

# RUPRI Center for Rural Health Policy Analysis

## *Rural Policy Brief*

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## **A Rural Taxonomy of Population and Health-Resource Characteristics**

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### **Purpose**

This policy brief reports the newly developed taxonomy of rural places based on relevant population and health-resource characteristics; and discusses how this classification tool can be utilized by policy makers and rural communities.

### **Key Findings**

- We classified 10 distinct types of rural places based on characteristics related to both demand (population) and supply (health resources) sides of the health services market.
- In descending order, the most significant dimensions in our classification were facility resources, provider resources, economic resources, and age distribution.
- Each type of rural place was distinct from other types of places based on one or two defining dimensions.

### **Introduction**

Characteristics of communities and the health care delivery systems that serve them jointly determine how health services are delivered, accessed, financed, and sustained as well as the health outcomes of the population.<sup>1, 2</sup> Public policies and community strategies that aim to improve population health and health equity could be enhanced by an understanding of these community characteristics and by implementing targeted, place-based interventions that address contextual factors affecting access, quality, and cost of care.

This policy brief reports an empirical taxonomy of rural places developed based on their relevant population and health-resource characteristics, including socio-demographics, economic indicators, health insurance coverage, and healthcare resources. Incorporating information related to both demand and supply sides of the health services market, this taxonomy provides a systematic tool for classifying and identifying similar rural communities and places.

### **Methodology**

We used the most current data from multiple sources. Demographic and health insurance coverage data were obtained from the American Community Survey five-year estimate data (2008-2012), an estimate of population demographics based on a statistical sample of the U.S. population. Health care provider data were obtained from the September 2012 version of the National Provider Identifier file. Hospital data were obtained from the 2011 American Hospital



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Association Annual Survey Data. Data on Medicare/Medicaid-certified nursing home beds were obtained from the Centers for Medicare & Medicaid Services “Nursing Home Compare” data for January 2013, which provides detailed information about every such facility in the country. Table 1 summarizes the variables used in classifying rural places.

Data were assembled using the Primary Care Service Area (PCSA) as the unit of analysis. Developed as part of the Dartmouth Atlas of Health Care project, PCSAs are small standardized geographic areas created by aggregating ZIP Code Tabulation Areas (ZCTAs) to reflect Medicare patient travel to primary care providers. Since PCSAs reflect health care utilization patterns, for this project they are preferred to other geographic units of analysis (e.g., counties) that place arbitrary spatial limits on health services markets.<sup>3</sup> The compiled data set covered 6,541 PCSAs in the United States.

**Table 1. Variables Used in Developing the Taxonomy**

<b>Characteristic</b>	<b>Variables</b>
Hospital Facility <sup>4</sup>	1. Staffed hospital beds; 2. average daily census
Certified Nursing Home <sup>4</sup>	3. Medicare/Medicaid-certified nursing home beds
Providers <sup>4</sup>	4. Primary care physicians; 5. medical specialists; 6. non-physician practitioners; 7. dentists
Race/Ethnicity	8. Percentage of population that is non-white
Income/Poverty	9. Percentage of population for whom poverty status is determined that has household income less than 150% of the federal poverty level
Unemployment	10. Percentage of population 16 years old and over and in the workforce that is unemployed
Health Insurance	11. Percentage of civilian, non-institutionalized population that is uninsured; 12. percentage of civilian, non-institutionalized population that is publicly insured
Age	13. Percentage of population aged 65 years and older; 14. percentage of population younger than 18 years

We excluded PCSAs with less than 25 percent of their population living in rural ZCTAs, defined based on Rural Urban Commuting Area Codes 4-10.<sup>5</sup> We then excluded five PCSAs<sup>6</sup> that were outliers in the distribution of one or more variables to avoid unwarranted influence of extreme values. Thus, urban PCSAs, outlier PCSAs, and areas without PCSA designation such as national forests and some federal lands were not classified in our analysis. The final sample included 4,019 PCSAs.

We conducted cluster analysis to classify the 4,019 PCSAs into distinct types of places. Cluster analysis can empirically identify groups of similar observations, called clusters, based on the distributions of selected variables. This analytic method is designed to empirically identify groups with the maximum similarity within members of the same groups and the minimum similarity between members of different groups. It is commonly used in market research and other disciplines to develop empirical taxonomies. A technical report that discusses the methodology in detail can be found on the RUPRI website: <http://ruprihealth.org/place/taxonomy.html>.

