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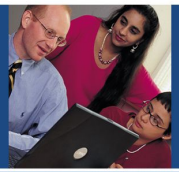
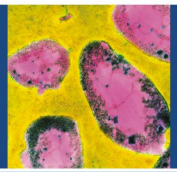




Protecting Health, Saving Lives—*Millions at a Time*

JOHNS HOPKINS BLOOMBERG SCHOOL of PUBLIC HEALTH

County Lung Cancer Mortality: A Decision Tree Model for Control and Prevention

Norma Kanarek, PhD, Johns Hopkins School of Public Health, Department of Environmental Health Sciences
Shu-Chih Su, MS, JHSPH, Department of Biostatistics
Melissa Brower, MPH, Bassett Healthcare
Haomiao Jia, PhD, Mercer University School of Medicine
Brian Fitzek, BA, JHSPH Department of EHS

Specific Aims

- Develop or aggregate county-level data pertinent to lung cancer prevention and control
- Use a classification and regression tree (CART) approach to illuminate county groupings
- Extend the use of CART for policy making, program planning and research

County-Level Indicators

- **Lung cancer** mortality (1999-2001, NCHS)
- **Smoking** prevalence (2000, BRFSS; Jia)
- Risk of **excess cancer death** estimates (National Air Toxics Assessment, 1996)
- Population **size** and **density, urban/rural status**, and **poverty** (2000, US Census)
- EPA/DHHS **region**
- Average **indoor radon** level > 4 pCi/L (EPA)
- **Coronary Heart Disease mortality** (1988-90, NCHS)

Classification and Regression Tree

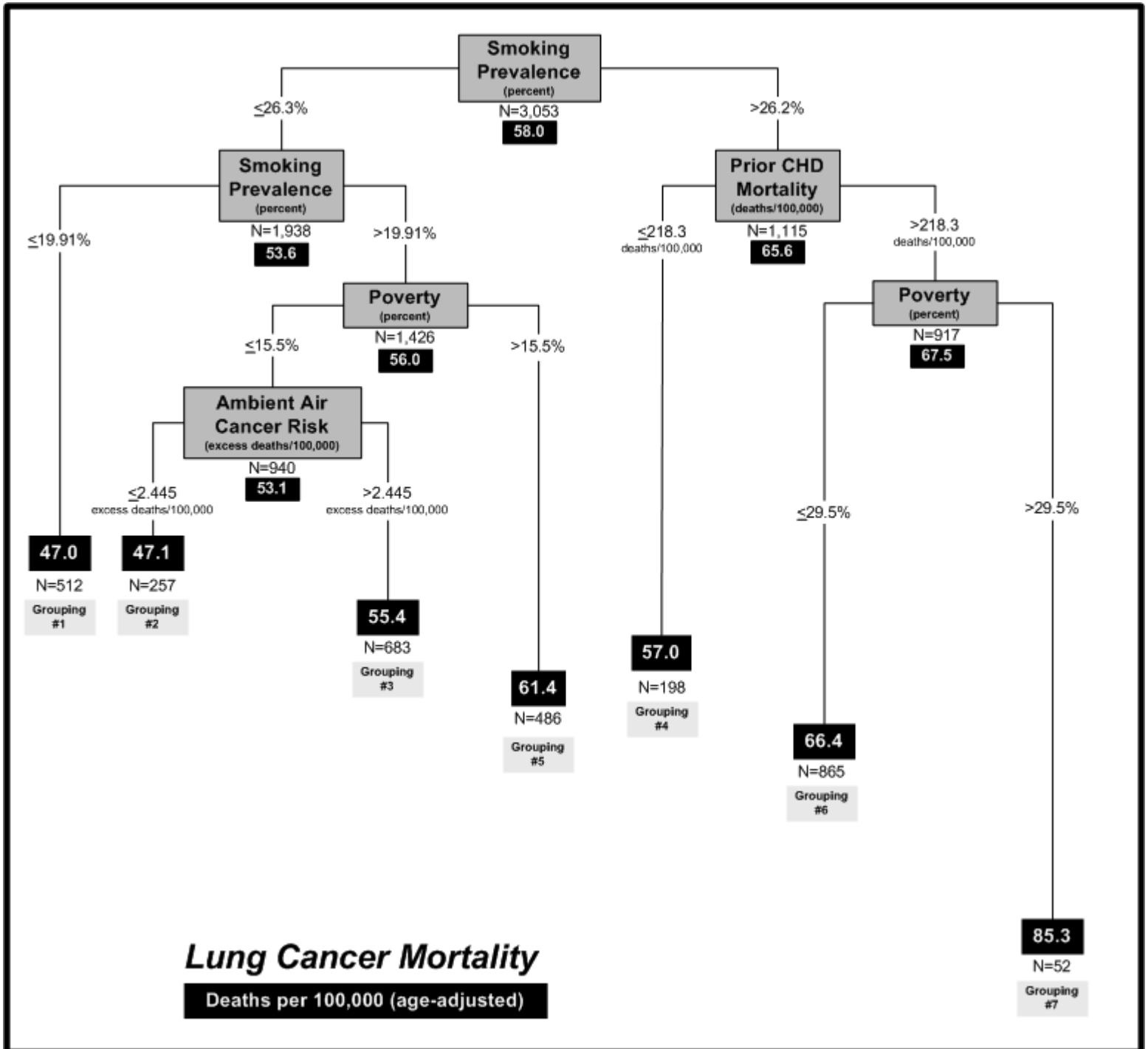
- Software, R Stat
- Two choices of tree building:
  - regression (maximizes the prediction) or
  - classification (maximizes sensitivity and specificity)
- Process:
  - grow a full tree (all significant leaves)
  - prune the tree (optimal number of leaves, balancing accuracy with complexity)

