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## **Availability of Health Care providers in rural Texas counties**

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**Selected Paper prepared for presentation for the 2016 Agricultural & Applied Economics Association,  
Boston, MA, July 31-August 2**

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## **Availability of Health Care providers in rural Texas counties**

### **I. Introduction:**

U.S. citizens have access to some of the most advanced health care systems in the world, and Texas is no exception. However, it is widely documented that there are areas of relative scarcity of health providers. These underserved areas have been delineated at the county as well as for metropolitan areas level for the entire state, with a focus on access to primary care physicians (PCPs). However, health and disease treatment is also strongly dependent upon access to other health care providers such as medical specialists (cardiologists, pulmonologists, endocrinologists, etc.), dietitians and nutritionists, besides PCPs. The need for medical specialists is generally perceived to be more acute in the more rural areas of the state.

In this paper, we seek to contribute towards a better understanding of health care needs by developing health care availability metrics that include a more comprehensive list of the types of health care providers for the three major disease conditions in Texas. In collaboration with healthcare specialists, we are developing a county-level user-friendly GIS map of health care provision needs and availability focusing on rural counties that can be used by state, local and private agencies to improve health care provision to underserved areas in particular, but also to all other regions in the state. Finally, we would provide prescriptions for bridging the gap between surplus and deficit areas of health care provision.

### **II. Goal and Objectives:**

The overarching goal of the proposed effort is to provide pertinent data on the need and availability of health care providers in rural Texas counties to serve as a guide for bridging the gap between medical care needs and availability of providers to meet those needs. In particular, we aim to identify the supply of specialty physicians, such as cardiologists, endocrinologists, and pulmonologists, - the top three chronic diseases in rural counties of Texas. To pursue this goal, the following specific objectives will be addressed.

1. Develop an index of the availability of health care providers in comparison to needs for these providers for all rural counties in Texas.

2. Develop an interactive user-friendly web-based GIS map that will display health care provider metrics in response to user requests.
3. Provide alternative options for bridging the needs-availability gap in an economically cost-effective manner

This paper deals with the first objective. Methodology used to construct county level indices are presented as well as estimates of these indices for rural counties in Texas.

### **III. Background and Literature Review:**

It has been identified that patient accessibility and availability on of the top barriers to patients meeting the health care needs at the United States (Kullgren et.al, 2012). Availability is defined as the relationship of the volume of existing services and resources to patient volume and types of needs. Besides physicians, resources will also include clinical facilities, hospitals, and specialized programs. Ku et.al, (2012) estimated the potential shortage of primary care physicians at the county level in Texas. They concluded that the shortage of primary physicians is worse in Texas compared to the rest of the nation and even more so in smaller and rural countries in the State. When the adequate or threshold physicians is unavailable, then treatable and minor health conditions could escalate to chronic diseases, which may not only be expensive to treat but also lead to catastrophic events such as strokes and myocardial infarctions - heart attacks (Misretta, 2007).

There are factors on both the supply and demand sides which can contribute to potential shortage of physicians in the future. These shortages are inevitable with increases in population and their composition, and to some extent could be mitigated by policy decisions on the supply side. Briefly, on the demand side, the factors include (a) rapid population growth with the sub-group of 65+ years of age witnessing the largest growth (b) wealth and future expectations which could drive Americans to demand more health care and (c) increased accessibility with more Americans covered under private insurance programs as result of Obamacare or as they become eligible to receive social insurance such as Medicare (for 65 + population) and Medicaid (Salsberg and Grover, 2006)

On the supply side, factors which could potentially lead to a shortage of physicians include (a) retirement age and other factors such as a changed incentive system and Medicare

reforms potentially forcing physicians early retirement, (b) changed preferences of the newer generation of physicians to work for fewer hours than the previous generations and (c) supply of medical graduates not keeping up with the demand (Salsberg and Grover, 2006, Cutchin et. al, 1994). Not only the market is facing a shortage, but it is also failing to retain them in rural areas which tends to exacerbate this problem (Cutchin et.al). Other factors contributing to the shortage of physicians in rural areas are associated with the providers which could include (a) generating an adequate level of income which in turn depends on the volume of patients and their ability to pay, (b) quality of life factors in rural areas, (c) presence of similar providers who could offer coverage during sick/vacation periods and (d) professional interactions and opportunities for growth. Hart et.al (2002) conclude that there could be “no real improvement in the current system until and unless rural health care promotes itself as a stable, rewarding and fulfilling professional and personal life experiences for rural health care providers”.