## Results

The variables were grouped into four key dimensions (as shown in the text box). Each dimension combined a set of highly correlated variables into a compound score, which was used in further analyses. Based on the analytical results, we identified 10 distinct types, or clusters, of rural PCSAs. Different types of PCSAs are distinct from one another based on their scores on the four key dimensions (see Table 2). Our analysis showed that the most significant differentiating dimension was facility resources, followed by provider resources, economic resources, and age distribution.

We found that each PCSA type could be clearly separated from other types based on one or two defining dimensions. Types 1-3 had noticeably higher facility resources than other types, and were distinct among themselves by the degree of abundance in their facility resources. Types 4 and 5 were distinct from others because they had varying levels of higher provider resources. Types 6-10 were differentiated from types 1-5 and among themselves based on combinations of economic resources and age distribution.

Table 2 presents the taxonomy of rural places with the number of PCSAs classified in each type and the dimensions that define them. We described a PCSA type as *high* or *low* for a dimension if this type of PCSAs had scores noticeably higher or lower than the average of the entire population of rural PCSAs. We added adjectives to the high dimensions in order to differentiate two or three types of PCSAs with varying levels of higher scores. We described a PCSA type as *average* for a dimension if this type of PCSAs had scores that were indistinguishable from the population average. We highlighted the defining dimension(s) of each PCSA type. For example, six PCSAs classified as type 1 had extremely high facility resources. In type 7, 574 PCSAs were classified as having high economic resources and low age distribution (i.e., low percentage of population aged 65 years and older, and high percentage of population younger than 18 years). Given this classification tool, policy makers, community leaders, and other users of the taxonomy can identify similar rural communities by searching PCSAs belonging to the same type. Users can also compare different types of PCSAs in which case the taxonomy provides a basic tool for outlining how these PCSAs are different from one another.

**Key Dimensions Used in Cluster Analysis**

**Facility Resources:** staffed hospital beds, average daily census, and Medicare/Medicaid-certified nursing home beds

**Provider Resources:** primary care physicians, medical specialists, non-physician practitioners, and dentists

**Economic Resources:** Percentages of population that are non-white, with household income less than 150 percent of the federal poverty level, unemployed, uninsured, and publicly insured<sup>7</sup>

**Age Distribution:** Percentages of population aged 65 years and older, and younger than 18 years<sup>8</sup>

**Table 2. A Rural Taxonomy of Population and Health-Resource Characteristics**

Type of PCSA	N	Facility Resources	Provider Resources	Economic Resources	Age Distribution
1	6	<b>Extremely High</b>	Average	Average	Average
2	59	<b>Very High</b>	Average	Average	Average
3	318	<b>High</b>	Average	Average	Average
4	179	Average	<b>Very High</b>	Average	Average
5	686	Average	<b>High</b>	Average	Average
6	743	Average	<b>Low</b>	<b>High</b>	Average
7	574	Average	Average	<b>High</b>	<b>Low</b>
8	364	Average	Average	Average	<b>High</b>
9	771	Average	Average	<b>Low</b>	Average
10	319	Average	Average	<b>Low</b>	<b>Low</b>

Figures 1-4 present sample state maps of Iowa, Montana, North Carolina, and Pennsylvania in which PCSAs are color-coded with their designated classification. The sample states were selected from the four census regions.

More detailed information, including state-level maps and tables that contain the classification and relevant data for all rural Primary Care Service Areas, can be found on the RUPRI website: <http://ruprihealth.org/place/taxonomy.html>.

