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Abstract

This paper examines the geographic accessibility of tertiary health services for the rural population of Idaho. Utilizing the two most commonly used rurality definitions, we determined the spatial distribution of the rural and urban residents in Idaho. The distance to each of the tertiary healthcare facility was calculated using Geographic Information Systems (GIS). Our analysis showed a large disparity between rural and urban geographic access to tertiary healthcare and revealed that there are significant variations in the disparity depending on the rural definition used. Thus there is a need to deploy strategies to enhance rural access and to construct rurality measures that capture the local heterogeneity, given that rurality designations impact the interpretation of access problems, and the funding eligibility for healthcare programs.

Introduction

Equity in access to healthcare can be expressed as providing the right care, at the right time, in the right place. It is indeed a complex concept covering the availability and provision of services, the knowledge and opportunity to use them, and the measurement of need (Gulliford et al., 2002[1]). Geographical access to health services is one aspect of access that presents barriers of cost, time and inconvenience (Jordan et al., 2004[2]).

Geographic maldistribution of healthcare providers and services is a major problem in the American healthcare system. Rural, low-income, and minority communities, in particular, suffer. It is paradoxical that some urban communities have an oversupply of some specialties and rural and inner-city communities suffer from a shortage of providers (Council on Graduate Medical Education, 1998[3]). Social inequities exist in spatial distribution of healthcare providers, including tertiary care providers. Informed strategies that improve access to primary and specialty healthcare services can potentially exert significant positive impacts on the healthcare disparities in rural populations.

Access to healthcare is a function of many variables, including patients' financial resources, education, race, age, gender, access to medical insurance, availability of providers, cultural and

linguistic understanding, knowledge of how and when to access providers, recommendations of friends and family, familiarity with the hospital, geographic location of healthcare services, distance to the facility, transportation facilities, and travel costs. According to Penchansky and Thomas (1981[4]), access to healthcare reflects the fit between characteristics and expectations of the providers and the clients. They group access under five dimensions: availability, accessibility, affordability, accommodation, and acceptability. Availability refers to the healthcare service facilities from which a patient can choose. Accessibility refers to geographic accessibility, which is determined by how easily the client can physically reach the provider's location. These first two groups are spatial in nature. The other three dimensions are aspatial and reflect socio-cultural and economic factors. The majority of research and policy efforts to improve access and eliminate disparities in healthcare have focused on these aspatial factors (Guagliardo, 2004[5]). While the importance of geographic accessibility to healthcare services has also been recognized, the need for more advanced research to understand and improve spatial access remains. Increasingly a number of geographic access studies are using Geographic Information Systems (GIS) as a tool for data integration, analysis, and visualization. *Healthy People 2010, Vol. II* objective 23.3 also encourages the use of GIS in national, state, and local health data systems (U.S. Department of Health and Human Services, 2000b[6]).

Aim of Study

The aim of this study is to examine spatial accessibility to tertiary or quasi-tertiary healthcare facilities in the primarily rural state of Idaho and to look at related variations arising out of different definitions of "rural" or "non urban".

With a shortage of healthcare services and a lack of transportation, investigating the physical distance the rural population of Idaho travels to access tertiary healthcare facilities becomes an important exercise. Assessment of the disparities between rural and urban access can also provide insightful information for healthcare planners, providers, and patients.

Background

The State of Idaho (Fig. 1) is located in the Pacific Northwest region of the United States and covers 82,747 square miles. According to the 2006 U.S. Bureau of the Census Population Estimates[7], it has a population of 1.5 million, made up of 95.2% white, 1.4% American Indian, 1.1% Asian, 0.7 Black, 0.1 Pacific Islanders and 1.5% of the population report two or more races. Boise is the capital and most populous city of Idaho and is located in the southwestern region of the state. Idaho is an important agricultural state, producing nearly one third of the potatoes grown in the United States. The population of Idaho is estimated to be 33-38% rural, depending on the definition used (see section 5.1.1). Idaho is considered to be among the more rural states and is characterized by a harsh topography and sparse population. These factors create problems of distance and isolation. Compared to their urban counterparts, the most remote and rural counties in Idaho consistently have lower per capita incomes, higher unemployment rates and poverty levels, and smaller job growth. The most rural communities have considerable needs for transportation infrastructure, utility services, and education opportunities. On average, rural Idaho's children under 18 and adults 65 and older experience higher rates of poverty as compared to their urban counterparts. The poverty rates for racial and ethnic minorities in rural Idaho follow a similar pattern (Salant and Porter, 2007[8]).