What should be the proper physical or geographical unit to measure the availability of physicians? The standard unit which has been used in most studies is data driven and is at the county level. While using a county as a unit may in most cases be a reasonable assumption, especially for urban and metropolitan counties, it particularly poses a problem when it comes to rural or semi-rural counties. It has been observed that people in rural areas are willing or actually have travelled across county lines for medical and health services and thus an alternate geographic unit be considered as a preferred measure .

Makuc et.al proposed using “Health Service Areas” rather than the county as the preferred unit of study. They examined travel patterns across county lines for people and also integrated information and differences in productivity among physicians to calculate the effective physician per population ratios. Others such as Sara McLafferty has applied GIS models to differentiate the need for physicians by taking into account factors such as:

- (a) Demographic and socio-economic variable such as race, class, ethnicity and income differences
- (b) rural and urban designations and
- (c) travel cost differences due to variation in terrain, traffic, and cost of transportation

The principal advantage of using GIS models is that it allows multiple factors to be examined simultaneously offering a stronger view of the region's health care needs.

Thus, the unit of selection could be as simple as a county or it could be detailed and complete to include multiple factors in assessing the health care needs and the availability of health care providers. The choice depends on the resource constraints of the research project, timeline to conduct the research and the overall research objectives.

#### **IV. Data Sources:**

A variety of data sources were used to determine the supply and demand for physicians of the chosen specialties. The following data sources were utilized in making the computations:

- a) Texas Health Harris Methodist – Stephenville, Texas (Nielsen, Inc.):  
Estimate of actual patient visits by specialty in the Stephenville area
- b) Aetna Inc. Publicly available online physical addresses by specialty
- c) Texas Medical Board: March 2016  
Physician licensure file containing data on supply of physicians by location. This dataset was used to estimate the stock and flow of physicians at the county level.
- d) Texas Health and Human Services: 2008 through 2014  
(Public Use Data File) data – hospital charges by disease codes
- e) Texas (MONARHQ) hospital data  
Utilization and Quality, 2012
- f) USDA Economic Research Service  
Rural-urban continuum codes. These codes were used to designate counties as rural or urban.
- g) U.S. Population Census

Population census figures at the county level were used in conjunction with MONARHQ data and patient visit information to estimate demand for physician services.

## **V. Methodology:**

As stated earlier, this paper focus on the availability and need for cardiovascular, pulmonary, and endocrinology (metabolic or diabetic diseases) specialists in rural Texas counties. These three specialties were selected due to the predominance of patient need for services provided by physicians with these specializations. Counties were designated as rural based on the 2004 USDA-ERS rural-urban county typology codes. In all, 85 of the 254 counties in Texas were designated as rural, based on a rural-urban continuum value of 7 or greater. Given this designation, the following methodology was used to compute county-level an index of health provider availability relative to needs for each of three medical specialties: cardiovascular, pulmonary, and endocrinology.

### Physician Supply:

We define availability or supply of physicians as the total “FTE’s” (of specialists) available to a county’s residents. Specialists’ addresses were obtained from a list of available providers at the county level. These were digitized into a GIS map. The Texas Medical Board physician licensure file provides physician supply information in terms of the number of doctors of each specialty that reside or practice within a given county. This data, coupled with the number of hours each physician works was used to compute the total number of FTEs of specialists in each county. Thus, the supply of physicians is simply determine as the current full-time equivalent stock of physicians within each county:

$$s = \sum_{i=1}^n h_i / \bar{h}$$

Where  $s$  is the supply of physicians of that specialty within a given county,  $h_i$  is the number of hours typically practiced by physician  $i$ , and  $\bar{h}$  is the full-time equivalent number of hours practiced by a physician within that specialty.

A Geographic Information Systems (GIS) database that catalogues medical providers by location was developed for the entire state based on digitized physical address of each medical specialist. Thus the distribution of physicians by specialty across the entire state was obtained as depicted in Figures 1, 2, and 3. The location of each provider was crucial in constructing an inverse-distance weighted availability index since physicians outside a given county are also partially available to patients of that county, depending on proximity.