**Population and Health-Resource Classification**  
Iowa Rural Primary Care Service Areas (PCSAs)

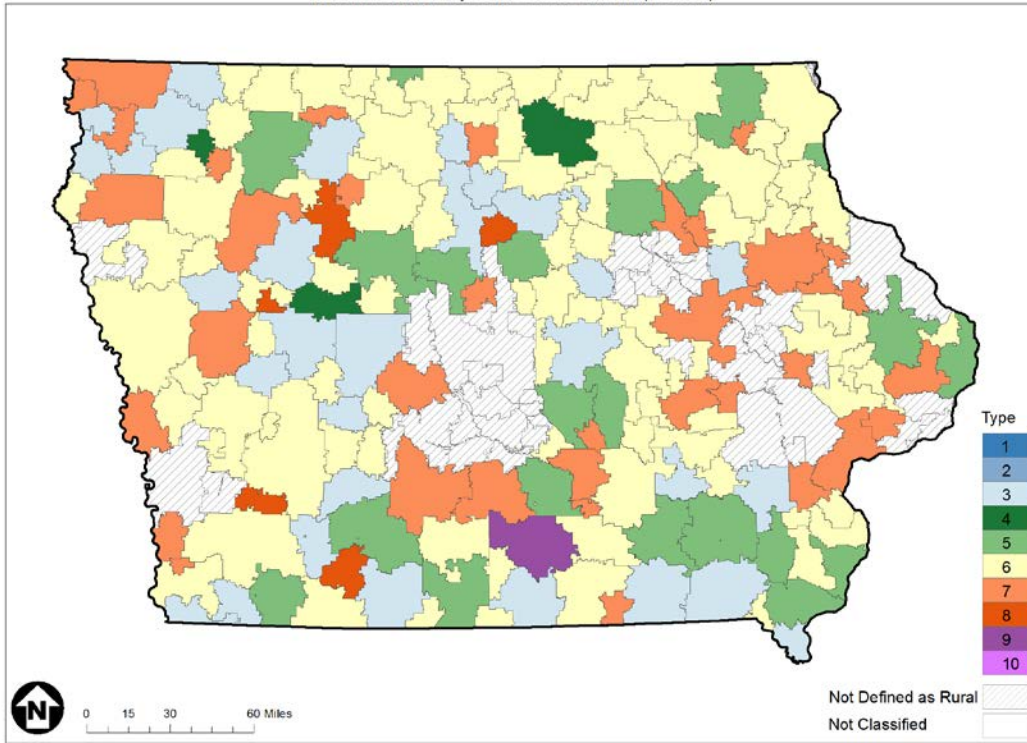


Figure 1. Iowa PCSAs with Designated Classification

