



Geographic Access To Care In Rhode Island Through the Use of GIS

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The Institute of Medicine (IOM) and the United States Department of Health and Human Services have pronounced improving access to care a public health priority.¹ The lack of a standard algorithm for measuring access to care, however, has impeded progress. In fact, there is still debate as to whether we are over- or under-producing doctors.^{2,3}

In 1981 Penchansky and Thomas identified five dimensions of access: 1) availability, 2) accessibility, 3) affordability, 4) accommodation and 5) acceptability.⁵ Two key components are geographic access and adequacy of the physician supply, traditionally measured through provider to population ratios.⁴ Studies throughout the 1990s found that even when controlling for sociodemographic and socioeconomic factors, the provider-to-population ratios was a significant predictor of lower mortality from heart disease, cancer, and stroke. The ratios further predicted infant mortality, low birth weight, and poor self-reported health.⁵

Several states have used Geographic Information Systems (GIS) software to analyze access to health care and to inform policy decisions.⁶ To date, GIS has not been used to assess access in Rhode Island.

In 2008, the Rhode Island AHEC (Rhode Island Area Health Education Center), at the Warren Alpert Medical School of Brown University, initiated the 2008 Primary Care Mapping Project. The project assessed provider to population ratios, enhanced by data on proximity to Rhode Island Public Transit Authority (RIPTA) bus lines.

METHODS

The University of Rhode Island's Rhode Island Geographic System (<http://www.edc.uri.edu/RIGIS/>) provided data on the state; the Rhode Island Board of Medical Licensure and Discipline, a division of the Rhode Island Department of Health, provided data on health care providers, which included all licensed doc-

tors and nurses in RI as well as their primary practice location and specialty. Physicians with primary practice locations outside RI were eliminated from the analysis. All primary practice locations in RI were mapped. Multiple addresses for physicians and practices were not included. While the use of only the primary practice address is a limitation of the project, the majority of secondary practice locations included hospitals and clinics; and we mapped hospitals and clinics in addition to the practices.

The data were broken down by towns and RI AHEC regions: Northern, Central and Southern. Some maps included municipalities. Other maps analyzed population density. Bus routes were incorporated into the data.

Nine maps depict the health care provider landscape in RI. (http://med.brown.edu/ahec/mapping_project.php)

RESULTS

A total of 3,195 licensed physicians serve the 1,048,319 residents of the thirty-nine cities and towns in RI;⁷ 1549 (48.5%) physicians are primary care providers, defined by the American Medical Association as internal medicine, family medicine, obstetrics and gynecology and pediatrics.⁸ Of the primary care physicians, 256 are family practitioners (16.5%), 781 (50.5%) are internal medicine physicians, 338 (21.8%) are pediatricians, 174 (11.2%) are obstetricians/gynecologists (OB/GYNs). The remaining 1610 physicians are specialists. (Table 1)

Physician Distribution by Region

Each of the three AHEC regions (Northern, Southern, Central) has a community office. The majority of physicians practice in the Central AHEC region. Clustering of providers around hospitals and medical facilities is prevalent in all regions, although most noticeable in the

Central AHEC region due to the many hospitals and the physicians associated with the Warren Alpert Medical School (some do not provide direct patient care). Visual depiction of the providers in each town indicates shortages on the western border and certain areas around the northern and southern borders of the state. Although these areas are less populated than the Central AHEC region, there still exist too few providers to meet the needs