#### Physician Demand:

We defined physician demand as the total FTE's of specialists required based on disease incidence and population size of the county. By far, the best data available on physician demand is the frequency of visits to specialists. Where available, data on frequency of patient visits to physicians of a given specialty constitutes physician demand for that specialty. Where data is not available, physician demand can be estimated by proxy based upon disease incidence and frequency of visits data from similar locations.

Disease incidence at the county level is provided by the Texas MONARHQ database. For each county and for each specialty, disease incidence expressed as number of patients with a given disease condition per thousand of the population was used as a proxy to determine the relative need for services for the corresponding physician. This disease incidence figure was used to estimate frequency of patient visits based on data in a reference county for which patient visit data exists.

Thus, given frequency of patient visit data in a reference county  $r$ , physician demand for a given specialty in a given county  $j$  is given as:

$$d_j = \frac{e_j}{e_r} v_r$$

where,  $d_j$  is the demand for specialist services in county  $j$ ,  $e_j$  is the disease incidence in county  $j$ ,  $e_r$  is the disease incidence in the reference county  $r$ , and  $v_r$  is the frequency of patient visits to physicians of this specialty in the reference county  $r$ . Using this method, the demand for physician services was constructed for each county and for each of the three specialties included in the study.



### County-level Availability Indices:

The demand and supply estimates for each county were used to construct county-level physician availability indices. These indices were computed simply as the ratio of supply to demand:

$$a_j = \frac{s_j}{d_j}$$

where,  $a_j$ ,  $s_j$ , and  $d_j$  are respectively the county-level availability index, supply, and demand of physicians of the given specialty in county  $j$ . Based on our construction, index values greater than 1 indicate a surplus or an overabundance of health care providers, while index values less than 1 indicate a deficit or shortage of medical providers.