**Population and Health-Resource Classification**  
Montana Rural Primary Care Service Areas (PCSAs)

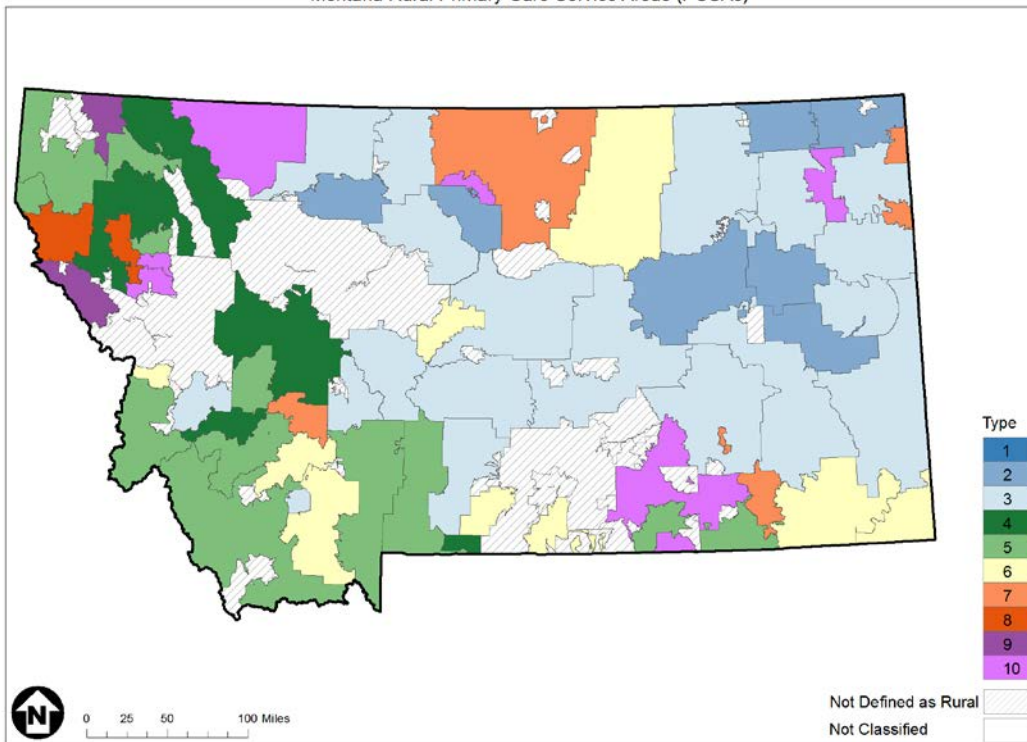
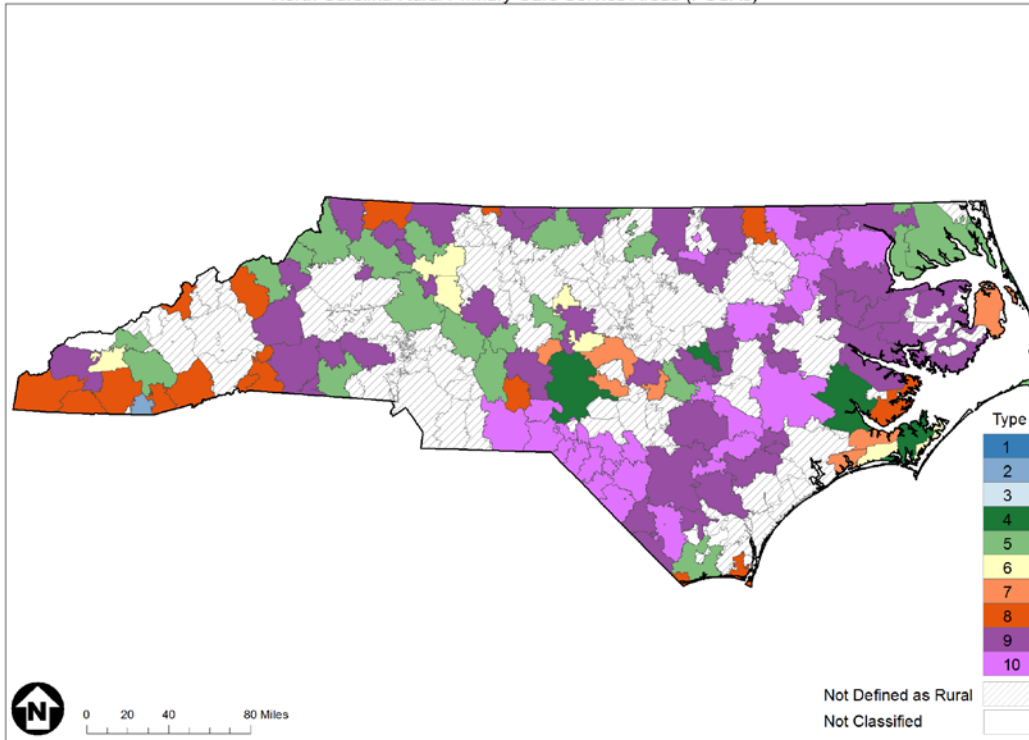


