calculate the travel distances and times "from facilities" and "from population" centroids (counties and census tracts) to lung cancer screening facilities using the road network
    - **Use a 40-mile threshold**
    - Perform a **sensitivity analysis using FP** with a 20-mile threshold
  - Summarize results nationwide by mean travel distances and times
  - Estimate the number of smokers with access
  - Overlay and integrate access of the estimated number of smokers with lung cancer mortality rates

From Facilities

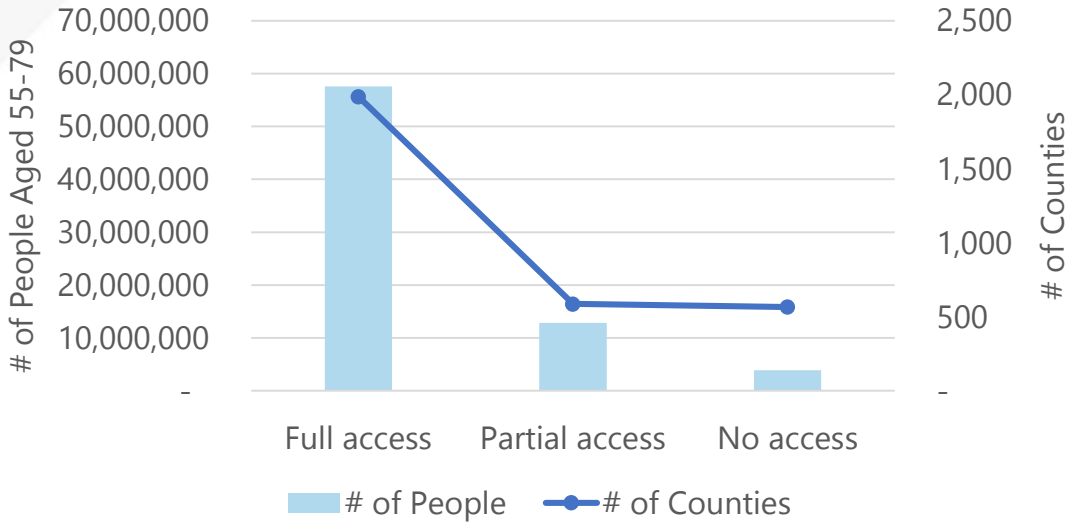


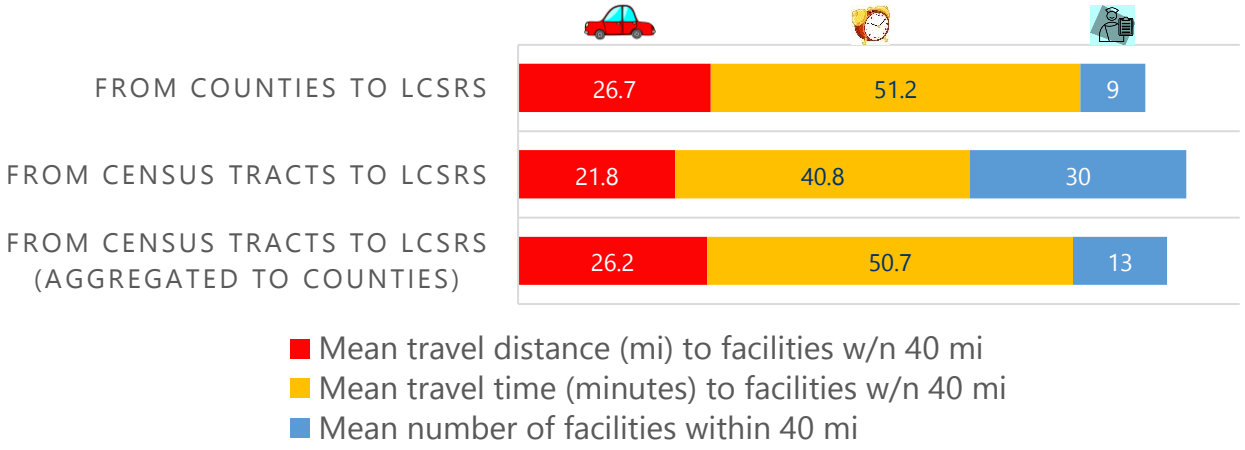
From Population

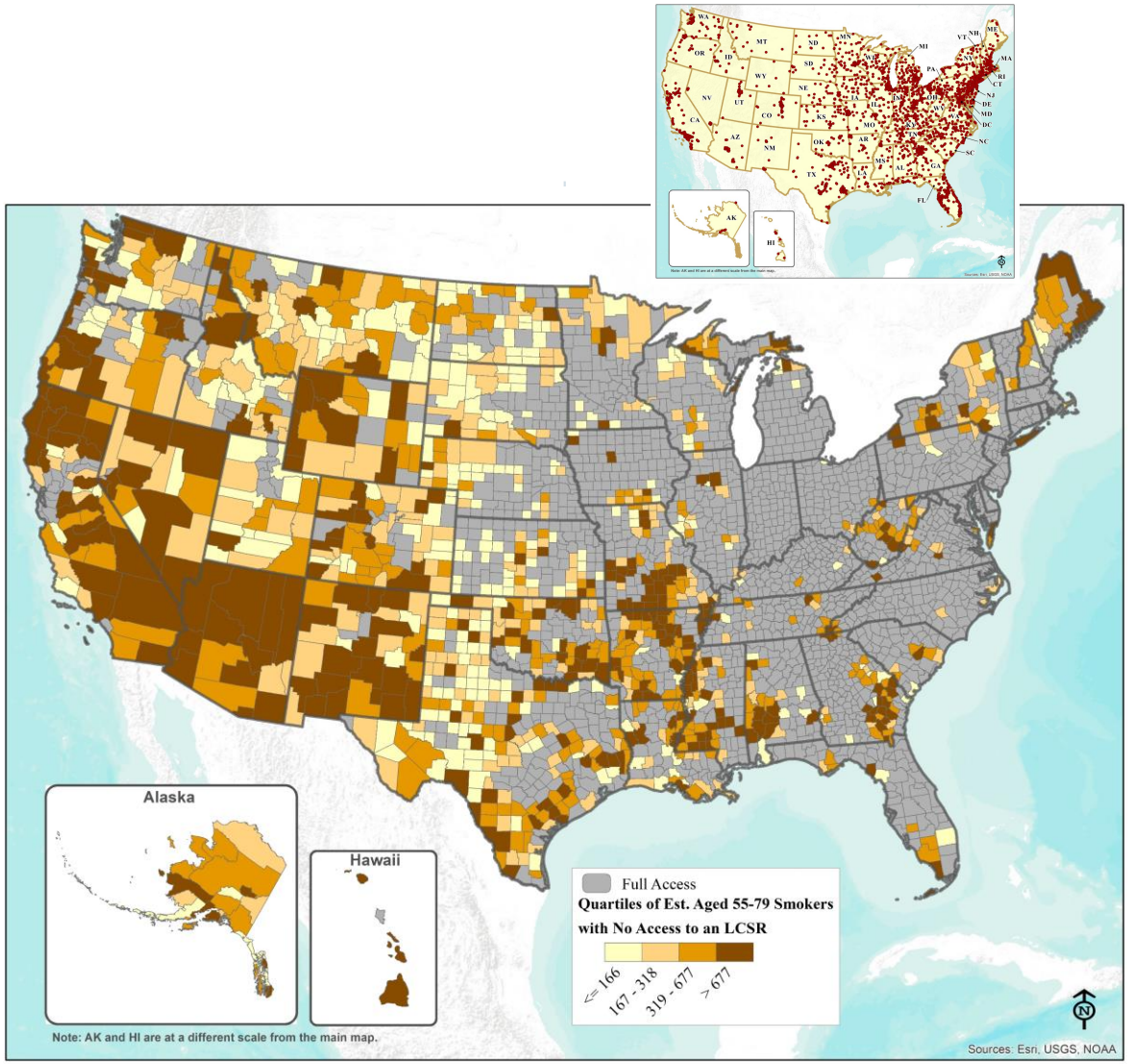


"USING GEOSPATIAL ANALYSIS TO EVALUATE ACCESS TO LUNG CANCER SCREENING IN THE UNITED STATES"