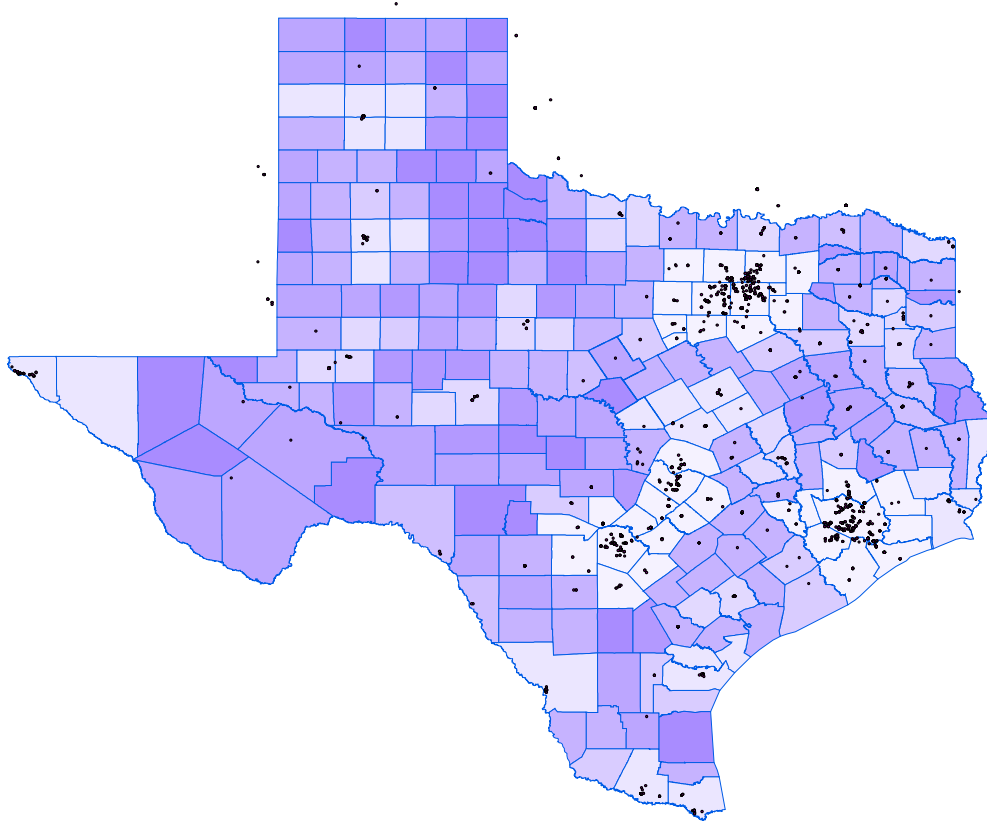
## **VI. Results and Analysis**

The findings of this study indicate that health care availability in rural Texas counties varies markedly depending on the location of the county. Health-care provider availability/needs indices range from 0.1 to 4.9 with an average of 0.6 if the feasible travel distance is limited to 50 miles. Results of the analyses suggest that some rural counties are well represented in terms of medical specialists because of the proximity to specialists in neighboring areas. However, a number of rural counties in the western portion of the state are significantly underserved. In such cases, while residents may well have access to medical specialists, significant opportunity costs are entailed in traveling to see the appropriate specialist. A little understood repercussion is that residents in underserved areas may resort to more affordable but less credible health care options or simply leave the condition untreated, often resulting in more serious health conditions later in life.

### Results for cardiology specialty:

The provider index depends to some extent on how far a patient can reasonably travel to see a specialist. Among all 254 counties in Texas, 58 would have a surplus if a 50-mile radius is

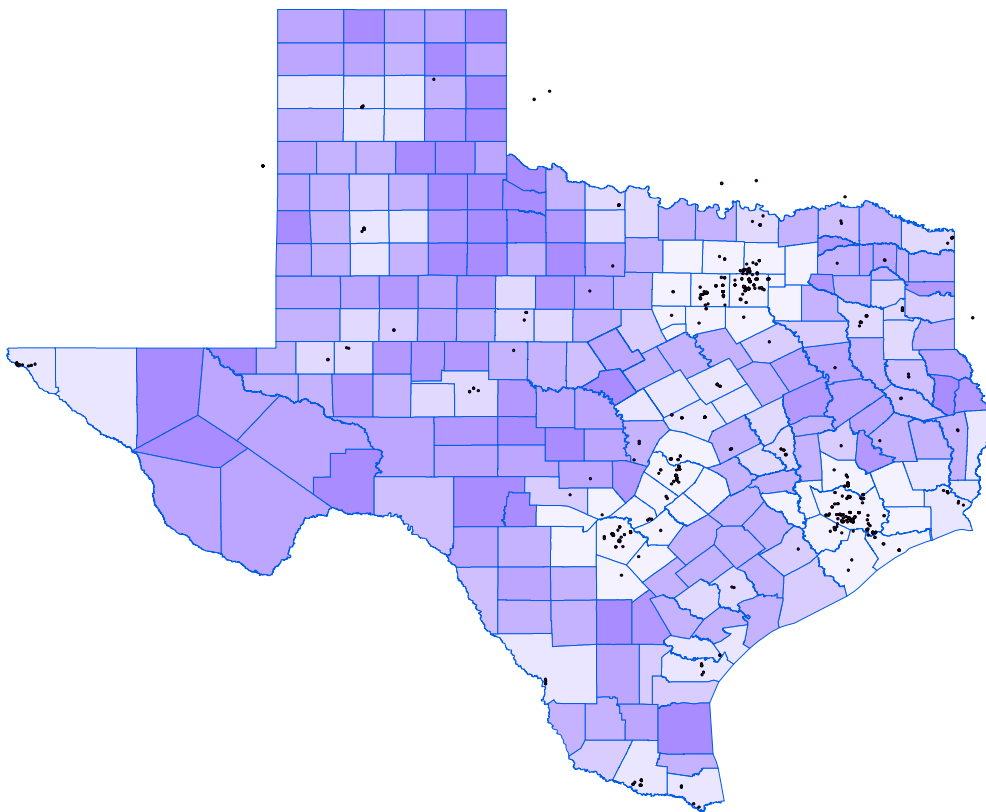
considered the limit for reasonable travel to a specialist. With this travel radius, the remaining 196 counties, which includes most of the rural counties in the western part of the state, would have a deficit. If the travel radius is unlimited, that is, patients can reach a specialist in any part of the state with reasonable ease, then the number of counties with adequate cardiologists rises to 77, with the number of deficit counties falling to 177. Figure 1 shows the distribution of cardiologist across the state, indicating as expected their concentration around the major metropolitan areas in the state. Rural counties not too far from these metropolitan areas generally have good access to cardiologists.



