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USING GEOGRAPHIC INFORMATION TO TARGET HEALTH DISPARITIES: STATE EXPERIENCE

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Using Geographic Information to Target Health Disparities: State Experience

Analyzing race and ethnicity data has allowed researchers and state officials to identify high priority populations suffering from the poorest health outcomes. While collecting this type of data has always been important for states, there is more momentum, as it is now federal law under the Affordable Care Act (ACA) that population surveys and federally funded health and health care programs enhance their collection and reporting of data on race and ethnicity.[1] The ACA also requires the Secretary of the U.S. Health and Human Services Department to lead efforts in analyzing and monitoring trends in health disparities from the data collected.[2]

Effective techniques now exist for collecting and analyzing race and ethnicity data to support the targeting of health interventions to more specific geographic areas. For example, some states are strategically capturing data down to the neighborhood level and using geographic information systems (GIS) mapping to illustrate where the worst disparities in health outcomes are clustered.[*] Tools such as GIS mapping used in conjunction with multi-level spatial analysis, as an example, allow researchers to identify multiple factors contained within the data *and* to study the inter-relationships between those factors.[†] These tools can help to better illuminate geographic patterns and data correlations that agree with – or differ from – what's expected. For instance, GIS mapping can highlight communities with low poverty rates where infant mortality is unexpectedly high, or vice versa. This general approach ensures that interventions are effectively targeted and fine-tuned to particular problems.

This brief describes how two states have analyzed race and ethnicity data and targeted interventions to specific geographic locations. Virginia coupled GIS mapping with multi-level spatial analysis to identify areas where infant mortality rates are the highest; the extent of racial and ethnic disparities in infant deaths; the underlying causes of those infant deaths; and how to best intervene. Rhode Island used GIS mapping in conjunction with Community Based Participatory Research (CBPR) to address health disparities related to tobacco-related diseases and lead poisoning.[‡] The technique helped the state locate communities where the most severe disparities exist; identify how multiple factors are causing the problem; and allocate resources for selected interventions.

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[*] Geographic information systems (GIS) is a graphical display system that captures, manages, analyzes, and displays geographically referenced data and other data to better describe the geographic relationships and patterns of a phenomenon. See additional resources on GIS mapping from the Centers for Disease Control and Prevention at http://gis.cdc.gov/ and the National Cancer Institute at http://gis.cancer.gov/.

[†] Spatial analysis or spatial statistics includes formal techniques for studying entities based on their topological, geometric, or geographic properties.

[‡] Community-based participatory research (CBPR) is a collaborative approach to research to improve health and well-being, which combines methods of inquiry with community capacity-building strategies. It is designed to ensure participation by communities (such as minorities and other disadvantaged populations) affected by the issue being studied.

Virginia

Virginia is using Geographic Information Systems (GIS) and multi-level spatial analysis of health data to help locate, and then give priority to, areas where health outcomes are the poorest. [3] As shown in Figure 1, researchers in Virginia learned that the Hampton Roads area of Virginia, which encompasses 14 localities in southeastern Virginia, represents a disproportionate percentage of infant mortality rates in the state (30 percent of all infant deaths in Virginia in 2006).

