Inequities in Infant Mortality and Low Birth Weight in Hampton Roads:

Rethinking Birth Outcomes Using GIS and Geospatial Analysis

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Virginia Department of Health

Office of Minority Health & Public Health Policy
Advancing Health Equity For All Virginians

Virginia Department of Health
Protecting You and Your Environment
Objectives

• Provide overview of GIS and spatial analysis capabilities

• Demonstrate added value for targeting infant mortality and promoting health equity
Infant Deaths in Hampton Roads

- In 2006, 30 percent of infant deaths in Virginia occurred to Hampton Roads residents.

<table>
<thead>
<tr>
<th>Locality</th>
<th>Number of Infant Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia Beach City</td>
<td>68</td>
</tr>
<tr>
<td>Norfolk City</td>
<td>45</td>
</tr>
<tr>
<td>Hampton City</td>
<td>25</td>
</tr>
<tr>
<td>Newport News City</td>
<td>23</td>
</tr>
<tr>
<td>Chesapeake City</td>
<td>22</td>
</tr>
<tr>
<td>Portsmouth City</td>
<td>21</td>
</tr>
<tr>
<td>Suffolk City</td>
<td>8</td>
</tr>
<tr>
<td>Accomack County</td>
<td>6</td>
</tr>
<tr>
<td>Gloucester County</td>
<td>4</td>
</tr>
<tr>
<td>Williamsburg City</td>
<td>3</td>
</tr>
<tr>
<td>York County</td>
<td>2</td>
</tr>
<tr>
<td>James City County</td>
<td>1</td>
</tr>
<tr>
<td>Poquoson City</td>
<td>1</td>
</tr>
<tr>
<td>Northampton County</td>
<td>0</td>
</tr>
<tr>
<td>Hampton Roads (Total)</td>
<td>229</td>
</tr>
<tr>
<td>Virginia</td>
<td>760</td>
</tr>
</tbody>
</table>

Source: Virginia Department of Health, Division of Health Statistics, 2006 Death Certificate data, compiled by the Office of Family Health Services, Division of Women’s and Infants’ Health
Infant Deaths and Infant Death Rate
Hampton Roads, 1995-2006

Virginia
7.4 infant deaths
per 1,000 live births
(average annual rate, 1995-2006)

9.5 infant deaths
per 1,000 live births
### Infant mortality

#### Hampton Roads, 2006

<table>
<thead>
<tr>
<th></th>
<th>Hampton Roads</th>
<th>Virginia 2006</th>
<th>Nation 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number</strong></td>
<td>228</td>
<td>760</td>
<td>28,440</td>
</tr>
<tr>
<td><strong>Rates</strong> (per 1,000 live births)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant deaths</td>
<td>9.5</td>
<td>7.1</td>
<td>6.9</td>
</tr>
<tr>
<td>Neonatal deaths</td>
<td>7.2</td>
<td>4.9</td>
<td>4.5</td>
</tr>
<tr>
<td>Postneonatal deaths</td>
<td>2.3</td>
<td>2.2</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>Race-specific rates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>6.6</td>
<td>5.5</td>
<td>5.7</td>
</tr>
<tr>
<td>Black</td>
<td>14.4</td>
<td>13.8</td>
<td>13.7</td>
</tr>
<tr>
<td>Other</td>
<td>6.2</td>
<td>3.7</td>
<td>--</td>
</tr>
</tbody>
</table>
Underlying Causes of Infant Mortality, 2004-2006

<table>
<thead>
<tr>
<th>Top 3 Underlying Causes of Infant Mortality</th>
<th>Hampton Roads</th>
<th>Virginia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disorders of Short Gestation and Low Birthweight</td>
<td>216.1</td>
<td>145.2</td>
</tr>
<tr>
<td>Sudden Unexplained Infant Death (SUID)</td>
<td>157.9</td>
<td>112.1</td>
</tr>
<tr>
<td>Congenital malformations, deformations &amp; chromosomal abnormalities</td>
<td>141.3</td>
<td>123.3</td>
</tr>
</tbody>
</table>