Questions that can be addressed using CART

- At this time, what is the local baseline lung cancer mortality in the US?
- Which counties need tailored messages to a low education/income population?
- How many communities or people are affected in each grouping?

Questions that can be answered using CART (continued)

- What groupings predominate in my state?
- Is there a geographic cluster of counties with high lung cancer mortality?
- What is the attributable risk percent for poor air quality?


Smoking Prevalence (percent)
N=3,053
58.0
≤26.3%
>26.2%
Smoking Prevalence (percent)
N=1,938
53.6
≤19.91%
>19.91%
Prior CHD Mortality (deaths/100,000)
N=1,115
65.6
≤218.3 deaths/100,000
>218.3 deaths/100,000
Poverty (percent)
N=1,426
56.0
≤15.5%
>15.5%
Poverty (percent)
N=917
67.5
Ambient Air Cancer Risk (excess deaths/100,000)
N=940
53.1
≤2.445 excess deaths/100,000
>2.445 excess deaths/100,000
≤29.5%
>29.5%
47.0
N=512
Grouping #1
47.1
N=257
Grouping #2
55.4
N=683
Grouping #3
61.4
N=486
Grouping #5
57.0
N=198
Grouping #4
66.4
N=865
Grouping #6
85.3
N=52
Grouping #7
Lung Cancer Mortality
Deaths per 100,000 (age-adjusted)

Data and CART Issues

- Contiguous US
- Correlations affect the tree:
  - education level and low income
  - radon and smoking prevalence
- Broad range of lung cancer mortality within grouping

