Spatial Analysis of Prostate Cancer Incidence and Race in Southeastern United States, 1996-1999

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Background

- Racial disparities exist in prostate cancer incidence
- Age-adjusted U.S. incidence (1997 – 2001):
  - 258 / 100,000 for African Americans (AA)
  - 163 / 100,000 for Caucasians
- Mortality rate 2 times higher in African-Americans than whites
- Disparity in mortality rates greater in southeastern U.S.

Possible Risk Factors for Prostate Cancer

- Dietary fat intake
- Cooking practices
- Selenium intake
- Exposure to pesticides and fertilizers
- Physical activity
- Socioeconomic status (SES)
- Access to and use of healthcare services
- Genetics
- Neighborhood characteristics – e.g. work conditions, housing, safety, air quality, facilities, education

Goal

Evaluate the association of prostate cancer incidence in relation to area-based U.S. Census measures through a GIS and spatial statistical model in the southeastern United States

Methods: Data Sources

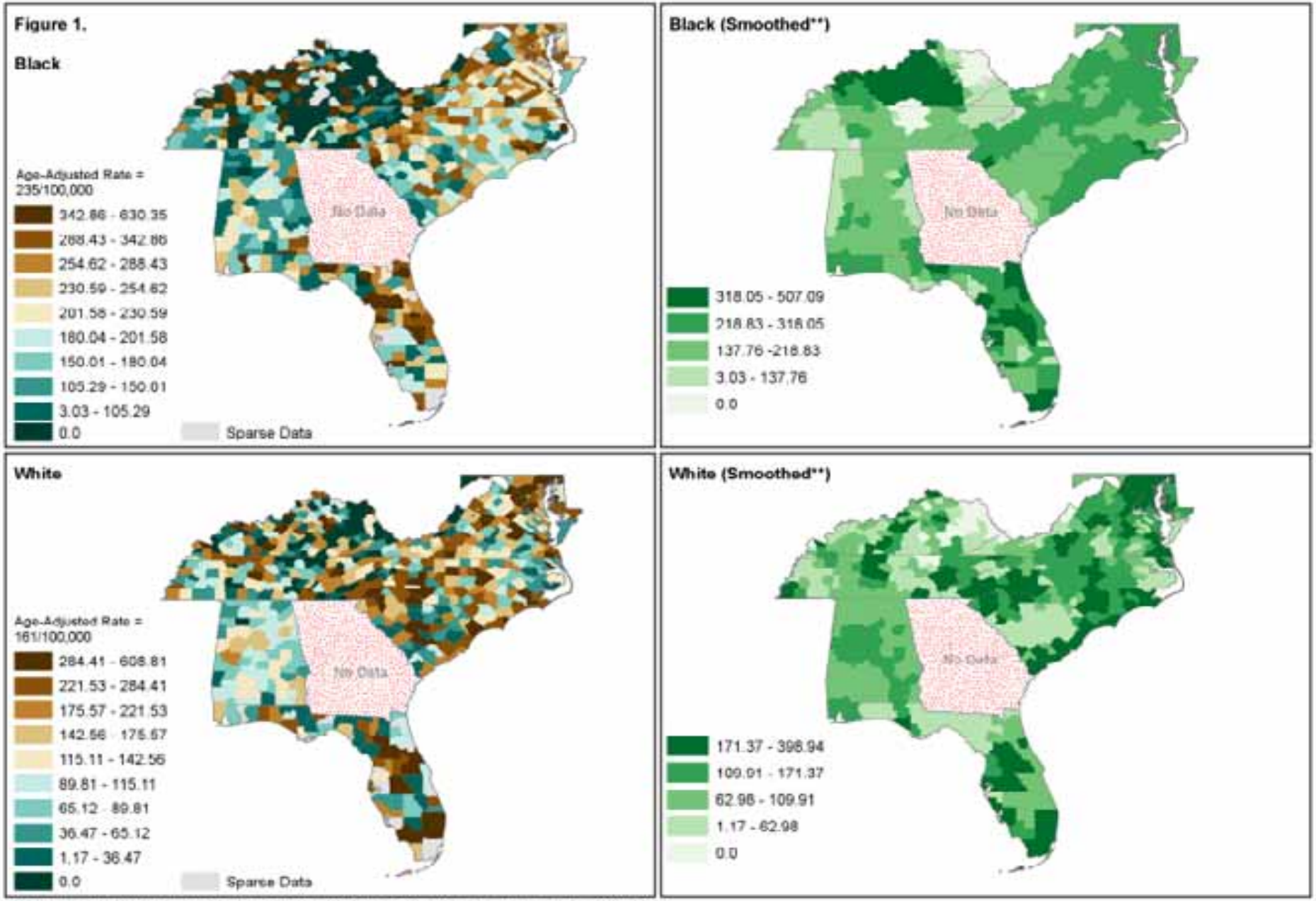
TYPE	SOURCE
Incidence rates	State cancer registries (MD, VA, TN, KY, NC, SC, AL, FL) 1996 – 1999
Area-based measures	1990 U.S. Census Data