Source: Virginia Department of Health, Division of Health Statistics, 2004-06 Death Certificate data, compiled by the Office of Family Health Services, Division of Women’s and Infants’ Health
## Period of Infant Death, 2004-2006

<table>
<thead>
<tr>
<th>Period of Infant Death</th>
<th>Infant Mortality Rate per 1,000 live births</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hampton Roads</td>
</tr>
<tr>
<td>Early Infant Death (less than one day)</td>
<td>4.7</td>
</tr>
<tr>
<td>Neonatal Infant Death (27 days or less)</td>
<td>6.7</td>
</tr>
<tr>
<td>Postneonatal Infant Deaths (28 to 364 days)</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Source: Virginia Department of Health, Division of Health Statistics, 2004-06 Death Certificate data, compiled by the Office of Family Health Services, Division of Women’s and Infants’ Health
Educational Inequities in Infant Mortality 2004-2006

Source: Virginia Department of Health, Division of Health Statistics, 2004-06 Infant Death Certificate linked to Birth Certificate data, compiled by the Office of Family Health Services, Division of Women’s and Infants’ Health

Source: Virginia Department of Health, Division of Health Statistics, 2004-06 Infant Death Certificate linked to Birth Certificate data, compiled by the Office of Family Health Services, Division of Women’s and Infants’ Health
Infant Mortality Rate
2004-2006

Legend
Infant Mortality Rate 2004-06
- 0.0000 - 4.5000
- 4.5001 - 7.3222
- 7.3223 - 10.2129
- 10.2130 - 14.1078
- 14.1079 - 21.4286

Source: Virginia Department of Health, Division of Health Statistics, 2004-06 Death Certificate data, compiled by the Office of Family Health Services, Division of Women’s and Infants’ Health
Multilevel Spatial Analysis of Fundamental Causes & the Social Determinants of Health

Statewide by City/County

Census Tract

Census Block Group

Social Profiles, Social Networks & Social Capital
Hampton Roads Area* - Population by Race/Ethnicity and Census Tract Poverty, 2000

* Hampton Roads Area includes Chesapeake, Norfolk, Portsmouth, Suffolk, Virginia Beach, Williamsburg, James City, York, Gloucester, Hampton, Newport News, Poquoson, Accomack and Northampton.

Source: US Census 2000; Poverty (SF3, P87); Race (SF1 P7); Hispanic ethnicity (SF1 P4).
Hampton Roads Area - Percent of Children by Race Living in Poor Neighborhoods*, 2000

<table>
<thead>
<tr>
<th>Race</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total**</td>
<td>43.9</td>
</tr>
<tr>
<td>White</td>
<td>19.6</td>
</tr>
<tr>
<td>Black</td>
<td>48.9</td>
</tr>
<tr>
<td>Asian</td>
<td>39.3</td>
</tr>
<tr>
<td>Other</td>
<td>34.9</td>
</tr>
<tr>
<td>Hispanic</td>
<td>45.0</td>
</tr>
</tbody>
</table>

* Children (under 18 years old); Poor neighborhoods - census tracts (CTs) with greater than 20.0% poverty. The racial categories include persons of Hispanic and non-Hispanic origin; 'Other' includes American Indian, Alaska Native, Native Hawaiian and other Pacific Islander, some other race alone, and two or more races. **Total number of children living below the federal poverty level reflects the sum of the four racial categories since Hispanic ethnicity could not be determined for each race. Source: Census 2000, SF3, P159.
Hampton Roads Area - Percent of Children Below Federal Poverty Level by Race, 2000

Source: U.S. Census Bureau, 2000
Double Jeopardy describes children (under 18 years old) that live in poor families and in poor neighborhoods. Poor neighborhoods are defined as census tracts (CTs) with greater than 20.0% poverty. The racial categories include persons of Hispanic and non-Hispanic origin; ‘Other’ includes American Indian, Alaska Native, Native Hawaiian and other Pacific Islander, some other race alone, and two or more races. **Total number of children living below the federal poverty level reflects the sum of the four racial categories since Hispanic ethnicity could not be determined for each race. Source: Census 2000, SF3, P159.
### TABLE A. Distribution of Low Birth-Weight Infants and Rates (LBW, per 100), by Race/Ethnicity* and Census Tract (CT) Poverty: Hampton Roads Area**: 1996-2005