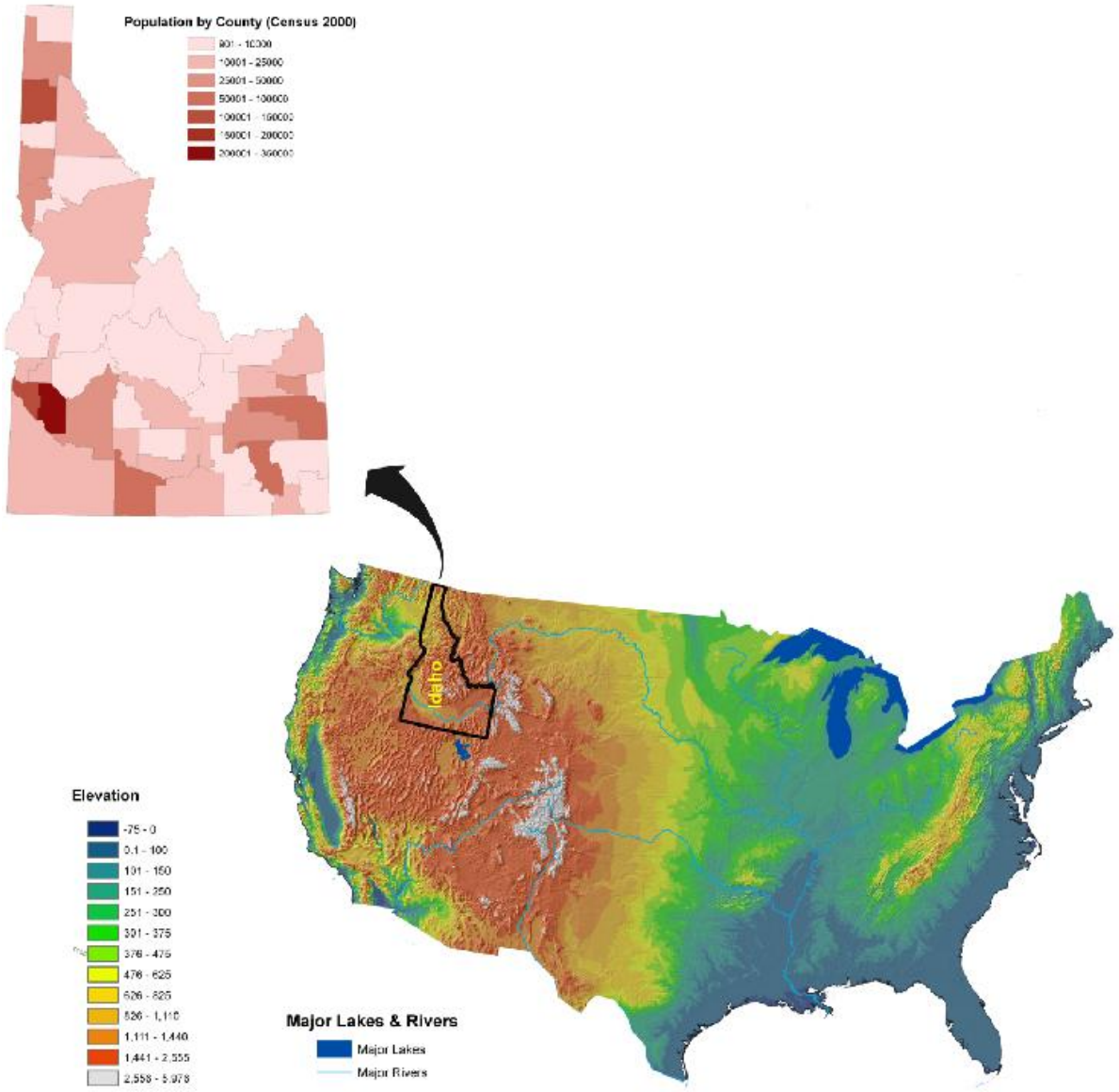

Figure 1- Idaho and its population by county

Recruitment and retention of medical healthcare professionals in rural areas are dominant issues in rural Idaho. Census data indicate a need for medical practitioners, particularly those with a background in obstetrics and increasingly in mental health.

In 2004, Idaho ranked 50th for the rate of active physicians, 169 per 100,000 population (Census Bureau, 2007[9]). The state has a shortage of mental health providers and all of the state's counties have been federally designated as Mental Health Professional Shortage Areas (HPSA). There is a shortage of primary care and dental health professionals in more than 80 % of the state. More than 61 % of the state has been designated as a medically underserved area (MUA). There are 43

hospitals in Idaho. The five health centers identified as providing tertiary healthcare services are located in urban areas.

Travel and Transportation

The transportation accessibility in rural Idaho is not adequate, with some deregulated transportation services like intercity airline and bus routes being cancelled or downsized (Salant P. and Porter A., 2007[10]). Most residents seeking health services have to travel by private vehicle, which poses problems for elders and members of low-income communities. At times some secondary roads are closed for weeks because of extreme weather conditions and rockslides (Muth et al., 2004[11]). Due largely to a higher number of motor vehicle accidents, accidental death rates in rural Idaho continue to exceed urban rates in the state. Longer driving distances and employment in industries like agriculture, forestry, construction, and mining cause this, in part.

Spatial Access to Healthcare in Rural Areas

Effect of travel and distance on the use of healthcare services

A lack of specialty care and primary care in rural areas means that residents must travel away from their communities to obtain healthcare services. Travel from rural areas to urban areas for specialized health services can be daunting when one is ill, especially if on very long isolated roads and/or during adverse weather conditions. Patients requiring tertiary care are accompanied by a caretaker or a member of the family. This adds to travel expenses. Muth et al. (2004[12]) observe that while Medicaid pays for travel costs—including companion travel fees—private insurance will not pay for companion travel or lodging associated with healthcare outside of a hospital setting. Additionally, patients must have private transportation in places with limited or no public transportation. This lack of access to quality health care, particularly for those living in underserved rural communities, is a serious problem.