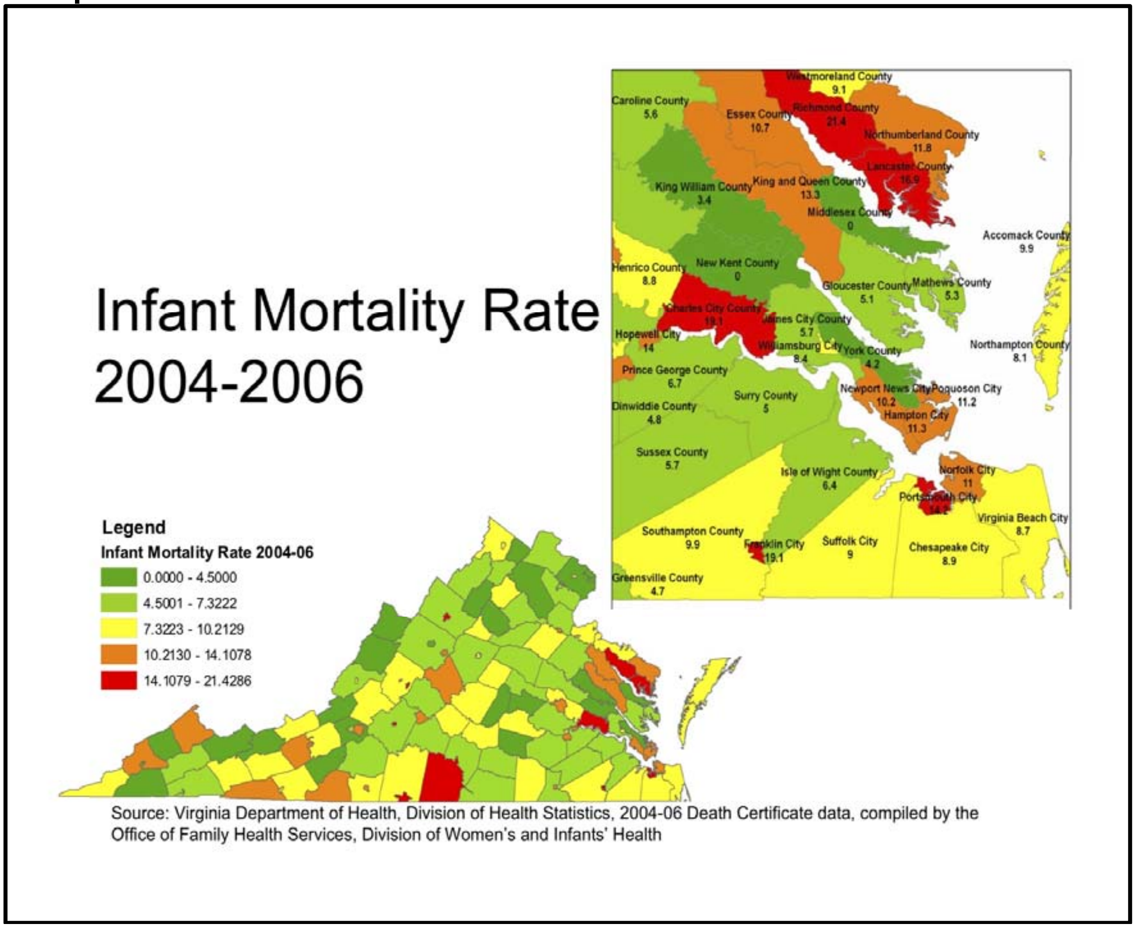
Figure 1. Infant Deaths in Hampton Roads VA by Locality, 2006

Locality	Number of Infant Deaths
Hampton Roads	229
Virginia Beach City	68
Norfolk City	45
Hampton City	25
Newport News City	23
Chesapeake City	22
Portsmouth City	21
Suffolk City	8
Accomack County	6
Gloucester County	4
Williamsburg City	3
York County	2
James City County	1
Poquoson City	1
Northampton County	0
Virginia (total state)	760

Source: Virginia Department of Health, "Spatial Analysis and High Priority Target Areas," Available: http://www.vdh.state.va.us/healthpolicy/policyanalysis/spatial-analysis.htm

Figure 2 shows infant mortality rates for all of Virginia, with the Hampton Roads area enlarged. Through GIS mapping, health data derived from multiple sources identified the underlying causes of infant deaths in Hampton Roads as short gestation, low birth weight, sudden unexplained infant death, and congenital malformations.[4]

Figure 2. Infant Mortality in Virginia by County and City Areas; Inset for Hampton Roads Area



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

A multi-level spatial analysis was conducted with data about a broader range of factors known to be associated with high infant mortality rates. These factors were grouped in various ways and GIS maps were used to visually illustrate data reflecting the following factors.

- Population by race at census tract poverty level
- Percentage of children by race living in poor neighborhoods
- Percentage of children below the federal poverty level (FPL) by race
- Percentage of children experiencing double jeopardy (more than 20.0% of residents below poverty and living in a family whose income is below FPL)
- Distribution of low birth weight infants & rates by race/ethnicity
- Poverty and low birth rates
- Ratio of population to primary care providers
- Primary care health professional shortage areas
- Medically underserved areas and housing stress

The overarching conclusion reached from the infant mortality study conducted in Hampton Roads was that inequities exist in birth outcomes mostly in communities where there is low education attainment, a significant African American population, and high poverty rates. High-risk communities have been flagged to consider for special intervention.