<table>
<thead>
<tr>
<th>CT Poverty Level</th>
<th>Total</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>LBW</td>
<td>n</td>
<td>LBW</td>
<td>n</td>
<td>LBW</td>
</tr>
<tr>
<td>0-4.9%</td>
<td>3,074</td>
<td>5.3</td>
<td>1,876</td>
<td>4.3</td>
<td>928</td>
<td>9.4</td>
</tr>
<tr>
<td>5.0-9.9%</td>
<td>3,535</td>
<td>6.2</td>
<td>1,709</td>
<td>4.7</td>
<td>1,433</td>
<td>9.6</td>
</tr>
<tr>
<td>10.0-19.9%</td>
<td>4,849</td>
<td>7.5</td>
<td>1,785</td>
<td>5.5</td>
<td>2,688</td>
<td>10.2</td>
</tr>
<tr>
<td>&gt; 20.0%</td>
<td>3,779</td>
<td>10.4</td>
<td>466</td>
<td>6.5</td>
<td>3,201</td>
<td>11.6</td>
</tr>
</tbody>
</table>

### TABLE B. Distribution of Infant Deaths and Rates (IMR, per 1,000), by Race/Ethnicity* and Census Tract (CT) Poverty, Hampton Roads Area**: 1996-2005

<table>
<thead>
<tr>
<th>CT Poverty Level</th>
<th>Total</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>IMR</td>
<td>n</td>
<td>IMR</td>
<td>n</td>
<td>IMR</td>
</tr>
<tr>
<td>0-4.9%</td>
<td>363</td>
<td>6.2</td>
<td>214</td>
<td>4.9</td>
<td>121</td>
<td>12.3</td>
</tr>
<tr>
<td>5.0-9.9%</td>
<td>383</td>
<td>6.9</td>
<td>192</td>
<td>5.3</td>
<td>164</td>
<td>11.0</td>
</tr>
<tr>
<td>10.0-19.9%</td>
<td>601</td>
<td>9.3</td>
<td>225</td>
<td>6.9</td>
<td>333</td>
<td>12.6</td>
</tr>
<tr>
<td>&gt; 20.0%</td>
<td>434</td>
<td>11.9</td>
<td>50</td>
<td>7.0</td>
<td>374</td>
<td>13.6</td>
</tr>
</tbody>
</table>

*White and Black classifications are non-Hispanic. Data consists of singleton births for mothers aged 15-44 years that geocoded correctly, (error rate = 10%). Rates were not calculated on sample sizes less than 30 or when the geocoding error rate exceeded 10%.

**Hampton Roads Area includes Chesapeake, Norfolk, Portsmouth, Suffolk, Virginia Beach, Williamsburg, James City, York, Gloucester, Hampton, Newport News, Poquoson, Accomack and Northampton.
Kernel Density Map
Infant Mortality Rate (per 1,000 live births) shown in purple on map. Source: VDH Vital Statistics, (1996-2005, geocoding error rate= 10%);
Data consists of singleton births for mothers aged 15-44 years.
Portsmouth-Norfolk-Chesapeake Area
Infant Mortality Rate and Poverty by Census Tract
with HUD Multifamily Housing (.construct) and HUD Townhouses (construct)

Infant Mortality Rate (per 1,000 live births) shown in purple on map. Source: VDH Vital Statistics, (1996-2005, geocoding error rate= 10%); Data consists of singleton births for mothers aged 15-44 years.
Newport News-Hampton Area
Infant Mortality Rate and Poverty by Census Tract

Infant Mortality Rate (per 1,000 live births) shown in purple on map. Source: VDH Vital Statistics, (1996-2005, geocoding error rate= 10%);
Data consists of singleton births for mothers aged 15-44 years.