Table 1. Rhode Island Providers by Specialty

Specialty	Number of Licensed Physicians
Allergy and Immunology	8
Anesthesiology	124
Cardiology	67
Dermatology	55
Emergency Medicine	143
Endocrinology	7
Family Practice	256
Gastroenterology	41
Hematology	13
Infectious Disease	13
Internal Medicine	781
Medical Genetics	3
Nephrology	16
Neurology/Neurosurgery	87
No Reported Specialty	70
Nuclear Medicine	2
Obstetrics and Gynecology	174
Oncology	33
Ophthalmology	72
Orthopedic Surgery	118
Osteopathic Manipulative Therapy	2
Otolaryngology	32
Pathology	84
Pediatrics	338
Physical Medicine and Rehabilitation	18
Plastic Surgery	19
Preventive Medicine	8
Psychiatry	257
Pulmonology	21
Radiology	127
Rheumatology	19
Surgery	143
Urology	44
Total	3195

of the individuals in each region. As a result we can assume that the catchment area in the greater Providence area extends across the whole state to account for the noticeable shortages along the state borders. (Figure 1)

Primary Care Physician to Population Ratios

The collective primary care provider to population ratio is 1:676. Statewide the ratio of primary care providers to patients is more than five times greater than the 1:3,500 cutoff, indicative of a **health professional shortage area (HPSA)**, as defined by the US Department of Health and Human Services Health Resources and Services Administration.⁹ In the towns the primary care provider to population ratios range from 1:287 to 1:9,948. On average towns in Providence County have a higher provider to population ratio compared to towns in the northern and southern areas of the state; however, Providence County encompasses Glocester, which has the lowest patient to provider ratio. As expected, Providence has the highest number of licensed primary care physicians. The primary care provider to patient ratio there is highest: about one primary care doctor for every 276 patients.

Eight of the 39 (20.5%) towns in Rhode Island have provider to population ratios which qualify them at HPSAs. Four of these towns, Exeter, Foster, Richmond,

and West Greenwich, had no providers at the time of data collection. This distribution of physicians may impede access to care outside of the greater Providence area. (Table 2 and Figure 2)

Proximity to Bus Lines

In addition to proximity to the patient's home, geographical access to primary health care also depends upon ease of access or availability of transportation. RIPTA serves thirty-eight of the thirty-nine towns, with fifty-eight bus routes. Most routes are concentrated in the central AHEC region, around the Providence area. Public transportation is especially important for individuals who do not have cars. Accordingly, all but one medical facility (clinic or hospital) in RI is located on a bus line.

Access to primary care providers by public transportation is strong throughout the state. Within the Central region almost all primary care provider locations are directly on a bus line. Due to the frequency of stops it is hard to tell the proximity of the practice location to an actual RIPTA bus stop, but we assume that an individual without a car would be able to access any of the locations in this area. In the Northern and Southern AHEC regions, only three or four lines run into these regions. However, given the few bus lines in these areas, many providers have clustered around bus routes and more than half of the primary

care physicians in the Northern and Southern region are located directly on a bus route. Despite proximity of primary care providers to bus lines in the Northern and Southern regions, access to providers using public transportation may be difficult. The scarcity of bus lines in the regions indicate that individuals likely rely on personal or shared vehicles for travel. (Figure 3)

Specialists in Rhode Island are not as closely distributed along bus lines as

Table 2. Primary Care Provider to Population Ratio by RI Town and County

TOWN	RATIO
State of RI	1:676
Bristol County	1:1205
Barrington	1:840
Bristol	1:1321
Warren	1:2272
Kent County	1:938
Coventry	1:4809*
East Greenwich	1:287
Warwick	1:773
West Warwick	1:3286
West Greenwich	0**
Newport County	1:1294
Jamestown	1:2811
Little Compton	1:3593*
Middletown	1:1575
Newport	1:696
Portsmouth	1:1905
Tiverton	1:3052
Providence County	1:556
Burrillville	1:1579
Central Falls	1:2103
Cranston	1:808
Cumberland	1:1137
East Providence	1:676
Foster	0**
Glocester	1:9948*
Johnston	1:1174
Lincoln	1:5801*
North Providence	1:1117
North Smithfield	1:816
Pawtucket	1:623
Providence	1:276
Scituate	1:3441
Smithfield	1:1212
Woonsocket	1:1394
Washington County	1:846
Charlestown	1:1964
Exeter	0**
Hopkinton	1:979
Narragansett	1:1817
New Shoreham	1:505
North Kingstown	1:1316
Richmond	0**
South Kingstown	1:498
Westerly	1:488