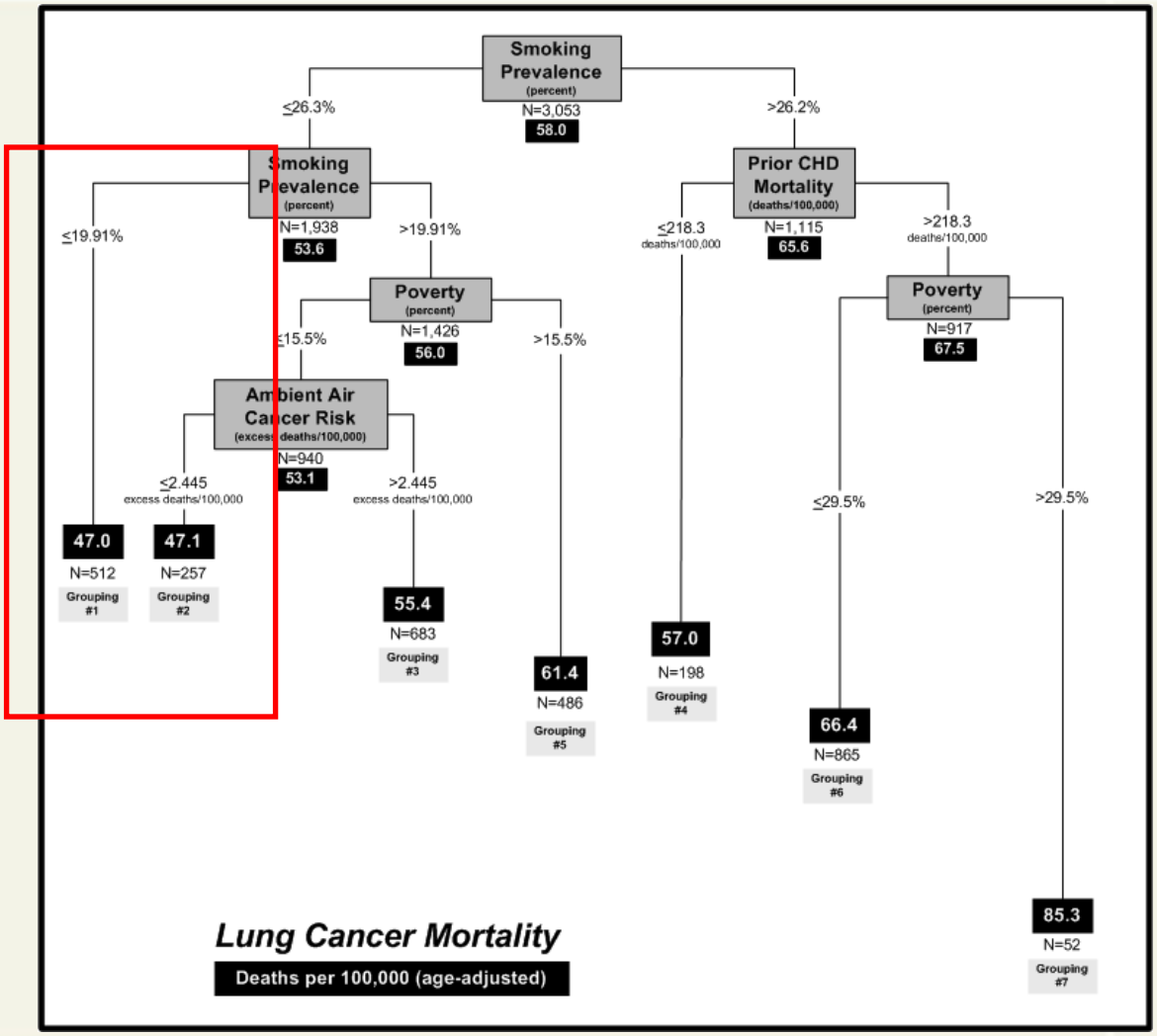
CART Advantages

- Graphic – “Pathways to Health”
- Exploratory and data-based
- Simplifying
- Continuous or categorical outcomes