According to Chan et al., (2006[13]) rural residents requiring treatment for cancer, cardiac diseases, and depression travelled longer distances than urban patients. Evidence suggests that increasing distance from health services inhibits the use of health services (Brustrom and Hunter, 2001[14]; Haynes et al., 1999[15]; Jones et al., 1998[16]; Gesler and Meade, 1998[17]), and that travel distance is associated with a range of poor health outcomes. For example, it has been reported that travel distance affected the utilization of cancer treatments (McCarthy and Blow, 2004[18]; Nattinger et al., 2001[19]; Desch et al., 1996[20]). With increased travel time, patients are more likely to undergo mastectomies (van Dis, 2002[21]), and a higher than expected number of deaths are caused by asthma (Jones and Bentham, 1997[22]). Travel time has also been associated with lesser quality treatment for depression (Fortney et al., 1999[23]). Increasing rurality has been associated with fewer visits to specialists and an increasing dependence on primary care physicians (Chan et al., 2006[24]). Distance also affects preventive care; due to the inconveniences of travel, rural residents may choose not to seek preventive treatment (Slifkin, 2002[25]). The long distance travel inconvenience may also compound the financial barrier (Blazer et al., 1995[26]).

While there is great concern regarding access to primary care services in rural areas, considering the higher incidence of chronic disease, access to specialty physician services is an equally pressing issue. Rural residents report fewer annual visits to healthcare providers than those in urban communities, even though they may report that they have a healthcare provider (Larson and Fleishman, 2003[27]). In *Healthy People 2010 Vol. I* (U.S. Department of Health and Human Services, 2000a[28]), it is observed that heart disease, cancer, and diabetes rates for rural areas exceed those in urban areas. The report also notes that timely access to emergency services and the availability of specialty care are major issues for rural populations. On the provider side, access to specialty care has also become an important concern for healthcare facilities and primary care providers (Deprez, 2004[29]). The latter often do not get enough patients or lose patients when access is poor. Giving greater attention to specialty health services access could be beneficial to the providers and their rural patients.

Rurality Definitions and Spatial Accessibility

Given that geographic access is an essential determining factor of a patient's treatment-seeking behavior, it is important to study and develop measures of spatial availability and accessibility of healthcare facilities for rural areas. Defining how an area is categorized as rural is also important, as there are many definitions of rurality. Depending on how rural regions are designated, research may produce varied results (Hewitt, 1989[30]). The classifications of rurality apply different criteria, geographic units of analysis, and methodologies to designate rural areas. The classification of rural and urban has for years been characterized by debates on how to define rurality. Some places are rural/non-metropolitan under one definition, but not under others. Rural has often been considered as being "not urban' or 'not metropolitan'. The rurality definitions of the Bureau of Census and the Office of Management and Budget (OMB), which are the most commonly used ones, are derived by exclusion, i.e., whatever areas not classified as urban or metropolitan are considered to be rural.

What most researchers agree upon is that defining "rural" is a not a simple task. The perception of rurality is multidimensional and its characterization is attached to particular objectives and views. Rural areas have been defined as particular types of regions and communities according to some objective measures, such as population density, commuting patterns, poverty or unemployment rates, or extent of wild areas and farmland (Beedasy et. al 2008[31]). There is no one standard definition of rural that can satisfy all stakeholders or their goals. It is difficult to arrive at a single definition, as the classification has to suit different purposes. Nevertheless, a need exists to arrive at adequate definitions of rural that capture the diverse characteristics of rurality. Even though the concept of rurality is diverse, funding agencies and organizations have to make rural and urban delineations to administer policies and programs, to target resources to rural areas, to adjust Medicare and Medicaid health care reimbursement levels, or to establish eligibility for rural grant programs.

Table 1 shows the percentage of land and people classified as rural under the most common definitions.

Table 1- The percentage of land and people classified as rural under the most common definitions. (Source: Shambaugh-Miller, 2007)

Definition	Percentage Classified as Rural/Non-Metropolitan	
	Land(percent)	Population(Percent)
U.S Census Bureau: Urban and Rural Areas	97.4	19.7
U.S Office of Management and Budget (OMB): Metropolitan and non metropolitan areas	74.5	17.4
Economic Research Service, U.S Department of Agriculture & WWAMI: Rural-Urban Commuting Areas (RUCA)	78.8*	19.6*

*****RUCA codes used to calculate percent of land and people classified as rural:4.0,4.2,5.0,5.2,6.0, 6.1,7.0,7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2, 10.0, 10.2,10.3,10.4,10.5, 10.6,

The population in rural America is smaller and more dispersed than in urban America. However rural America is not only home to nearly one fifth of the nation's population but also extends over more than three quarters of America's total land area (Fig 2).