*Meets criteria for HPSA

** Provider to population ratio could not be calculated

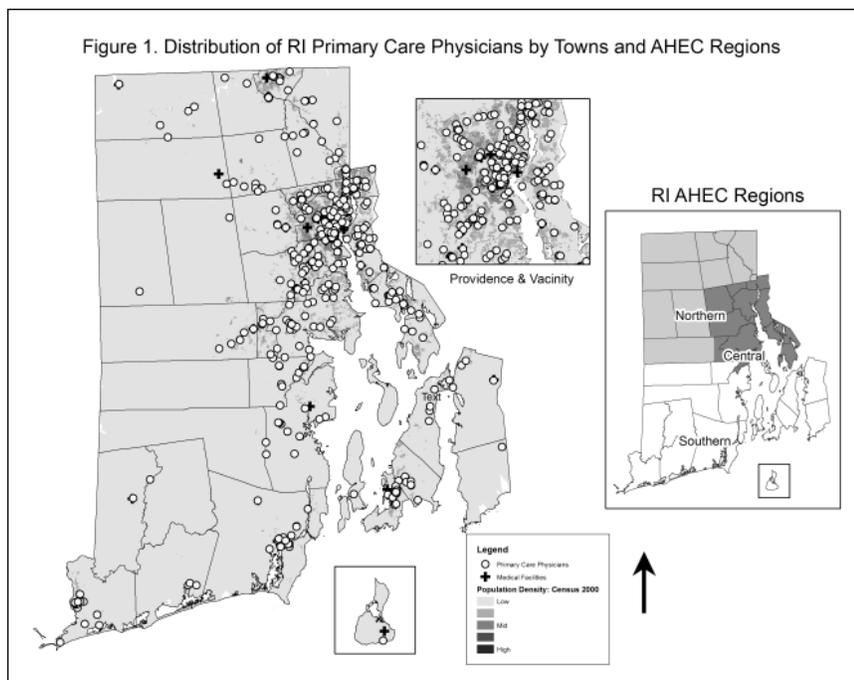


Figure 2: Primary Care Provider to Population Ratios across RI Towns

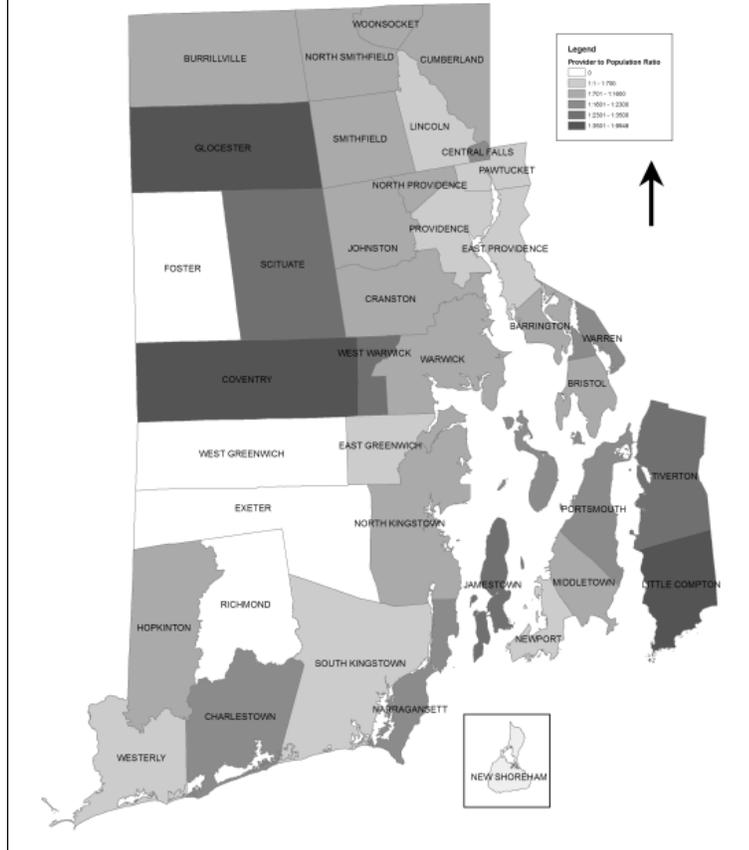
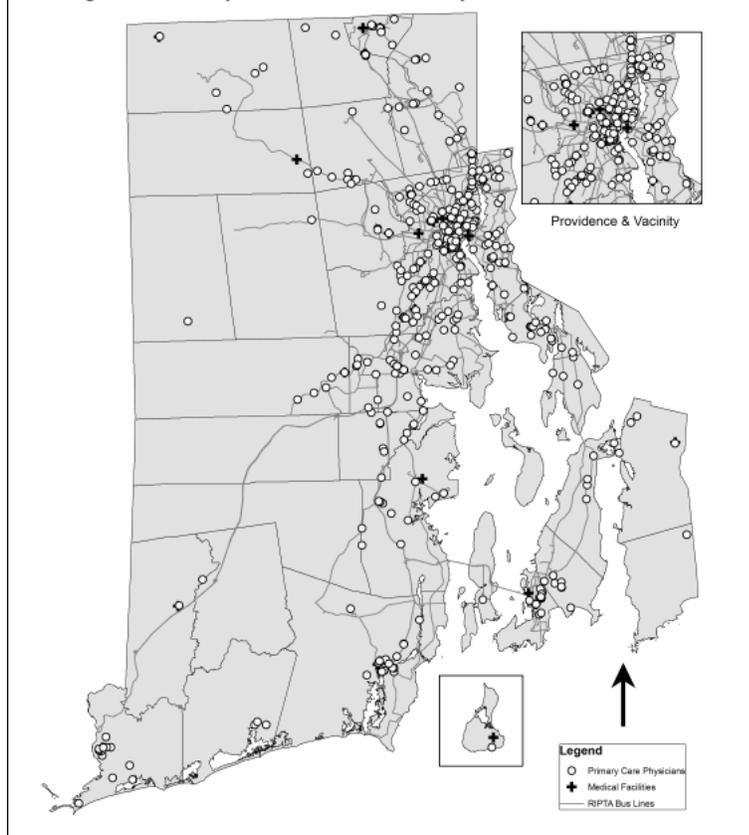


Figure 3: Primary Care Access: Proximity to RIPTA Bus Lines



primary care providers. The abundance of bus lines in the Central region allows for easy access to both primary and non-primary care physicians via public transportation. The scarcity of lines in the Northern and Southern regions has a greater impact on accessibility of non-primary care doctors. Further dispersal of non-primary care physicians leads to decreased proximity to bus lines and less ease of access. Despite challenges of accessibility via bus in the Northern and Southern regions, the majority of doctors across the state are located directly on a bus line and access assessed by proximity to a RIPTA bus line is sufficient on average.

DISCUSSION

Access to health care in Rhode Island, measured by accessibility and availability, is generally strong across the state. However, the distribution of provider locations and scarcity of bus lines in the Northern and Southern regions point to challenges regarding primary care access, and the inconsistencies of provider to population ratio by town highlight disparities in access. Currently the provider to population ratio for the state far exceeds the health professional shortage area criteria. However, we do not account for part-time practitioners with limited exposure to patient care or for the setting in which primary care providers work, such as hospitals with limited patient access. Twenty percent of towns meet the criteria for HPSA.

As mentioned in other primary care access papers, there are a sufficient number of providers but they are unevenly distributed based on the population. Because the population is most dense in Providence, an abundance of physicians in this area is necessary. However, there may be an over abundance in this area and a shortage in the peripheral regions. Consequently we can expect frequent travel into Providence to seek health care, impeding ease of access for the poor and the elderly. Future planning should attempt to incentivize doctors to practice in the underserved locations. RI AHEC's use of GIS is effective for visualizing large datasets and depicting access gaps for residents, health care professionals and leaders. Admittedly, the small size of RI may mitigate against serious maldistribution of care, but special attention should be given to the most vulnerable populations to achieve an equitable health care system.