Utility of CART

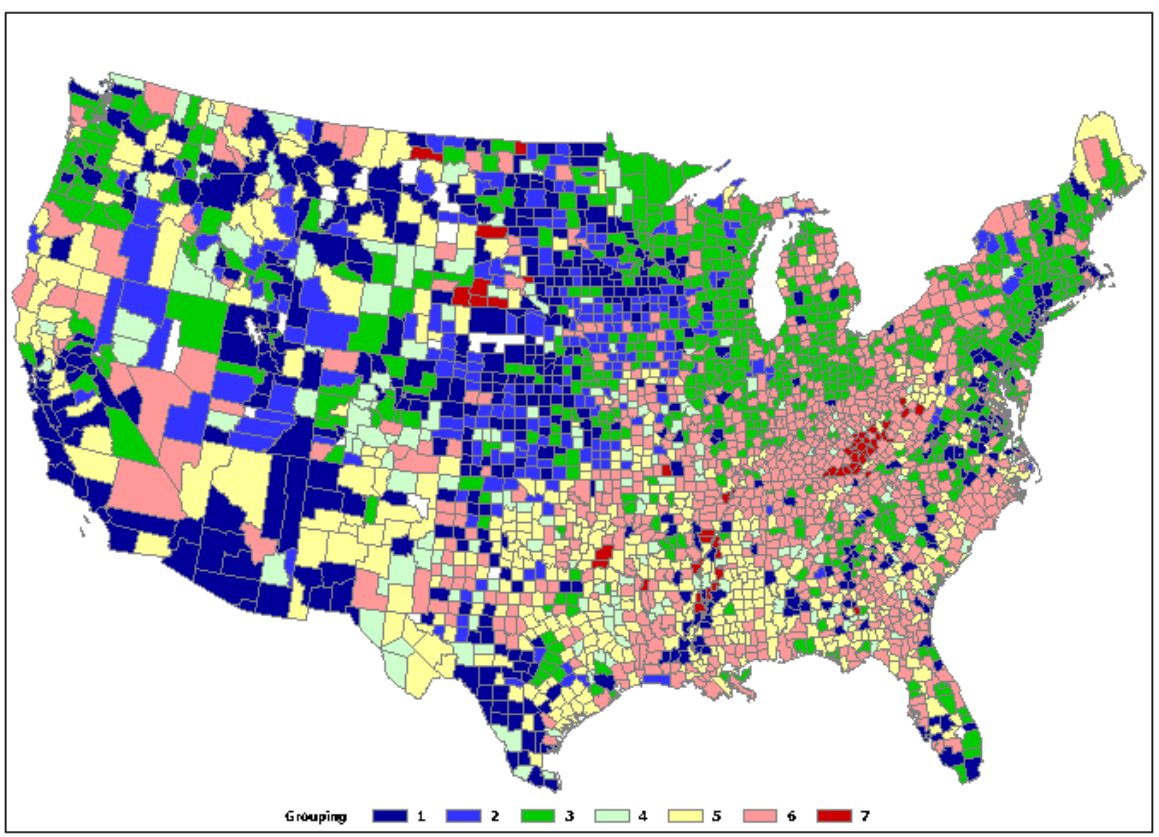
- Program management
- Policy making
- Research

At this time, what is the local baseline lung cancer mortality in the US?



Which counties need tailored messages to a low income/education population?

Groupings #5 and #7



What groupings predominate in my state?

Grouping #1

Carroll
Harford
Howard
Montgomery
Prince Georges

Grouping #2

Garrett

Grouping #3

Anne Arundel
Baltimore
Caroline
Charles
Frederick
Kent
Queen Anne's
St. Mary's
Talbot
Washington
Wicomico
Worcester

