Mapping Efforts to Identify Populations at Higher Risk of Lead Exposure: *HUD Perspective*

2021 Lead Exposure and Prevention Advisory Committee (LEPAC)
Virtual Meeting: December 2021
Veronica Helms Garrison

Agenda

Background

Deteriorated Paint Index (DPI)

Housing and Lead Index (HaLI)

Background

DIFFERENT TOOLS AND APPROACHES FOR DIFFERENT PURPOSES

HUD's mission is to create strong, sustainable, inclusive communities and quality affordable homes for all.

Lead exposure in housing.

It is the mission of the U.S. Department of Health & Human Services (HHS) to enhance and protect the health and well-being of all Americans.

Health impacts of lead exposure.

The mission of EPA is to protect human health and the environment.

Lead in the environment.

US Dept Housing & Urban Development (HUD)

HUD is responsible for overseeing the nation's housing and community development policies

Office of Lead Hazard and Control and Healthy Homes

- FY21 - $325 million for Lead Hazard Reduction Grant Program
- FY21 - $40 million for Healthy Homes Production Program
- FY21 - $7 million for Lead and Healthy Homes Technical Studies Grant

- FY20 - $12 million for Healthy Homes Production Grant Program for Tribal Housing Program

Office of Policy Development and Research

- Data and research support
- Geospatial resources
- According to the *data*, what jurisdictions have the highest risk?

Lead Dust Exposure in the Home

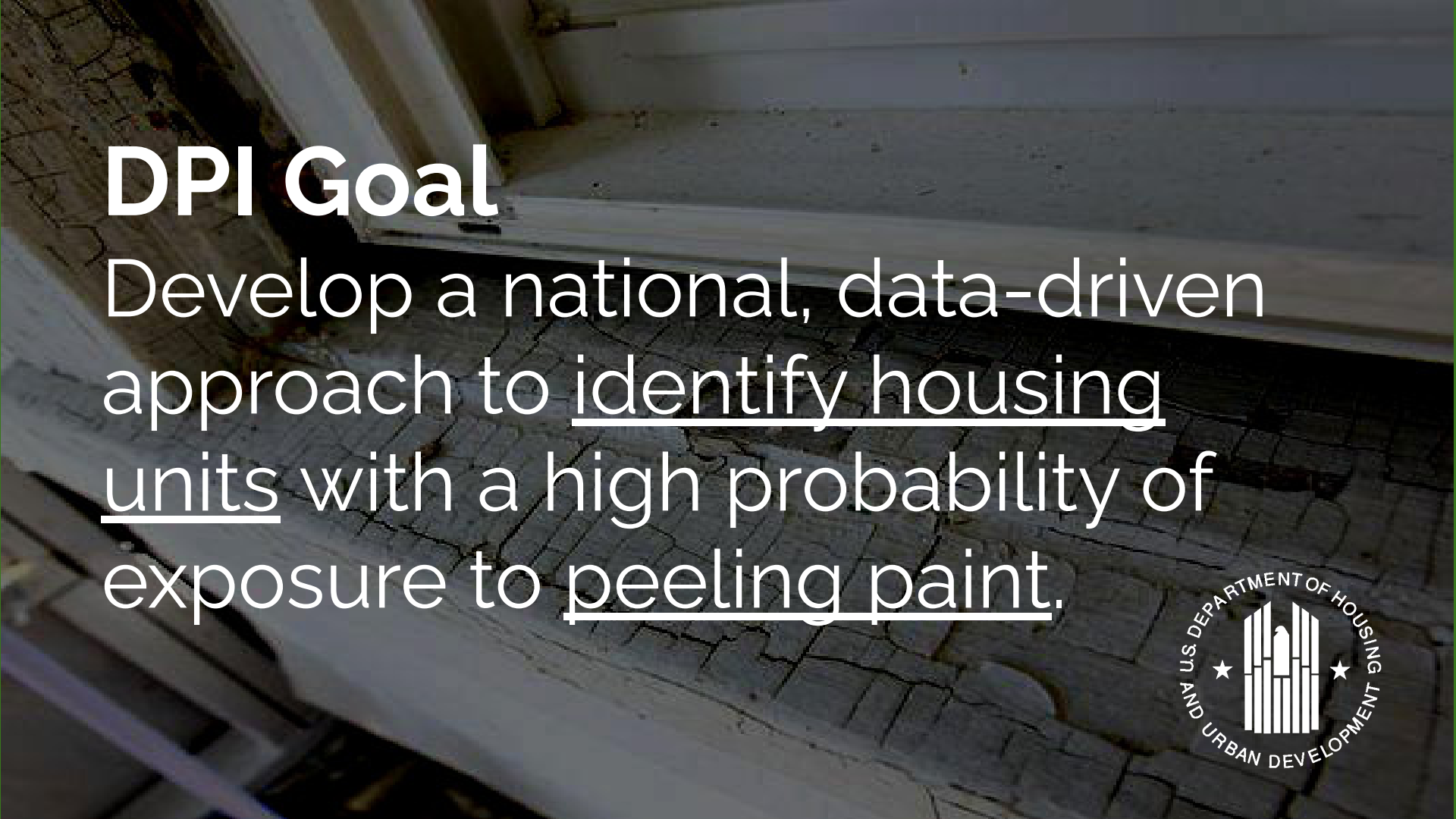
Most common source of lead exposure = ingestion of household lead dust resulting from deteriorating lead-based paint

When paint deteriorates, chipping creates contaminated lead dust

Settling dust can be ingested, particularly by children

Residential lead dust is highly correlated with elevated blood lead levels in young children

Deteriorated Paint Index (DPI)



DPI Goal

Develop a national, data-driven approach to identify housing units with a high probability of exposure to peeling paint.

DPI Project Aim(s)

1. Predict the prevalence of peeling paint exposure in the U.S. housing stock

2. **Identify high-risk geographic areas**

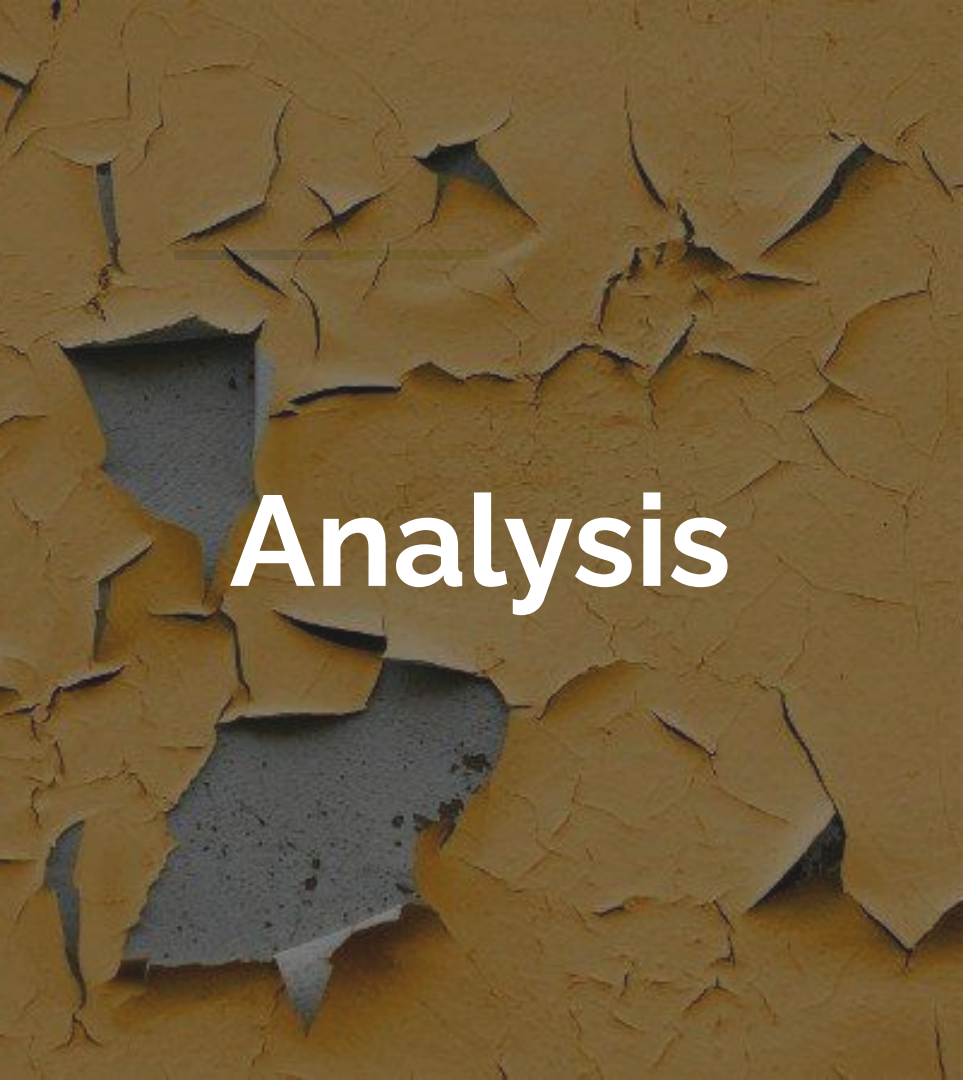
Data Sources

American Housing Survey (AHS)