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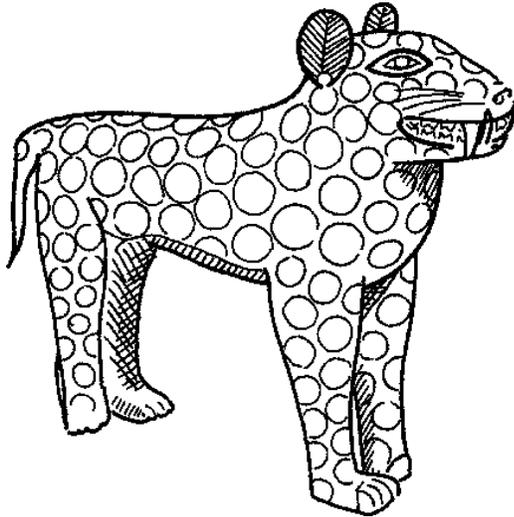
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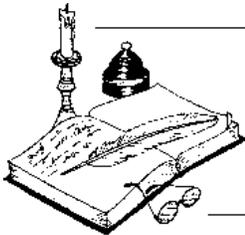
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Physician's Lexicon

The Impermanency of Definitions

"When I use a word," Humpty Dumpty said, in a variously petulant and scornful tone, "it means what I choose it to mean—neither more nor less." The meanings of English words, from year to year, are not quite that capricious or mercurial; but the intended meanings of some common words can sometimes vary dramatically from one context to another. And knowledge of the etymology of such metastable words only adds to the confusion.

Consider the simple English word *privy* (from the Latin, *privus*, meaning singular or special). The cognate word, *private*, means roughly the same, something belonging to a single person. But closely related words—*privative*, *privation* or *deprive*—convey an opposing meaning denoting the *lack* of something, a sense of poverty. Contrariwise, a *privilege* (from the Latin, *privilegium*, meaning a regulation or law pertaining to an individual rather than a class or family of persons) defines something gained, some-

thing positive and generally sought after. The word, *privy*, can also define opposite things. In general, it denotes something private ("They are privy to certain state secrets") And a *Privy Counsel* (generally an advisory group for a sovereign) or a *Privy Seal* suggests gatherings or things associated with royalty. In contrast, a *privy*—uncapitalized—typically refers to a commode or a chamber pot. And even here its synonym, *commode*, may convey ambiguous meanings. A *commode* is usually a polite way of describing a privy or toilet but it can also define an ornamental cabinet; and when turned into an adjective, *commodious*, it describes something that is ample or spacious and clearly unconnected to bathrooms. And a *commodity*, from the same root (*commodus* in Latin, meaning suitable or convenient) is a noun meaning a product of some merit or value.

Yet another word that must be employed with care is the noun, *prodigy*, currently denoting one or more off-

spring, good, bad or indifferent (but generally suggesting a gifted offspring.) It is from the Latin, *prodigium* meaning a sign, a portent or an omen. But turn it into an adjective, *prodigal*, and we have an extravagant, profligate or wasteful son or daughter (cf. Luke 15: 11-32). Then we may encounter yet another adjective, *prodigious*, meaning extraordinary, marvelous or just wonderful.

The meanings and intents of words shift from decade to decade, sometimes even from season to season. To convey a sense that accurately reflects our intended meaning requires a sensitivity to contemporary language definitions and a judgment-free appreciation of the nuances, the subtle variations in expression, employed by the public. Comparative etymologists have suggested, with ample evidence, that words are much like flora and fauna in that they evolve accordingly to selective - Darwinian—pressures and through the process of natural selection.

— STANLEY M. ARONSON, MD