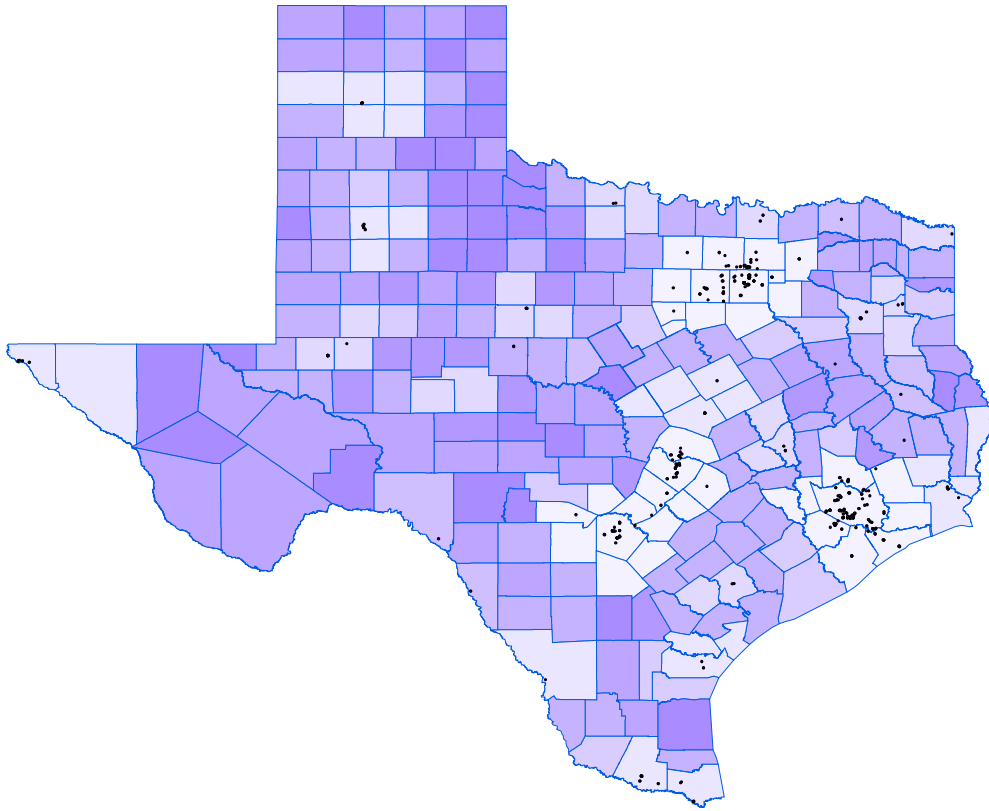
**Figure 1. Distribution of cardiologists in and around Texas counties: 2015**

Results for pulmonology and endocrinology specialties:

Figures 2 and 3 show the distribution of pulmonologists and endocrinologists across the state. Counties are also colored based on the rural-urban continuum, so that darker shades correspond to the more rural counties. The visual display of specialist distribution shown here corresponds reasonably with the county level availability indices. In general, rural counties in the western part of the state are underrepresented, and patients would have to travel quite far to get to some specialists. Results of county level health provider analyses suggest that the degree of disparity in access between counties is more marked for pulmonology and endocrinology specialties than it is for cardiologists. However, rural counties in the central and eastern portions of the state have greater access actually than some urban dwellers.



**Figure 2. Distribution of pulmonologists in and around Texas counties: 2015**



**Figure 3. Distribution of endocrinologists in and around Texas counties: 2015**

**VII. Policy Implications:**

Given that rural areas in Texas are characterized by shortages, it appears that certain policy initiatives and a change in both resource allocations as well as incentivizing career decisions can greatly influence physicians locating their practices in and around rural areas.

In the short-run, incentives can be offered in terms of loan forgiveness or loan reductions can motivate some physicians to set up practices in rural regions. Likewise, admission to Graduate Schools in Medicine can be tailored to offer preferences those who commit to serve in underserved areas, once they complete their training. For areas which face severe shortages, the

State Department and Department of Homeland Security can increase the J-1 visa quota to allow foreign medical graduates to practice in the United States. Indeed, in the 1970's, during the height of the Vietnam war, several hundreds or thousands of qualified foreign medical graduates were offered residency programs and a vast majority of them settled down in the United States as citizens. In our current environment, one of the conditions for giving foreign medical graduates a visa could include a commitment to serve in rural areas. A long-run step which can be also explored is to increase enrollments in both medical education and residency program. This will require investing in building the necessary infrastructure as well as faculty resources to offer education and training of new medical graduates.

