Screening for Lead Poisoning
A Geo-spatial Approach to Determine Testing of Children in At-risk Neighborhoods
City of Atlanta 2005

March 14, 2007

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[*] TKC Integration Services/CDC; [+] GACLPPP; [**] CDC; [#] Georgia Tech;

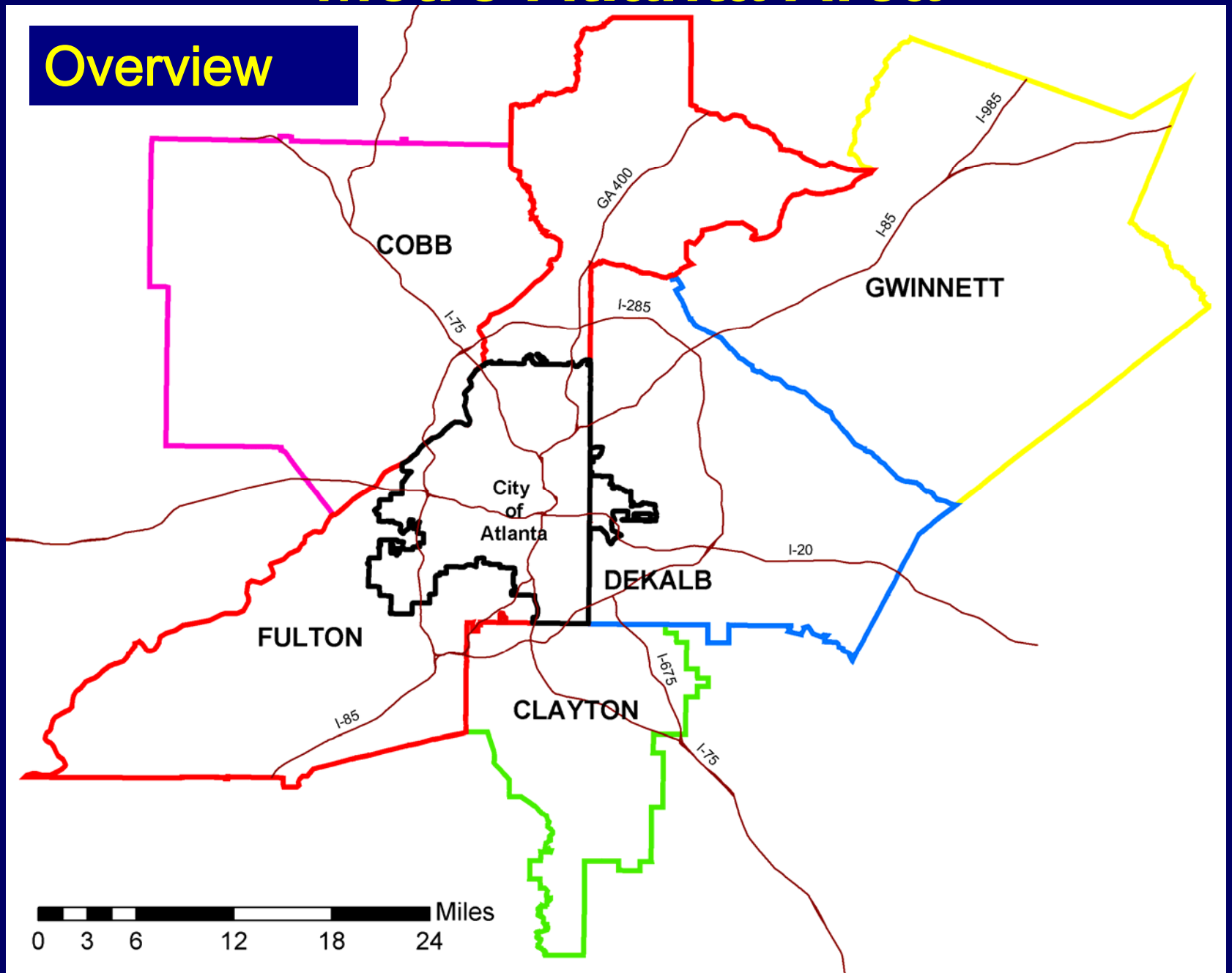
Objective

To assess lead testing of children at high risk for lead poisoning in the City of Atlanta

Georgia Lead Testing Guidelines

- Risk should be verbally assessed for all children at 12 and 24 months of age
- Georgia children who should be tested:
  - their verbal assessment indicates risk
  - Medicaid/PeachCare for Kids/WIC eligible
  - reside in homes built before 1978
  - adopted from outside the United States
  - parents may be exposed to lead at work

Metro Atlanta Area



Focus on Neighborhood

- Risk for lead poisoning varies geographically
- Smaller geographic unit more accurate to assess risk
- Neighborhoods seem an ideal geographic resolution for assessing testing
  - Residents/physicians can easily identify their location by neighborhoods
- Amenable to outreach and interventions

Methods

Lead testing & WIC data (2005)

1. De-duplication of addresses
2. Geocoding

Residential land tax parcel data (2002)

1. Selecting parcels with year structure built
2. Single and multi-family residential parcels

Population data from census (2000)

1. Area-weighted analysis by block groups
2. Children ≤ 3 years

Aggregation

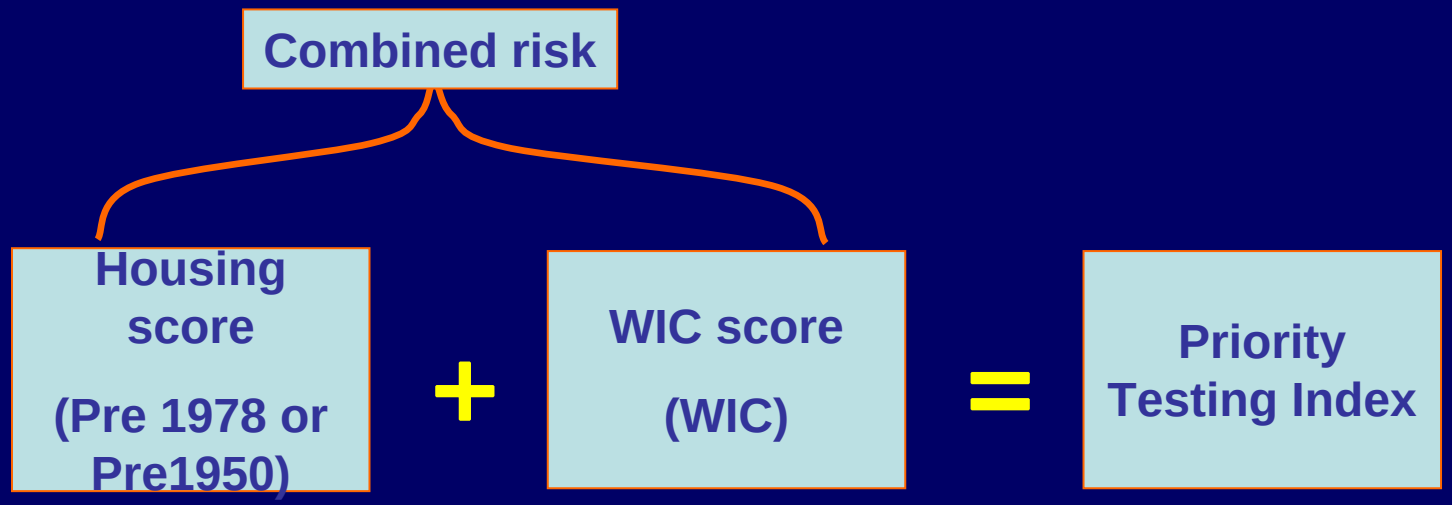
Neighborhood level dataset for analysis

Methods: Neighborhood Risk

- Created priority testing indices
  - To characterize risk by neighborhoods
  - Based on risk factors:
    - % of Pre-1978 housing
    - % of Pre-1950 housing
    - % of WIC children
  - Divided risk factors into quantile groups
  - Developed a scoring scheme to assign value to different quantile ranges of the risk factors

Priority Testing Index

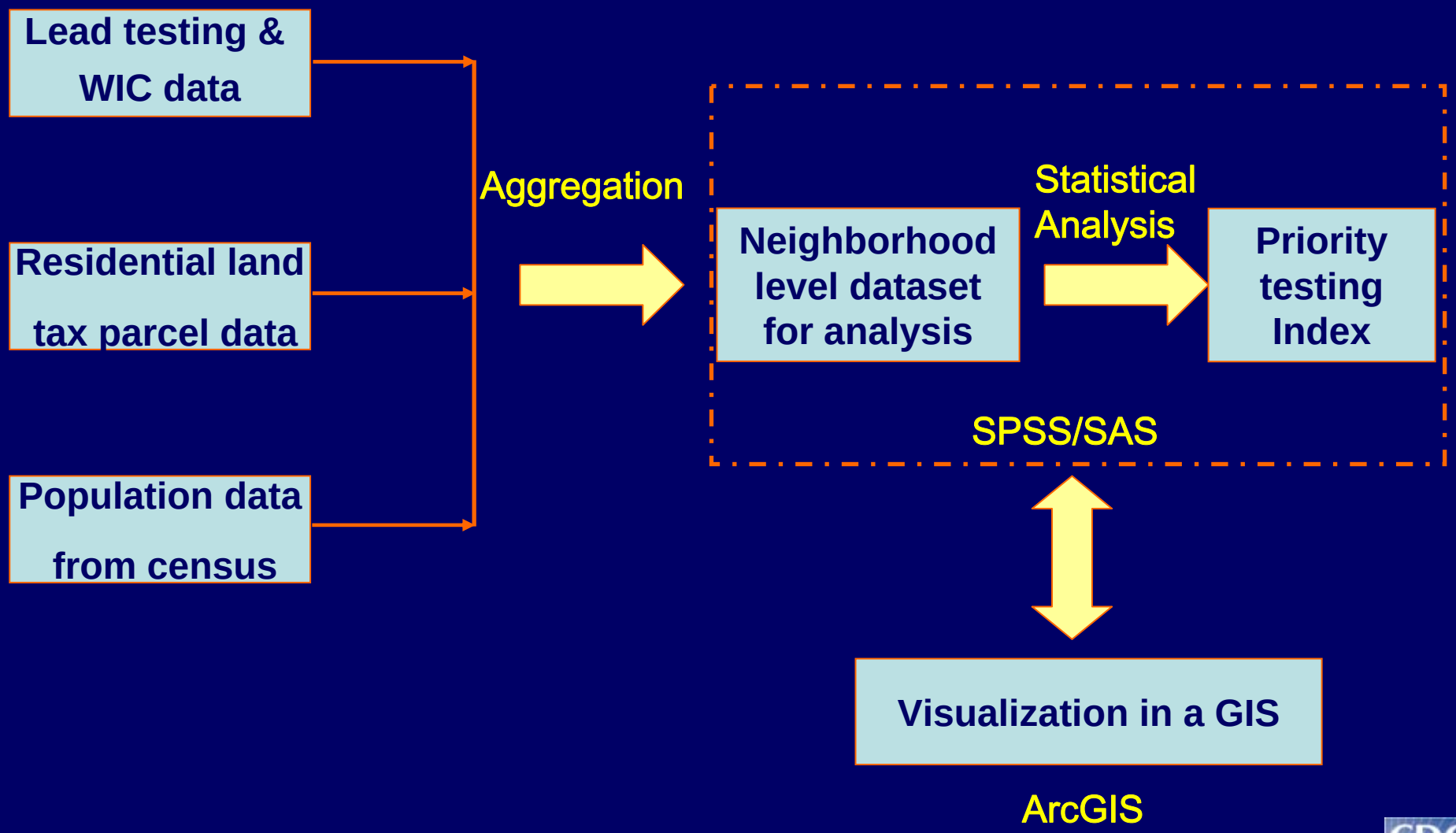
For each neighborhood…



Priority Testing Index

- Priority testing indices categorized
  - Low, Low-Medium, Medium, High-Medium, High
- Calculated two priority testing indices
  - Pre 1978 and WIC
  - Pre 1950 and WIC
- Enabled us to prioritize neighborhood risk
  - e.g. the identification of 10 % of the highest risk neighborhoods

