Disparities in Female Breast Cancer Stage at Diagnosis in New Jersey – a Spatial Temporal Analysis
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Introduction
Female Breast Cancer, U.S.

• Breast cancer is the leading cancer diagnosis and second largest cause of cancer mortality among U.S. women.

• In 2014 an estimated:
  – 232,670 new cases
  – 40,000 deaths

Female Breast Cancer Survival, U.S.

• Survival has improved greatly since 1975.
• 2003-2005 five-year relative survival rate:
  – 92% - white women
  – 79% - black women
• Stage at diagnosis an important prognostic factor, five-year relative survival rates:
  – 100% - in situ
  – 99% - local stage
  – 70% - regional stage
  – 13% - distant stage

Female Breast Cancer Incidence, New Jersey

Historical Trends (1977-2012)
Incidence, New Jersey
Breast, Female
All Ages
Female Breast Cancer Mortality, New Jersey

- Five-year relative survival rate for 2001-2005:
  - 89.7% - white
  - 88.3% - Asian/Pacific Islander
  - 87.4% - Hispanic
  - 76.4% - black

- Black women’s lower survival likely related to:
  - lower percentage diagnosed at the local stage
  - lower survival rate at each stage

- Early detection through mammography increases treatment options and decreases mortality.

Female Breast Cancer Survival, New Jersey

Purpose of Study

- Identify, map and characterize geographic areas and time periods in New Jersey with significantly high proportions of women diagnosed with breast cancer: 1) in situ and 2) distant stage.

- Current study expanded upon our 2002 study with:
  - 14 additional diagnosis years
  - element of time
  - search for clusters with high proportions of breast cancer diagnosed in situ, as well as at the distant stage.

Methods Cases

- Primary female breast cancer cases from the New Jersey State Cancer Registry (NJSCR):
  - in situ and invasive
  - diagnosed in 1997-2011
  - their address at the time of diagnosis geocoded to 2000 census tract centroids

- ICD-O-3 codes – C500-509

- Exclusions:
  - ascertained by death certificate or autopsy only
  - no valid census tract
Spatial-Temporal Analysis
SaTScan space-time scan statistic to identify clusters; specifications:
- census tract level
- elliptical spatial windows, 3-year temporal windows
- Poisson model
- maximum cluster size – 50% of the population at risk
- statistical significance determined by 999 Monte Carlo simulations, p<0.05
- “cases” – women diagnosed with in situ or distant stage breast cancer and “population at risk” – all women diagnosed with breast cancer.

Estimated clusters were mapped using ArcGIS ArcMap.

Comparisons of Cases and Populations in the Clusters vs. Rest of New Jersey
- Cases in the estimated clusters were compared with cases in the rest of NJ on:
  - clinical, demographic, socio-economic factors
  - Pearson’s chi-square, p<0.05
- Populations in the estimated clusters were compared with the population in the rest of New Jersey on:
  - demographic and socio-economic factors
  - data from the 2005–2009 American Community Survey, U.S. Census Bureau

Results
127,718 total cases, excluded:
- 602 ascertained by death certificate or autopsy report only
- 360 without a valid census tract

126,756 cases in the study:
- 5,951 (4.7%) diagnosed at the distant stage
- 27,181 (21.4%) diagnosed in situ

Three estimated space-time clusters were identified, one distant stage and two in situ.
Space-Time Clusters – Distant Stage

One cluster with significantly high proportions of distant stage breast cancer (Cluster 1):
  - in northeastern New Jersey
    • all of Hudson County
    • parts of Bergen, Essex, Union, Middlesex and Monmouth counties
  - during 1997-2011
  - relative risk = 1.35, p<0.001
  - 1,613 cases diagnosed at the distant stage
    • 6.1% of all cases in the cluster
    • 27.1% of the distant stage diagnoses statewide

Case Comparison
Cluster 1 (Distant Stage)

Cases in Cluster 1 compared with cases in the rest of New Jersey were significantly:
  – younger (0-44) or older (65+), black, Asian and Pacific Islander, Hispanic, not married and uninsured or Medicaid insured
  – more likely to reside in a high poverty census tract (20-100% of residents in poverty)

Population Comparison – Cluster 1

The population in Cluster 1 compared with the population in the rest of New Jersey had higher percentages of persons who:
  - are black, Hispanic, foreign born, unmarried, speak Spanish or an Indo-European language at home, speak English less than well, do not have a high school education
  - are unemployed, in renter occupied housing, have a family income below poverty

The population in Cluster 1 has a lower per capita income.

Space-Time Clusters – In Situ

Two estimated clusters with significantly high proportions of in-situ breast cancer, Cluster 2 and Cluster 3:
  – Cluster 2 in northeastern New Jersey (Bergen County)
  – during 2004-2011
  – relative risk = 1.35, p<0.001
  – 3,195 cases diagnosed in situ
    • 25.6% of all cases in the cluster
    • 11.8% of all the in situ cases diagnosed statewide
Space-Time Clusters – In Situ

– Cluster 3 in central New Jersey
  • all of Union, Somerset, Mercer, Middlesex, Monmouth counties
  • most of Hunterdon County
  • parts of three other counties
– during 2006-2011
– relative risk = 1.24, p<0.001
– 6,894 cases diagnosed in situ
  • 23.5% of all cases in the cluster
  • 24.4% of all the in situ cases diagnosed state-wide

Case Comparisons
Clusters 2 and 3

Cases in Clusters 2 and 3 (in situ) compared with cases in the rest of New Jersey:

– significantly lower percentages were older (65+), black, Hispanic, not married and uninsured or Medicaid insured, reside in a high poverty census tract (20-100% of residents in poverty)
– significantly higher percentages were API

Population Comparisons – Clusters 2 and 3

Populations in Clusters 2 and 3 (in-situ) compared with the population in the rest of New Jersey:

– lower percentages are black, Hispanic, have less than a high school education, are not currently married, unemployed, in renter occupied housing, have a family income below poverty
– higher percentages are foreign born, speak Indo-European or API language at home, speak English less than well
– have a higher per capita income.

Discussion

Distant Stage Cluster

Current study’s distant stage cluster:

– covers approximately the same geographic area as the two clusters in earlier study
– has high percentages of minority and low SES cases and populations similar to the two earlier clusters
– the gap in % diagnosed distant stage has narrowed:

<table>
<thead>
<tr>
<th>Study</th>
<th>Diagnosis Years</th>
<th>% Diagnosed at Distant Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cluster</td>
<td>Rest of New Jersey</td>
</tr>
<tr>
<td>Previous</td>
<td>1995-1997</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9%</td>
</tr>
<tr>
<td>Current</td>
<td>1997-2011</td>
<td>6.1%</td>
</tr>
</tbody>
</table>
**In Situ Stage Clusters**

- In New Jersey the proportion of breast cancer cases diagnosed *in situ* increased between 1997 and 2011 from 17% to 24%.
- Unfortunately, in recent years (2004-2011), certain areas of the state (southern and northwestern) have not improved as much as the *in situ* cluster areas.
- This disparity is especially noticeable in Bergen, Union and Middlesex counties where the *in situ* stage clusters overlap with the distant stage cluster.

**Conclusion**

- Additional attention to breast cancer education and screening are needed throughout New Jersey.
- The geographic area with a significantly higher proportion of breast cancer diagnosed at the distant stage especially needs these services.
- The demographic and socioeconomic information about this geographic area can be used to target needed services.

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