*No Georgia data

Geographical Information Systems (GIS)

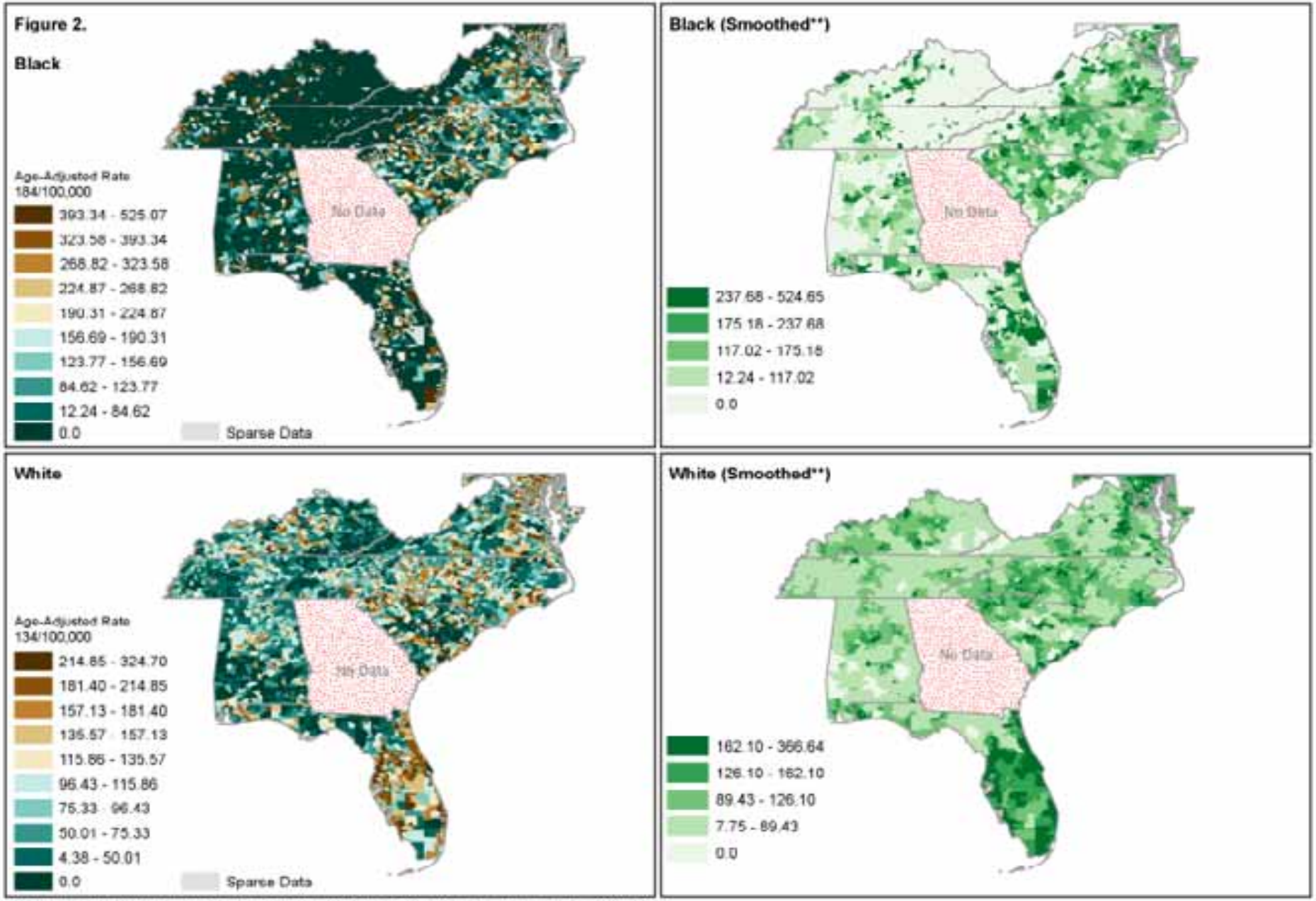
- Ease of data management
  - County level data and U.S. Census data
- Manipulation of area data
  - Poverty levels (SES)
  - Education
  - Income
  - Rural
- Spatial analysis