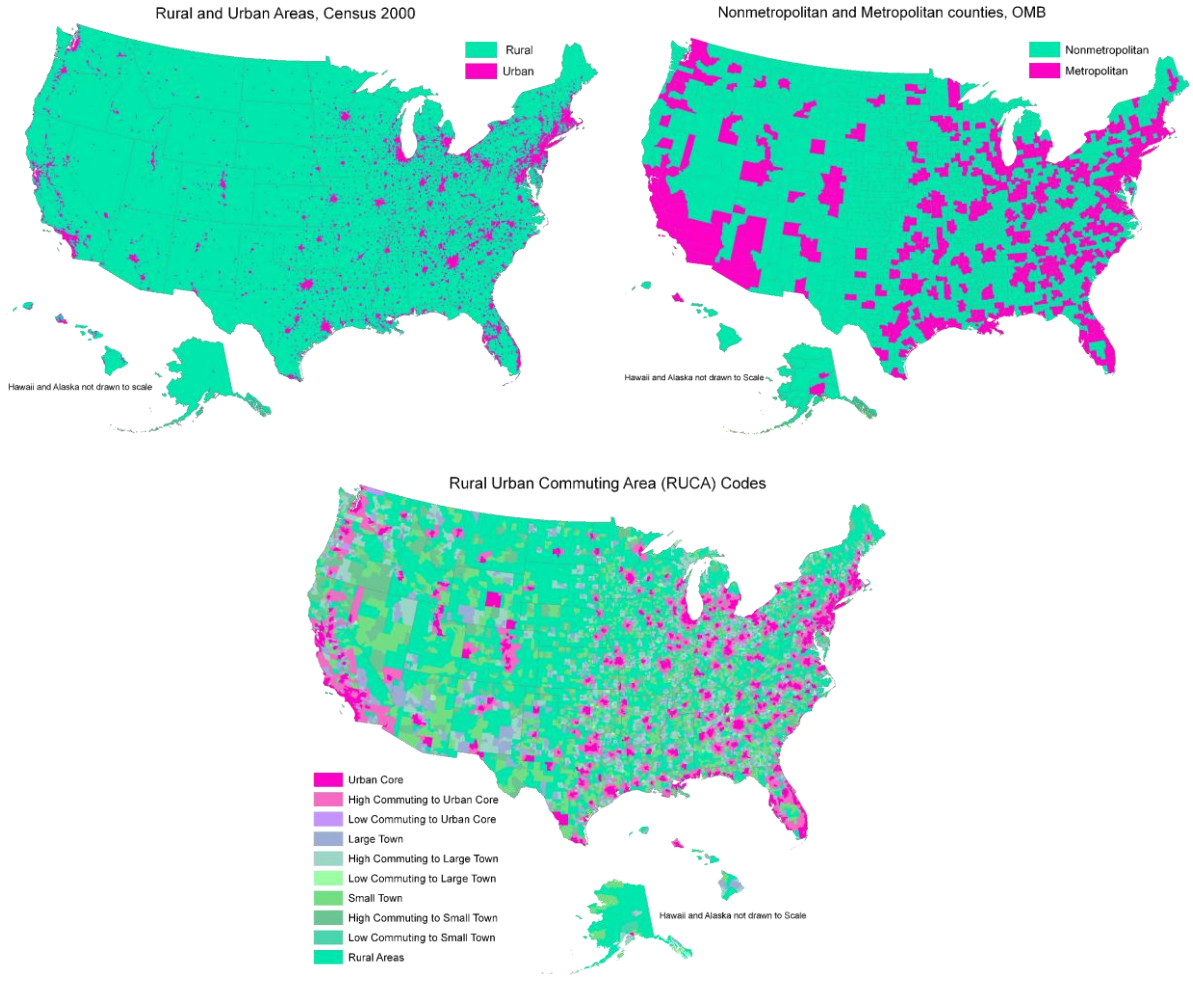

Figure 2- Rural / Urban Maps of the US according to rurality definitions of the Bureau of Census and the Office of Management and Budget (OMB), and the Rural-Urban Commuting Areas (RUCA) codes

Current Spatial and Quasi-Spatial Accessibility Measures

One of the most published measures of spatial accessibility to healthcare is the provider-to-population ratio. Other common measures that have a spatial component very relevant for funding purposes are Health Professional Shortage Areas (HPSAs), Medically Underserved Areas (MUA), and Medically Underserved Populations (MUPs). HPSAs may have shortages of primary medical care, dental, or mental health providers and may be urban or rural areas, population groups, or medical or other public facilities.

Materials and Methods

Dimensions of Geographic Access

The two dimensions of geographic access are availability and accessibility. Both the availability of, and spatial accessibility to, tertiary healthcare centers was determined. Availability refers to points of service from which a patient can choose. For this study, availability was defined as the in-state tertiary facilities in Idaho, assuming that all residents can receive treatment in any of these facilities and that there are no service area or catchment area limitations. Accessibility is the cost of travel in terms of distance, time, or expenses, between patient location and service points.

We defined spatial accessibility as the straight distance between each population block centroid and the closest facility. Disparity between rural and non-rural access was assessed. The variation in this disparity was investigated using two different definitions of rurality. On the basis of the definition used, each census block was classified as rural or non-rural according to the location of its centroid.

Census Bureau and OMB Definitions of Rural

Two commonly used definitions of the term rural were considered for this study: the census block/block group-based definition of urban by the Census Bureau and the county-based definition of metropolitan by the U.S. Office of Management and Budget (OMB).