RESULTS

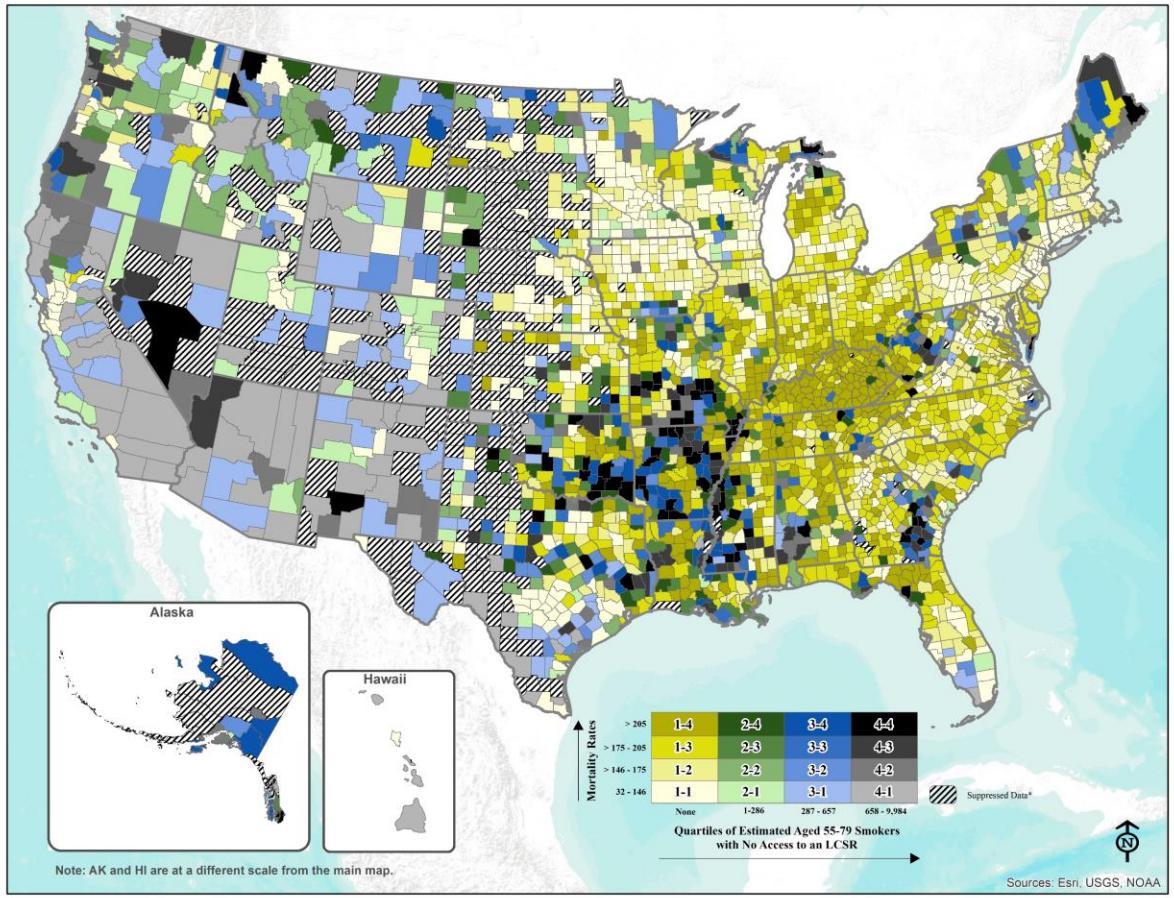






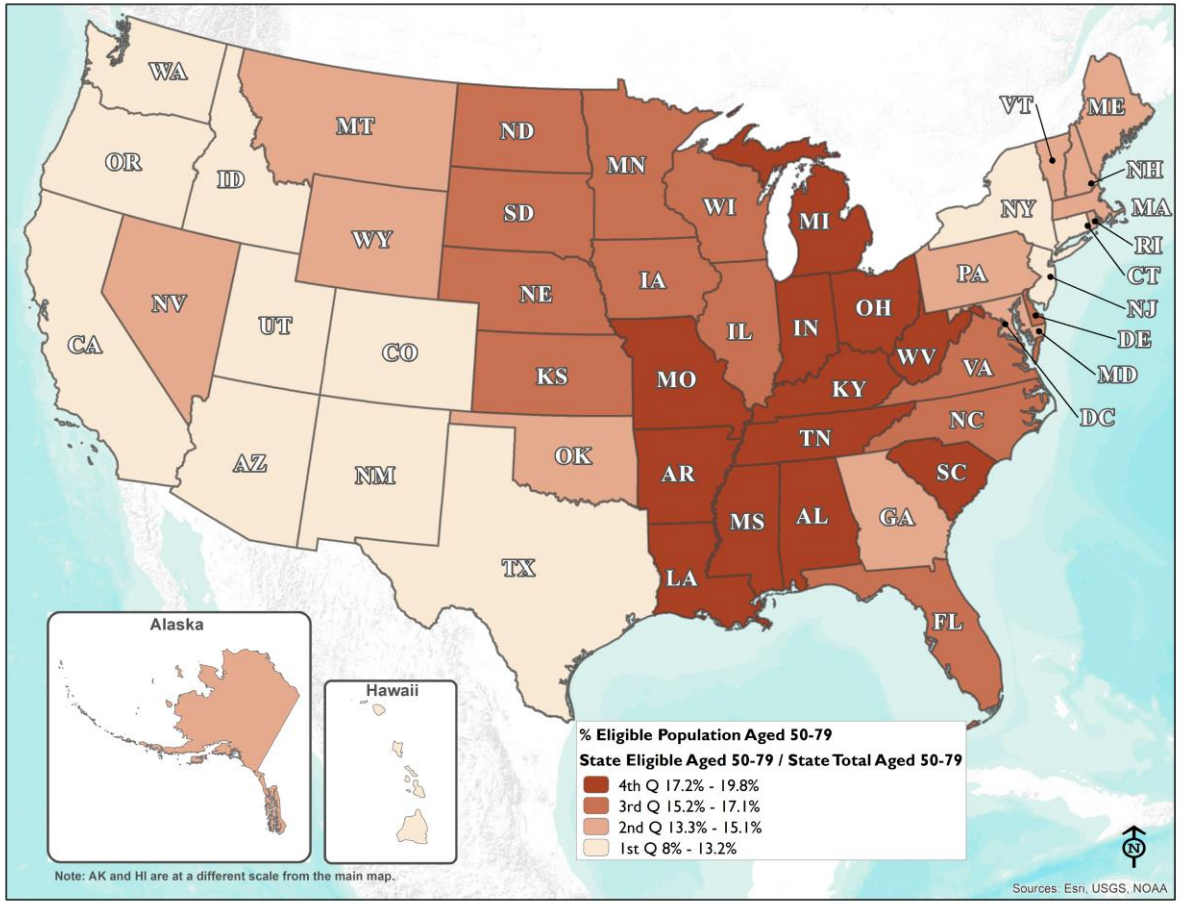
"USING GEOSPATIAL ANALYSIS TO EVALUATE ACCESS TO LUNG CANCER SCREENING IN THE UNITED STATES"

- CONCLUSION
  - Subcounty accessibility calculations provide granular analysis and reveal local variations in access
  - Greater accessibility in the east vs the west
  - Integrating accessibility with smoking prevalence and lung cancer mortality rates help identify focus areas for interventions
  - Distinct characteristics of focus areas:
    - Areas with **low** access by the estimated number of smokers and high mortality rates (4-4, 4-3, 3-4, and 3-3)
    - Areas with **high** access by the estimated number of smokers and high mortality rates (1-4, 1-3, 2-4, and 2-3)
  - Focus areas can help inform decision-makers with lung cancer screening programs and geographic analysis should be updated regularly to stay current



Access to LC Screening Across Rural and Urban Environments in the US (in-progress)

- DATA
  - **American College of Radiology's** lung cancer screening registry participants (3,249 locations)
  - American Community Survey 2018 5-year **50-79 and 55-79 population at county** (3,142) and census tract (73,056) levels
  - 2017 BRFSS **adult smoking prevalence** (Robert Wood Johnson Foundation, County Health Rankings)
  - Office of Management and Budget's **rural and urban** classification schema for counties (March 2020 update)
