

Our previous geospatial briefs have shown the potential of geospatial hot-spotting methods to identify priority areas of need (e.g., Topmiller, 2016). Geospatial methods can also be integrated with Bayesian approaches to account for spatial variation and variance instability in regards to population. This brief illustrates the use of a spatial empirical Bayes approach to identify high-need areas based on low-income populations not served by the federally-funded Health Center Program (HCP).

The HCP is part of the health care safety net and includes approximately 1,400 grantees operating more than 9,800 clinic sites to meet the needs of the medically underserved population in the US (HRSA, 2016). The HCP experienced substantial growth under both the George W. Bush and Obama administrations, with recent literature demonstrating the positive impacts of this expansion (Iglehart 2008; Han et al., 2017; Cole et al., 2017). In an uncertain health care climate, where health centers (HCs) are seen as important cornerstones of the health care safety net, it is important to understand where HCs are currently serving patients and where there may be continued or growing need.

Using 2015 data from the Uniform Data System (UDS) Mapper (UDS, 2015), we utilized a variety of geospatial approaches to identify ZIP Code Tabulation Areas (ZCTAs)ⁱ most in need based on low-income penetration rates and the number of low-income population not being servedⁱⁱ. Because health centers serve patients living outside of the ZCTA in which they are located, it is necessary to create weighted or smoothed estimates of penetration rates which incorporate need in contiguous ZCTAs. Smoothed low-income penetration rates were estimated using a spatial empirical Bayes approachⁱⁱⁱ, which adjusts or smooths the rates for each ZCTA based on its low-income population and the local mean, which is the average of contiguous ZCTAs' rates; ZCTAs with smaller low-income populations will have their rates adjusted more towards the local mean (Cromley & McLafferty, 2012). We also created spatially-weighted estimates for the total number of low-income population by calculating the average of each ZCTA and its contiguous neighbors.

High-need ZCTAs were identified by (1) removing all ZCTAs that had zero low-income population; (2) creating smoothed low-income penetration rates^{iv}, low-income rates, and poverty rates using a spatial empirical Bayes approach; (3) creating spatially-weighted estimates for the number of low income population not being served by health centers (weighted average of ZCTA and its neighbors); (4) identifying all ZCTAs with smoothed low-income penetration rates of less than 1 percent; (5) finally, focusing only on those ZCTAs with smoothed low-income penetration rates of less than 1 percent, we identified the top 500 ZCTAs^v ranked by the highest number of spatially-weighted low-income population not being served by health centers.

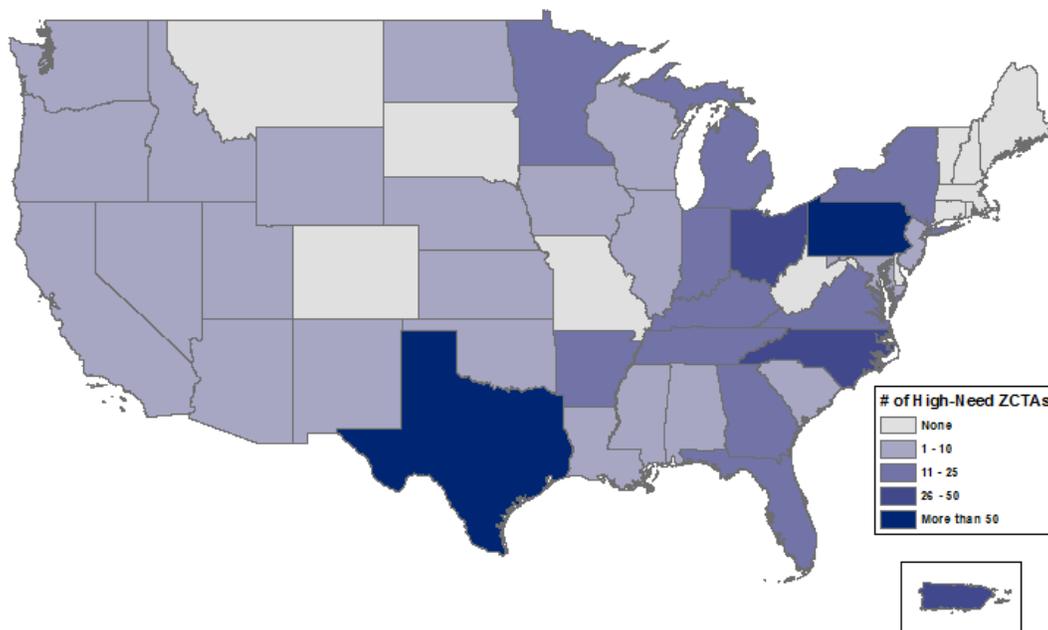
Smoothed & Weighted Characteristics of High-Need ZCTAs