Researchers in Virginia have recommended additional analyses with more social, economic and medical variables before recommending resource allocations. Going forward, they are incorporating a health opportunity index into the multi-level spatial analysis.[§]

Results of this effort will be captured in the soon-to-be-released *2011 Virginia Health Equity Report*. The previously published *2008 Virginia Health Equity Report for Virginia* emphasizes the value of GIS mapping of census data at the neighborhood level.[5, 6] The approach used to study infant mortality is being replicated in other projects within Virginia that are aiming to eliminate disparities among high-risk populations.

Rhode Island

GIS mapping and CBPR also played a key role in disparities reduction efforts in Rhode Island. GIS mapping led researchers there to ask new questions about health disparities and to find cutting-edge solutions.

In one example, Rhode Island convened a workgroup to address how to best eliminate tobacco-related health disparities. This workgroup was motivated by findings that tobacco-related illnesses, such as heart disease, cancer and diabetes, are affecting certain groups – including ethnic and racial minority populations – at higher levels than others.[7] Some other at-risk populations identified include pregnant women, youth, Native Americans, the disabled, mentally ill and low-income persons. GIS mapping and CBPR were used to collect insights from residents living and working in at-risk communities.[8] Eight cities and towns were studied to identify the number of tobacco vendors, advertisements, price incentives, illegal sales, and tobacco proximity to youth. Findings were that children in lower income neighborhoods were exposed to a higher rate of tobacco vendors, often operating within school zones. And, it was clear that towns with a lower socio-economic status had higher levels of access to tobacco products. To help motivate change, GIS maps depicting clusters of these at-risk populations were disseminated to key policymakers. As a result, localities where priority populations live and work received additional access to comprehensive cessation services via local health networks. A searchable database including information from both GIS maps and CBPR is being used for tobacco risk reduction efforts.

In another example, Rhode Island applied similar techniques to the public health problem of lead poisoning. A study by Brown University, a frequent partner of the Rhode Island Department of Health, revealed that the risk of lead poisoning in children living in

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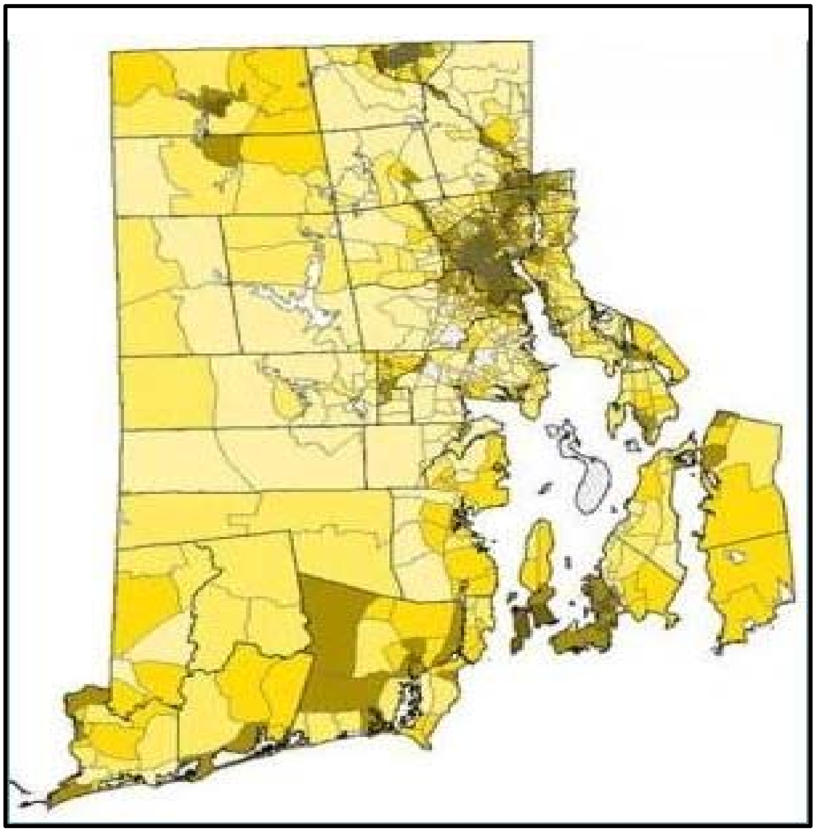
[§] Health opportunity index identifies critical medical and social determinants of health and tracks them over time in conjunction with global health outcome indicators. (From the Commissioner's Minority Health Advisory Committee Meeting Minutes, April 13, 2010, Richmond, VA).