  - American Cancer Society's cRUCA[1] rural and urban classifications for census tracts (2019 update)
  - **Estimated % of eligible individuals 50-79 at the state level** – Provided by Stacey Fedewa, PhD, American Cancer Society. Based on the recent draft update of the USPSTF recommendation (50-79 & 20 pack-year smoking history)



[1] *Sahar, L., Williams, R., Rao, A., Alcaraz, K. I., & Portier, K. M. (2018). Using GIS Technology to Define and Assess a Rurality Scheme Suitable for Decision Support in Health and Patient Services. International Journal of Applied Geospatial Research (IJAGR), 9(3), 1-17.*

Preliminary results (unpublished) – please do not distribute.

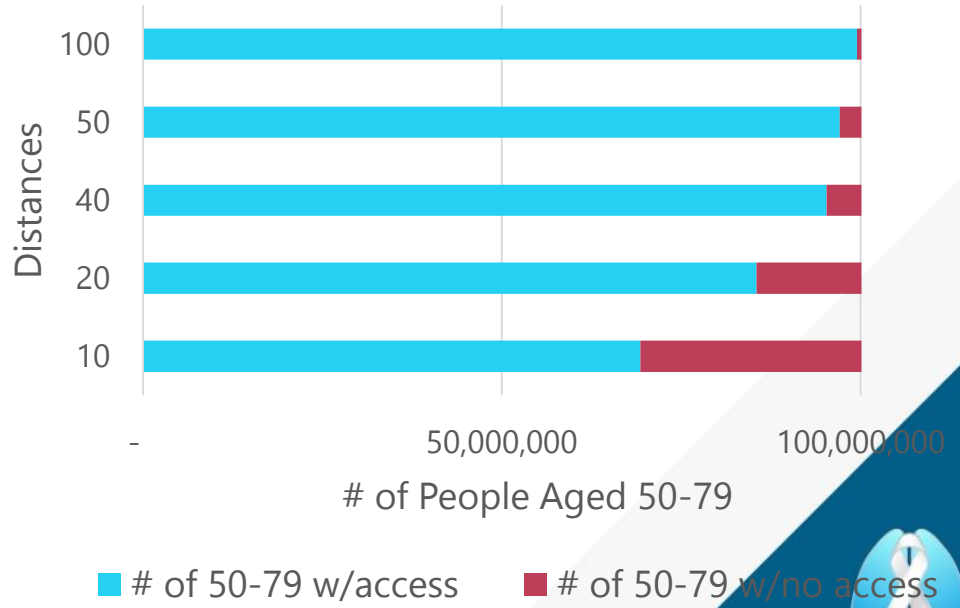
Access to LC Screening Across Rural and Urban Environments in the US (in-progress)

- METHOD
  1. Calculate access for the entire 50-79 population (census tracts and counties)
  2. Calculate access for the estimated eligible population (counties)

  - Calculate the travel distances and times from the population centroid of census tracts to lung cancer screening facilities using the road network
  - Use multiple thresholds for analysis: 10, 20, 40, 50, and 100 miles
  - Summarize results by mean travel distances by OMB and cRUCA for the entire US
  - Weigh the travel distances based on the 50-79; 55-79; Estimated eligible population