- Biannual
- Nation's largest housing survey
- Healthy homes module (2011, 2015, 2023)

American Community Survey (ACS)

- Premier source for detailed population information
- Nation's largest household survey
- Sent to approximately 295,000 addresses monthly (or 3.5 million per year)



Analysis

Analyses were conducted using SAS (SAS Version 9.1.4; SAS Institute Inc., Cary, NC)

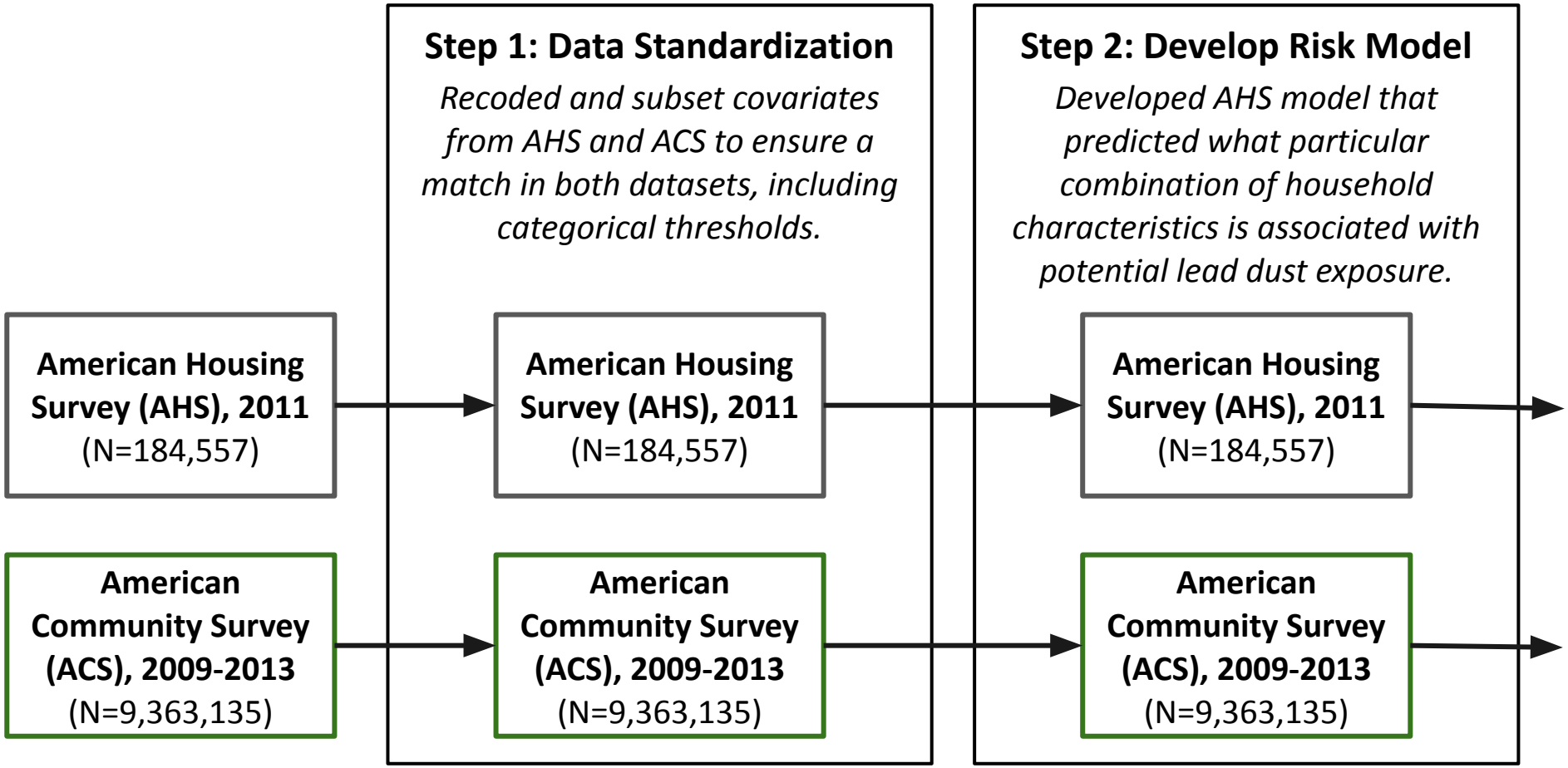
Household-level microdata

Census Bureau-approved partner institution Federal Statistical Research Data Center (RDC) to ensure a secure environment

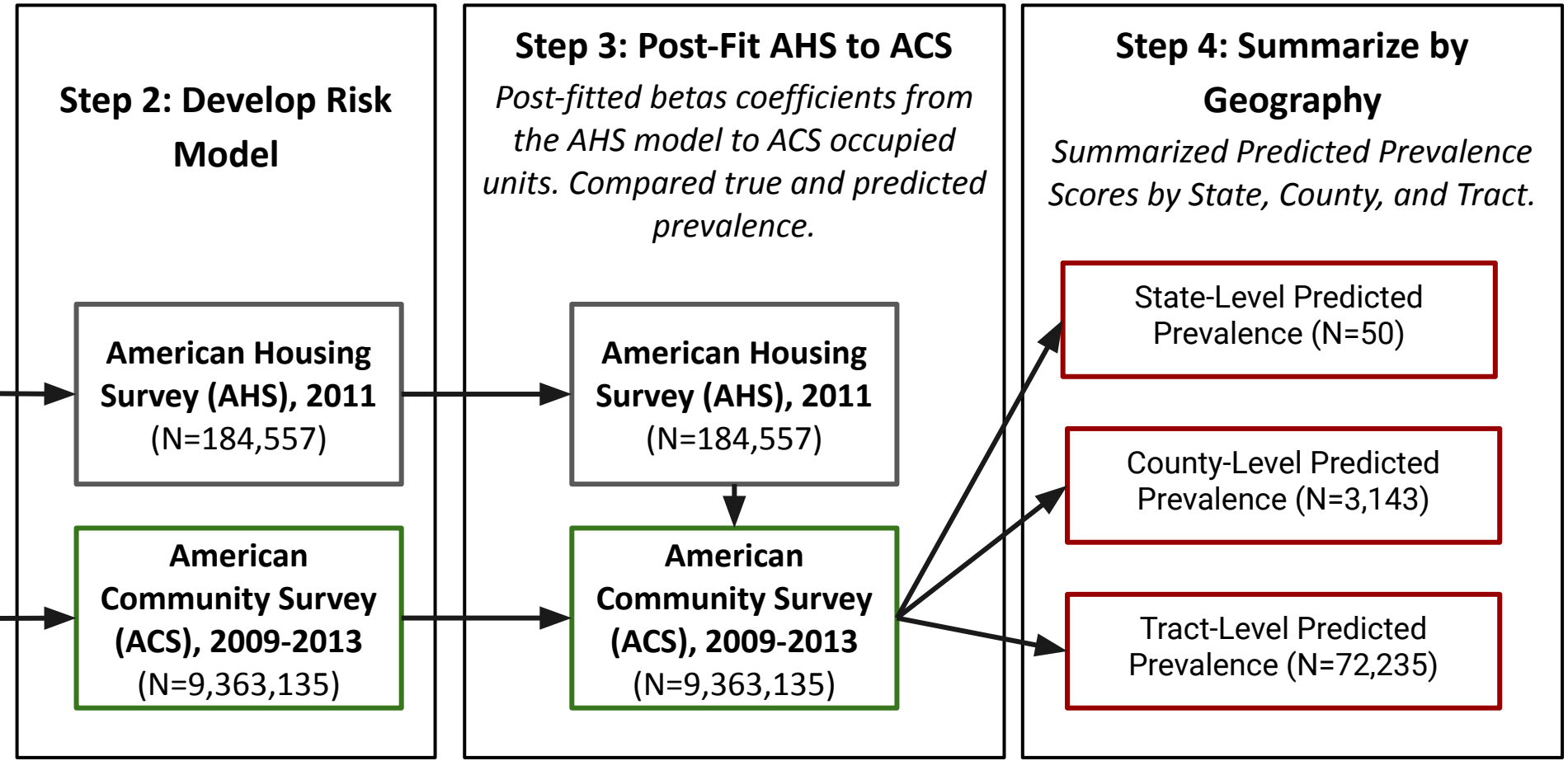
DPI Methodology

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Data Management Processes (1 of 2)