Rhode Island's poorest neighborhoods was four times higher than the average.[9] In the hardest hit census blocks in Providence, Pawtucket, Central Falls, Woonsocket and Newport, lead poisoning afflicted as many as 49 percent of children under six years of age.[10]

Through the Rhode Island Childhood Lead Action Project,[11] several partner organizations created GIS maps that showed, at the census block level, the geographic areas with the highest rates of lead poisoning (see Figure 3).

Figure 3. Incidence of Lead Poisoning by Census Block, 1993–2005



Note: Darkest colors represent highest incidence of lead poisoning.
Source: Vivier et al., Brown University (2010, November 1). "Lead Poisoning Maps in Rhode Island Reveal Huge Disparities, Guide Cleanup," *ScienceDaily*. Available online: http://www.sciencedaily.com/releases/2010/11/101101151857.htm.

GIS mapping tools, CBPR, and data analysis showed that the most vulnerable population being exposed to home lead poisoning was Rhode Island's refugee population. Lead poisoning was correlated with lower income areas and communities with a preponderance of older pre-1950 housing stock. Once the most at-risk populations were identified, policymakers allocated the state's limited resources to the highest need areas.[12] Given the serious consequences of lead poisoning and the limited funding to address the problem, access to robust tools such as GIS mapping and CBPR resulted in more efficient use of scarce state resources.

Conclusion

States like Virginia and Rhode Island have learned that strategically using a variety of tools to collect and analyze data at the neighborhood and community level is an efficient way to develop targeted interventions aimed at eliminating disparities in health for racial and ethnic minorities as well as other at-risk populations. Evidence-based, state-of-the-art tools such as GIS mapping, multi-level spatial analysis and CBPR have helped these two states to develop and mine neighborhood level data, producing important insights for reducing health disparities.

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[1] National Conference of State Legislatures, "Disparities in Health," Last Updated April 2011. Accessed August 5, 2011. Available: http://www.ncsl.org/default.aspx?tabid=14494

[2] *Ibid.*

[3] Virginia Department of Health, "Spatial Analysis and High Priority Target Areas," Available: http://www.vdh.state.va.us/healthpolicy/policyanalysis/spatial-analysis.htm

[4] Michael Royster, "Inequities in Infant Mortality and Low Birth Weight in Hampton Roads: Rethinking Birth Outcomes Using GIS and Geospatial Analysis," Virginia Department of Health, Office of Minority Health and Public Health Policy. Available: http://www.vdh.state.va.us/healthpolicy/policyanalysis/documents/hamptonroads-IM-SDOH-8-2008.pdf

[5] Virginia Department of Health, Division of Health Statistics, Office of Minority Health and Public Health Policy. *Unequal Health Across the Commonwealth: A Snapshot. 2008 Virginia Health Equity Report*. Richmond, VA: Virginia Department of Health, 2008. Available online: http://www.vdh.state.va.us/healthpolicy/documents/health-equity-report-08.pdf.

[6] Hanlon C, Rosenthal J, and Hinkle L. *State Documentation of Racial and Ethnic Health Disparities to Inform Strategic Action.* Online March 11, 2011. U.S. Agency for Healthcare Research and Quality, p. 42. Available: http://www.hcup-us.ahrq.gov/reports.jsp.

[7] Rhode Island Department of Health, *Tobacco Use and Health Risks Among Rhode Island Adults in 2008*. Providence, RI: RI Center for Health Data and Analysis, 2008. Available: http://www.health.ri.gov/data/tobacco/

[8] Rhode Island Department of Health, "Preventive Health and Health Services Block Grant." Available: http://www.health.ri.gov/grants/preventivehealthandhealthservices/

[9] Donoghue, K. "R.I. Lead Poisoning Map Shows Huge Disparities in Rate of Affliction," *Providence Business News*. Providence, RI: Published Online November 1, 2010. Available: http://www.pbn.com/RI-lead-poisoning-map-shows-huge-disparities-in- affliction,53511.

[10] Donoghue, "R.I. Lead Poisoning Map Shows Huge Disparities in Rate of Affliction," *Providence Business News*. Available: http://www.pbn.com/RI-lead-poisoning-map-shows-huge-disparities-in-affliction,53511.

[11] For more information, visit the Childhood Lead Action Project. Online: http://www.leadsafekids.org/

[12] *Ibid.*