Access to LC Screening Across Rural and Urban Environments in the US (in-progress)

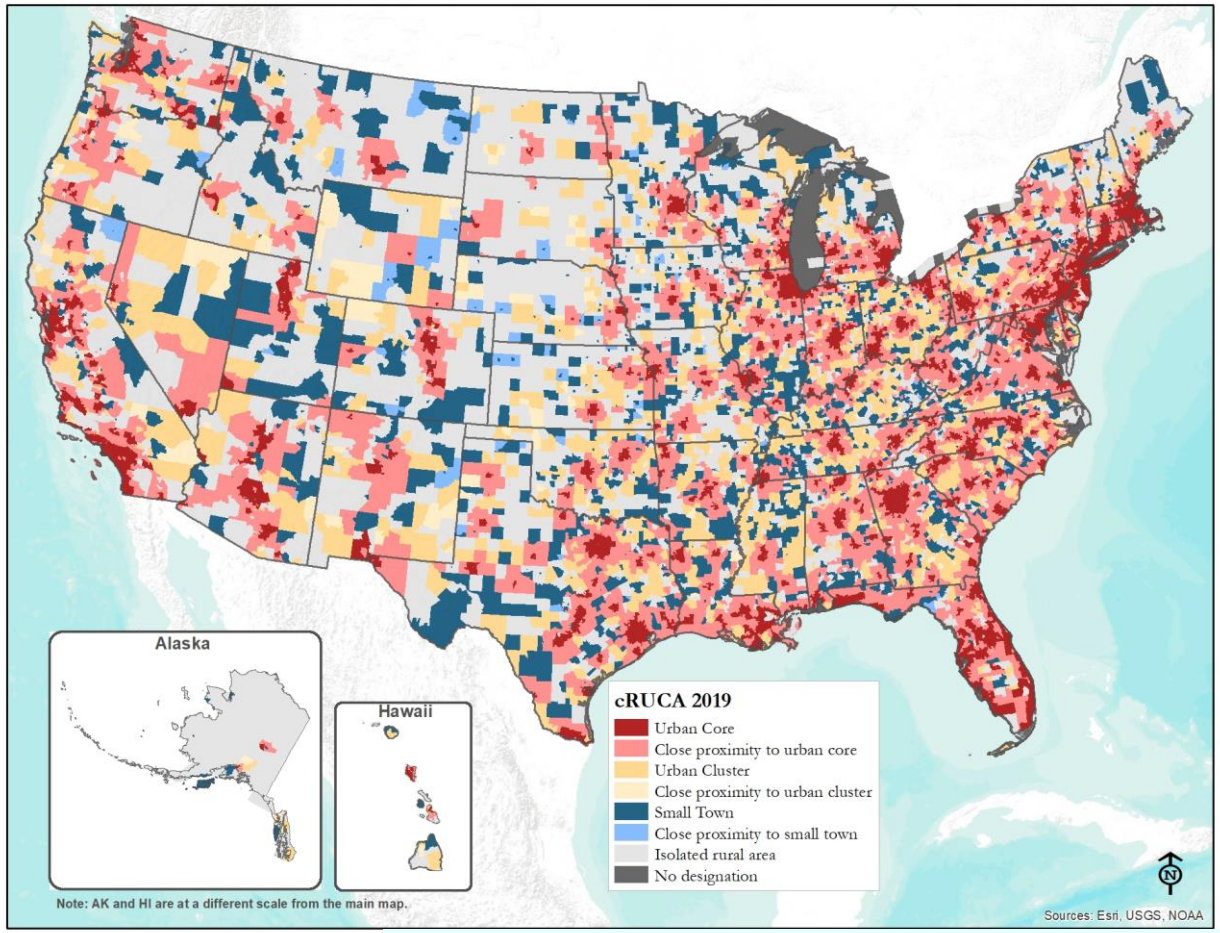
- RESULTS
  - Similar results for 50-79 and 55-79
  - More individuals More individuals (from 70M (55-79) to over 100M (50-79))
  - 50-79 (~100M) compared to the eligible (~14.8M)
  - More people have access as the threshold distance increases