% population below federal poverty level

- ≤ 4.9
- 5.0 - 9.9
- 10.0 - 19.9
- 20.0 - 29.9
- ≥ 30.0

Infant Mortality Rate (per 1,000 live births) shown in purple on map. Source: VDH Vital Statistics, (1996-2005, geocoding error rate= 10%); Data consists of singleton births for mothers aged 15-44 years.
Hampton Roads Area Persistent Poverty

**Poor census tracts** in the:
- **Current decade (2000)**
- **Last 2 decades (1990-2000)**
- **Last 3 decades (1980-2000)**

*Poor census tracts—20 percent or more residents were below the federal poverty level as determined by the US Census.*

Portsmouth-Norfolk-Chesapeake Area
Persistent Poverty and Low Birth Weight Rate*

Poor census tracts** in the:
- Current decade (2000)
- Last 2 decades (1990-2000)
- Last 3 decades (1980-2000)

*Low Birth Weight Rate: (per 100 live births); shown on map. Source: VDH Vital Statistics, (1996-2005, geocoding error rate= 10%); Data consists of singleton births for mothers aged 15-44 years.

**Poor census tracts--20 percent or more residents were below the federal poverty level as determined by the US Census.

Newport News-Hampton

Persistent Poverty and Low Birth Weight Rate*

Poor census tracts** in the:
- Current decade (2000)
- Last 2 decades (1990-2000)
- Last 3 decades (1980-2000)

*Low Birth Weight Rate: (per 100 live births); shown on map. Source: VDH Vital Statistics, (1996-2005, geocoding error rate= 10%), Data consists of singleton births for mothers aged 15-44 years.

**Poor census tracts--20 percent or more residents were below the federal poverty level as determined by the US Census.

Hampton Roads Area
Population to Primary Care Provider* (PCP) Ratio by Census Tract

Population to PCP Ratio
- < 3,000:1
- 3,000:1 - ≤ 4,500:1
- 4,500:1 - ≤ 6,000:1
- 6,000:1 - ≤ 7,500:1
- > 7,500:1

*PCP data from the Virginia Board of Medicine, Quarter 1, 2008. PCP specialties include general or family medicine, internal medicine, pediatrics, and obstetrics and gynecology. Population data from 2000 Census, SF1.
Housing Stress
Virginia Counties

30% or more of households had one or more of these housing conditions:
- lacked complete plumbing
- lacked complete kitchen
- paid 30% or more of income for owner costs or rent
- had more than 1 person per room

Hampton Roads Area
Housing Stress Census Block Groups

30% or more of households:
- Lacked complete kitchen
- Paid 30% or more of income for owner costs or rent
- Lacked complete kitchen AND paid 30% or more of income for owner costs or rent

Source: Census 2000, SF3; H20, H47, H50, H73, H97.
Conclusions

• Inequities exist in birth outcomes in Hampton Roads
  – Low education attainment, African American, High poverty communities

• Analyses with additional social, economic, and medical variables is necessary

• GIS and spatial analysis allow targeting of scarce resources to high risk communities

• GIS and spatial analysis lead to new questions and new answers
Some ‘New’ Questions

- How does **individual SES** shape the risk for infant mortality?

- How does **neighborhood SES** shape the risk for infant mortality?

- **What other social determinants** of health influence infant mortality?

- How does spatial analysis support the **life course perspective**?

- What types of strategies might address these factors?
Some ‘New’ Answers

• Preconceptional care

• Community-based participatory approach
  – Ask and involve affected women, families, and neighborhoods

• Collaboration among agencies and community organizations to target high risk neighborhoods
Some ‘New’ Answers

• Target social networks and social capital

• Targeted and new health messages

• Address policy issues that affect the SDOH
  – Childhood poverty, childcare and preschool, insurance coverage, zoning, transportation, neighborhood redevelopment, education quality, economic opportunity, public housing rules, public safety
Acknowledgements

• David Trump- Peninsula Health District

• Joan Corder-Mabe- Division of Women’s and Infant’s Health, VDH

• Kristin Austin- Division of Women’s and Infant’s Health, VDH

• Kathleen Moline- Division of Women’s and Infant’s Health, VDH

• Ken Studer- Office of Minority Health and Public Health Policy, VDH