Data Management Processes (2 of 2)



Step 1: Data Standardization

Same unit of analysis: occupied households

Caveat: Variables must be present and consistent in both AHS and ACS, including categorical thresholds

Examined ACS and AHS characteristics side by side

Step 2: Develop Model

Model developed using domain expertise, results from bivariate analyses, and existing literature.

The American Housing Survey was used to develop the outcome measure:

Occupied households built <1980 that reported a large area of peeling paint.

Known Covariates

Age of Housing + Peeling Paint:

- Level of lead surface loading in indoor dust has been associated with the age of the home, chipping and peeling interior paint (Egeghy et al. 2012).

Age of Housing:

- Pre-1978 (particularly pre-1950 housing) is a strong predictor of residential dust lead exposure (Jacobs et al. 2002; Gaitens et al. 2009).

Race/Ethnicity:

- Blacks shown to be at significantly higher risk of lead exposure and absorption (Lanphear et al., 1996).

Renter vs. Owner Status:

- Rental housing has been shown to be an indicator of a lead hazard in the home and associated with elevated blood lead levels (Lanphear et al. 2005).

Socioeconomics and Community Characteristics:

- Poverty; population density; lower housing value; lower percentage of high school graduates; and lower percentage of owner-occupied housing (Lanphear et al., 1998b; Vivier et al., 2011).

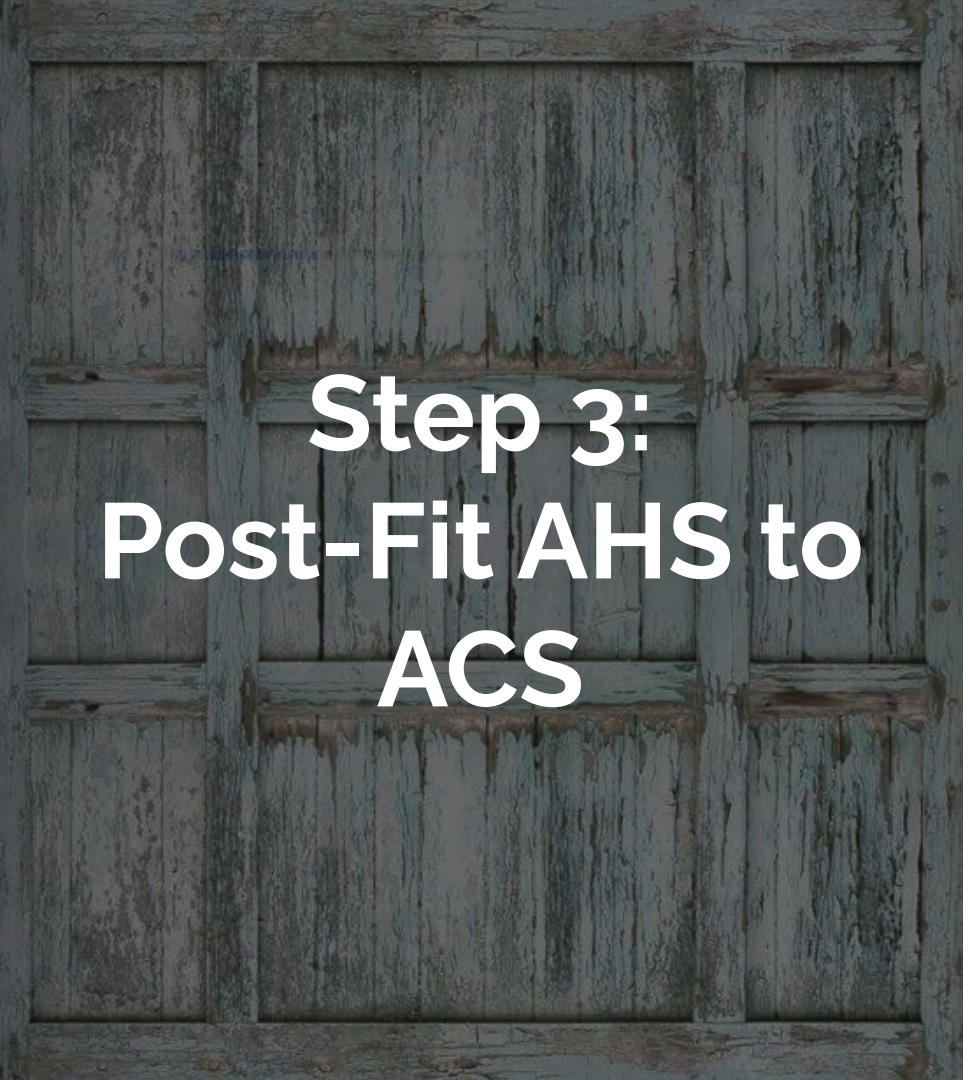
Selected Covariates

Household-Level:

- Presence of children aged 0-17
- Housing tenure status (owned, rented, or other)
- Household income
- Census division

Head of Household Level:

- Race (white, black, other)
- Ethnicity (Hispanic or not Hispanic)
- Education level