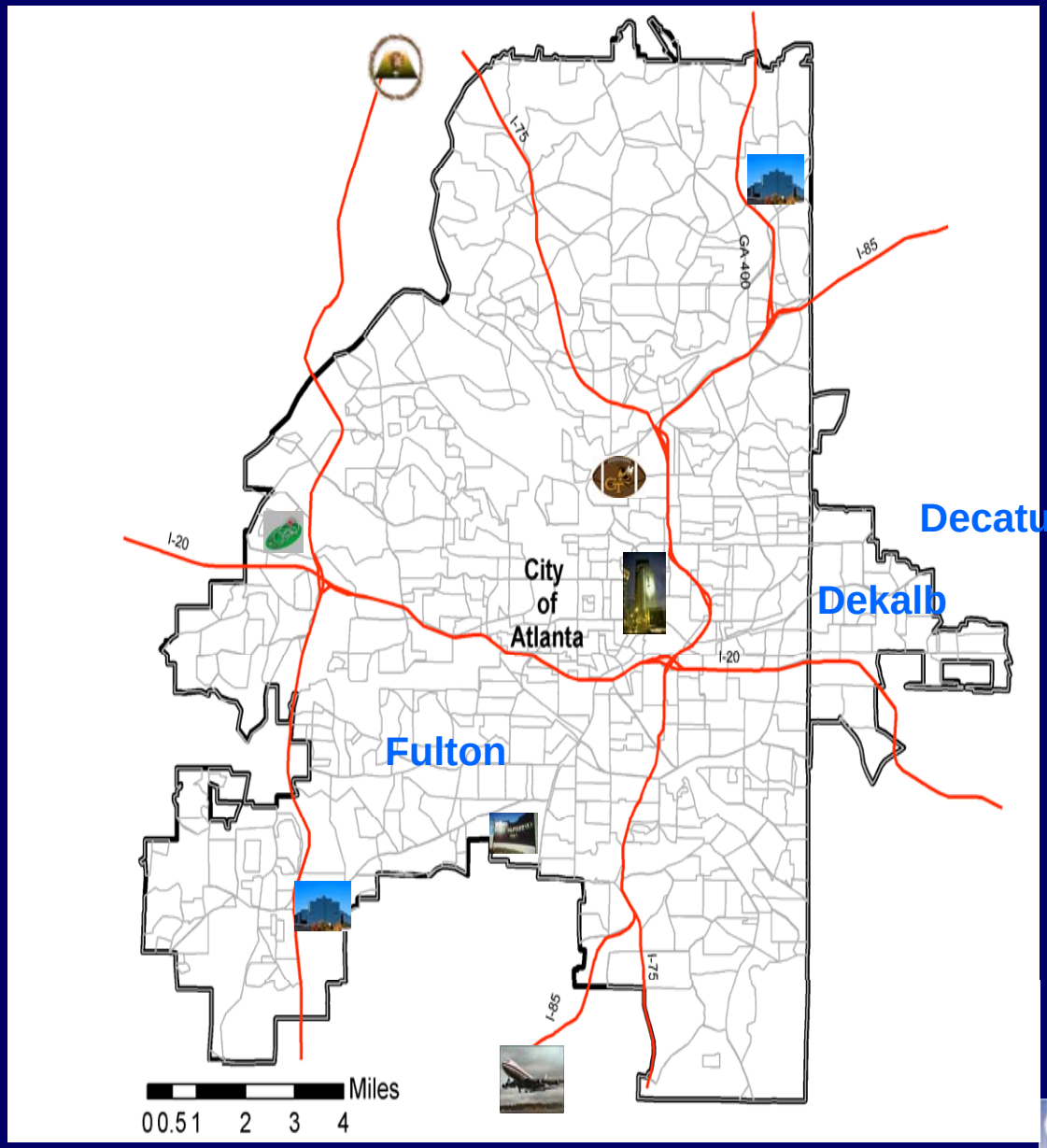
Methods


Lead testing & WIC data
Residential land tax parcel data
Population data from census
Aggregation
Neighborhood level dataset for analysis
Statistical Analysis
Priority testing Index
SPSS/SAS
Visualization in a GIS
ArcGIS

Results

Demographics

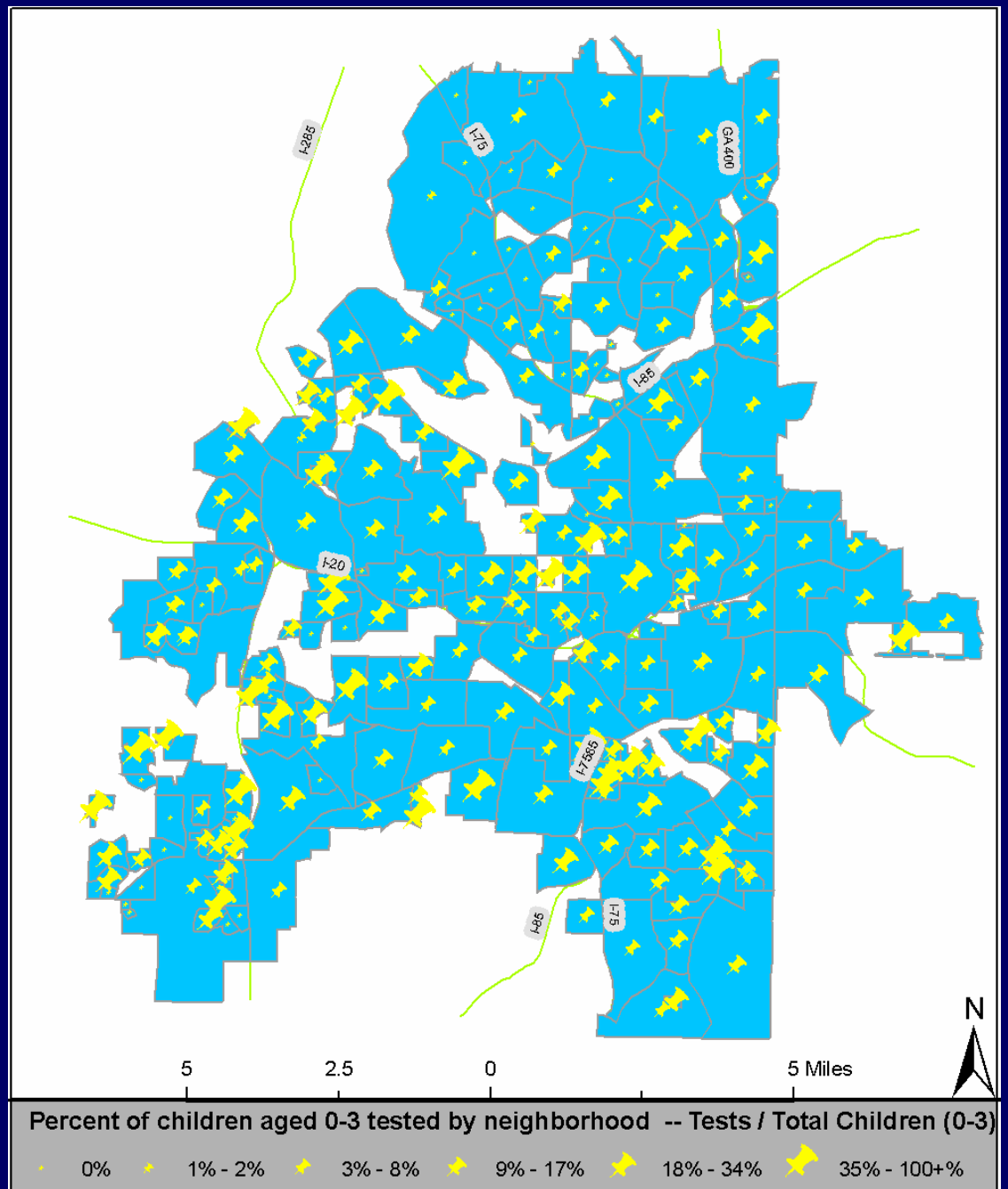
- 236 neighborhoods in the city of Atlanta
- 18,627 children aged (0-3) years



Results

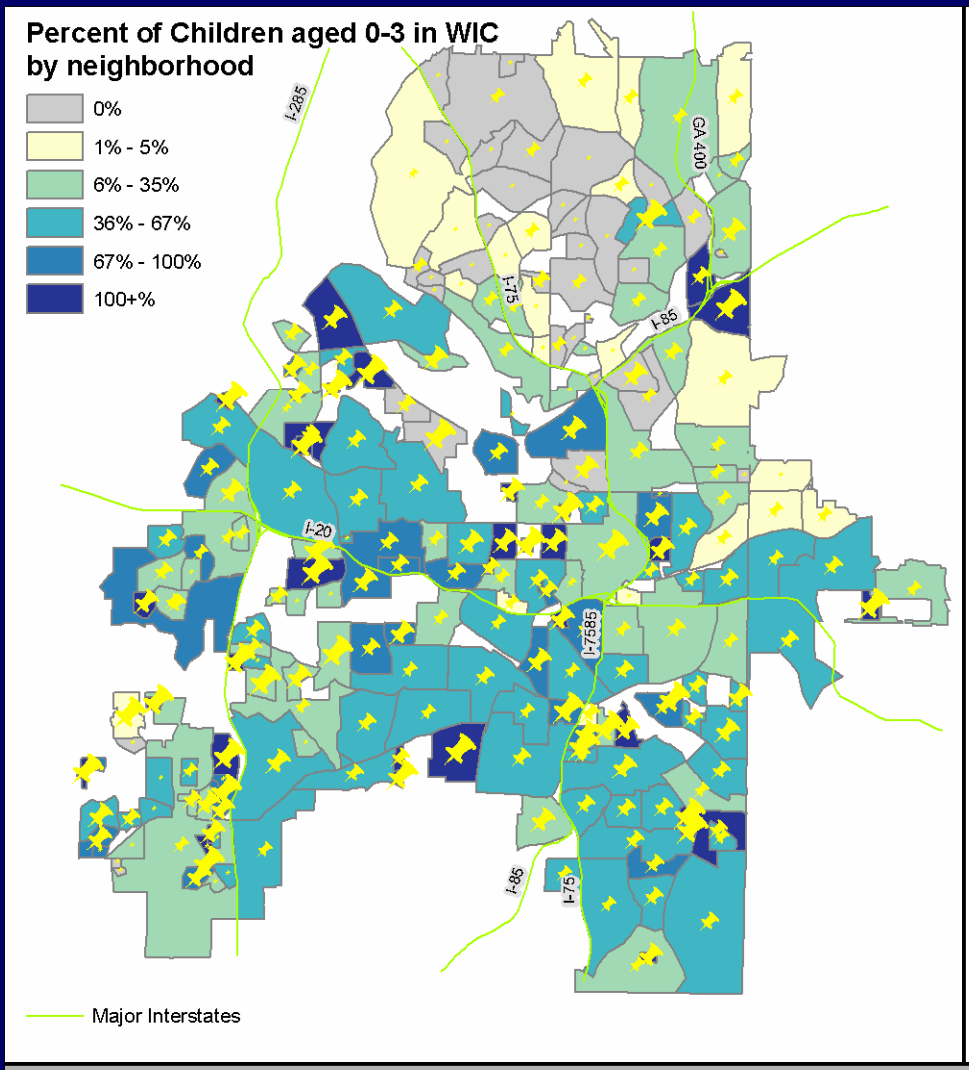
- **Testing and WIC**
  - **2,231 children tested for lead in 2005**
  - **23 children had BLL $\geq$ 10 μg/dL**
  - **8,229 children aged (0-3) enrolled in WIC**
- **Housing**
  - **84,055 residential parcels with year housing built**
  - **Of these 75,286 (89.6%) parcels were built before 1978**
  - **47,142 (53.5%) residential parcels built before 1950**