The U.S. Census Bureau classification of urban includes all territory, population, and housing units located within an urbanized area (UA) or an urban cluster (UC) (Census Bureau, 2002[32]). By exclusion, the rest of the territory and population is considered non-urban or rural. The definition is based on census block groups and census blocks where the census block is the smallest geographic entity within a county for which the Census Bureau tabulates population. UAs and UCs consist of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. An urbanized area consists of densely settled territory that contains 50,000 or more people. An urban cluster encompasses a population of at least 2,500 people but less than 50,000 people. Figure 3 shows the rural and urban areas in Idaho based on the Census 2000 classification.

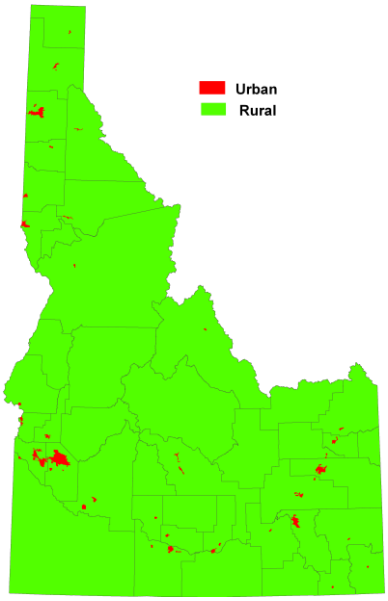

Figure 3 - Rural and urban areas in Idaho according to the Census 2000 classification

The OMB defined metropolitan statistical areas (MSA), micropolitan (micro) statistical areas, and core-based statistical areas (CBSA) according to Census 2000 data (Census Bureau, 2006[33]). A metro area is a Census Bureau-defined urbanized area that has a population of at least 50,000. The MSA comprises a central county or counties containing the core population plus adjacent outlying counties that retain a high degree of social and economic integration with the central county as measured through commuting ties. Non-metropolitan counties not designated micro areas are referred to as non-core counties. A micropolitan area is an area with at least one urban cluster that has a population of at least 10,000, but less than 50,000. Figure 4 shows the metropolitan and non-metropolitan counties in Idaho categorized according to the OMB 2003 definition.

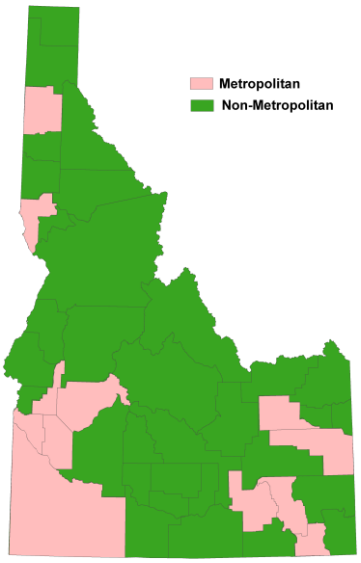

Figure 4 - Rural and urban areas in Idaho according to the OMB definition

Data

The distribution of the population in each census block was based on data from the U.S. Census 2000 and was tabulated in 88,452 blocks. Figure 5 shows the population block centroids and the five facilities identified as offering some tertiary services.

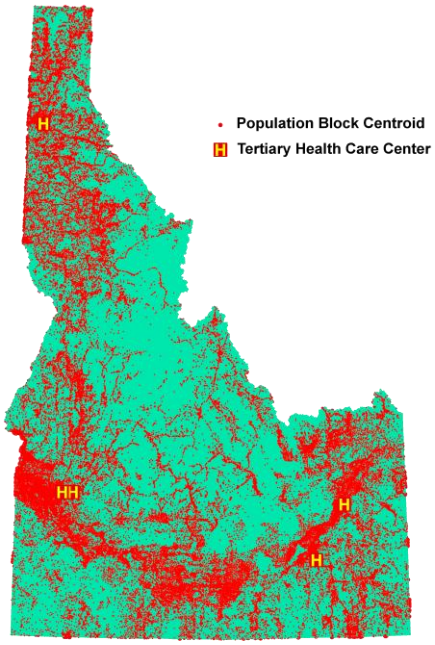

Figure 5- Population Block Centroids and Facilities providing tertiary services

The population of Idaho in 2000, was 1,293,953. According to the Census Bureau definition, 66.4% resided in urban areas with the remaining population (33.6%) in rural areas. Under the OMB classification there were 62.4 % residing in metropolitan counties and 37.6% in non-metropolitan counties.

Although crucial to a population's well being, no official list of tertiary healthcare centers exists, so our identification was based on the healthcare industry criteria. The healthcare sector identifies a tertiary care center as a facility comprised of highly specialized staff for the treatment of complex or serious conditions (Alabama Hospital Association, 2008[34], Minnesota Department of Health, 2008[35], USA Managed Care Organization, 2008[36]). Such services frequently serve as referral centers, requiring sophisticated technology and support facilities. Patients seek care at a tertiary care center for complex and severe conditions. Data on healthcare facilities were obtained from the Idaho Department of Health and Welfare and the Idaho Hospital Association websites. Five healthcare facilities were identified as meeting the industry's definition of tertiary care center. All are located in urban or metropolitan areas (Fig. 6). For this study, these five tertiary healthcare hospitals were considered to be available to all Idahoans without service or catchment area limitations.

