

# Use of a GIS to Analyze Disparities in Cervical Cancer Incidence in New Jersey

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## Introduction

- Among NJ women aged 20 and older, invasive cervical cancer age-adjusted incidence rates:
  - declined 40% from 1979 to 2009, with a much greater decline among black women than white women (62% vs. 32%);
  - between 1990 and 2009, incidence rates decreased among Hispanic and Asian and Pacific Island (API) women, 56% and 71%, respectively; however,
  - 2009 incidence rates remained higher among black and Hispanic women than API and white women - 15.5 and 13.5 vs. 6.3 and 11.9 per 100,000 women.
- Every year between 2005-2009, among NJ women 20 or older about 400 were diagnosed with and 120 died of cervical cancer.
- Nearly all invasive cervical cancer can be prevented by a combination of Human Papilloma Virus (HPV) vaccination and PAP screening.
- We used a GIS to ascertain geographic and socio-economic patterns in cervical cancer incidence and stage.

## Methods

- All primary invasive cervical cancer cases among NJ women 20 years or older diagnosed in 2005-2009 from the New Jersey State Cancer Registry (NJSCR) were included. Cases were geocoded to their census tract based on their address at the time of diagnosis; 7 cases with unknown census tract were excluded.
- Significant spatial clusters (of census tracts) of high incidence rates or high percentages of late-stage (regional and distant stage) diagnosis were ascertained using NCI's SATScan software.
- U.S. Census American Community Survey 2005-2009 population estimates were used for the incidence rates and to characterize the geographic areas of significant clusters. The relative risks (from SATScan) were age-adjusted using three age groups – 20-44, 45-64, 65+.
- SATScan settings included census tracts as the geographic units, Poisson model, maximum cluster size of 25% of the population at risk and circular spatial windows. Statistical significance was determined with 999 Monte Carlo simulations, p-value < 0.05. Borderline statistical significance was a p-value ≥0.05 and <0.10.

## Results

- Two significant high incidence clusters were found in northeastern NJ and a third borderline cluster was found in southwestern NJ (see map).
- The 3 clusters of high cervical cancer incidence rates accounted for 19% of the cases and had relative risks ranging from 1.6 to 2.3 (see map).
- No significant cluster of late-stage diagnosis was found.

### Case Characteristics (Table 1)

- Higher percentages of cervical cancer cases in the clusters were black, Hispanic, uninsured and unmarried compared with cases in the rest of NJ.
- The percent of cases diagnosed in the late stage (regional and distant stages) was higher in cluster 1 and cluster 3 than in the rest of NJ.

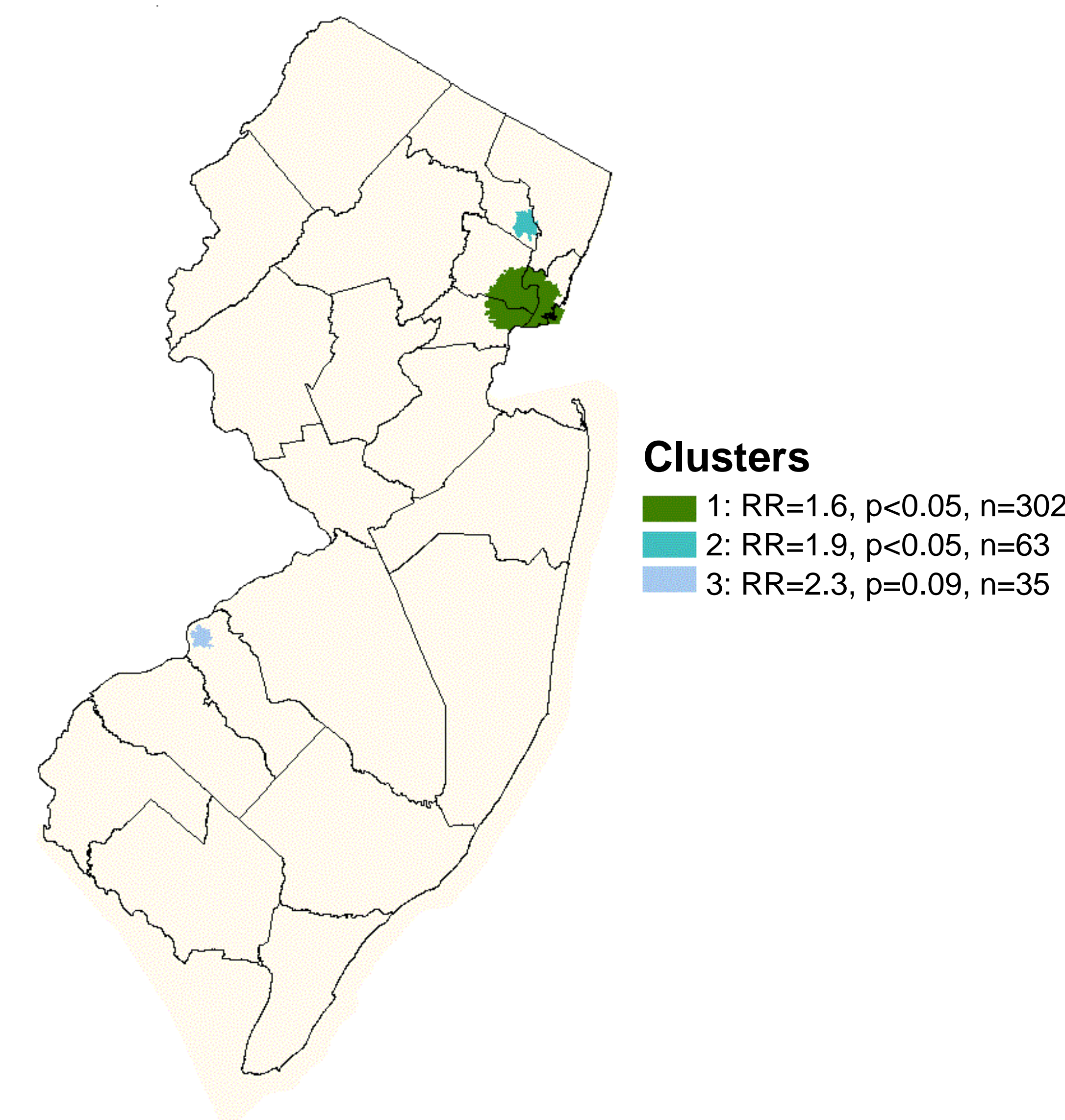
### Population Characteristics (Table 2)