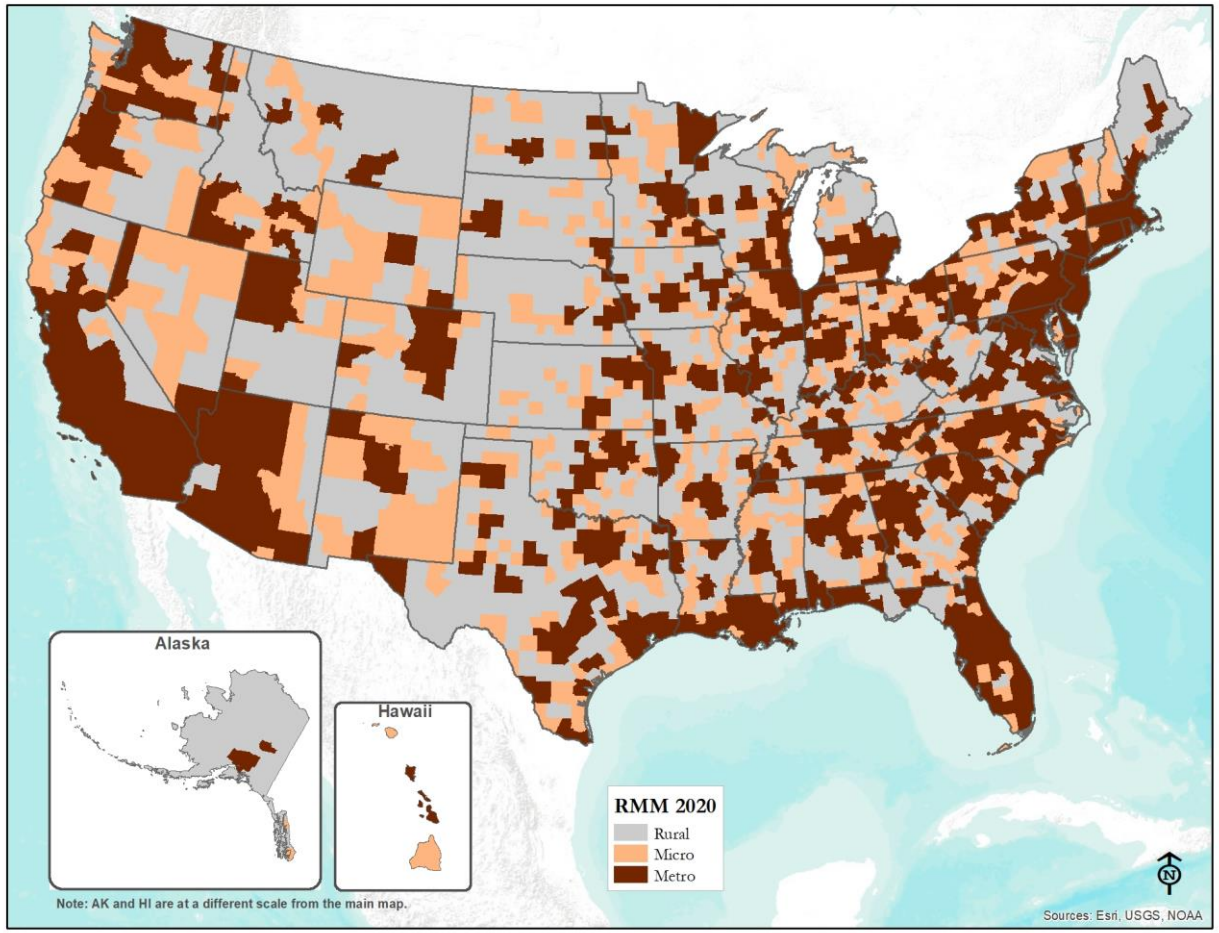


Preliminary results (unpublished) – please do not distribute.

Access to LC Screening Across Rural and Urban Environments in the US (in-progress)

- RESULTS -
  - Census tracts with access. Each tract is symbolized by cRUCA. White indicates no access.

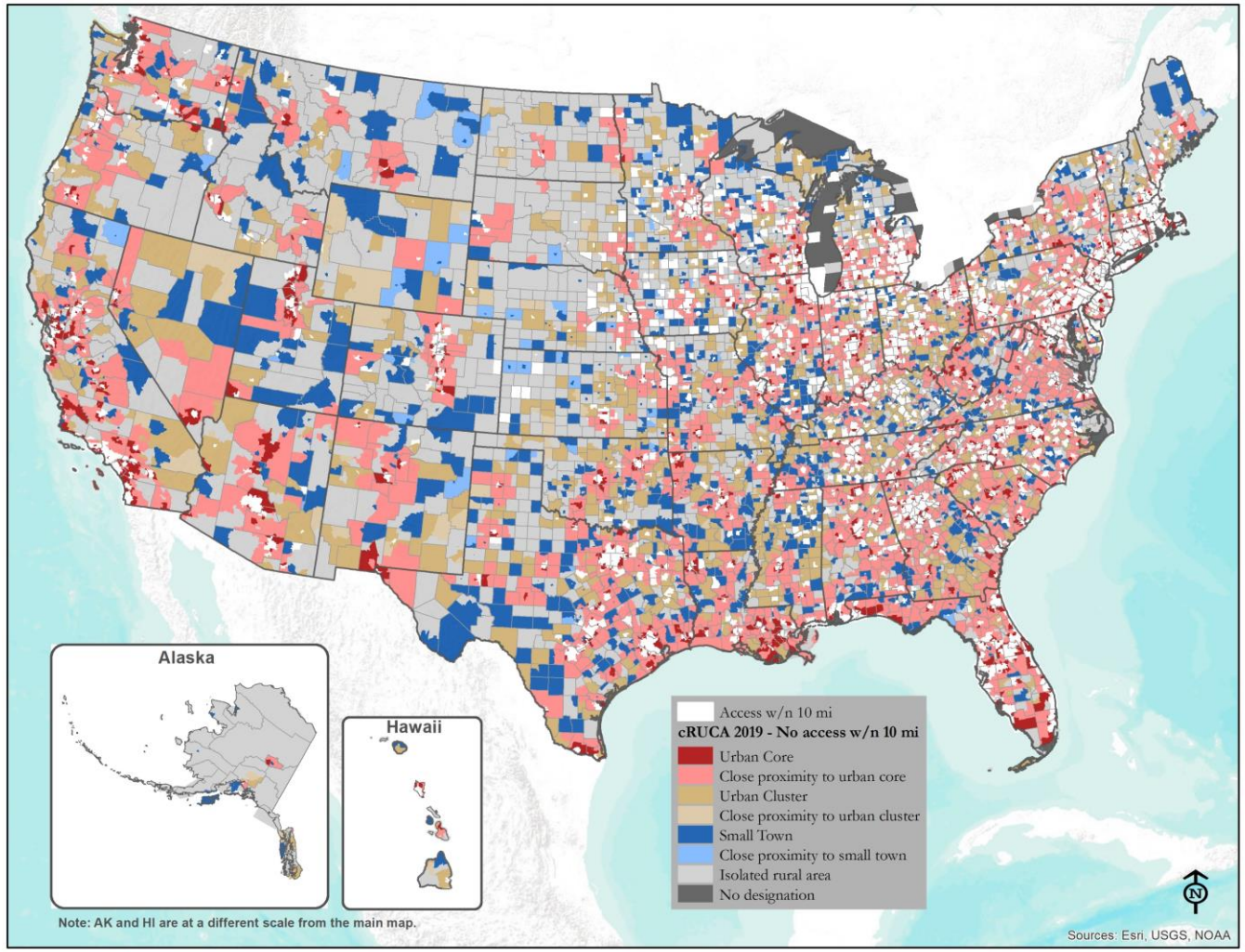




- NEXT WE WILL LOOK AT ACCESS WITHIN 10, 20, 40, 50, 100 MI

Preliminary results (unpublished) – please do not distribute.