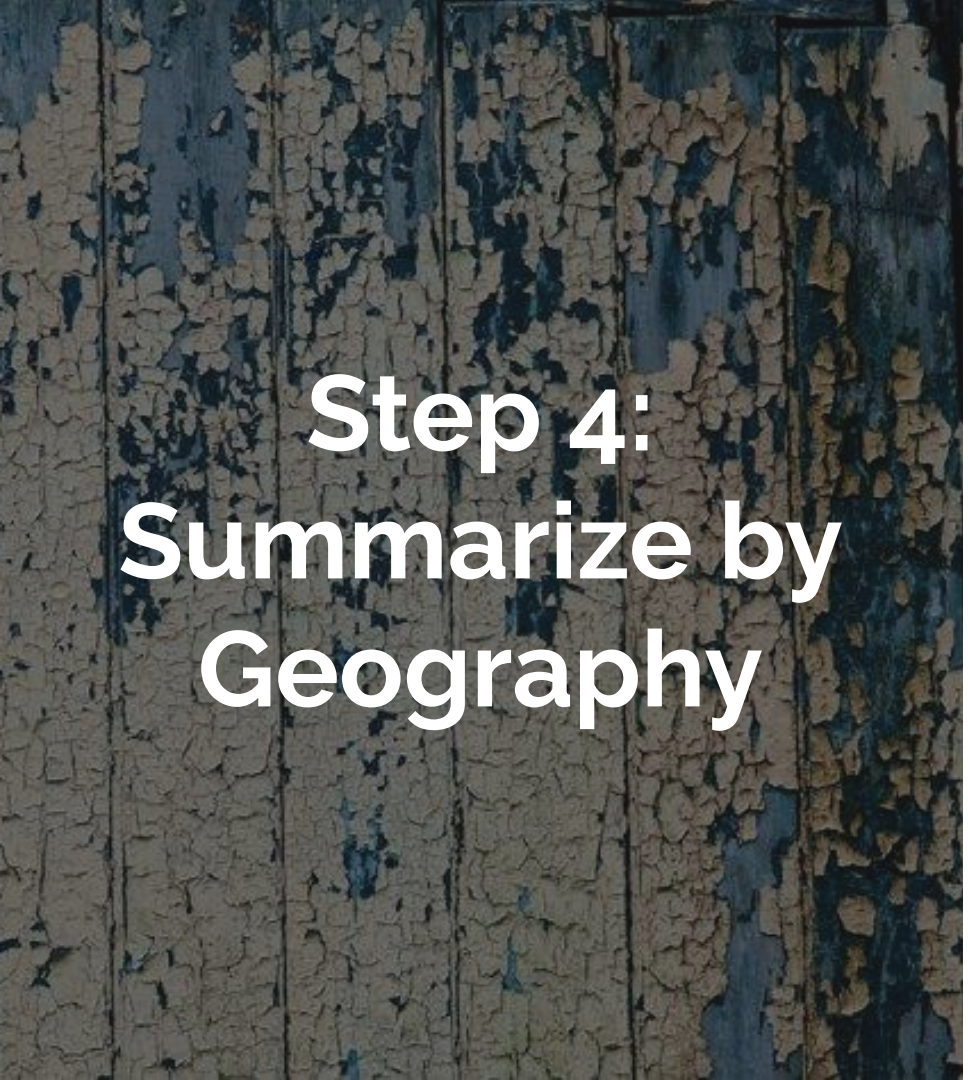


Step 3: Post-Fit AHS to ACS

Using the same unit of analysis and covariates in the AHS and the ACS, logistic regression beta coefficients from the AHS models were fitted to ACS households.

Resulted in the development of a lead dust exposure risk score for each ACS housing unit.

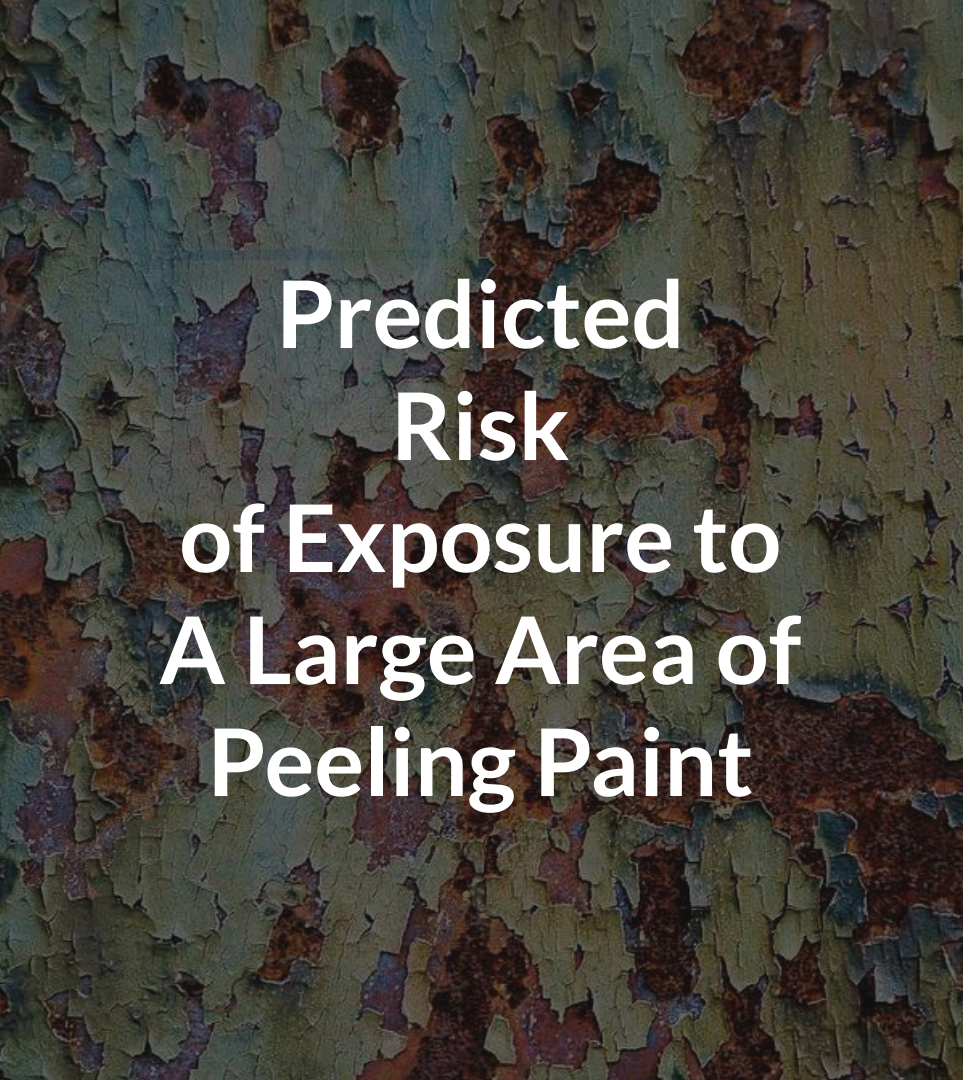
Predicted ACS risk scores were then compared alongside outcome prevalence in the AHS by model attribute.



Step 4: Summarize by Geography

For each state, county, and tract in the 2009-2013 American Community Survey, a risk score was calculated by summarizing the median household-level risk score across each respective jurisdiction.