Figure 2. Montana PCSAs with Designated Classification

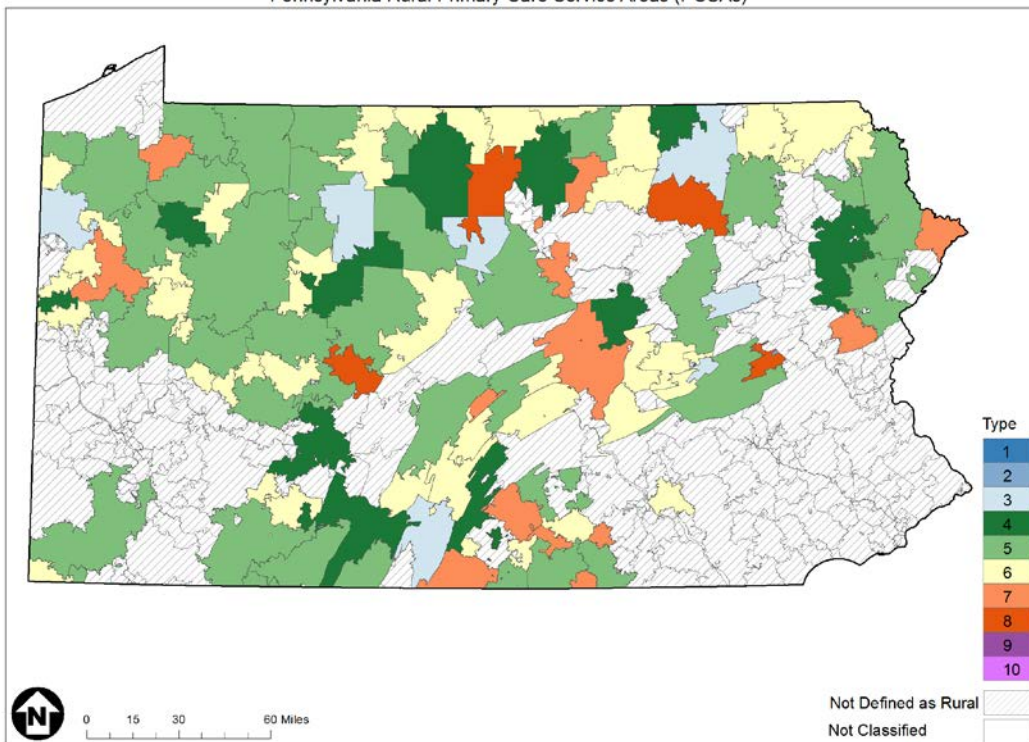


**Population and Health-Resource Classification**  
North Carolina Rural Primary Care Service Areas (PCSAs)



**Figure 3. North Carolina PCSAs with Designated Classification**

**Population and Health-Resource Classification**  
Pennsylvania Rural Primary Care Service Areas (PCSAs)



**Figure 4. Pennsylvania PCSAs with Designated Classification**

## Discussion

In this brief, we report the key findings from the analysis that resulted in a taxonomy of rural PCSAs based on population and health-resource characteristics of rural communities. The taxonomy has several desirable features: (1) using PCSA geographies provides a “cleaner” definition of community characteristics and health resources as it allows the self-identification of “community” based on the healthcare-seeking behavior of the population in an area – such behavior rarely respects political boundaries (e.g. counties); (2) a reasonably small number of types accounted for a large amount of variation in community characteristics; (3) all but one type had a substantial number of PCSAs, indicating that the taxonomy was not heavily influenced by a few outliers or outlier groups; (4) all types of PCSAs were clearly separated from one another; and (5) while taking into account many characteristics (14 original variables and 4 key dimensions), the 10 types of PCSAs in the empirical taxonomy were mostly distinct from others on one or two defining dimensions.

This taxonomy of rural PCSAs can be used to inform rural health policy making; help rural communities develop strategies, adopt innovations, and form learning collaboratives; and extend health services research by incorporating typological characteristics of places (i.e., the combination of characteristics that differentiate a place) in the investigation of access, spending, and outcomes of health care. Policy makers and analysts can use the taxonomy as the “base case” to simulate the impact of policy changes (e.g., changes in insurance status) on the rural community. Interested users can find the classified type and supportive data for individual PCSAs on the Rural Health Value website as mentioned above.

The taxonomy provides a baseline description of a community’s profile regarding its essential demographic, socioeconomic, insurance, and healthcare resource conditions in comparison to other rural communities. Rural communities can use the taxonomy to assess the community’s own profile, identify similar communities, and develop strategies for improving health and health care using a comparative framework.

Community leaders can search for meaningful comparisons among communities by (1) identifying communities from the same type in the taxonomy, and (2) considering other characteristics relevant for health system innovation, such as those related to market conditions (e.g., number of clinics and other health care organizations in the area, competition among clinics and providers), the system (e.g., whether parts of care delivery system are integrated), geography (e.g., distance to tertiary care, spread of the population), and culture (e.g., care-seeking patterns of community members). Building on such comparisons, rural communities can adopt innovations that are successfully implemented in similar communities or develop learning collaboratives with such communities.

## References and Notes

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2. Amaro H. The action is upstream: Place-based approaches for achieving population health and health equity. *American Journal of Public Health*. 2014;104(6):964-964.
3. Mobley, L. R., Root, E., Anselin, L., Lozano-Gracia, N., & Koschinsky, J. (2006). Spatial analysis of elderly access to primary care services. *International Journal of Health Geographics*, 5(1), 19.
4. These variables were measured as per capita ratios. For example, “staffed hospital beds” was measured as the total number of staffed hospital beds divided by the size of the population in a PCSA.
5. U.S. Department of Agriculture. Rural-Urban Commuting Area Codes. <http://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx>. Accessed June 15, 2014.
6. The five outlier PCSAs are Danville, PA; Hettinger, ND; West Lebanon, NH; Cooperstown, NY; and Grand Ronde, OR.
7. All variables included in the Economic Resources dimension were inverted because higher scores on the original variables suggest less economic resources.
8. The variable “percentage of population younger than 18 years” was inverted because it is negatively correlated with the other variable “percentage of population aged 65 years and older.”