No Access at 10 miles



CENSUS TRACTS

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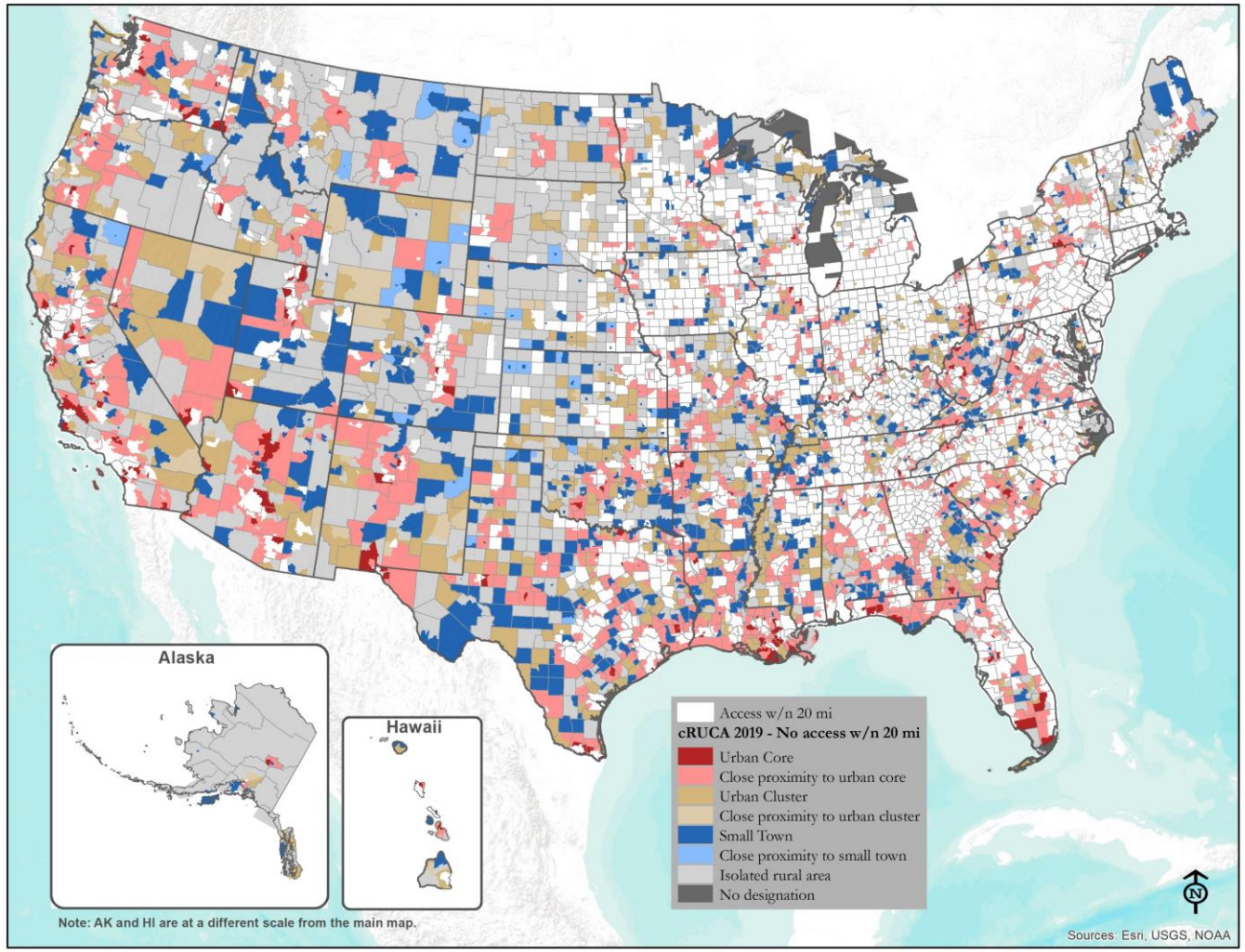
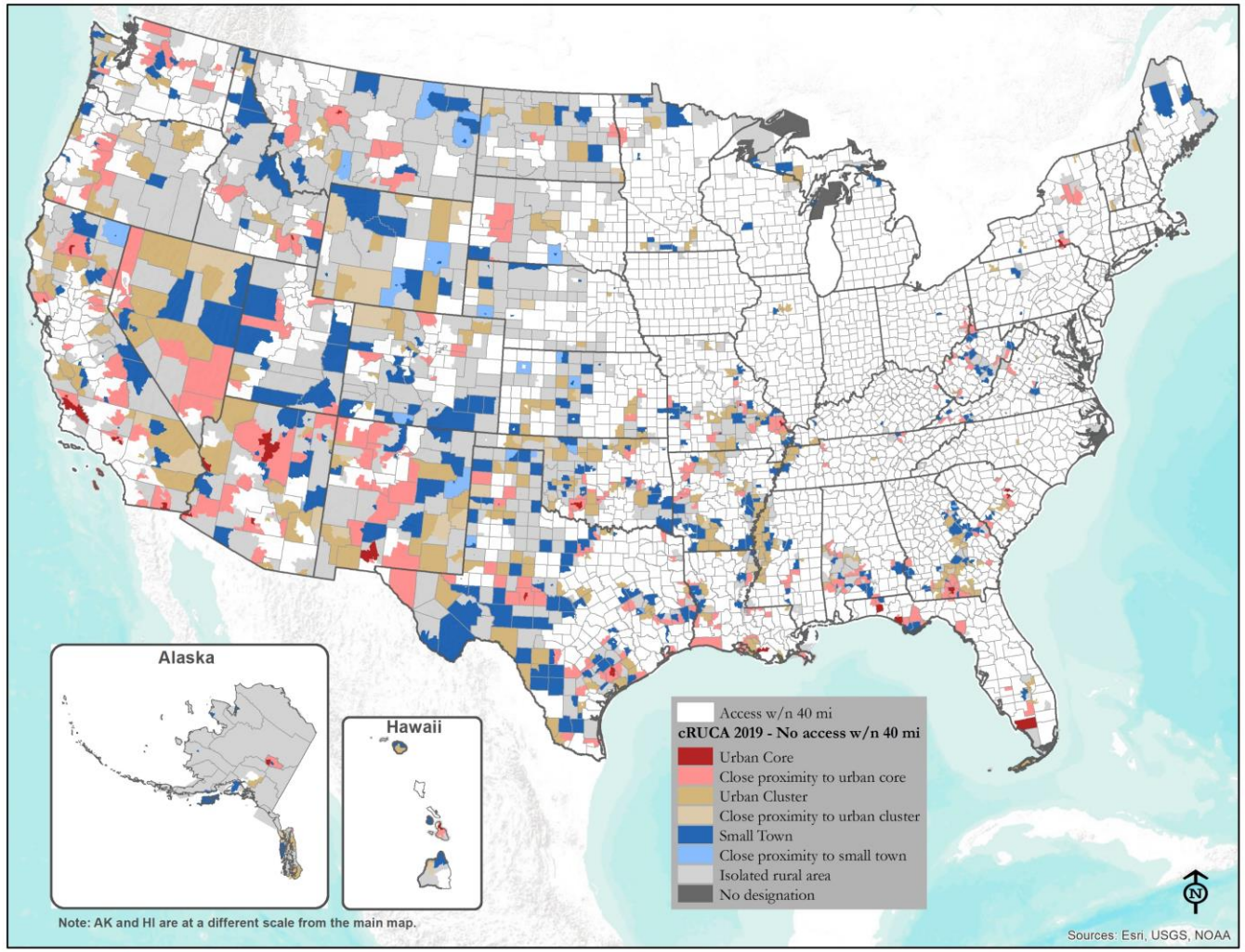
No Access at 20 miles