DPI Results:
Peeling Paint & Built < 1980

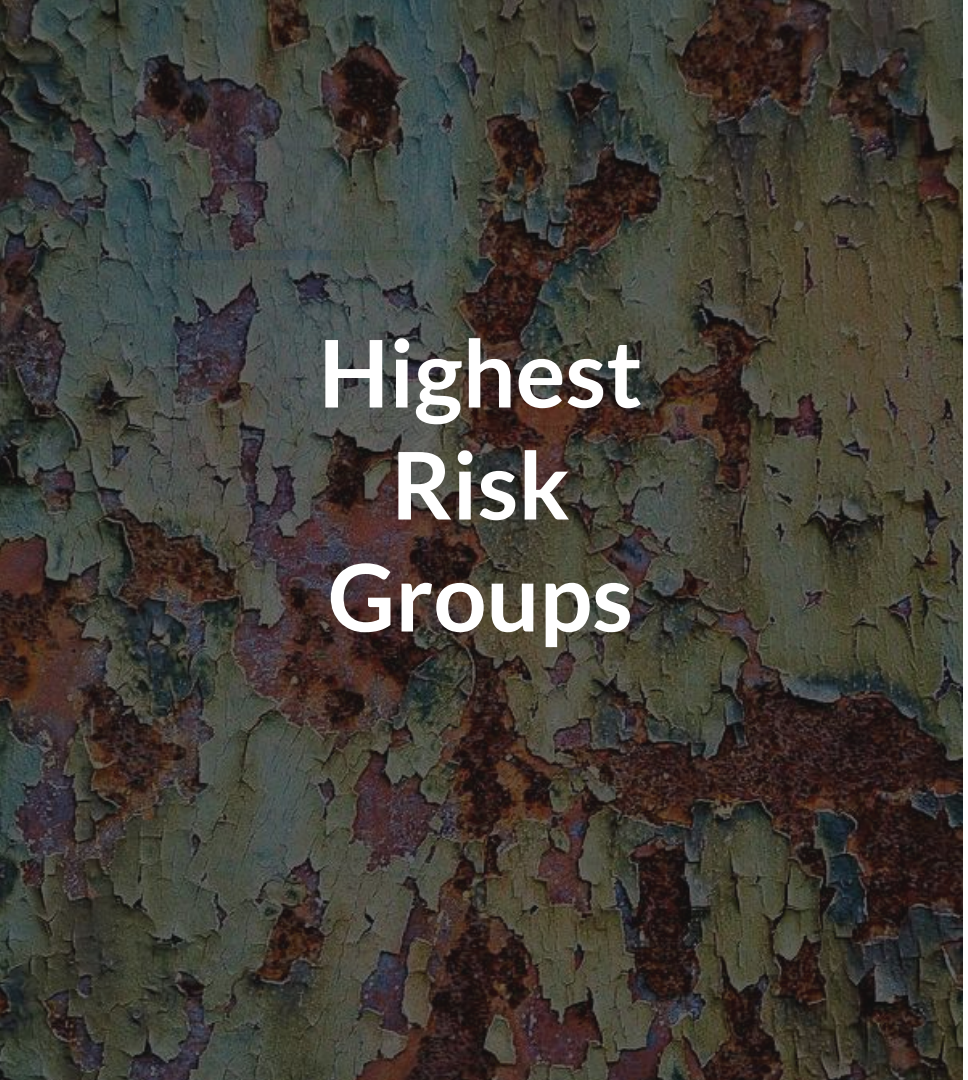


Predicted Risk of Exposure to A Large Area of Peeling Paint

Percentage of occupied housing units with potential deteriorated peeling paint

True: 1.74%

Predicted: 1.73%



Highest Risk Groups

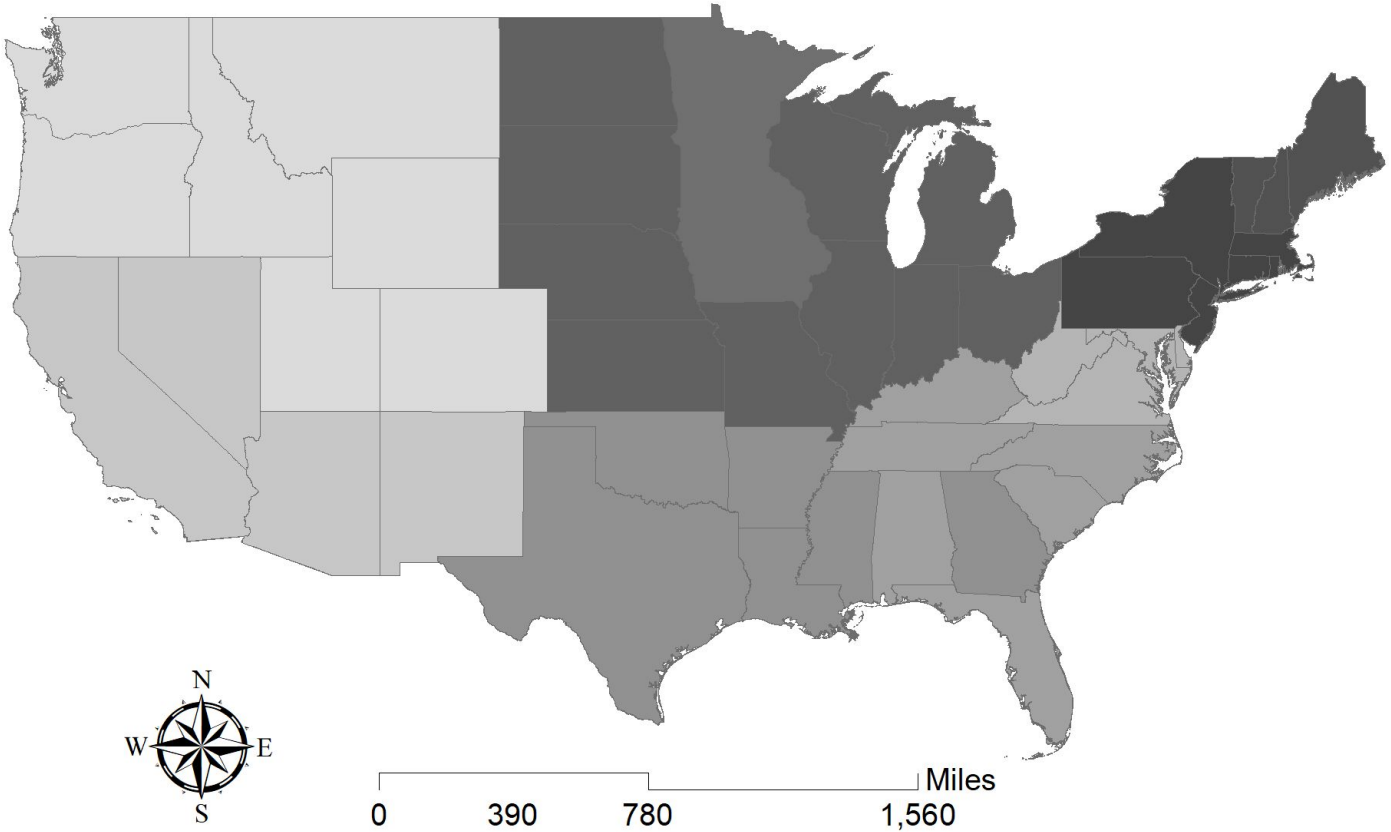
Low-Income (1.38x)

Renters (1.82x)

Households headed by black persons (1.94x)

Northeast (2.06x)

State-Level Predicted Risk of the Presence of Occupied Housing Units with Large Areas of Deteriorated Paint by Decile, United States, 2009-2013



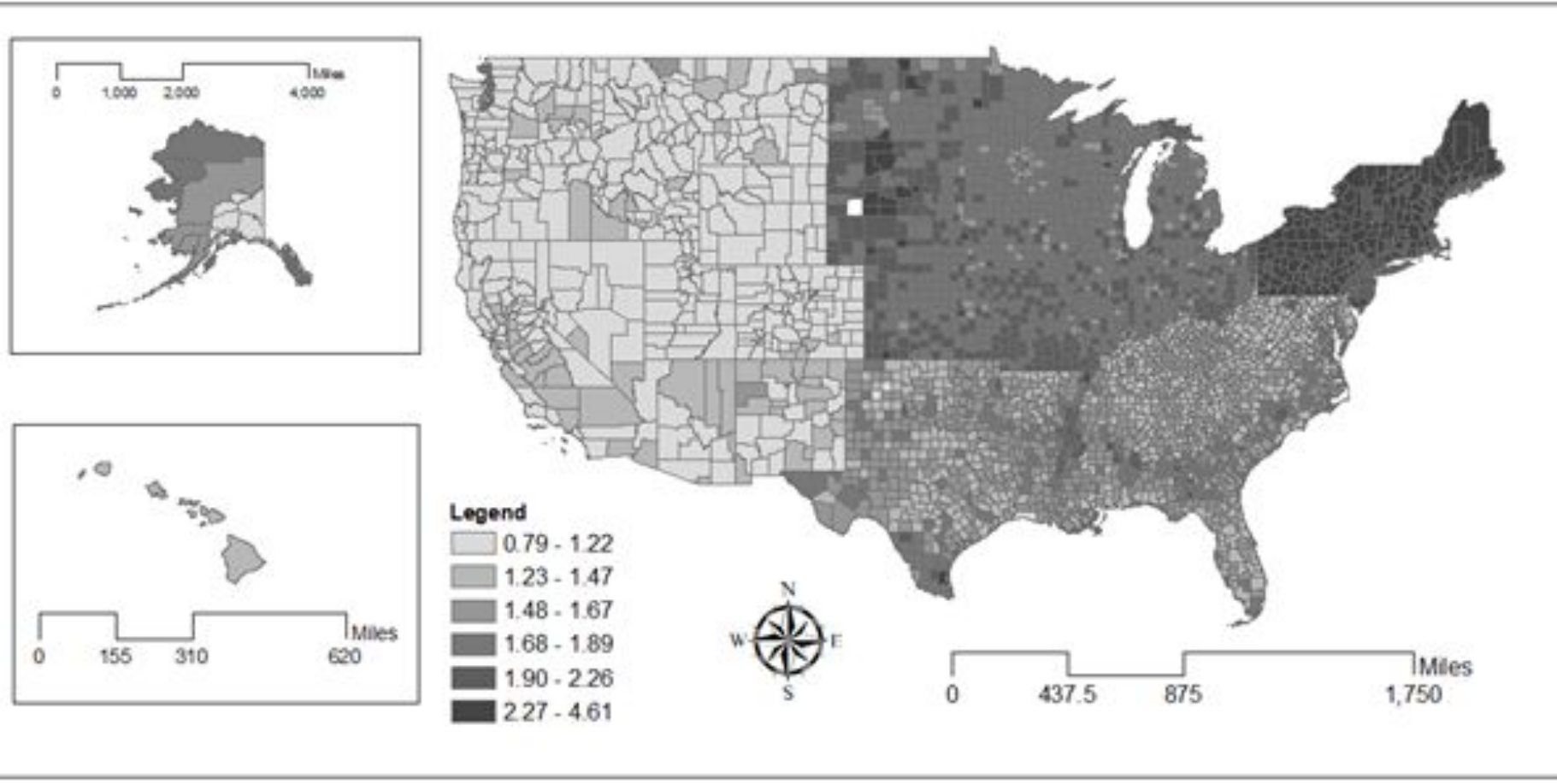
States with Highest Predicted % of Housing Units with Lead Dust Exposure Risk