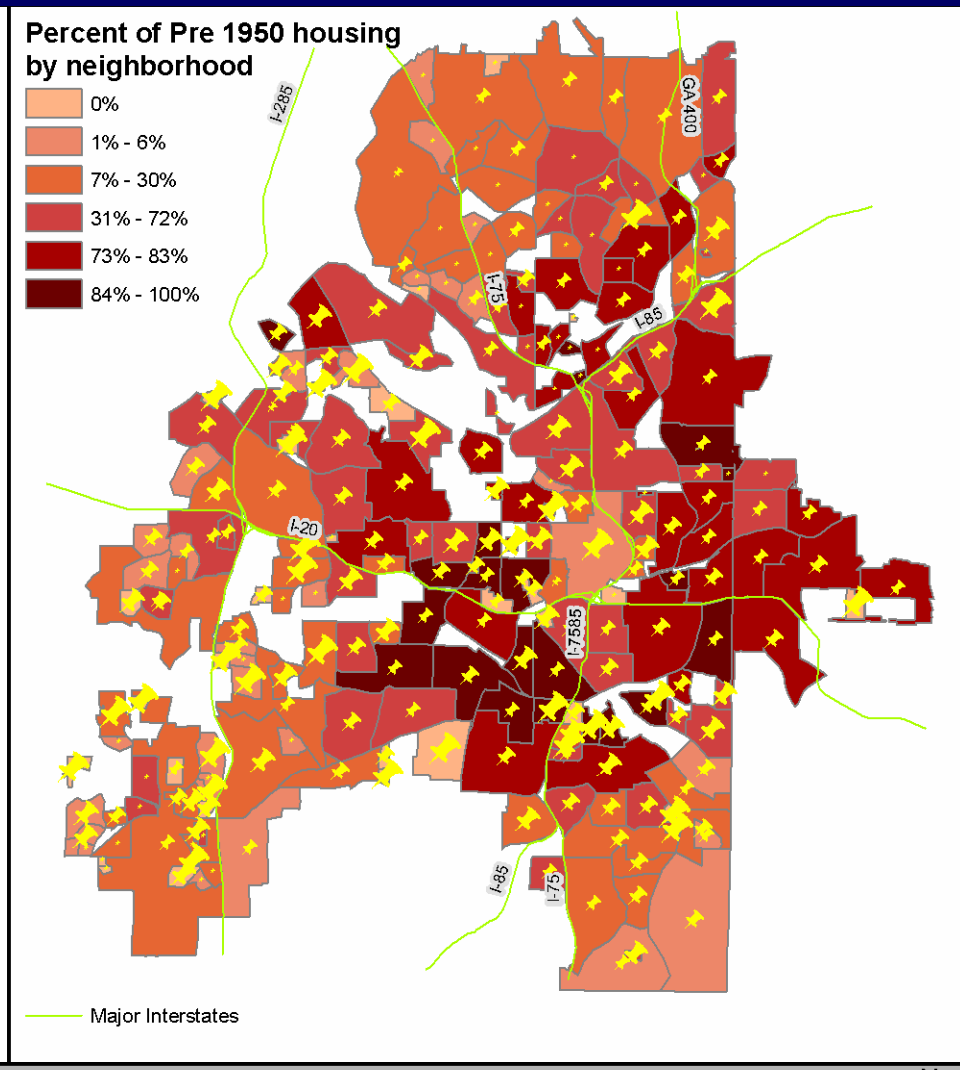
Results



- An estimated 39 children live in each neighborhood
- Of the 18,627 children in the City of Atlanta, 2,231 (11.9%) were tested for lead
- Of children tested, 23 (1%) had elevated BLLs
- Overall low testing

Results





Percent of children aged 0-3 tested by neighborhood -- Tests / Total Children (0-3)

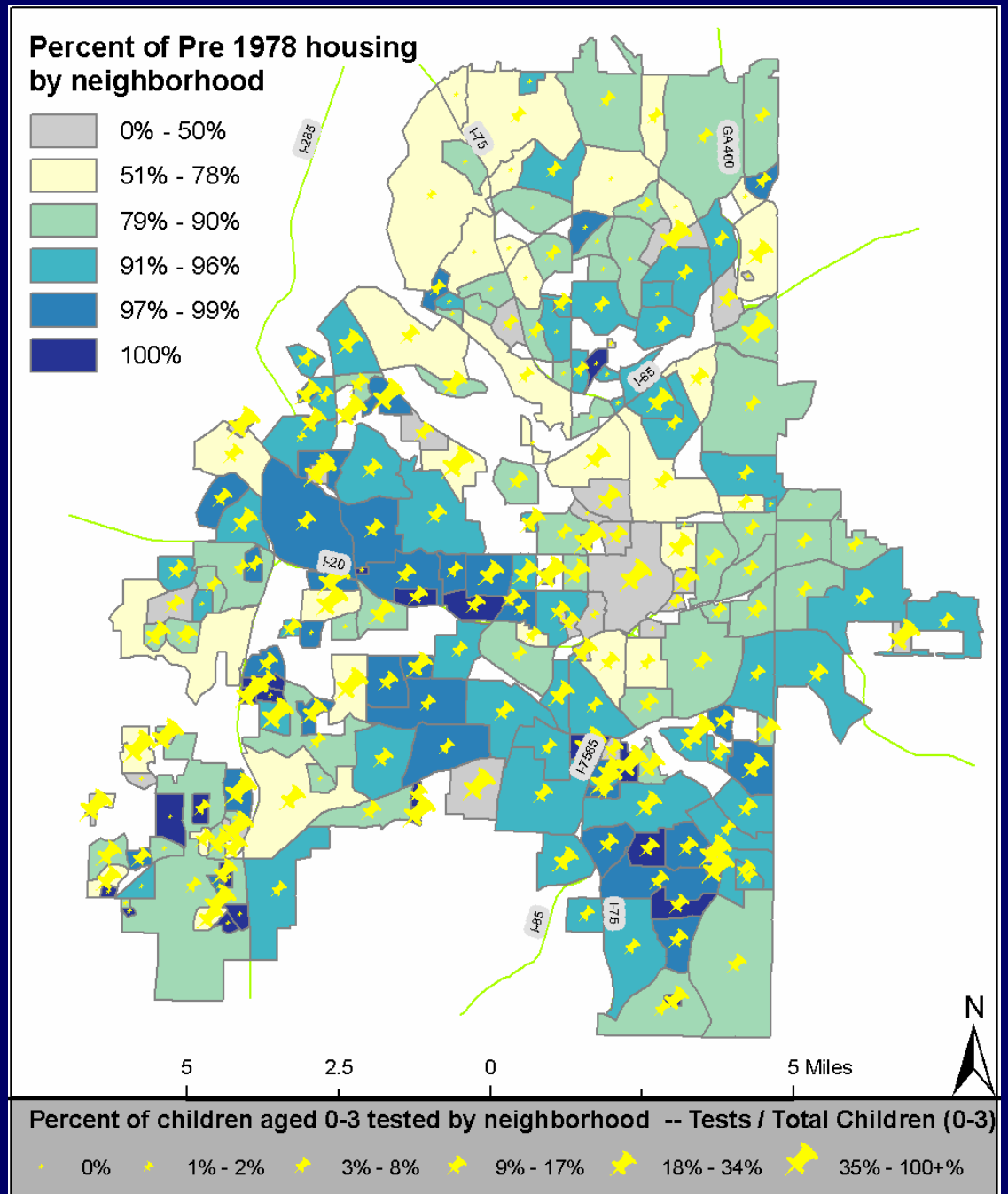
0% 1% - 2% 3% - 8% 9% - 17% 18% - 34% 35% - 100+%

5 2.5 0 5 Miles

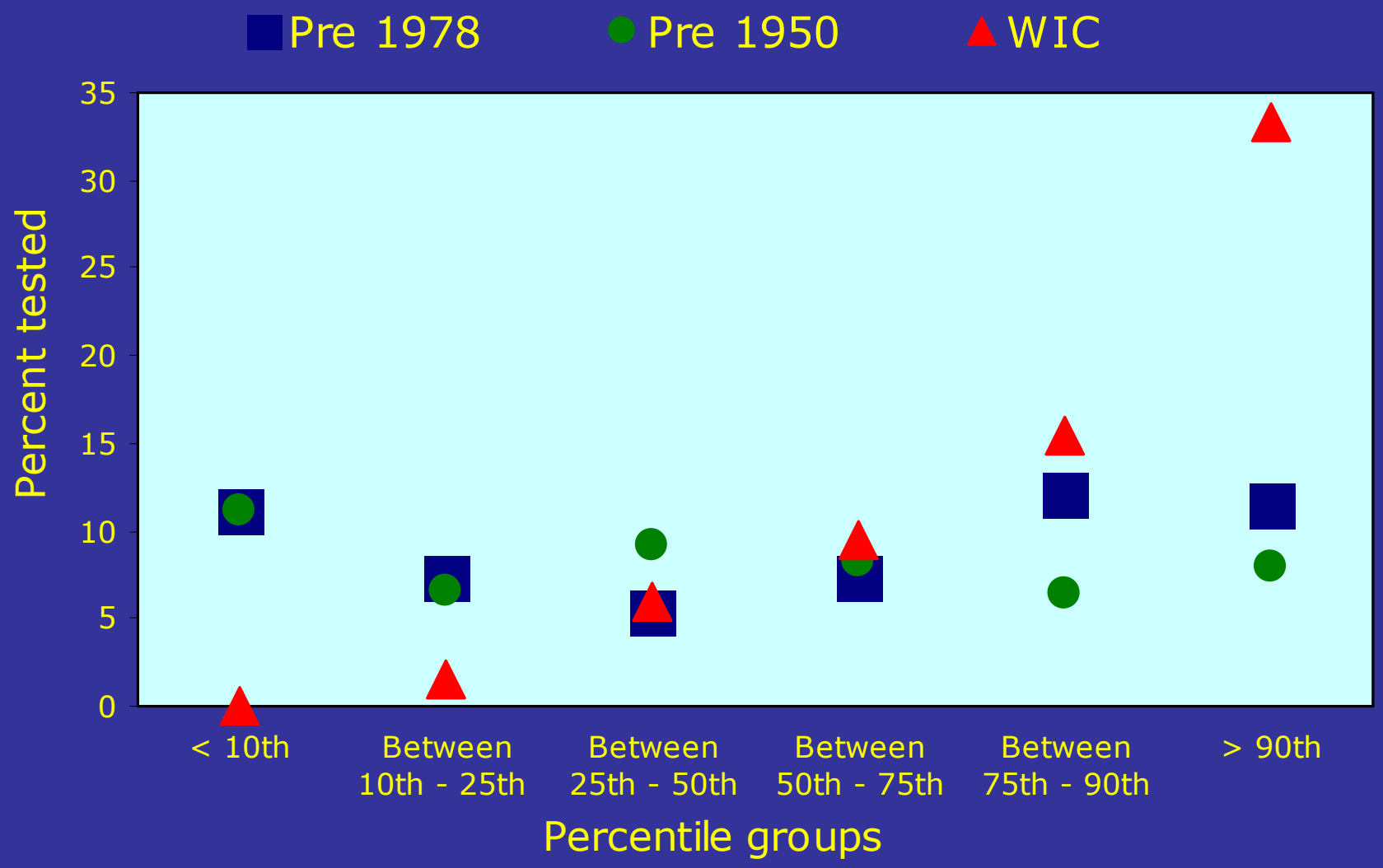
N

- **Pre 1950 housing concentrated in central Atlanta**
- **Testing does not match housing risk**