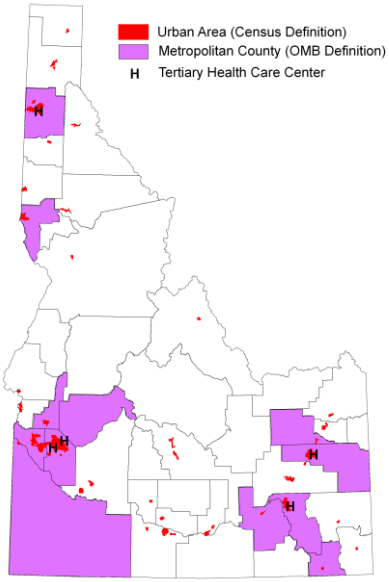

Figure 6 – Locations of the five identified tertiary healthcare facilities in Idaho

The population was categorized by assigning each block as urban or rural using the Census Bureau definition. The distance from the population block centroid to the nearest facility was then calculated. The distances from the health facilities for the two categories of residents were then compared. Similarly, using the OMB definition, each block was designated as metropolitan or non-metropolitan and the shortest distance to a tertiary facility was calculated.

Spatial Access Calculation

The measurement of spatial accessibility is conventionally based upon the use of physical distance, time, and population aggregates as a means of studying the problem. Spatial accessibility can be measured as a spatial distance, or conceptualized as the cost (time or money) it takes to cover that distance (Apparicio et al., 2003[37]) There are several ways of calculating physical accessibility to health, including Euclidean distance, road network distance, or road network travel time. Euclidean distance is the straight-line distance between destination and source. Road network distance is the distance traveled from the source to the destination along an existing transportation network. Network travel time is the time associated with the travel distance through that road network.

Travel cost to the nearest provider is used as a measure of spatial access to health care. It is typically measured from a patient's residence or from a population center depending on the resolution of the available data, such as the centroid of a census block or block group or county. Travel cost to the nearest provider can be considered as a measure of spatial access for rural areas where provider choices are very limited and the nearest provider is also the most likely to be used (Guagliardo, 2004[38]).

In this study, straight-line distance was used as a measure of spatial accessibility. Williams et al. (1983[39]) analysis of rural patients' proximity to medical specialists proved not to hold a strong bias for travel time over straight-line distance. Comparing alternative methods of measuring access to health services, Fortney et al. (2000[40]) also report only marginal gains in predictive

accuracy when using road network distances along the shortest route between source and destination. A travel time analysis is most practical and beneficial for small geographic areas (Phibbs and Luft, 1995[41]). Thus for our study's large geographic area and dataset, straight-line distance is valid given the very high correlation between straight-line distances and actual travel times for travel on a road network.

A GIS application, ARC GIS ™, was used to calculate the distance between the residents and the nearest tertiary facility. To do so, we employed an aggregate method, i.e., the population centroid of the block was used instead of individual addresses. It was not practical to get the addresses of all the 1.3 million residents of Idaho for geocoding and it is also important to note that this level of detail is not appropriate, given the privacy requirements of the Health Insurance Portability and Accountability Act (HIPAA).The calculations were weighted with the number of people residing within each block. Next, the address of each of the five hospitals was geocoded using the GIS. This involved matching the complete address of each facility on a digital road map. Finally, the shortest distance from each of the population block centroids to the nearest facility was calculated using the GIS.

Results

Disparity in Rural and Urban Access

Irrespective of the different rurality definitions, rural residents have to travel longer distances to access tertiary facilities. This disparity in access varies depending on the classification used for determining rurality. On average, the closest tertiary facility was 32.9 miles away from an Idaho residence. According to the OMB definition, a metropolitan resident in Idaho lived only 13.2 miles away from a tertiary facility, that is, five times closer than the average non-metro resident, who was 65.7 miles away. In contrast, using the Census definition, the closest tertiary hospital was 25 miles away for an urban resident and for a rural resident such a facility was located nearly twice the distance away, i.e., 48.5 miles.

Our analysis also indicated that, using the OMB definition, 50% of non-metropolitan residents were located more than 66 miles away from the closest tertiary center and 25% of non-metropolitan residents were located more than 95 miles away from the closest tertiary center. Under the Census classification, 50% of rural residents were at least 39 miles away from the closest tertiary facility and 25% of rural residents were at least 75 miles away from the closest tertiary facility. On the other hand, 50% of those classified either as metropolitan (OMB definition) or as urban (Census definition) were within 7 miles of a facility.

Residency Patterns for Rural-Urban and Metro-NonMetro Definitions

As discussed in previous sections, there are different definitions of rurality. Some places are rural/non-metropolitan under one definition, but not under others. Depending on how rural regions are designated, research may produce varied results. In the year 2000 according to the Census Bureau definition, 66.4% of the population in Idaho resided in urban areas and 33.6% in rural areas. Under the OMB classification 62.4 % of the population resided in metropolitan counties and 37.6% in non-metropolitan counties. We calculated the percentage of rural/urban

residents (Census Bureau classification) living in non-metro/metro counties (OMB definition) and the percentage of non-metro /metro residents living in rural/urban areas (Tables 2 and 3). The term non-metropolitan is often used interchangeably with rural, even though, the Census definition of rural (not urban) and the OMB definition of non-metropolitan are quite different.
The comparison of residency patterns for rural-urban and metro-non metro shows that 61.6 % of Idaho's rural residents live in non-metropolitan counties while 38.4% live in metropolitan counties. On the other hand, 55.4 % of the people designated as non-metropolitan live in rural areas and 44.6 % live in urban areas.