The use of Telemedicine is also growing popular with patients and doctors connected using satellite technology. While telemedicine may not be a panacea for the problems facing residents of rural areas, yet it maybe the second or third best solution to overcome shortages. Telemedicine can help in early detection of diseases, follow-up visits and more affordable in time and money. Telemedicine can be viewed as a complement / supplement but not certainly as a substitute for the services of a physician.

Day clinics staffed by nurse practitioners, physician assistants, all working under a qualified medical doctor can also help alleviate the shortage problems. Preventive measures such as developing WebMD, community outreach programs, nutritional and exercise programs can lead to a better healthy lifestyles which can minimize the incidence of diseases such as diabetes, high blood pressure, etc. Finally, offering periodic one or two days "Free Clinics" held in rural areas can be subsidized could lead to early detection of diseases and treatment could also bring down the overall cost of medical care.

### **VIII. Suggestions for further research:**

Estimates can be improved if for each county, we incorporate each physician's time available to patients of each county. Further, technically speaking, each physician is "available" if the patient's situation is not critical and he/she can afford to travel – distance may be a limiting factor for low-income residents with chronic disease conditions. In our study, patient demand is

based on patient visit for the local area. The results will be more accurate if demographic data is included for each independent area.

#### **IV. References:**

Cutchin MP, Norton JC, Quan MM, Bolt D, Hughes S, Lindeman B. 1994. To Stay or not to stay: issues in rural primary care physician retention in eastern Kentucky. *Journal of Rural Health*, 1994 Fall, 10(4), 273-8.

Hart LG, Salsberg E, Philips DM, Lishner DM., 2002. Rural health care providers in the United States. *Journal of Rural Health*. 2002; 18 Supplement: 211-32.

Henderson, James W. 2015. Health Economics and Policy, Southwestern Cengage Learning, 6<sup>th</sup> Edition

Ku, Leighton, Alice Levy and Brian Bruen. 2012. "The Potential Primary Care Crisis in Texas: A County Based Analysis" Prepared for Methodist Healthcare Ministries, Accessed at [http://www.mhm.org/images/stories/advocacy\\_and\\_public\\_policy/The\\_Potential\\_Primary\\_Care\\_Crisis\\_in\\_Texas\\_A\\_County\\_Based\\_Analysis1.pdf](http://www.mhm.org/images/stories/advocacy_and_public_policy/The_Potential_Primary_Care_Crisis_in_Texas_A_County_Based_Analysis1.pdf)

Kullgren, Jeffrey T., Catherine G. Mclaughlin, Nandita Mitra, and Katrina Armstrong. 2012. Nonfinancial Barriers and Access to Care for U.S. Adults. *Health Services Research* 47.1pt2 (2012): 462-85.

Makuc DM, Haglund B, Ingram DD, Kleinman JC, Feldman JJ., 1991. The use of health service areas for measuring provider availability. *Journal of Rural Health*. 1991; 7 (4 Supplement): 347-56.

McLafferty, Sara. 2003. GIS and Health Care Annual Review of Public Health, Vol. 24:25-42, May 2003

Mistretta, Martin J. 2007. Differential Effects of Economic Factors on Specialist and Family Physician Distribution in Illinois: A County-Level Analysis. *National Rural Health Association* (2007): 215-21.

Salsberg E, and Grover A. 2006. Physician workforce shortage: implications and issues for academic health centers and policymakers. Acad Med. September 2006, 81(9):782-7.

Supply, Demand and the Future of Health Care: Clinician Review (2008); 18(7): C1,6-9  
<http://www.clinicianreviews.com/speciality-focus/practice-management/article/supply-demand-and-the-future-of-health-care/48f2bb05d7fef6bb9911f6911f69c7cd7baf3.html?trendmd-shared=1> accessed May 8, 2016.

USDA-ERS. 2015. Rural-Urban Commuting Area (RUCA) codes. Accessed at  
<http://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/documentation.aspx>