Results

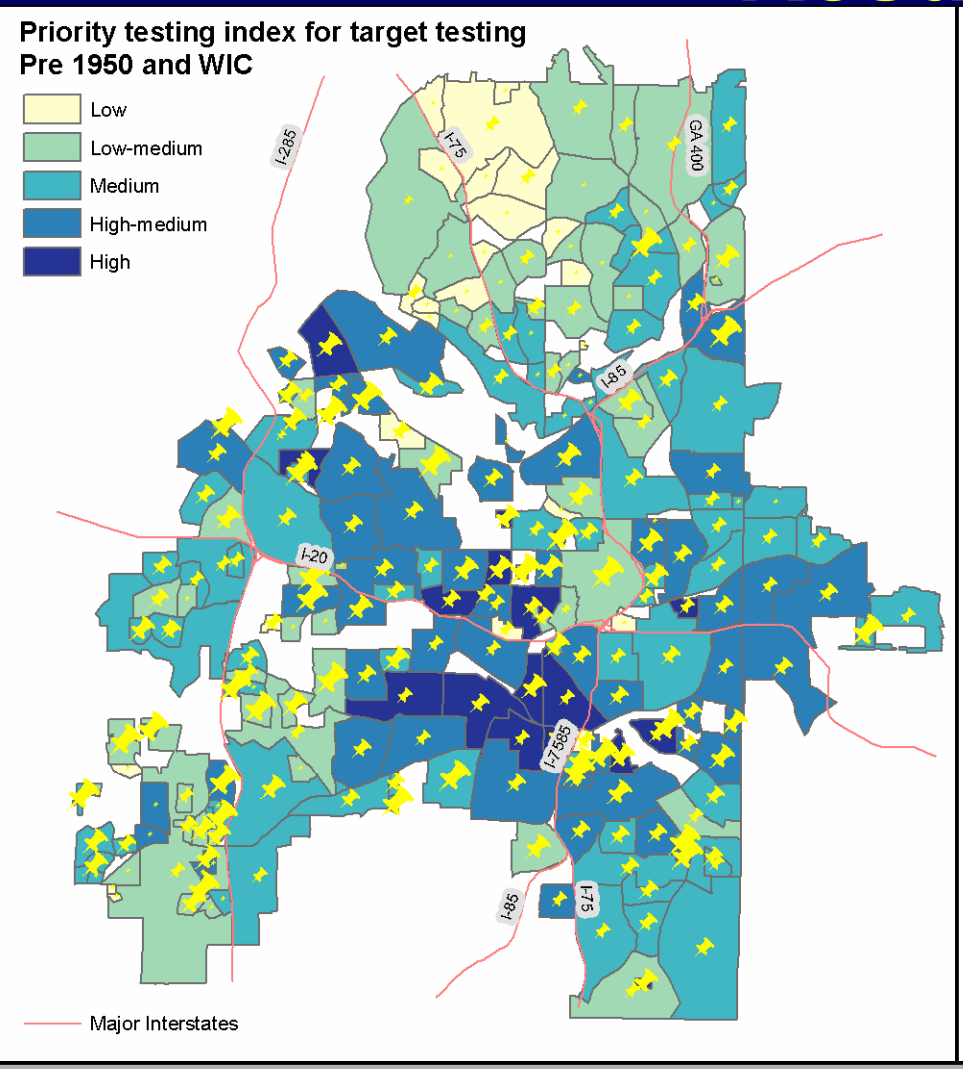

Percent of Pre 1978 housing by neighborhood
0% - 50%
51% - 78%
79% - 90%
91% - 96%
97% - 99%
100%
I-285
I-75
GA 400
I-85
I-20
I-75/85
I-85
I-75
N
5
2.5
0
5 Miles
Percent of children aged 0-3 tested by neighborhood -- Tests / Total Children (0-3)
0%
1% - 2%
3% - 8%
9% - 17%
18% - 34%
35% - 100+%

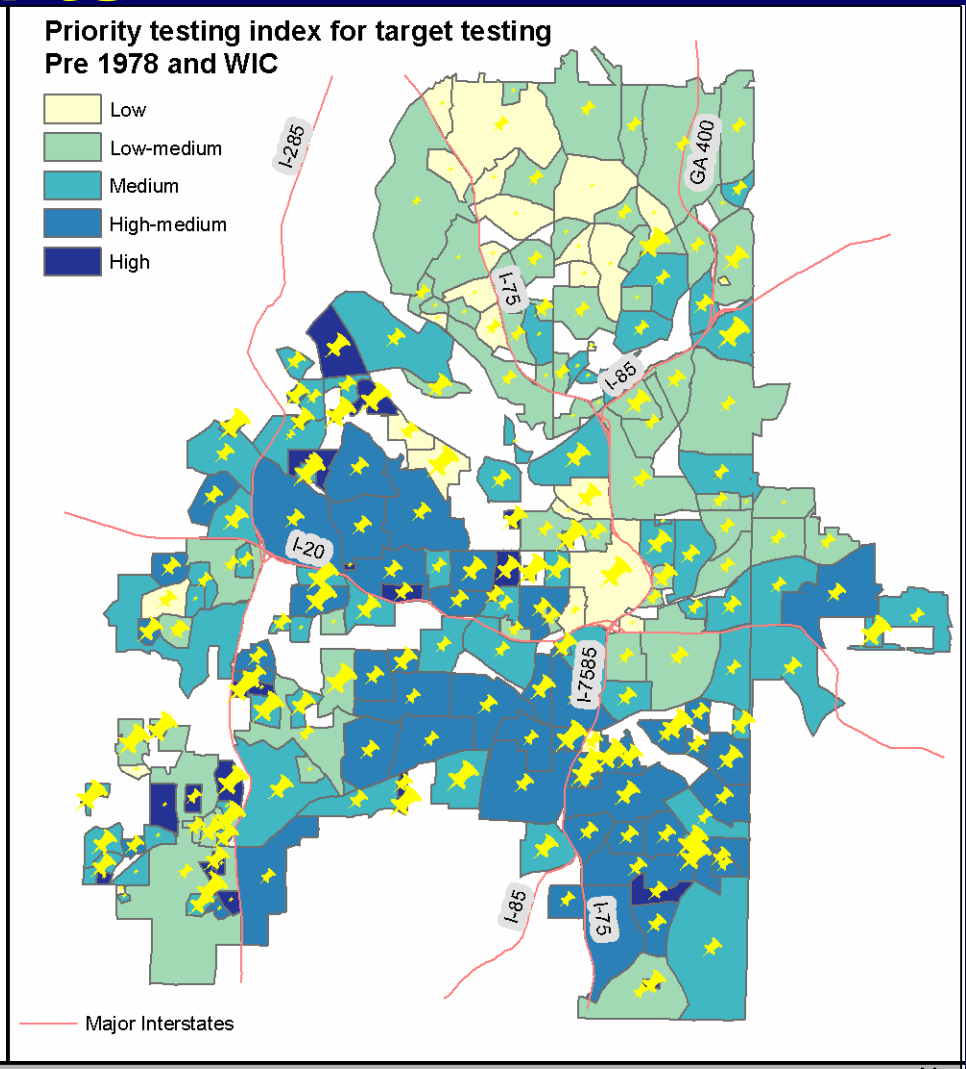
Results



- **Testing increases as percent of WIC children increases**
- **Housing risk and testing do not follow clear trend**

Results





Percent of children aged 0-3 tested by neighborhood -- Tests / Total Children (0-3)

0% 1% - 2% 3% - 8% 9% - 17% 18% - 34% 35% - 100+%

5 2.5 0 5 Miles

N

- **Low category virtually non-existent**
- **High priority neighborhoods located in center of the city**

Discussion

- In general, testing reflects the numbers of WIC children and not housing risk
- Creating priority testing indices was an approach to characterize neighborhood risk
- Combining risk factors can improve risk assessment and ultimately testing

Discussion

- Dissemination of information about high risk neighborhoods can be accomplished by community-based organization
- Maps can help communities and providers identify children living in high risk neighborhoods.
- Maps can be generated for specific clinic/hospital service areas on neighborhood risk
- Primary prevention strategies are key for achieving the 2010 goal of eliminating childhood lead poisoning

Strengths and Limitations

- **Strengths**
  - **Use of tax parcel data enables accurate assessment of housing risk**
  - **Smaller geographic units recognized by residents, such as neighborhoods, are better suited for outreach**

- **Limitations**
  - **datasets used in our analyses used data covering different times**

Next Steps

- Assess testing among children enrolled in Medicaid
- Translate methods of this study into a state-wide effort

Conclusion

There is a need to increase testing of children living in old housing and in poor families.

Thank you !!

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Back-up Slides

Methods: Datasets

- Childhood blood lead , 2005
  - Aggregated, de-identified information by neighborhoods
    - number of children tested for lead
    - number of children with elevated BLLs for children ≤ 3 years of age
- WIC, 2005
  - WIC data used as proxy for poverty
  - Aggregated, de-identified information by neighborhoods
    - number of children ≤ 3 years of age enrolled in WIC
- Population, 2000
  - Number of children ≤ 3 years of age from US Census

Methods: Datasets (continued)

- **Residential land parcel data**
  - **Can have one or more housing units depending on type of property**
  - **Provided by Center for GIS , Georgia Tech.**
  - **Includes structure construction date, appraised value, land use information etc.**

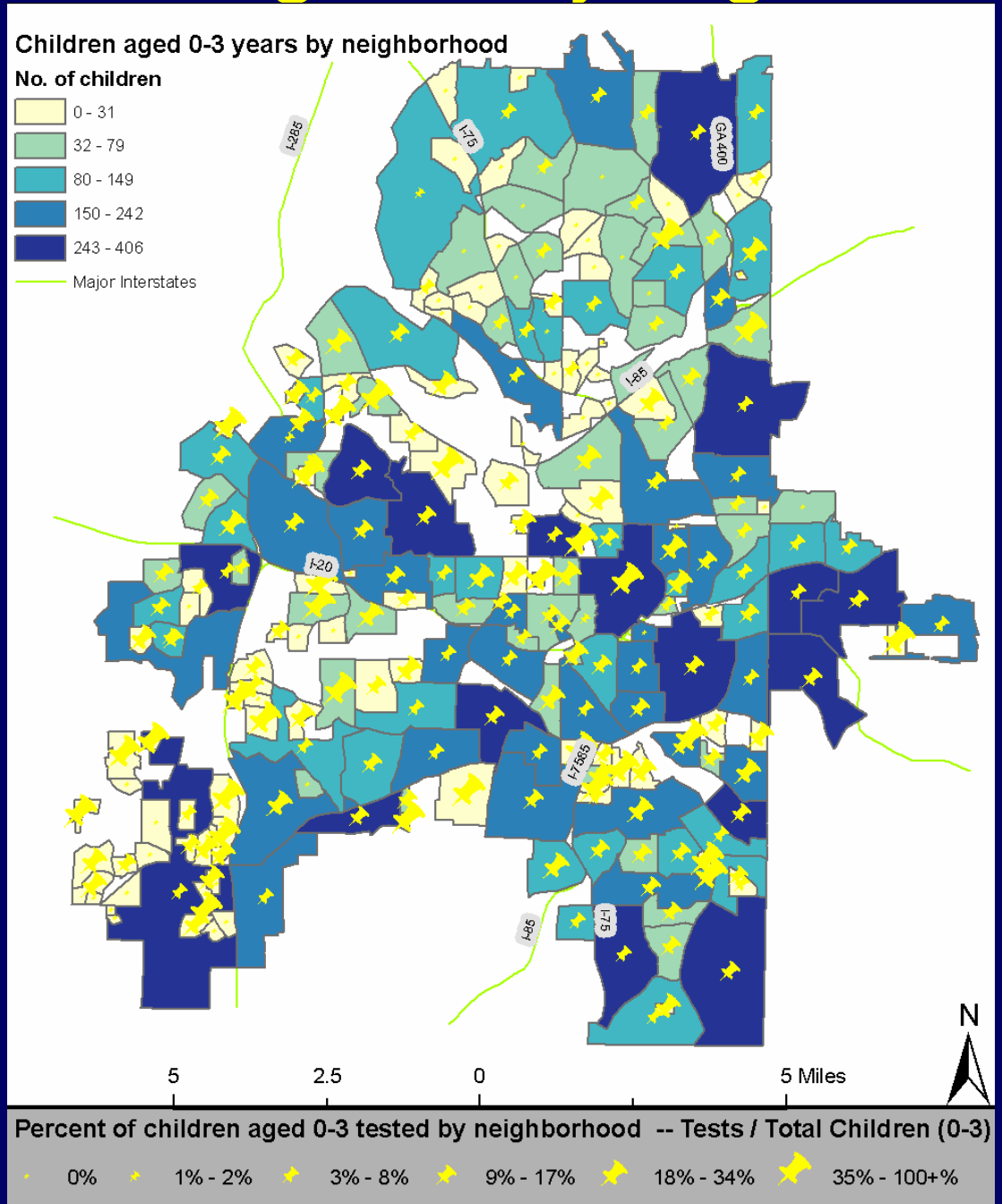
Scoring Scheme for Priority Testing Index

Percent of Neighborhoods with Risk Factors			Percentile Groups	Risk Score
Pre-1978 housing	Pre-1950 housing	Children in WIC		
0-50 %	0 %	0 %	0-10th	1
51-90 %	1-30 %	1-35 %	11th-50th	2
91-99 %	31-83 %	36-100 %	51th-90th	3
100 %	84-100 %	100 %	91th-100th	4