Table 2 - Percentage of rural/urban residents living in non-metro/metro counties

	% Rural Residents	% Urban Residents
Non-Metro Counties	61.6	25.6
Metro Counties	38.4	74.4
Total	100.0	100.0

Table 3 - Percentage of non-metro /metro residents living in rural/urban areas

	% Non-Metro Residents	% Metro Residents
Rural Areas	55.4	21.3
Urban Areas	44.6	78.7
Total	100.0	100.0

Discussions and Conclusions

This research examined the geographic access to tertiary health centers at the block level of aggregation for the population of Idaho. It compared urban and rural spatial access. It also investigated variation in the spatial access disparity using two different official definitions for designating rurality. The study provides a simple measure of spatial access to tertiary healthcare facilities and some useful insights into the impact different definitions of rurality may have on spatial access to health care. This potential disparity warrants serious consideration when planning interventions to improve access to healthcare in rural areas.

Rural Spatial Access to Tertiary Hospitals

The study showed that Idaho residents' geographic access to tertiary hospitals is generally not satisfactory and access is even poorer for Idaho's rural residents. Studies (see section 4.1) indicate that when people seek healthcare they can become discouraged when traveling beyond a threshold distance (Gesler and Meade , 1998[42]) even though sometimes the service is offered free of charge (Brustrom and Hunter, 2001[43]). Travel distance of more than 50 miles appears to create an often insurmountable challenge for rural residents in need of specialty care. Yet, our study indicates that at least a quarter of Idaho's rural residents would have to travel more than 75 miles to get to a tertiary facility irrespective of the two different rurality definitions used. According to

congressman Peterson (2004[44]) "Throughout history, rural America has consistently done more with less, whether it be in regards to education, economic development, basic public health infrastructure or healthcare." Yet it is fundamental to improve access to care for rural residents.

The urban and rural spatial access disparity varies significantly depending on the definition of rurality utilized. Under the OMB definition, the average distance to a tertiary facility was five times more for non-metropolitans as compared to metropolitans, while the average geographic access was approximately twice for non-urban residents compared to urban residents using the Census definition. Even though the term urban is often used interchangeably with metropolitan, the Census definition of urban and the OMB classification of metropolitan are quite different. Significant disparities were observed when the residency patterns for rural-urban and metro-non metro designated areas were compared.

One of the major differences in the two definitions is the basic geographic unit utilized. The unit for the OMB definition is a county and for the Census definition it is a census block. The county-based definitions are not homogeneous, given the larger spatial area of each unit. Metropolitan areas may include isolated rural areas while non-metropolitan areas may include some densely populated pockets. Many metropolitan counties in Idaho are home to remote, rural populations that simply go unrecognized under the OMB system. Measures of rurality alter with the spatial unit at which analysis takes place. When a unit of analysis is too large, the degree of heterogeneity that characterizes rural areas cannot be captured. Compared to a county, the smaller census block used for the Census definition gives a better measure of population density. Yet, while the Census definition gives a better measure of population-density, the OMB definition better considers commuting ties with neighboring areas.

The different classifications of rurality apply different criteria, methodologies, and geographic units of analysis to designate rural areas. Inconsistent and conflicting designations have to be taken into account during health access research and health services planning to avoid serious negative outcomes (Ricketts et al., 1999[45]). When comparing results from different studies, it is necessary to ascertain the specific methods and definitions utilized by each study before drawing any conclusions.

Limitations of Study

This study has several limitations. First, we measured geographic access from the population block centroid rather than each resident's home or work address. Different levels of aggregation exhibit limitations. Ideally for purposes of rural healthcare planning, data obtained at the level of the individual are most useful because the observed patterns and relationships are not already predetermined by any level of aggregation. While geocoding individual addresses at street level would be ideal, it is neither practical nor desirable to get the addresses of all the residents of Idaho.

The second limitation stems from the boundary or border effect. The edge effect occurs when the areal unit under study is defined by a boundary that can actually be crossed. The results coming from bordered area studies depend on the configuration of the study area. This is a well-known problem termed as the modifiable areal unit problem. Geographic boundaries, including census

block, tract, county, and state are only administrative borders. People can cross these boundaries. Residents of Idaho are free to travel outside the study area to receive healthcare in the tertiary health facilities closest to them, even in surrounding states. The impact of the border effect can be lowered by increasing the size of the areal unit. This study area (state of Idaho) is already relatively large and the neighboring states of Wyoming, Utah, Montana, Oregon, Washington, and Nevada were not included in the geographic access analysis. There is a point where a tradeoff has to be made between the feasibility of the study and any error due to the boundary problem.