Figure 1.



*Rates were excluded more than 2 standard deviations from the mean were excluded
**Smoothing done using a weighted median-based "Headbanging" Algorithm.
Source: AL,DC,FL,KY,MD,NC,SC,TN,VA Cancer Registries and 1990 & 2000 Census of Population.

Figure 2.



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Results of statistical modeling at tract level

Variables	African Americans		Whites	
	Effect	p-value	Effect	p-value
Age (years)				
≥75	5.305	<0.0001	5.316	<0.0001
50-74	4.751	<0.0001	4.764	<0.0001
<50[a]	—	—	—	—
Poverty				
≥20%	0.027	0.5041	-0.090	0.0001
10%-19%	0.036	0.2588	-0.056	<0.0001
<10%[a]	—	—	—	—
Median household income	0.083	<0.0001	0.038	<0.0001
Education (among persons aged >25 years)				
% High[b]	0.298	0.0083	0.170	0.0054
% Low[c]	-0.285	<0.0001	-0.104	0.1578
Rural				
100%	-0.707	0.0010	0.304	0.0008
51% to <100%	-0.020	0.9286	0.333	0.0003
<50%[a]	—	—	—	—
% female head of household	0.784	<0.0001	0.212	0.0618
Interaction terms				
High education[b] by 100% rural	0.474	0.3051	-0.357	0.1237
High education by 51%-99% rural	0.582	0.1476	-0.555	0.0120
High education by <50% rural[a]	—	—	—	—
Low education[c] by 100% rural	-0.108	0.6688	-1.649	<0.0001
Low education by 51%-99% rural	-0.221	0.4393	-1.050	<0.0001
Low education by >50% rural[a]	—	—	—	—
House (median household income)				
House by 100% rural	0.165	0.0002	-0.015	0.3652
House by 51%-99% rural	-0.011	0.8093	-0.013	0.4791
House by <50% rural[a]	—	—	—	—
Poverty ≥20% by 100% rural	-0.260	0.0156	-0.263	<0.0001
Poverty ≥20% by 51%-99% rural	-0.263	0.0329	-0.169	0.0035
Poverty ≥20% by <50% rural[a]	—	—	—	—
Poverty 10%-19% by 100% rural	-0.092	0.2852	0.003	0.9138
Poverty 10%-19% by 51%-99% rural	-0.115	0.2203	-0.015	0.6357
Poverty 10%-19% by <50% rural[a]	—	—	—	—