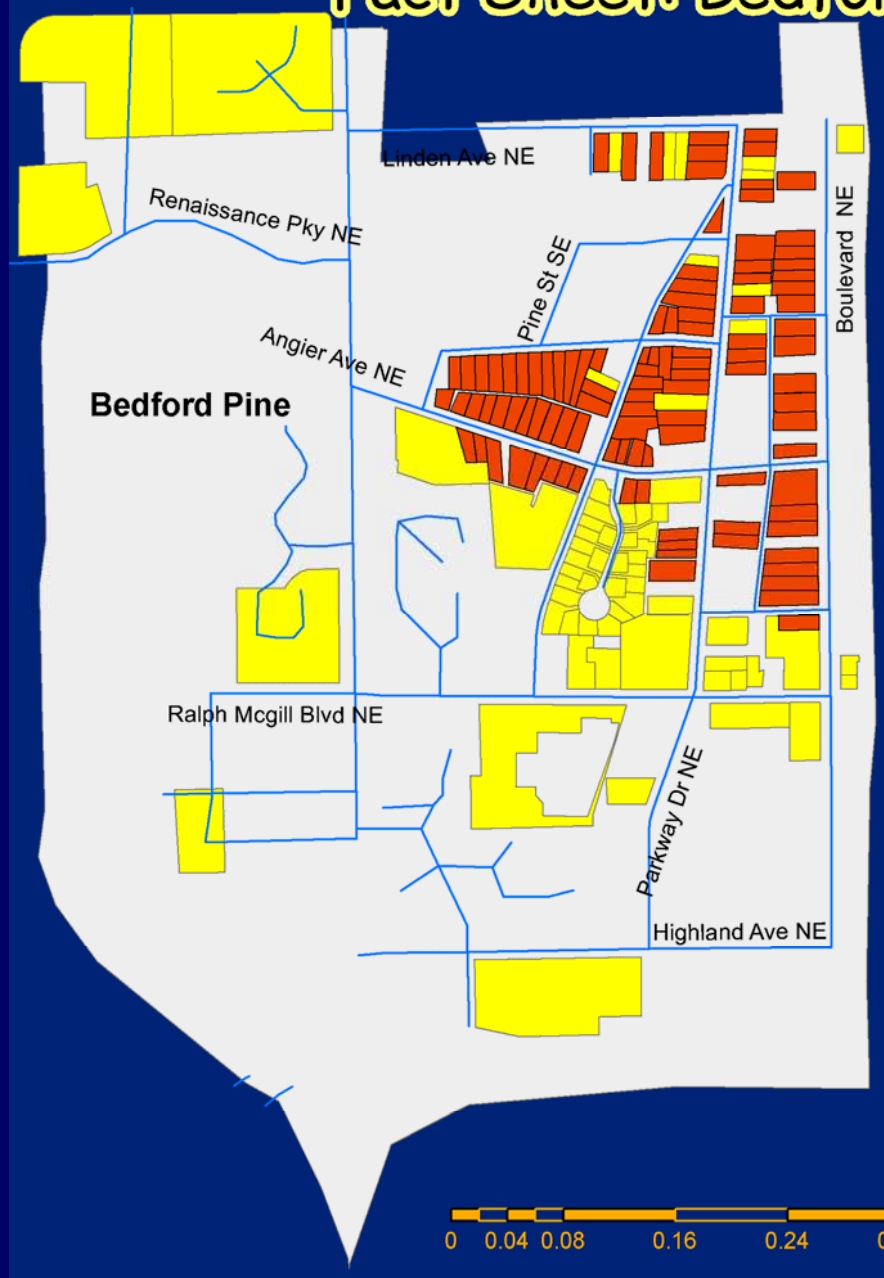
Scoring Scheme for Priority Testing Index

Score	Quantile	Pre-1978 housing %	Pre-1950 housing %	WIC
1	0th -10th	0-50%	0%	0%
2	11th -25th	51-78%	1-6%	1-5%
3	26th -50th	79 - 90%	7 - 30%	6 - 35%
4	51st -90th	91-99%	31-83%	36-100%
5	76th -90th	97 - 99%	73 - 83%	68 - 100%
6	91st -100th	100%	84-100%	100+%*

Children aged 0-3 by neighborhoods



Fact Sheet: Bedford Pine Neighborhood



Lead screening

Number of screens in 2005: **73**

Cases with elevated Blood lead level (BLL >= 10 ug/dL):**1**

Blood lead screening rate:**30.41%**

Demographic and Housing Information

# of children aged (0-3) years:**172**

# of children enrolled in Women Infant and Children (WIC):**133**

Size of neighborhood:**0.4 sq.mile**

Total # of residential parcels:**187**

# of Pre 1978 residential parcels:**133**

Community information

Organizations:

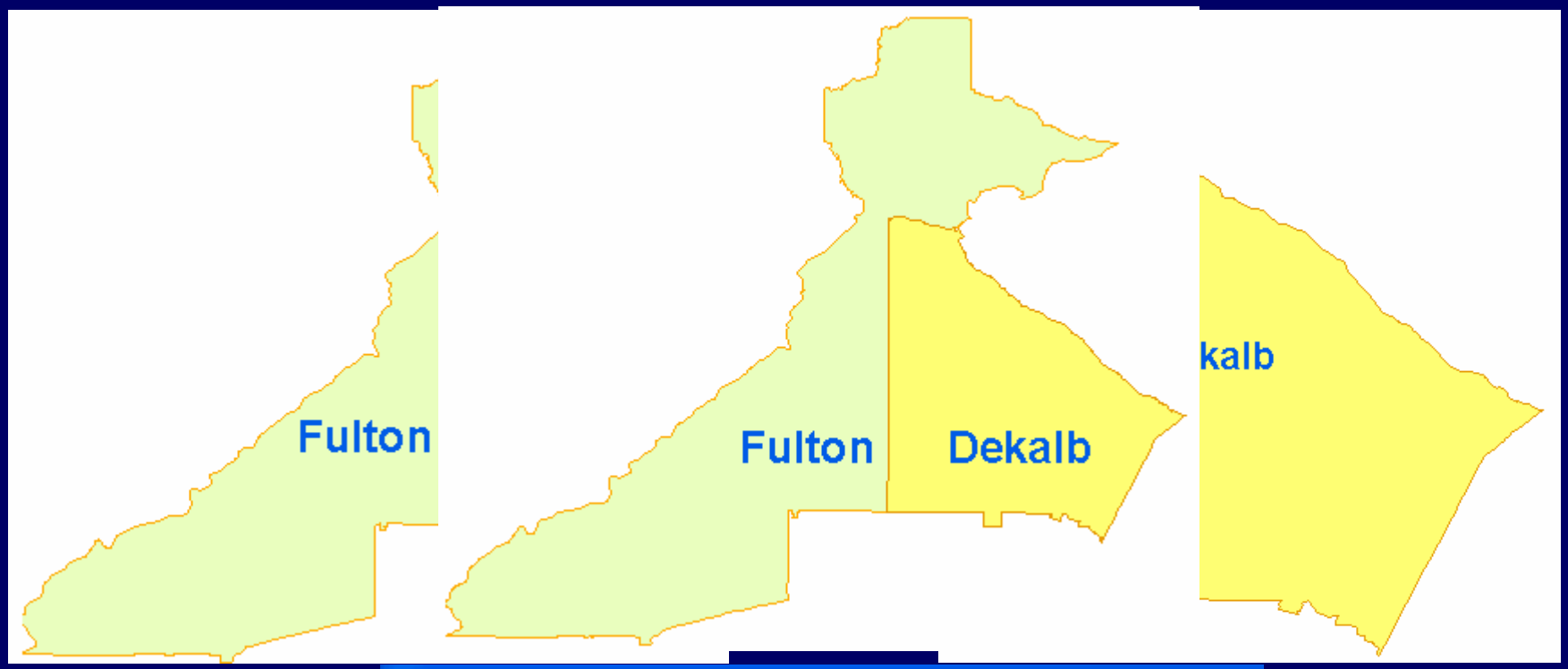
1. **Atlanta Downtown Neighborhood Assoc.**
2. **Central Atlanta Neighbors**

# of Pediatricians:**2**

# of Family Practioners:**1**

Processing housing data

- Append parcel databases



Attributes of fulton_parcel

PIN	COUNTY	TAXVALU
12 19420440037	Fulton	2041
11 01440085035	Fulton	1802
12 25820696014	Fulton	1000
11 02420123036	Fulton	2622

Attributes of Dekalb_Futlon_parcel

PIN	COUNTY	TAXVALUE	IMPVALUE	YR_BUILT
17 01100005010	Fulton	530000	129400	1923
15 242A02 009	DeKalb	530000	373400	1924
15 242F01 006	DeKalb	530100	485100	1989
17 00420007014	Fulton	530200	145200	1995
17 02150002008	Fulton	530400	84040	1966

VALUE	IMPVALUE	YR_BUILT
269600	201200	1970
38000	0	0
237800	177800	1976
239300	179300	1968
232900	178900	1977

Why Housing data?

- Housing value
  - Condition of the house tied to housing value
  - Identifying neighborhoods with substandard housing

Why Housing data?

- Identify year of construction of a house
  - Proxy for presence of lead paint
  - Pre 1950 houses had high levels for lead
  - 1978 lead in paint was banned
- Housing value

Housing data from US Census

- Census data resolution
  - Blocks → Blockgroups → Tracts → City → County → State
- Available housing attributes
  - Total housing units
  - Occupancy (renter/owner)
  - Median year structure was built
  - Age of housing:- dis-aggregated by every ten years, e.g., Built 1940-1949, Built 1939 or earlier

Housing data from US Census

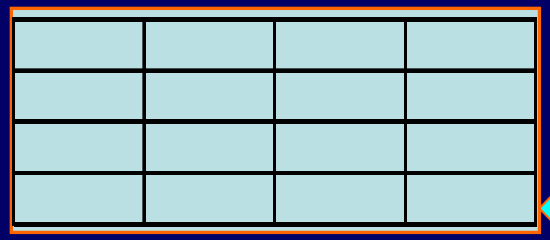
Limitations

- Housing data by blocks do not have all the afore-mentioned attributes
- Converting housing data from a census resolution to other non-census geographies involves some approximation
- Census boundaries are not easily recognized by residents

Tax Parcel Data

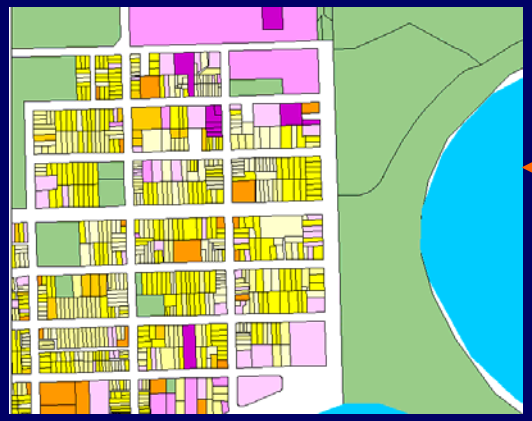
- Tax parcel is a unit of land
- Collected to assess the value and improvement on the land
- Information available from CAMA files
  - Computer Aided Mass Appraisal
  - Electronically available
- Usually, data available from the County tax assessor's office