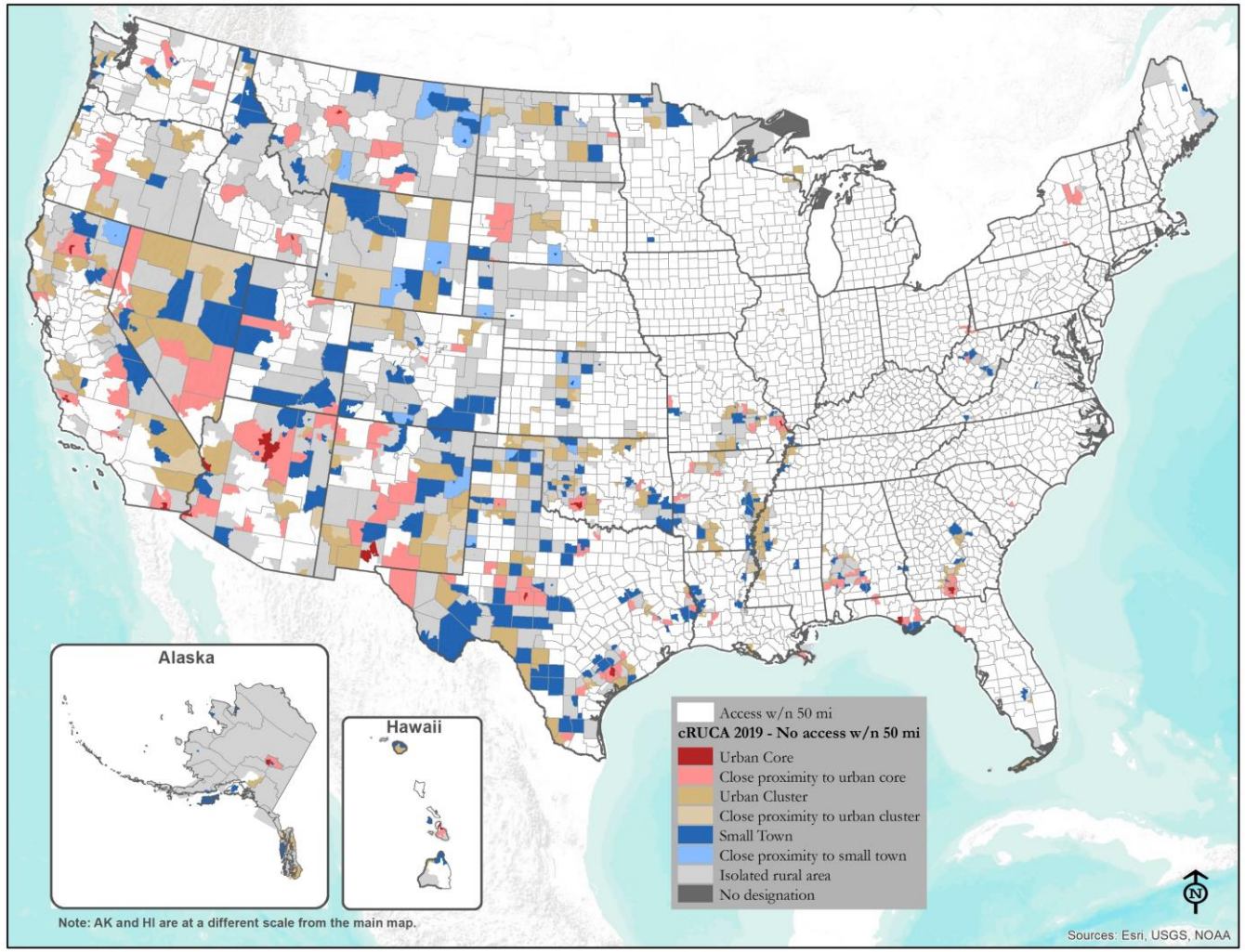
Preliminary results (unpublished) – please do not distribute.

No Access at 40 miles



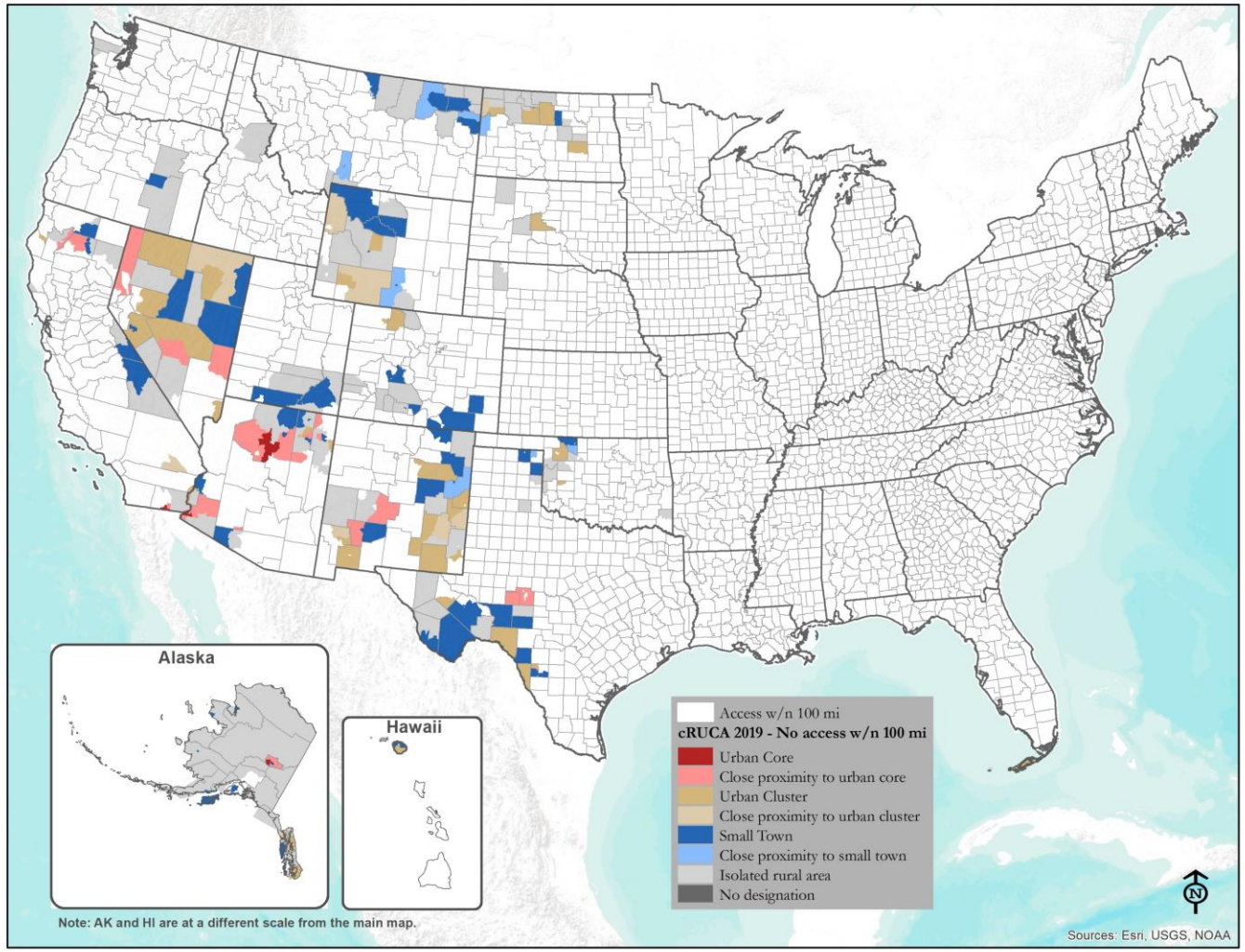
Preliminary results (unpublished) – please do not distribute.