Grouping #4

Calvert

Grouping #5

Somerset

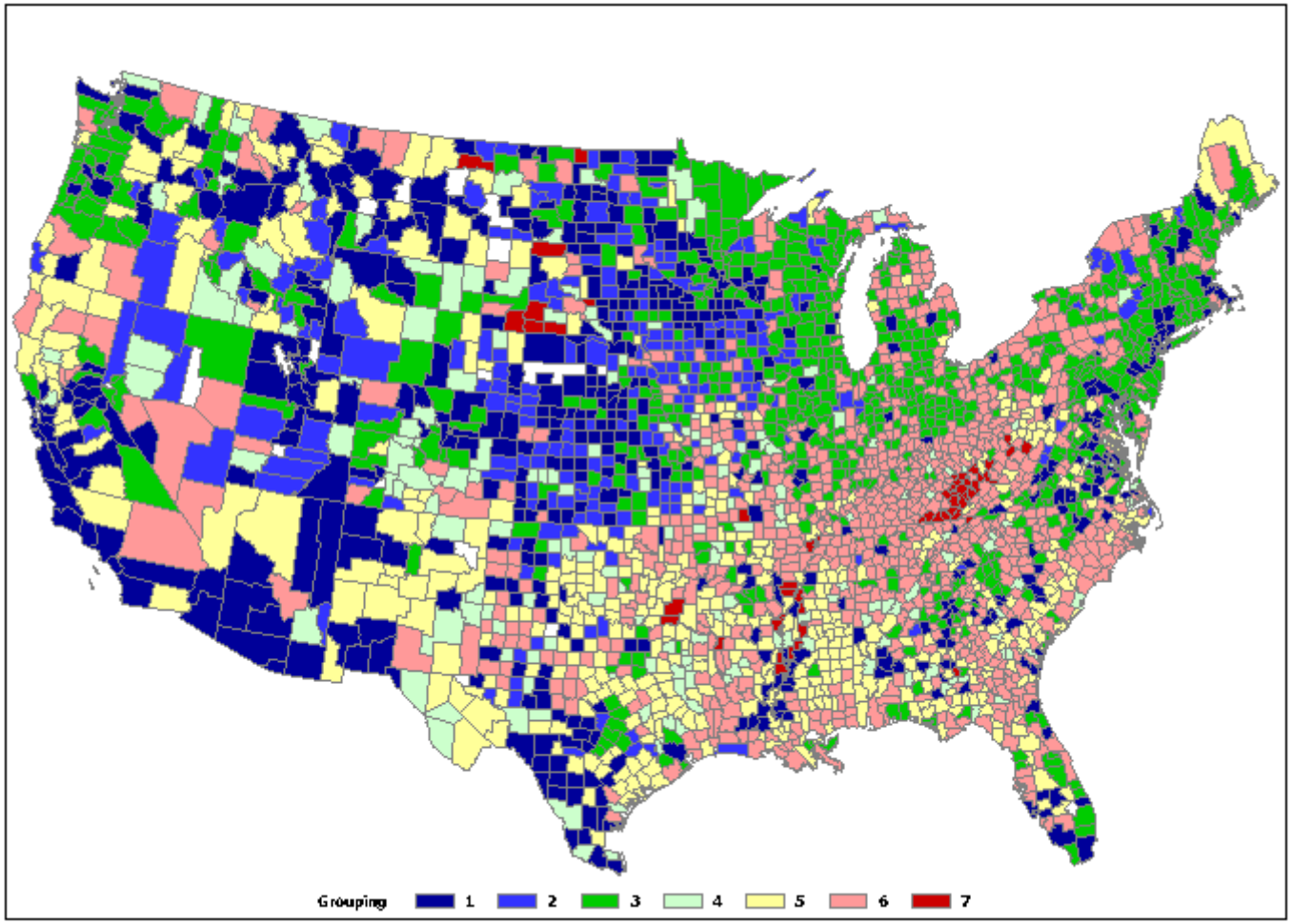
Grouping #6

Allegany
Baltimore City
Cecil
Dorchester

Grouping #7

The sample state, Maryland, has 23 counties and one city.
MD is statistically different from the nation ($p<0.05$).