Rank	State Name	Mean Predicted %
1	New York	2.90
2	Rhode Island	2.66
3	New Jersey	2.61
4	Massachusetts	2.56
5	Pennsylvania	2.52

States with Highest Predicted % of Housing Units with Lead Dust Exposure Risk

Rank	State Name	Mean Predicted %
6	Connecticut	2.51
7	Maine	2.41
8	Vermont	2.36
9	New Hampshire	2.29
10	Illinois	1.95

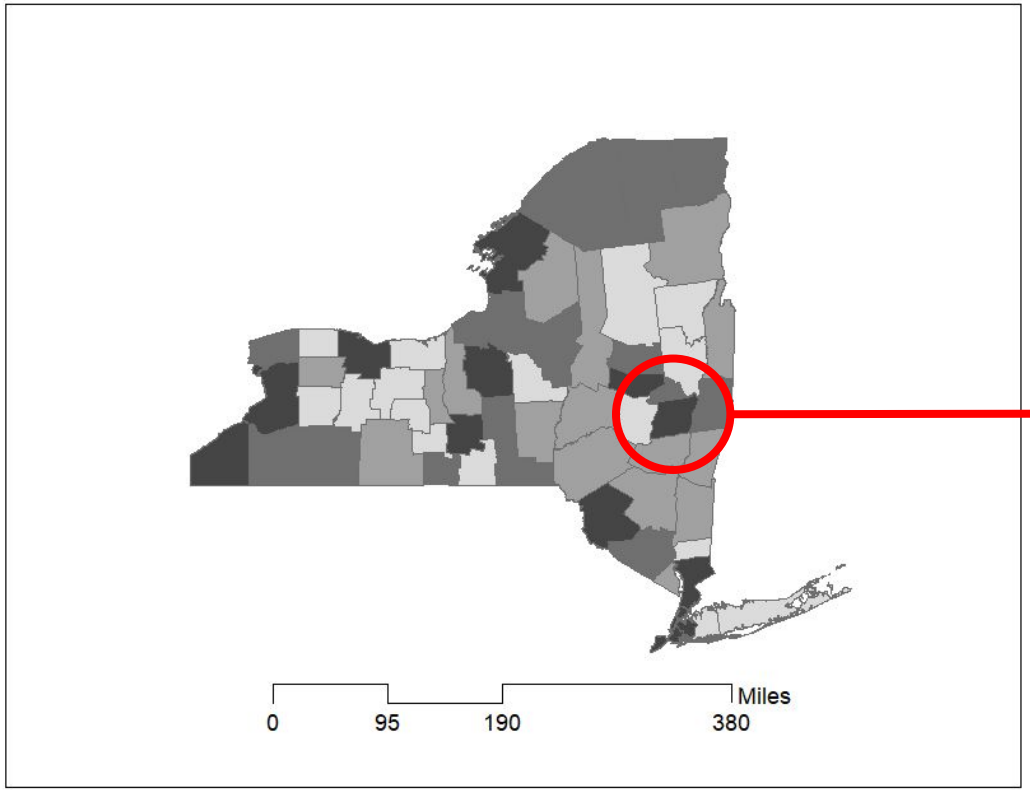
Decile Rank	State Names			Mean Predicted % Range
10	New York New Jersey	Rhode Island Massachusetts	Pennsylvania	2.52-2.90
9	Connecticut New Hampshire	Maine Illinois	Vermont	1.95-2.51
...		**...**		**...**
1	Washington Idaho	Montana Utah	Colorado Wyoming	1.02-1.08

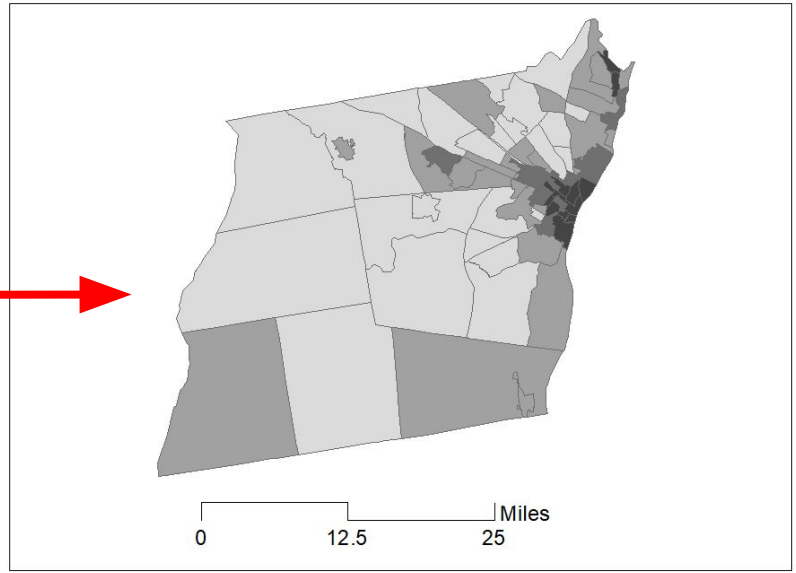

0
1,000
2,000
4,000
Miles
0
155
310
620
Miles
Legend
0.79 - 1.22
1.23 - 1.47
1.48 - 1.67
1.68 - 1.89
1.90 - 2.26
2.27 - 4.61
N
W
E
S
0
437.5
875
1,750
Miles

Counties with the Highest Predicted Percent of Housing Units at Risk of Lead Dust Exposure

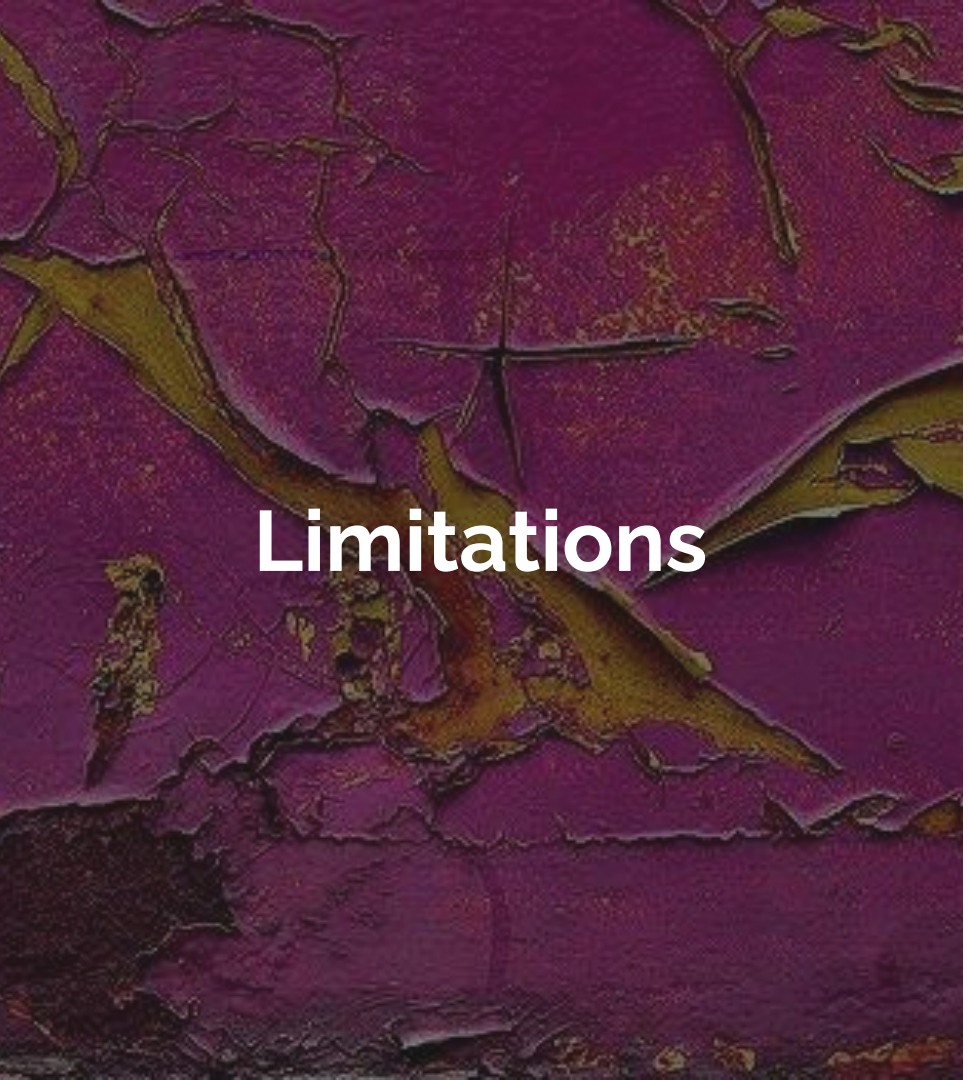
Rank	Name, State Abbreviation	Corresponding CBSA	Predicted % Units
1	Bronx County, NY	New York-Newark-Jersey City, NY-NJ-PA	4.61
2	Buffalo County, SD		3.59
3	Kings County, NY	New York-Newark-Jersey City, NY-NJ-PA	3.58
4	Hudson County, NJ	New York-Newark-Jersey City, NY-NJ-PA	3.47
5	Todd County, SD		3.42
6	Queens County, NY	New York-Newark-Jersey City, NY-NJ-PA	3.34