No Access at 50 miles



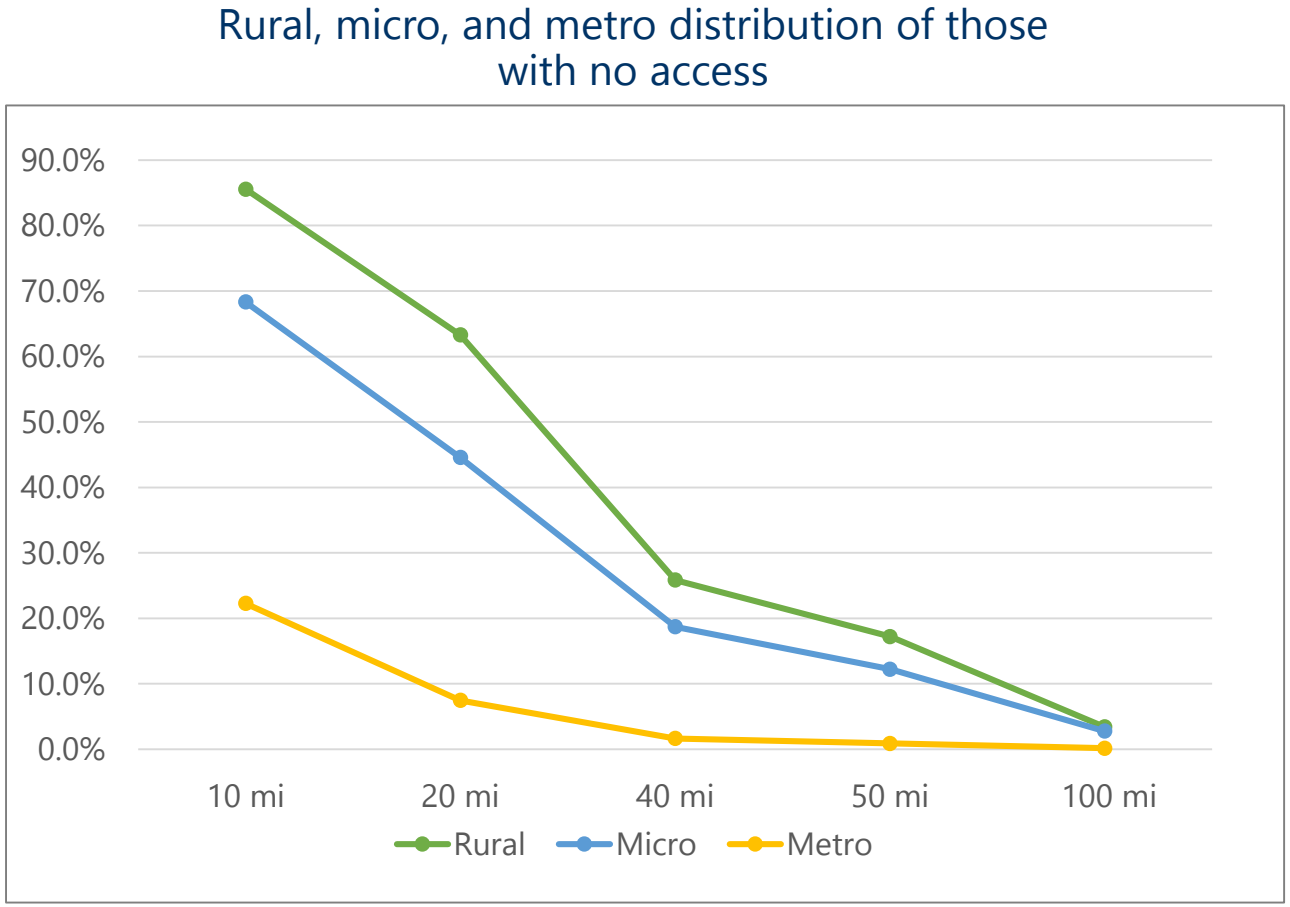
Preliminary results (unpublished) – please do not distribute.

No Access at 100 miles



Preliminary results (unpublished) – please do not distribute.

% of individuals with no access across metro/micro/rural counties



BUT, About 84% of the 50-79 population resides in Metro counties.
Consider also the number of people with no access

Preliminary results (unpublished) – please do not distribute.

Conclusions/Discussion

- Disparity in access to ACR lung cancer screening facilities in rural and urban areas.
  - Across all distances, across counties and census tracts, there is a **larger percentage population in the rural designated geographies with no access**
  - When reviewing the **actual number of individuals with no access** the trend is not as consistent
  - Disparity should be examined within the context and **both percentages and counts** should be considered when planning interventions.

- OMB's rural and urban classification is for **counties and mask subcounty differences** that are revealed using the census tract classification. Analysis should be done at the census tract level to reveal more detailed trends in communities

- Decision makers should avoid using binary classifications of rural and urban.

- Rural areas require a different intervention approach than urban areas. **Rural areas have fewer people, but they cover larger geographic areas than urban areas.**

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