	All ZCTAs [^] (N=32,166)	All High-Need (N=500)	High-Need Urban (N=381)	High-Need Large Rural (N=76)	High-Need Small or Isolated Rural (N=15)	High-Need Puerto Rico (N=28)
Unservd Low-Income Population (% of High-Need)	84,303,659	3,378,283	2,355,967 (69.7%)	385,493 (11.4%)	64,975 (1.9%)	571,848 (16.9%)
Poverty Rates (Below 100% FPL)	14.9%	16.5%	14.2%	18.8%	20.0%	38.5%
Low-Income Rates (Below 200% FPL)	34.5%	35.8%	32.0%	41.8%	47.4%	65.1%

Sources: UDS, 2015; American Community Survey, 2010-2014

[^]Not weighted

The weighted unserved low-income population for the top 500 ZCTAs ranges from 3,497 to 39,455, with a total of almost 3.4 million people living in these ZCTAs. More than one-quarter of these 3.4 million people live in the top 50 ZCTAs in need, where almost half (24) of the ZCTAs are located in Puerto Rico, and more than one-fourth (13) are located in Texas. More than one-half of the high-need population is located in just four states or territories, with Texas (21.5%), Puerto Rico (16.9%), Pennsylvania (8.6%), and North Carolina (7.6%) having the largest populations in high-need areas. Fifteen states have no high-need ZCTAs based on our criteria. Less than 20% of the high-need ZCTAs and about 13% of the high-need population are located in rural areas, where low-income rates exceed 40%, compared to 32% for urban high-need ZCTAs, and 34.5% for all ZCTAs. Poverty and low-income rates are highest in small and isolated rural ZCTAs, as well as in Puerto Rico. About 60% of high-need ZCTAs are located in Medically Underserved Areas/Population (MUA/Ps) and more than half (276) are being served by at least one health center, with almost 25% (119) already being served by at least two health centers. The map below displays the number of high-need ZCTAs by State.



This brief highlights innovative geospatial approaches for identifying priority areas in the context of the federally-funded Health Center Program. These methods could be used as a starting point for identifying priority areas for future health center funding, as they incorporate need across contiguous ZCTAs and account for variations in population. This research is subject to several limitations. First, we defined our high-need criteria based on low-income penetration rates; there are many other ways we could have defined high-need ZCTAs, such as excluding ZCTAs with relatively low rates of low-income population or focusing only on ZCTAs that are located in MUA/Ps. In addition, the UDS data do not include patients being served by non-HC providers, such as free clinics or private physicians. Thus, it is possible that some of the high-need areas that we identified are being served by other providers. Ideas for future research include using other criteria and exploring differences among high-need areas and comparing the location of high-need areas with the actual locations of new health centers.

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References

- Cole, Megan B., Omar Galarraga, Ira B. Wilson, Brad Wright, & Amal N. Trivedi. 2017. At Federally Funded Health Centers, Medicaid Expansion Was Associated with Improved Quality of Care. *Health Affairs* 36(1): 40-48.
- Cromley, Ellen K., & Sara L. McLafferty. 2012. *GIS and Public Health*. New York, NY. Guilford Press.
- Han, Xinxin, Qian Luo, & Leighton Ku. 2017. Medicaid Expansion and Grant Funding Increases Helped Improve Community Health Center Capacity. *Health Affairs* 36(1): 49-56.
- Health Resources and Services Administration (HRSA), 2016. The Health Center Program. (<https://www.bphc.hrsa.gov/about/healthcenterprogram/index.html>)
- Iglehart, John K. 2008. Spreading the Safety Net — Obstacles to the Expansion of Community Health Centers. *New England Journal of Medicine* 358:1321-1323.
- Lu, Yao, David Slusky. 2016. Impact of Women’s Health Clinic Closures on Preventive Care. *Applied Economics* 8(3): 100-124.
- Topmiller, Michael, 2016. “Where are “Hot Spots” of Medicare Spending and Preventable Hospitalizations and “Cold Spots” for Preventive Care?” HealthLandscape Geospatial Research Brief #2. Accessed at <http://www.healthlandscape.org/Geospatial-Analysis.cfm>
- Uniform Data System (UDS), 2015. Available at <http://www.udsmapper.org>.

ⁱ Health Centers report data by ZIP Code, but the data are converted to ZCTAs in order to compare health center patient data to area demographic data. ZCTAs are created for the decennial census approximating the area covered by a ZIP Code.

ⁱⁱ Low-income includes those people who live below 200% of the Federal Poverty Level. This population is used by the Health Center Program as an approximation of the medically underserved population.

ⁱⁱⁱ Spatially smoothed rates were calculated using GeoDa (Anselin, et al., 2006).

^{iv} Health centers do not report patients by ZIP Code by income level, therefore low-income penetration rates are calculated by dividing the number of health center patients from a ZCTA divided by the total low-income population living in a ZCTA. Nationally in 2015, 93% of all health center patients were low income. For more information, see <http://www.udsmapper.org/about.cfm>.

^v The HC Program has added between 400 and 700 new health centers annually over the past seven years.