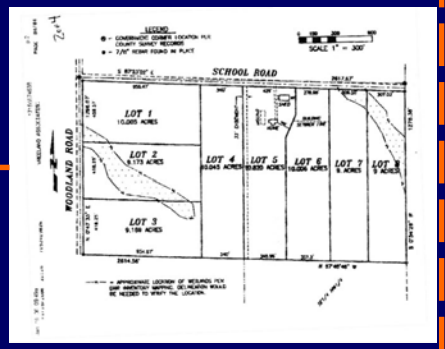
Tabular data



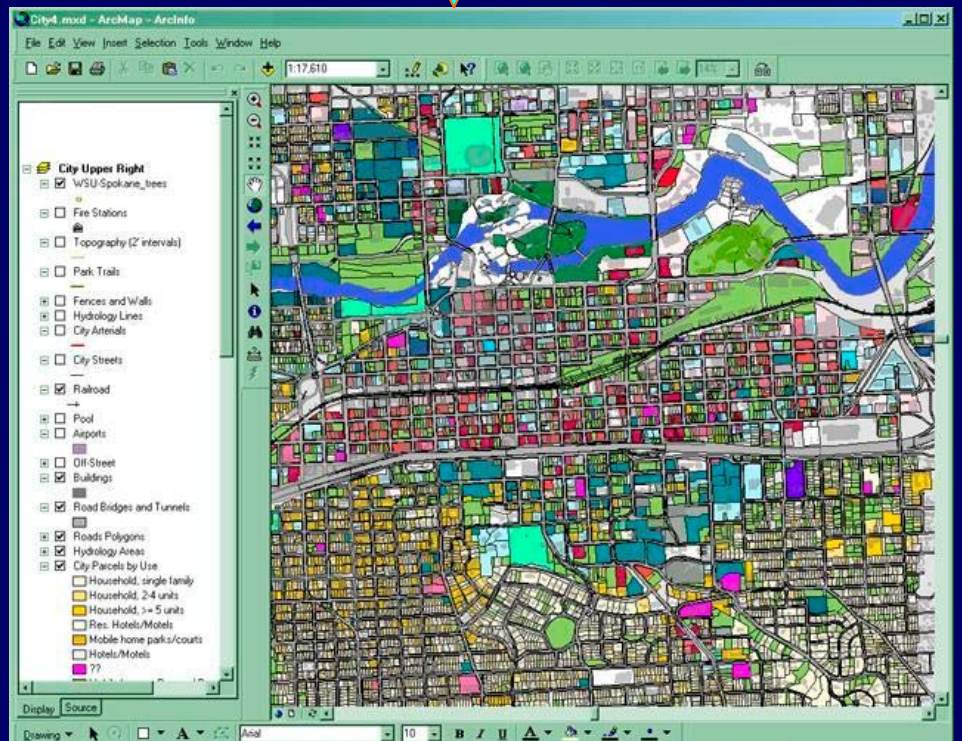
CAMA files

Spatial data





County Survey Records

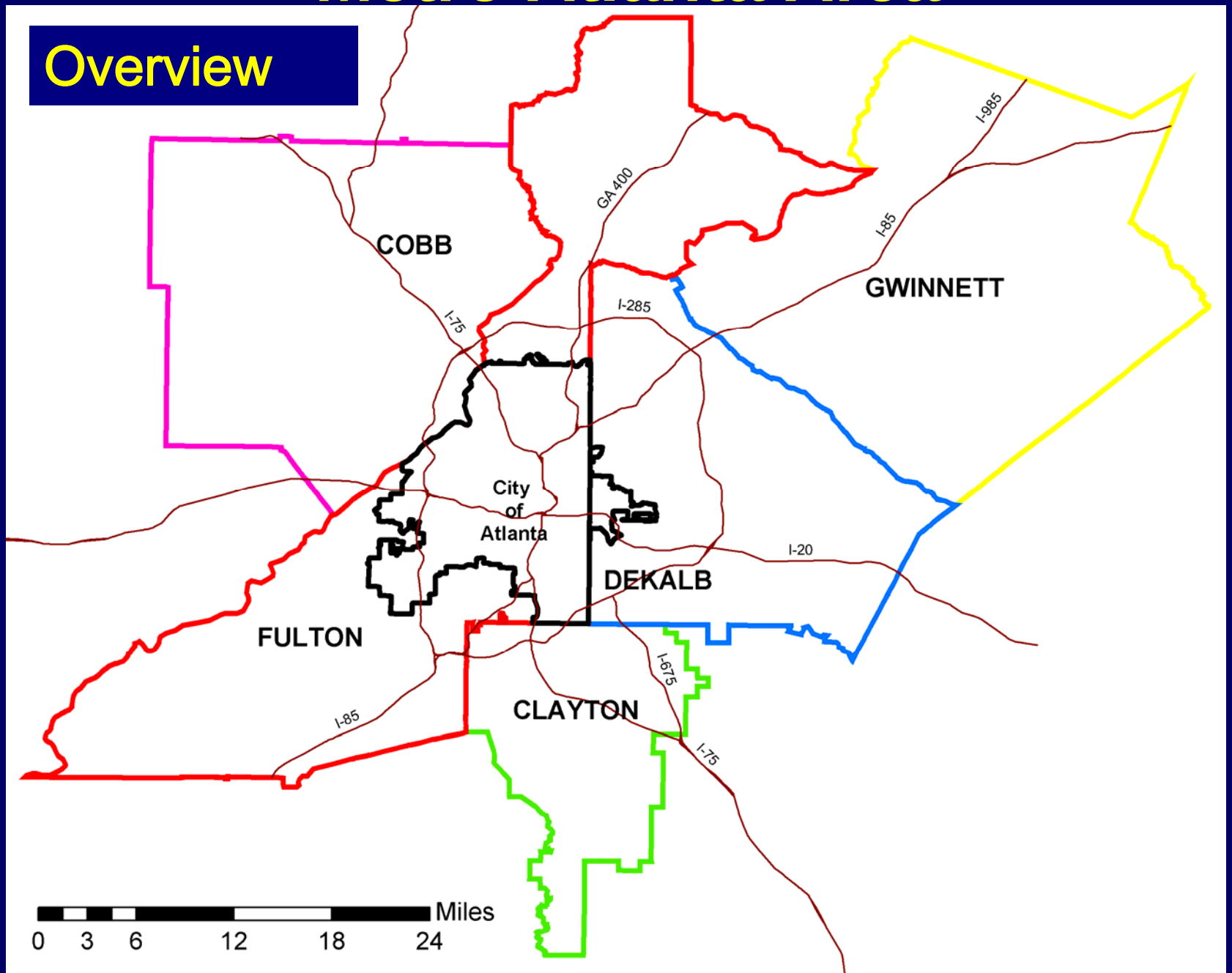


GIS Visualization

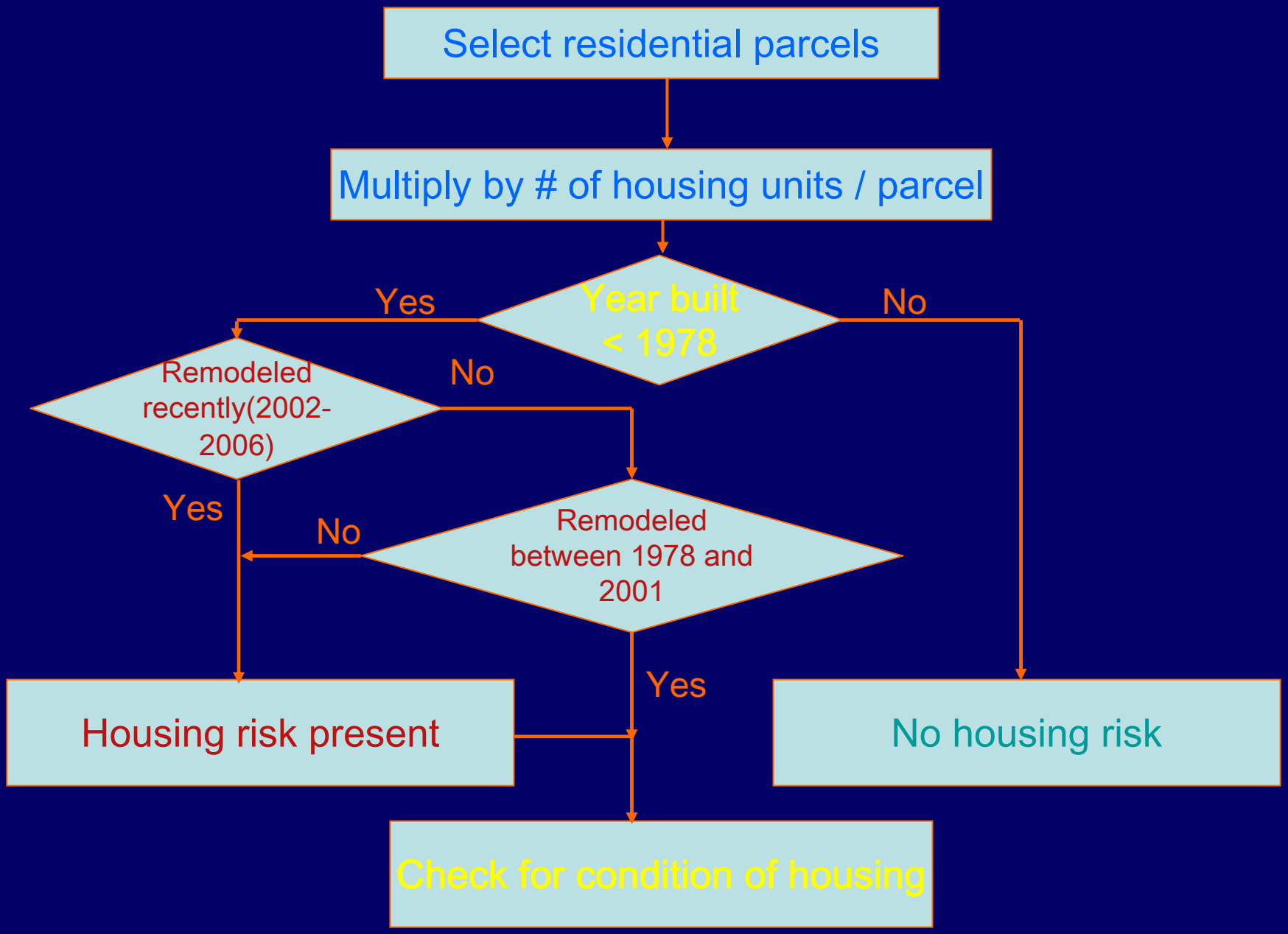
Tax Parcel Data

- Information available on
  - Age of construction of the structure
  - Year structure was remodeled
  - Land use code, e.g., residential, commercial, etc
  - # of housing units per residential parcel
  - Built-up area
  - Improvement value of the house
  - Assessed grade of the house e.g., A- excellent condition; F- poor condition