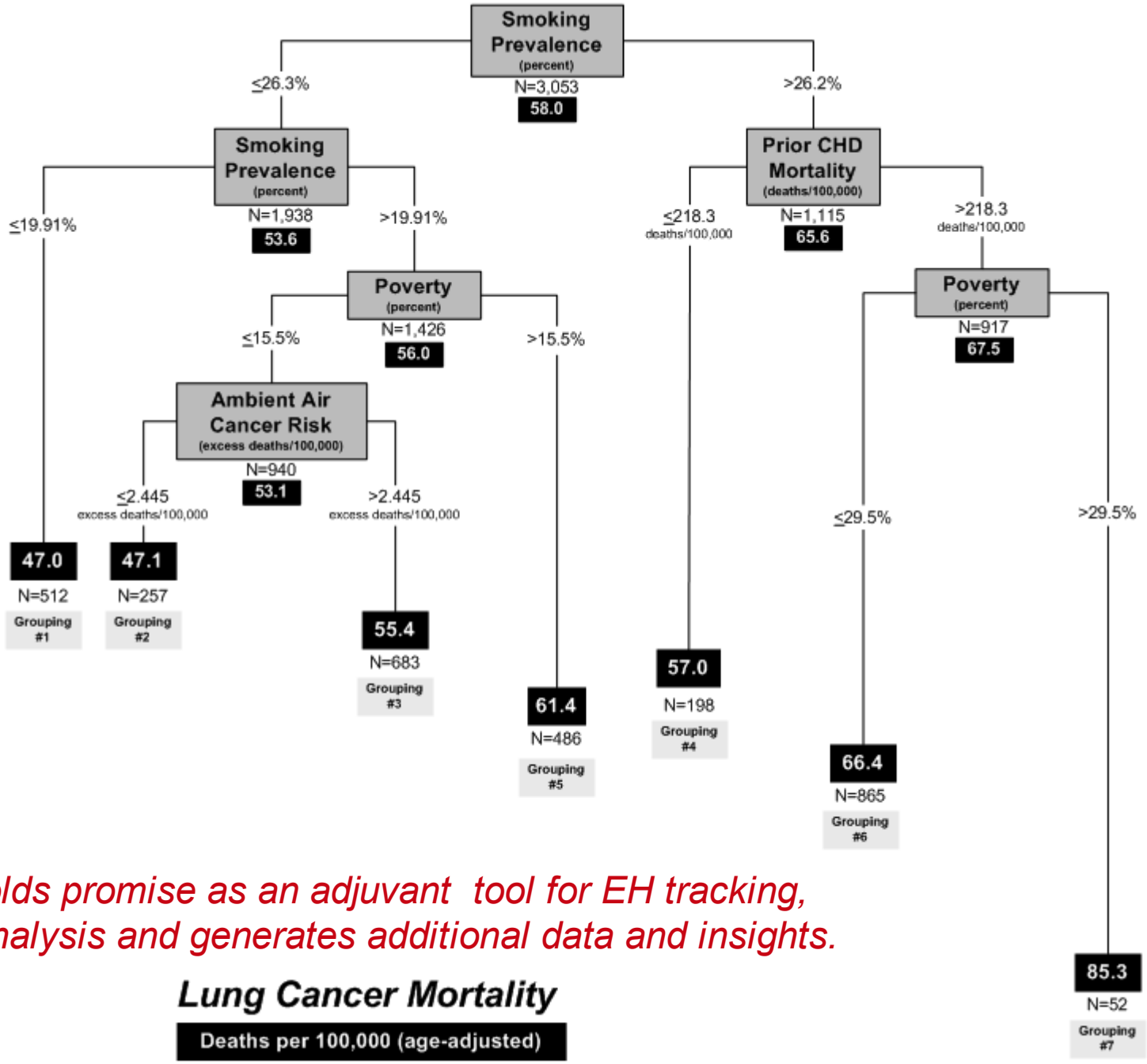
Is there geographic clustering of counties with high lung cancer mortality?



How many communities or people are affected in each grouping?

Grouping	#1	#2	#3	#4	#5	#6	#7
Lung Cancer Mortality (per 100,000)	47.0	47.1	55.4	57.0	61.4	66.4	85.3
Population Size (%)	90.1 m (33%)	2.9m (1%)	90.5m (32%)	6.6m (2%)	31.6m (12%)	56.6m (20%)	1.1m (<1%)
Number of Counties (%)	512 (17%)	257 (8%)	683 (22%)	198 (6%)	486 (16%)	865 (28%)	52 (2%)

What is the attributable risk percent for poor air quality?



CART holds promise as an adjuvant tool for EH tracking, guides analysis and generates additional data and insights.

Acknowledgements

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