[a] Reference category

[b] At least 4 years of college

[c] Less than a high school education

Results of statistical modeling at county level

Variables	African Americans		Whites	
	Effect	p-value	Effect	p-value
Age (years)				
≥75	5.414	<0.0001	5.455	<0.0001
50-74	4.773	<0.0001	4.869	<0.0001
<50[a]	—	—	—	—
Poverty				
≥20%	1.158	<0.0001	0.846	<0.0001
10%-19%	1.136	<0.0001	0.684	<0.0001
<10%[a]	—	—	—	—
Median household income	0.051	0.2610	0.343	<0.0001
Education (among persons aged >25 years)				
% High[b]	0.819	0.0962	2.112	0.0005
% Low[c]	-1.066	0.0001	2.234	0.0046
Rural				
100%	-2.726	0.0468	-2.807	0.1069
51% to <100%	0.711	0.1687	1.156	0.1621
<50%[a]	—	—	—	—
% female head of household	3.428	<0.0001	2.586	0.0289
Interaction terms				
High education[b] by 100% rural	11.096	<0.0001	3.186	0.4317
High education by 51%-99% rural	-1.369	0.2646	-0.533	0.7596
High education by <50% rural[a]	—	—	—	—
Low education[c] by 100% rural	0.784	0.4680	1.954	0.3395
Low education by 51%-99% rural	-0.738	0.1904	-2.136	0.0997
Low education by >50% rural[a]	—	—	—	—
House (median household income)				
House by 100% rural	0.682	<0.0001	0.446	0.2514
House by 51%-99% rural	0.269	<0.0001	-0.072	0.6270
House by <50% rural[a]	—	—	—	—
Poverty ≥20% by 100% rural	0.241	0.8424	-0.883	0.3306
Poverty ≥20% by 51%-99% rural	-0.854	0.0013	-1.340	<0.0001
Poverty ≥20% by <50% rural[a]	—	—	—	—
Poverty 10%-19% by 100% rural	-0.138	0.9096	-0.769	0.3862
Poverty 10%-19% by 51%-99% rural	-0.917	0.0004	-0.571	0.0468
Poverty 10%-19% by <50% rural[a]	—	—	—	—

[a] Reference category

[b] At least 4 years of college

[c] Less than a high school education

Tract Level by State

	African Americans		Whites	
Variables	**Effect**	**p-value**	**Effect**	**p-value**
Maryland	1.788	<0.0001	0.710	<0.0001
Kentucky	-0.060	0.8394	0.692	<0.0001
Tennessee	-0.109	0.5885	0.384	<0.0001
North Carolina	0.180	0.0278	0.643	<0.0001
South Carolina	0.317	0.0050	0.653	<0.0001
Alabama	0.347	0.0843	0.401	<0.0001
Florida	0.729	0.0002	0.841	<0.0001

County Level by State

	African Americans		Whites	
Variables	**Effect**	**p-value**	**Effect**	**p-value**
Maryland	-0.328	0.0024	-0.134	0.4486
Kentucky	0.291	0.2731	0.412	0.1812
Tennessee	-0.263	0.2061	0.015	0.9548
North Carolina	0.073	0.3940	0.048	0.7930
South Carolina	0.134	0.3135	-0.345	0.2041
Alabama	0.000	0.9986	-0.615	0.0782
Florida	0.533	0.0164	-0.464	0.2393

Results

- Prostate cancer incidence for AA's was 1.6 times whites - same ratio as national data
- Increased annualized, age-adjusted rates in prostate cancer incidence in eastern and central VA (1990-1999)
- Poverty and lower education associated with decreased incidence among whites only

Results

- Increased % of female heads of households and physician: population ratio associated with increased incidence in whites only
- Median household income and urban status positively associated with incidence (both populations)
- No association between prostate cancer incidence and PSA screening

Limitations

- All cases not geocoded to census tract level
- Statistical model limited in precision due to limited data

Conclusions

- Incidence rates for prostate cancer comparing AA's and whites similar to national data
- Area measures of poverty and education do not explain increased incidence of prostate cancer among African Americans
- Other factors may explain racial disparities (e.g. dietary practices, fat intake)
- More tract-level data needed for adequate cancer surveillance

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