Metro Atlanta Area

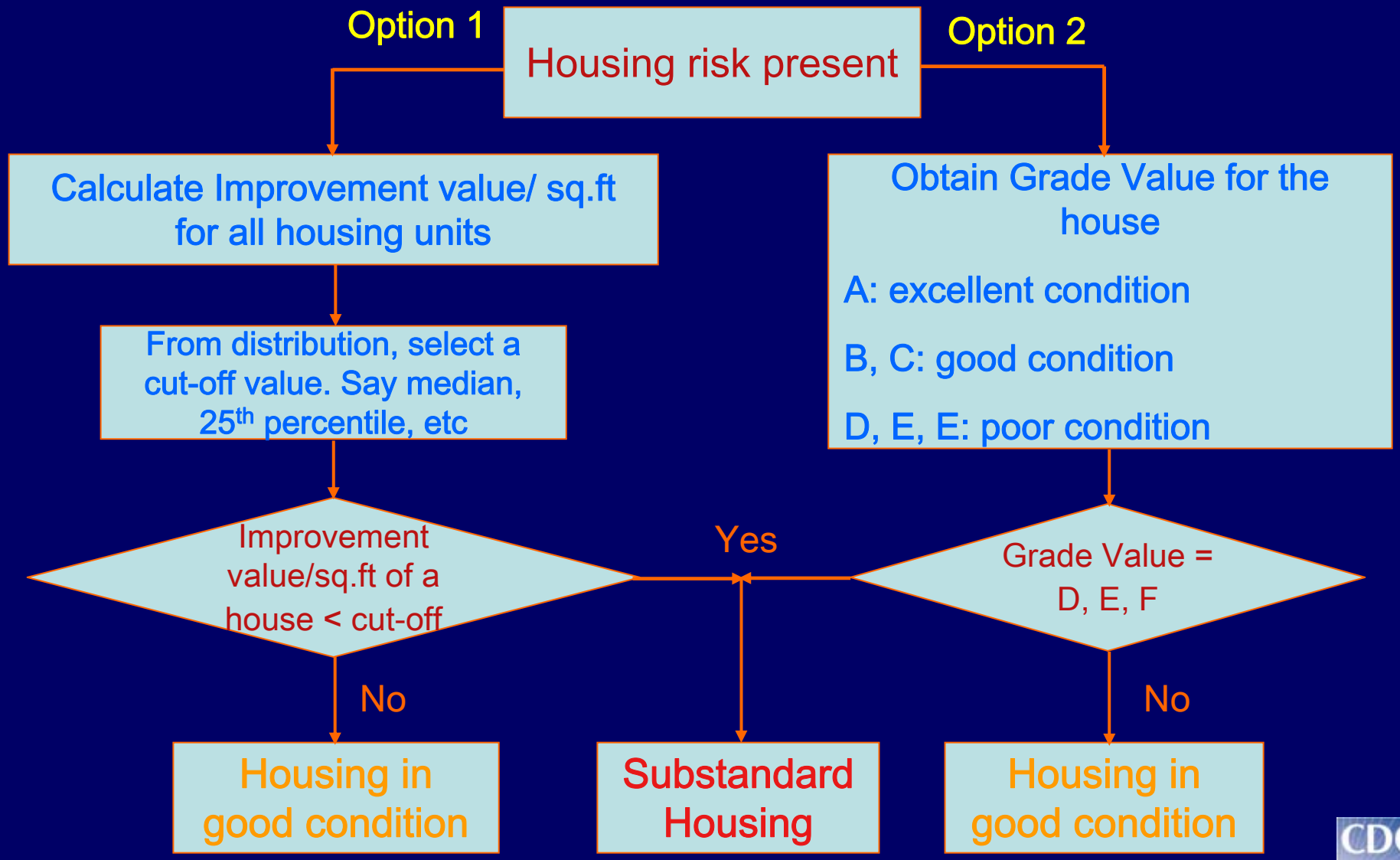


Assessing housing risk



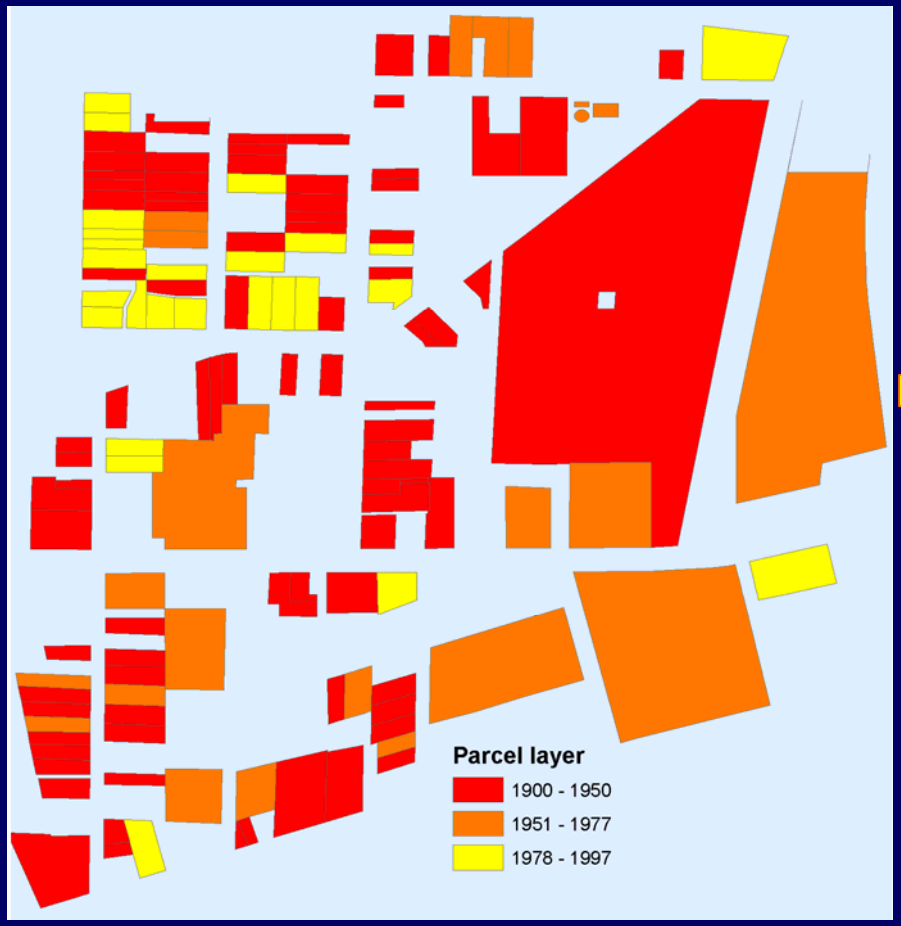
Assessing housing risk

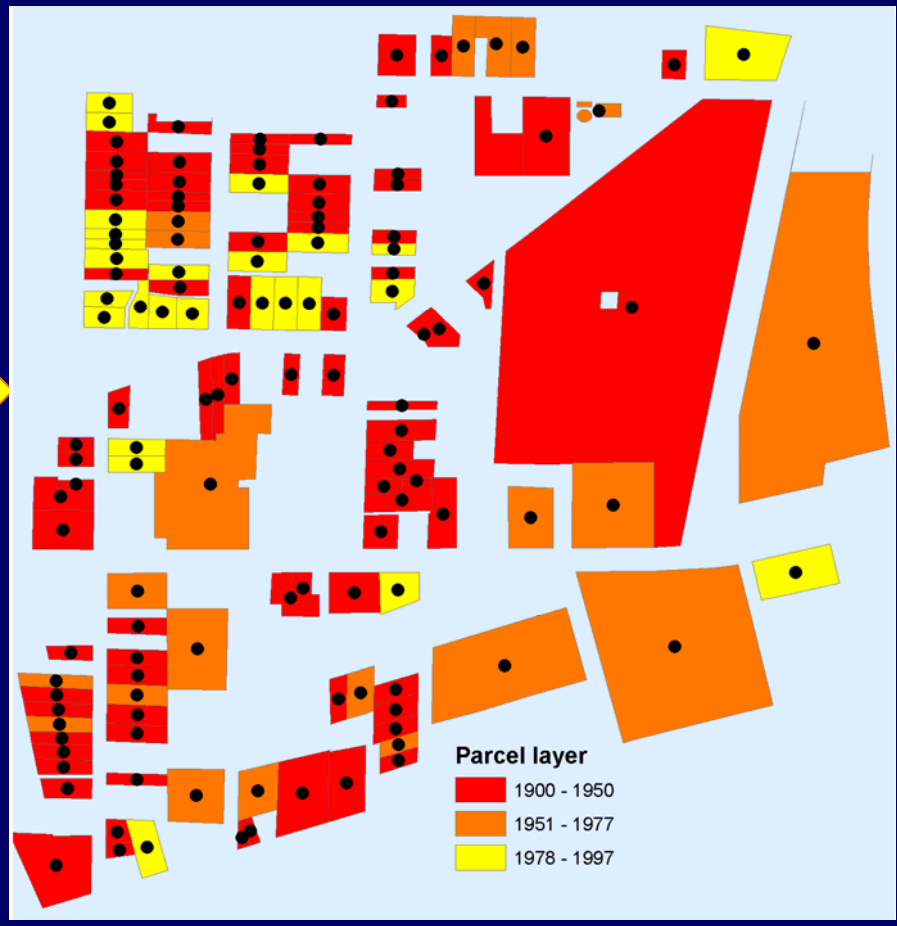
Two ways to assess condition of housing



GIS methods

Parcel layer in a GIS





Creating parcel centroid

Resolution for analysis

- Parcel level
  - Datasets with address information
  - Analyzing individual level data
- Aggregated
  - Resolution:- Census or non-traditional geographies like neighborhoods, NPU, etc
  - Ecologic approach

Housing based risk factors

Aggregated level data

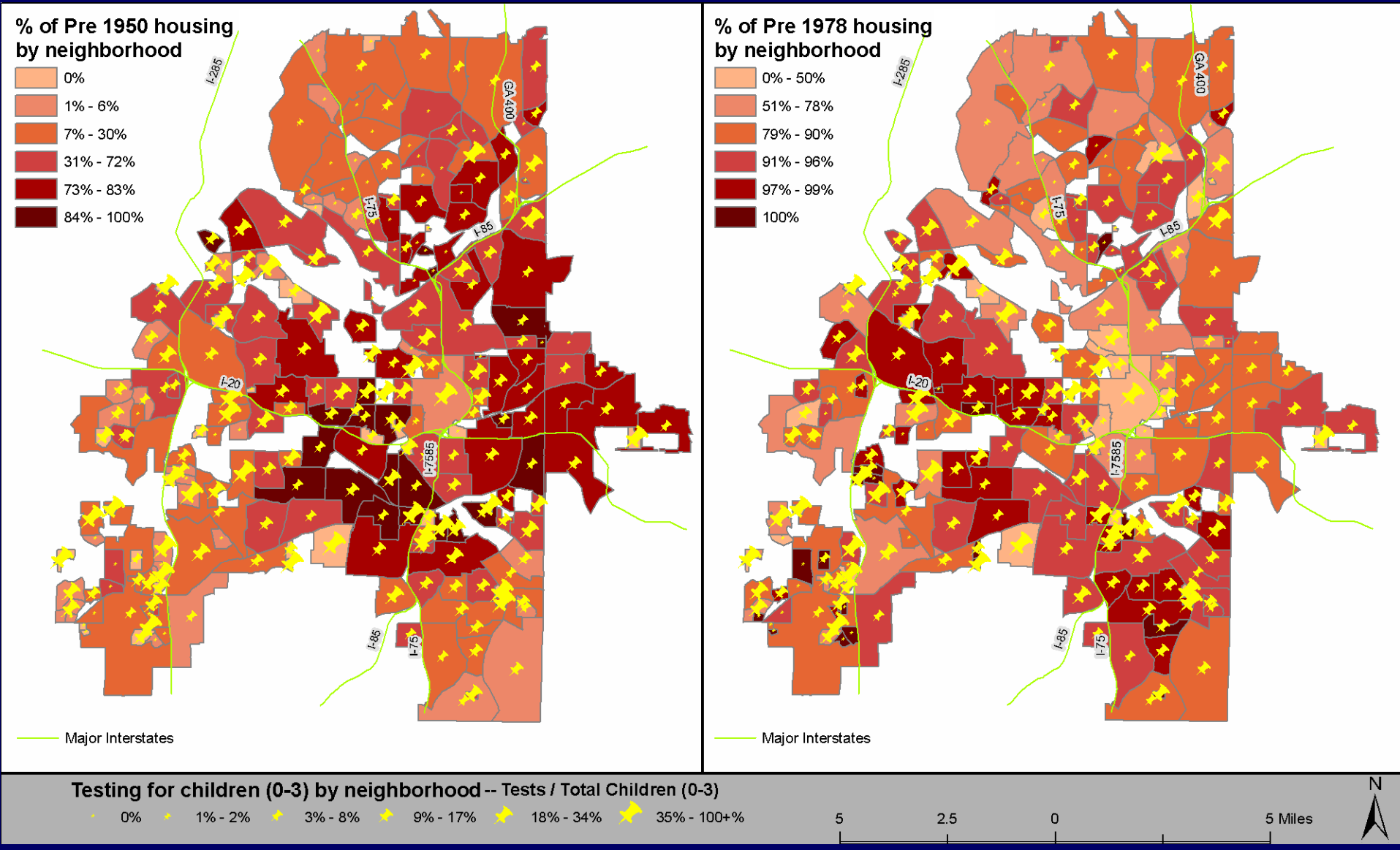
- Calculating risk factors for housing
  - % of Pre-1978 residential parcels

    $$\frac{\text{\# of parcels with structures built before 1978}}{\text{Total \# of residential parcels}}$$

  - % of Pre-1950 residential parcels

    $$\frac{\text{\# of parcels with structures built before 1950}}{\text{Total \# of residential parcels}}$$