- The 3 cluster areas contained 12.1% of NJ's population and 11.8% of NJ's women age 20 or older.
- Much higher percentages of the populations in the 3 cluster areas were black (except cluster 2), Hispanic, foreign born (except cluster 3), and speak English less than very well compared to the rest of the NJ's population.
- The language other than English most often spoken at home in the 3 cluster areas was Spanish. There were much higher percentages of the population speaking Spanish at home in the 3 clusters than in the rest of the state.
- Much lower percentages of the populations in the 3 cluster areas had at least a high school diploma or were married than the population in the rest of the state.
- In the 3 cluster areas the percent of the population unemployed, in poverty and in renter-occupied housing was higher and the per capita income was lower than in the rest of the state.

## Discussion

- Additional planned spatial analyses include SATScan with elliptical windows and nested circles.
- Additional efforts to educate and provide the HPV vaccine to adolescents and PAP testing with follow-up to women are needed, especially in the three cluster areas.
- We are sharing these results with the Cancer Control and Prevention Program within the NJDOH and with other groups addressing cancer disparities, e.g. GIS Mapping Lab at the New Jersey Medical School.

Clusters of Census Tracts with Elevated Cervical Cancer Incidence Rates in Women 20 and Older New Jersey, 2005-2009, N=2,105



Characteristic	Cluster 1 n=302 <sup>2</sup>	Cluster 2 n=63 <sup>2</sup>	Cluster 3 n=35 <sup>3</sup>	Rest of New Jersey
<b>Race</b>				
black	51.3%	14.3%	40.0%	13.0%
<b>Ethnicity</b>				
Hispanic	30.5%	47.6%	37.1%	14.2%
<b>Insurance Status</b>				
not insured	24.8%	19.1%	25.7%	11.9%
medicaid	10.6%	7.9%	22.9%	6.5%
<b>Marital Status</b>				
married	28.8%	39.7%	20.0%	43.4%
<b>Stage at Diagnosis</b>				
late <sup>4</sup>	49.4%	46.0%	51.5%	48.2%

<sup>1</sup>Data are from the New Jersey State Cancer Registry, New Jersey Department of Health, 2012 analytic file.  
<sup>2</sup>p-value < 0.05, <sup>3</sup>p-value = 0.09  
<sup>4</sup>Late stage is regional and distant stages combined.

Characteristic	Cluster 1	Cluster 2	Cluster 3	Rest of New Jersey
<b>Total Population</b>	831,960	144,988	66,427	7,607,173
women 20+	313,315	52,157	23,810	2,913,363
black <sup>2</sup>	43.6%	10.7%	48.0%	11.0%
Hispanic (of any race)	29.3%	53.3%	32.6%	13.6%
foreign born	31.5%	40.4%	12.4%	18.0%
<b>Language (age 5+)</b>				
English less than very well	16.0%	27.6%	13.8%	7.5%
speak Spanish at home	20.2%	37.4%	22.5%	8.2%
speak Indo-European language at home	10.1%	11.4%	1.3%	7.1%
speak Asian or Pacific Islander language at home	2.8%	4.0%	2.2%	3.7%
<b>Education (age 25+)</b>				
less than a high school diploma	24.6%	27.4%	32.9%	11.6%
<b>Marital Status (women)</b>				
now married (age 15+) <sup>3</sup>	33.2%	39.8%	25.8%	50.5%
<b>Economic status</b>				
unemployed (age 16+)	10.8%	6.8%	14.7%	6.5%
family income below poverty <sup>4</sup>	16.1%	18.3%	31.1%	5.6%
per capita income <sup>5</sup>	\$21,133	\$19,880	\$15,891	\$36,485
housing renter-occupied	65.9%	57.7%	56.3%	28.7%

<sup>1</sup>Data are from the American Community Survey, U.S. Census Bureau, 2005-2009.  
<sup>2</sup>from one race or two or more races  
<sup>3</sup>excludes separated  
<sup>4</sup>in past 12 months  
<sup>5</sup>in 2009 inflation-adjusted dollars