Enhancing Rurality Definitions

The several official definitions of rurality affect the eligibility for funding programs for healthcare services and the way in which service needs and problems of access are interpreted. The two principal classifications of rural used by the federal government, the OMB and the Census Bureau definitions, were applied in this study. The increasingly utilized Rural-Urban Commuting Area (RUCA) codes, introduced by the Federal Office of Rural Health Policy, could also be studied to assess their impacts on rural healthcare spatial access. While finding a single definition of rural may not be possible, or even desirable, this study indicates that more adequate definitions of rurality that capture the local heterogeneity are essential. Given the variety of terrain and sociocultural aspects of the United States, more complex definitions based on multiple social and spatial criteria would serve local needs better. This can only enhance policymakers' understanding of rural healthcare deficits. Tools such as GIS offer the opportunity to combine weighted standardized spatial and socio-economic attributes to arrive at more comprehensive definitions. The data integration and analysis capabilities of GIS provide a set of tools for understanding and investigating the relationship between the geographic organization of healthcare and the delivery, access, and outcome of healthcare (McLafferty, 2003[46]). In addition, there is little consensus and practically no rigorous theoretical or empirical basis for distances termed as "poor access to healthcare services." Such threshold distances or range of distances can be established taking into consideration socio-economic and physical variables such wages, poverty levels, terrain, weather and transportation infrastructure.

Refining Measures of Geographic Access

More robust and refined measures of geographic access will have better potential to detect the effect of travel costs (distance, time, expenses) on healthcare utilization.

While there is a high correlation between straight-line distances and actual travel times for travel on a road network, there may be areas of low correlation, particularly in peripheral and very remote and frontier areas. Road network travel distances or travel time enhanced by a variety of elements such as financial cost, congestion, road, and weather conditions can be investigated. In addition, integrating public and private transport to reflect the experience of low-income groups and those without their own means of transport can lead to more effective measures of access to healthcare services by specific population subgroups.

Integrating how non-spatial access factors affect access, such as financial, cultural, socio-economic and administrative, with spatial access factors will be useful to understand, and improve access to healthcare services.

Strategies to Improve Rural Healthcare Access

One of the goals of society and of the Department of Health and Human Services' Healthy People 2010 program is to improve access to comprehensive, high-quality healthcare services. Ideally the aim is to provide equity in healthcare access. From a spatial or geographic standpoint this is not practical. Health services are inevitably concentrated in particular places, and are therefore more accessible to people living nearby than to people who live further away (Lovett et al., 2002[47]). For rural areas, disadvantaged by remoteness and low accessibility to health services, different types of delivery methods and standards of healthcare provision could be adopted. Methods devised to reduce the geographic barrier or to circumvent these barriers are now being promoted in remote areas. The Institute of Medicine *Quality through Collaboration* report (2004[48]), proposes a strategy to address the health quality challenges in rural communities, which includes assuring that rural healthcare systems are financially stable and investing in an information and communications technology (ICT) infrastructure. ICT is anticipated to have enormous potential for enhancing health and healthcare over the coming decade. Technological improvements and the trend of high-speed Internet replacing dial-up connections are growing in Idaho (Salant and Porter, 2007[49]). Financial, technical, and attitudinal barriers have been limiting factors in the adoption of telehealth. Telehealth activities are still not widely practiced in the USA despite their attractive attributes, and despite the substantial efforts of policy-makers, regulators, and telemedicine champions. Some reasons include technophobia, the unwieldiness and inconvenience of the technology being used, concerns about the quality, reliability, cost-effectiveness, and safety, resultant concerns about legal exposure, and behavioral inertia, i.e., the reluctance to change one's habits. The high cost of telecommunications infrastructure, the lack of that infrastructure in many remote and rural locations, the lack of qualified technical professionals, and the difficulties of interoperability have also been major issues (Milstein, 1999[50]). These challenges can be met by providing low cost, easy to use, and innovative delivery technologies that support mass participation.

Collaboration and networking links among rural hospitals, tertiary hospitals, and individual providers has the potential to improve primary and tertiary healthcare delivery to rural patients. Simultaneously, through telemedicine, the need for patient travel to tertiary care facilities may be reduced significantly, while specialty healthcare can be brought to those who would otherwise find such services unavailable. The healthcare delivery system will undergo an impressive change by adopting telemedicine. The use of appropriate computer technology and telecommunications has allowed remote rural hospitals to connect to tertiary hospitals, resulting in much higher patient satisfaction and a dramatic decrease in patient transfers (Davis, 1999[51]). In Idaho, a few telehealth and telemedicine networks are involved in improving health delivery in rural areas. More resources, networks and further broadband penetration will prove crucial to the expansion of telehealth programs within rural communities.

Expanded telehealth networks will improve the quality of health information available to healthcare providers, patients, and their families in underserved rural and frontier communities of

Idaho. They will support best practices in healthcare and enhance access to healthcare information and services by connecting the underserved rural and frontier communities with the wider healthcare system using low cost innovative mechanisms which have already proved to be effective in the education and business domains. These mechanisms are grounded in the current social networking media revolution, which, we can no longer afford to ignore given their undeniable public success. In the rural healthcare scene, this low cost approach will create a momentum for online patient support groups, online physician support groups, physician to patient teleconsultations, and peer to peer provider teleconsultations to allow rural doctors and nurses to exchange important diagnostic information on the health status of patients and decide on appropriate treatment.

Additionally, measures such as reimbursements of rural residents' travel expenses to healthcare services, including the cost of companion travel, will improve rural patients' access to healthcare. Likewise the improvement in public transportation systems in poor communities will lead to better outcomes. Furthermore, it is evident that geographic access models can provide insights into equity of access to healthcare and inform policy decisions. Additional factors and larger data sets can be reprocessed quickly, efficiently and consistently using a GIS. The model used in this study can be augmented with further research to arrive at more comprehensive models.

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