County-Level and Tract-Level Predicted Risk of the Presence of Occupied Housing Units with Large Areas of Deteriorated Paint by Quartile, New York State, 2009-2013



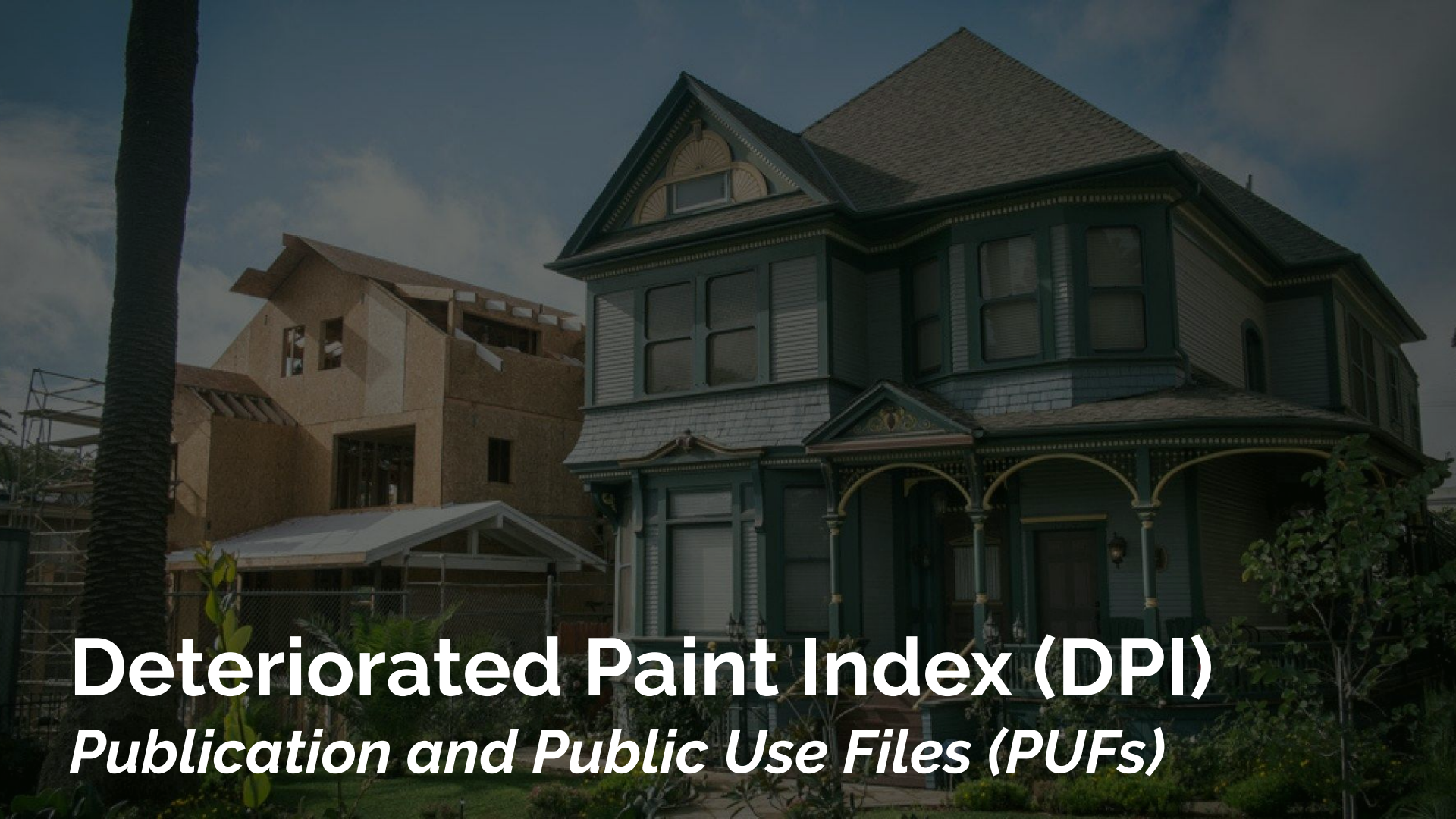


Most useful when specific jurisdiction predetermined → Quartile, decile, etc.