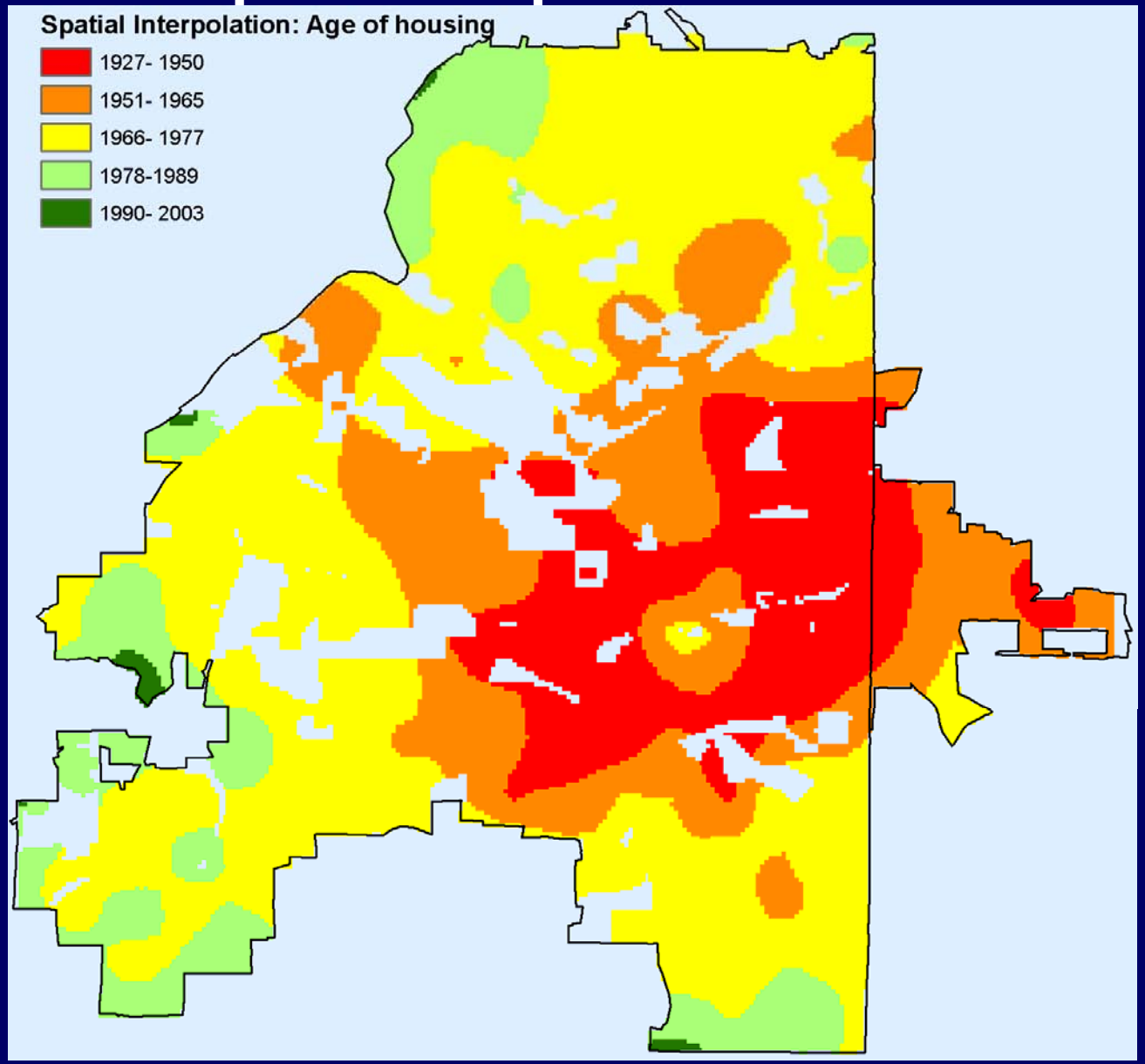
Mapping housing risk



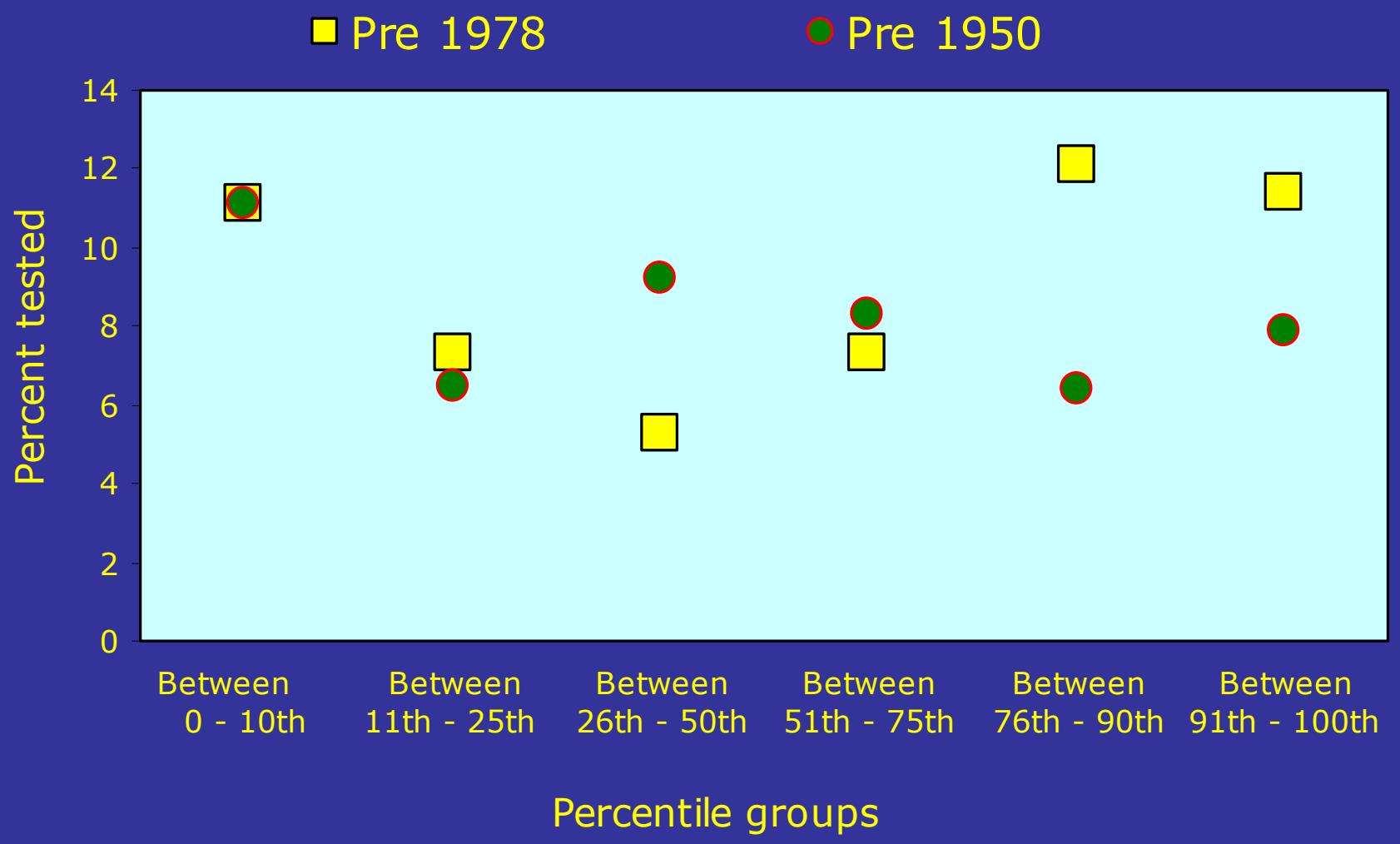
- **Pre 1950 housing concentrated in central Atlanta**
- **Testing does not match housing risk**

Mapping housing risk

Other approaches: Spatial interpolation



Testing vs. Housing risk



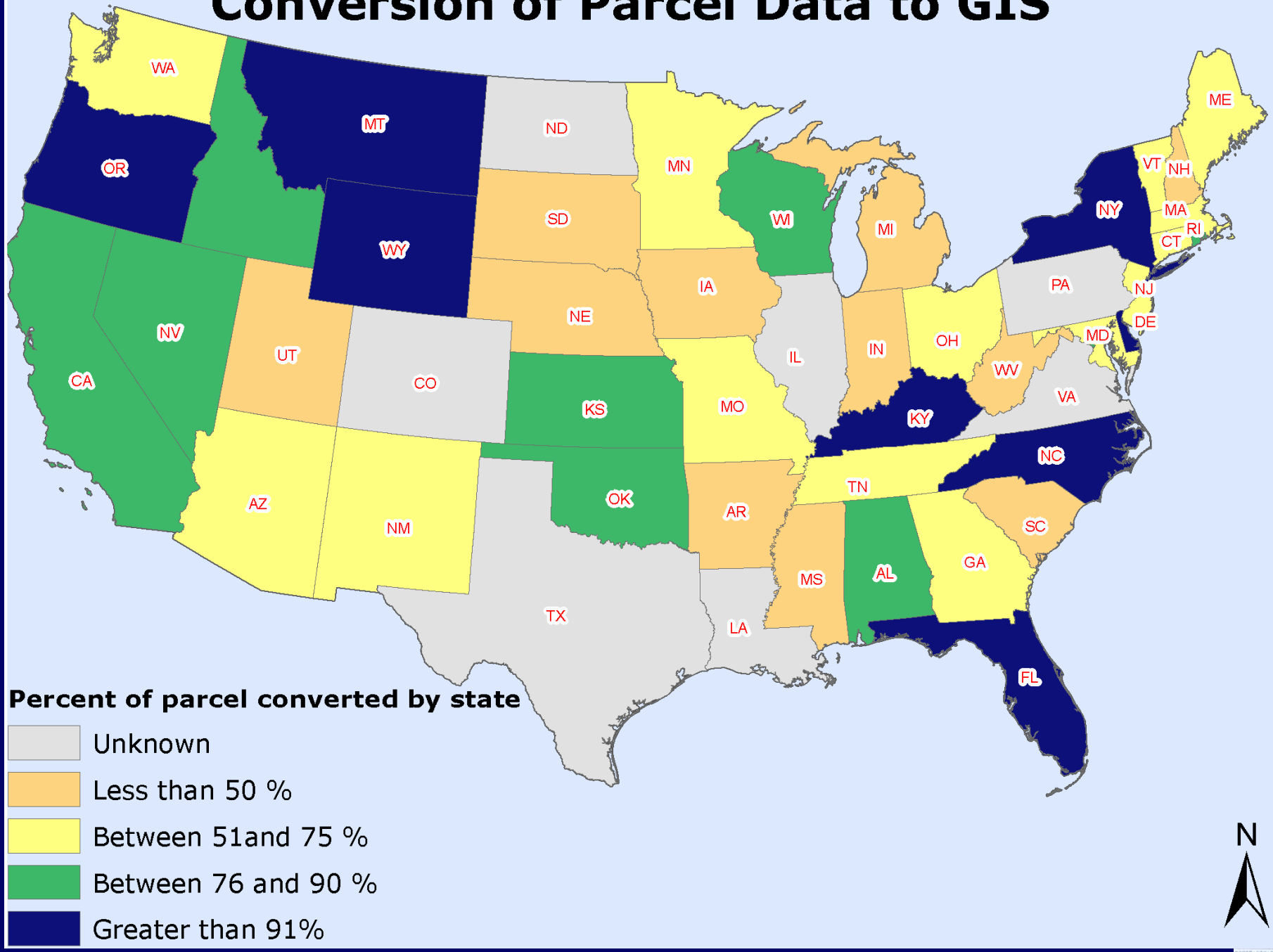
- **Housing risk and testing do not follow clear trend**

Discussion

Utility of Tax parcel data

- **Improving geocoding of addresses**
- **Disaggregated age of housing data suited for advanced techniques**
  - **Spatial interpolation of housing risk**
  - **Bayesian techniques**
- **Information on condition of housing**
  - **Stratifying housing risk by condition of housing important for targeted testing**

Conversion of Parcel Data to GIS



Assessment of parcel data in the US

- Federal Geographic Data Committee
  - Cadastral survey sub-committee
  - Assessing status of parcel conversion to a GIS format in the US
- Some states have a centralized parcel management program
- Counties primarily responsible for collecting and managing parcel data

Assessment of parcel data in the US

- 144.3 million parcels in the US
- 68 % of parcels converted into GIS format
- Counties with population over 150,000 have GIS parcel layer
- Parcel conversion to GIS is taking place rapidly in urban areas

Limitations

- Lack of metadata
- Issues with projection and datum conflict
- No standard naming convention for fields in the tax assessors database across US
- Not available from all counties, especially in rural areas

Discussion

- Testing does not reflect housing risk
- Maps can help communities and providers identify children living in high risk neighborhoods
- Primary prevention strategies are key for achieving the 2010 goal of eliminating childhood lead poisoning

Strengths and Limitations

- Strengths
  - Use of tax parcel data enables accurate assessment of housing risk
  - Smaller geographic units recognized by residents, such as neighborhoods, are better suited for outreach
- Limitations
  - Datasets used in our analyses had data covering different times

Conclusion

Housing based primary prevention important for childhood lead poisoning prevention and accessing residential tax parcel data when available will improve housing risk assessment

Acknowledgements

- Forrest Staley, MUP, MPHc
- Judy Qualters, PhD
- Pam Meyer, PhD
- Mary Jean Brown, ScD, RN
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- Carl Anderson, MS

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