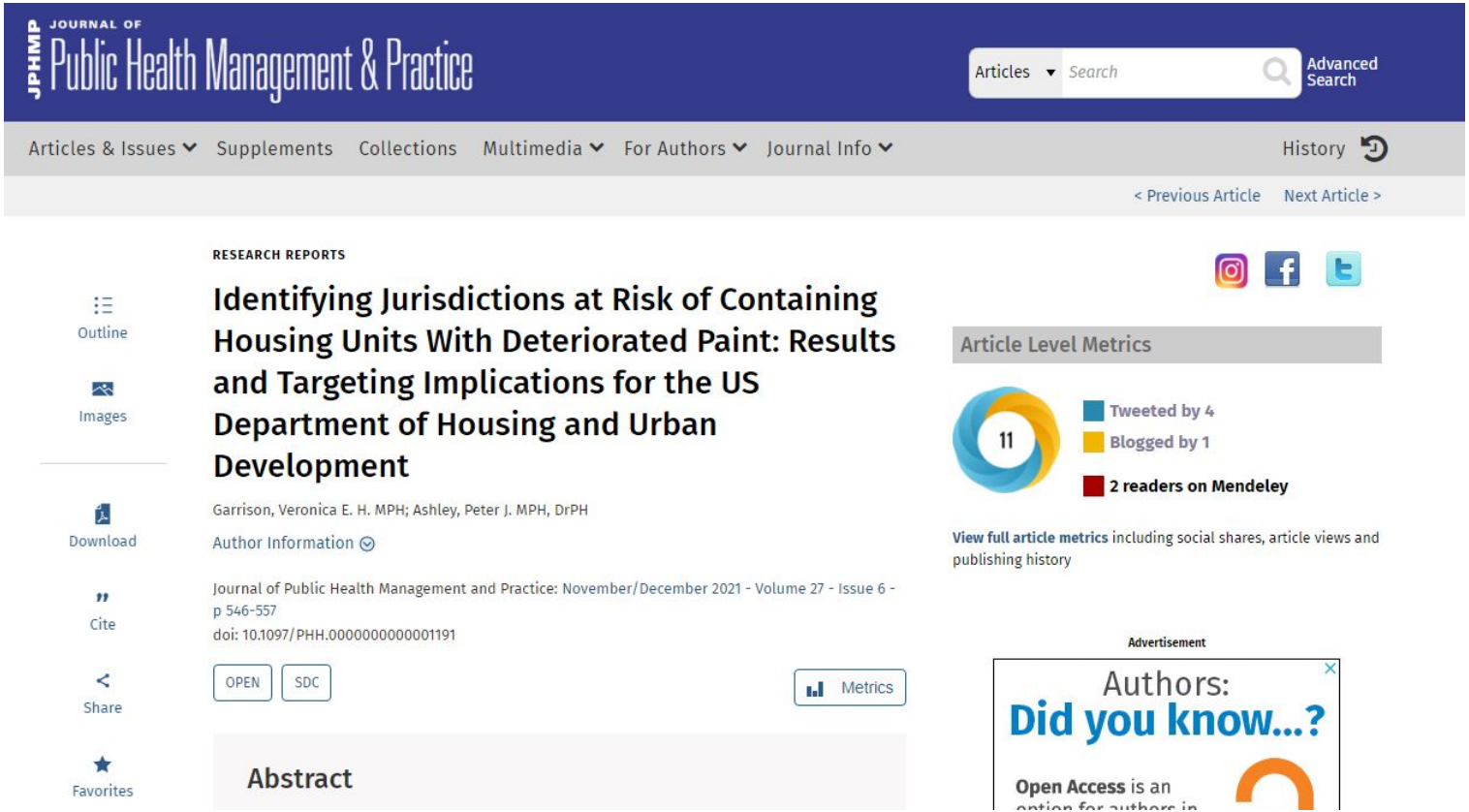
Limitations

1. Outcome had relatively small N
2. Study limited to covariates that were available in both the ACS and the AHS
3. AHS responses are self-report
4. No way to determine if housing unit had already undergone remediation
    - Tract-level OLHCHH data
5. Compared against NHANES or screening/testing data



Deteriorated Paint Index (DPI)

Publication and Public Use Files (PUFs)



November 2021: [Identifying Jurisdictions at Risk of Containing Housing Units With Deteriorated Paint: Results and Targeting Implications for the US Department of Housing and Urban Development]

Public Use Files (PUFs)

- HUD's Geospatial Data Storefront
  - Deteriorated Paint Index by Tract
  - Deteriorated Paint Index by County
  - Deteriorated Paint Index by State

Interactive Map

- Deteriorated Paint Index (DPI): DPI Interactive Map
- Corresponding User's Guide

The United States (U.S.) Department of Housing and Urban Development (HUD) Deteriorated Paint Index (DPI): Interactive Map User's Guide

State and local policymakers and administrators interested in using HUD's Deteriorated Paint Index (DPI) for lead remediation and abatement targeting should consult this document. **The purpose of this document is to outline steps a user should take when using HUD's interactive DPI map to view results for a specific jurisdiction[1].** In this document, Northeast Washington, District of Columbia is used as an example jurisdiction and tract-level risk scores are examined. As an alternative to the online map, raw data can be downloaded by visiting the HUD-EGIS Open Data Storefront: http://hudgis-hud.opendata.arcgis.com/.

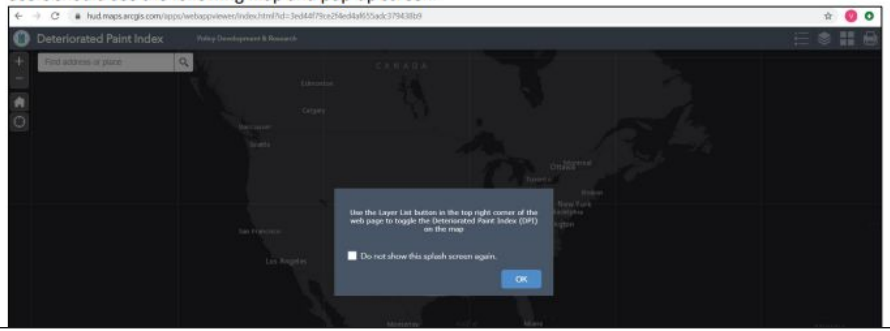
1 Visit the Webpage

Users should visit the interactive map webpage at:
https://hud.maps.arcgis.com/apps/webappviewer/index.html?id=3ed44f79ce2f4ed4af655adc379438b9

For best viewing, users should utilize one of the following browsers:

- Microsoft Edge
- Mozilla Firefox
- Google Chrome
- macOS Safari

Users should see the following map and pop-up screen.



Housing and Lead Index (HaLI)

Housing and Lead Index (HaLI) = DPI+

Deteriorated Paint Index Plus (DPI+)

Important Demographic Variables

- Children aged 0-5
- Mean household income/area median income (AMI)

Environmental Variables

Shift Towards a "Tool" Versus a Map

- PDF reports for specified jurisdiction
- Add your own data

Comparisons → NHANES, screening/testing data, etc.

Improve Model. Machine learning approaches, newer data, state data, etc.

Partnership with GSA

Robust evidence-based tool created from efforts to modernize application processes using advanced analytics → *The U.S. Department of Housing and Urban Development (HUD) partnered with GSA's Federal Acquisition Service Technology Transformation Services (TTS) to streamline application processes using advanced analytics.*

More:

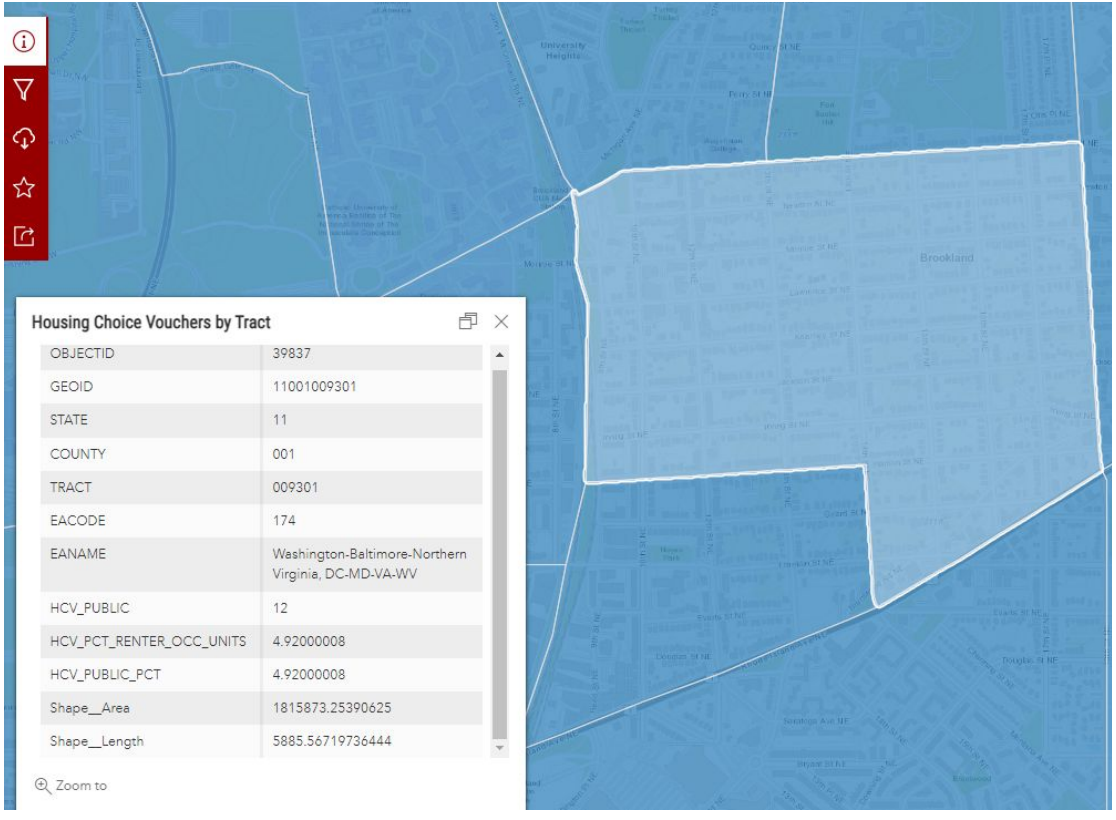
- **Impact Story**
- Finalists for **Accelerating Government Mission Outcomes Through Collaboration, Leadership And Education (ACT-IAC) Igniting Innovation 2020 Conference** and Awards

Tract-Level OLHCHH Program Data

Show the success of OLHCHH grant program targeting

Similar to Housing Choice Vouchers by Tract → Percentage of occupied renter households with vouchers

What is the best way to show this information while preserving privacy?



Thank You! Questions?

Veronica Helms

Email: Veronica.E.Helms@hud.gov

Phone: 202-402-4194