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Abstract. *Development of tools for identifying and tracking differences in older adult service utilization by race, ethnicity, income, and geographic area is vital in the face of current demographic and economic changes in rural areas, particularly in areas experiencing rapid demographic changes. In this conceptual article, we explain how to calculate a service use index that compares service utilization of a specific group of older adults to that of the entire older adult population. We then illustrate its usefulness with a case example using geographic information systems (GIS). This unique approach can be utilized to understand differences across fields of practice, enhance planning to address differences, and monitor changes over time.*

Keywords: applied research, geographic information systems, older adults, policy/practice tools, rural service utilization

As the United States undergoes major demographic shifts and becomes increasingly diverse, social workers and social services staff will need improved tools for identifying differences in service utilization across race, income, and geographic areas. This article presents a unique and replicable approach to understanding service utilization through the calculation of a service use index. The service use index is a technique that can be used by social workers and agency directors to better understand service utilization by specific client groups in relation to the larger population. The service use index is mapped to further enhance planning and tracking of service utilization in geographic space. This application of geographic information systems (GIS) technology provides a visual display of the relationship between people and their environments, which combined with the service use index provides a tool for improving social workers' understanding of agency services in relation to clients and to communities.

The service use index and mapping techniques are applicable across fields of practice and produce easy to understand information that can help focus the attention of both policy-makers and the public on the needs of at-risk populations. Social workers have been encouraged to use GIS to describe and comparatively analyze service use, thereby, enhancing the administration, delivery, and evaluation of social services (Hillier, 2007; Queralt & Witte, 1998). Our development of an easy-to-use tool for analyzing service utilization that takes advantage of the benefits of GIS will hopefully encourage further use of GIS by social work professionals. Specifically, mapping of the service use index can identify geographical locations with lower than average service utilization rates, which can point to issues of inaccessibility or a need for further outreach.

In this conceptual article, we explain the development of the service use index and how we used this index to compare the service use of older adults who live in rural counties to that of the general older adult population statewide. After describing the calculation of the service use index with a statewide case example, we provide a map illustrating the service use index in each county in order to explore and visualize geographic differences in utilization. This map provides baseline data on service utilization for older adults living in rural counties relative to the general older adult population, which is critical in times of major demographic and economic changes. We also identify the benefits of analyzing and visualizing services through these techniques, and we highlight the broader implications for social workers, administrators, and policymakers across fields of practice and age groups.

Examination of Social Service Utilization with Geographic Information Systems

Since the 1990s, social workers and social service agencies have been urged to utilize GIS techniques, and social work programs have considered teaching these techniques to students (Felke, 2006; Wier & Robertson, 1998). Geographic information systems are computerized database management systems used to collect, store, analyze, and illustrate spatial data, which occupy identifiable locations on the earth's surface (United States Geological Survey, 2007). One of the primary benefits of GIS is that visualization of data on a map can highlight salient geographic patterns and distributions that might not be seen or recognized with data presented in a table (Hirshorn & Stewart, 2003).

The use of GIS in social work practice and administration is especially valuable given that the social work profession places a heavy emphasis on understanding the person-in-environment and engaging in community practice. GIS tools provide a way to examine physical and social aspects of a community in order to identify community strengths, service gaps, and access needs (Coulton, 2005; Dulin et al., 2010; Hoefer, Hoefer, & Tobias, 1994). GIS is also used to link information related to the economic, social, or health characteristics of a population with distinct areas on a map (Goodchild & Janelle, 2004; Huxhold, 1991; Lo & Yeung, 2007). Specifically for social service agencies and social workers, Queralt and Witte (1998) outlined 15 potential uses of GIS, which include inventorying an agency's services and clientele, mapping the flow of clients to and from community services, and determining areas in need of special outreach initiatives.

Review of current literature on the application of GIS in the social sciences indicates that it has been successfully, though sparsely, used for examining geographical differences in service utilization. A few researchers used mapping techniques to examine service utilization ratios within a given geographic area—for example, the number of child care slots per 100 children in a specific census tract (Queralt & Witte, 1998) or the number of home- and community-based long-term care service users compared to the total number of Medicaid recipients in a county (Goins & Hobbs, 2001). Other researchers mapped service utilization in one specific location compared to utilization in the broader surrounding area. As an example, Wong and Hillier (2001) highlighted specific census tracts with lower ratios of participation in homelessness prevention programs compared to the overall city. Their maps helped identify underserved areas. We advance this literature by presenting a service use index that draws on publically accessible census data and agency service data, and by highlighting its application

through a county-level map. Although we highlight geographic differences in community-based long-term care service utilization among older adults in Kansas, the service use index is applicable across a wide variety of practice settings.

Impetus for Examining Differences in Service Utilization

Kansas, like many other states, is experiencing several simultaneous demographic shifts. Many of our rural counties are rapidly losing population. However, older adults are more likely to remain in rural areas than are younger people. Simultaneously, our state has experienced an influx of immigrants in some of our rural as well as urban counties. Further, the non-immigrant racial and ethnic minority population is growing. Given these realities, our state department on aging was interested in examining how service utilization patterns of older adults differed by rurality, income, race, and ethnicity. In this article, we focus on the following specific research question posed by the state department on aging:

> Are older adults living in rural counties receiving state-funded long-term care services at the same rate as the entire older adult population?

To answer this question, we developed the service use index as a meaningful tool for examining service utilization. We identified the total number of individuals who had received an assessment through the Area Agencies on Aging (AAA) for community-based long-term care services. The AAAs in Kansas provide a variety of federal and state funded services to older adults. Assessments administered by the AAAs determine if older adults are eligible to receive home- and community-based services from the Medicaid Home and Community-Based Services for the Frail Elderly (HCBS/FE) waiver, Older Americans Act (OAA) services, and/or Senior Care Act (SCA). The HCBS/FE waiver provides a variety of long-term care services for adults aged 65 years and older who qualify for Medicaid and meet functional eligibility criteria. OAA services examined in this study include nutrition services (both congregate and home-delivered meals) and supportive services such as transportation, attendant care services, and homemakers. The SCA is a state and locally funded program for Kansas adults aged 60 years and older who are at risk of NF admission and who are low income but do not qualify for the HCBS/FE waiver. SCA services vary by county, but available services include attendant care, respite care, homemaker, chore services, adult day care, and transportation (Kansas Department for Aging and Disability Services, 2012). Once eligibility is determined, these home and community-based services are provided to assist older adults to remain in their home and avoid nursing home placement. This study did not include informal care or privately funded social services.

Development of the Service Use Index

In order to construct a service use index and analyze service utilization statewide, we employed a two-step approach. The first step was to construct an index for the use of home- and community-based long-term care services that compared service utilization of all Kansas adults aged 60 and older with subgroups of these adults meeting designated criteria (e.g., low-income, rural residence, racial and ethnic minority status). We identified the proportion of older adults

who received assessments for services and who received services by integrating state agency data with publically accessible census data. The second step was to map the service use index for each county in Kansas, enabling a visual comparison of the utilization of older adults who are members of the subgroups to the utilization of older adults in general within each county.

The focus of this article is the introduction of a practice tool for identifying differences in service utilization and understanding its value for planning efforts to address these differences. In order to explain the calculation of the service use index and illustrate the visual benefits of subsequent mapping, we selected one subgroup of older adults for this article. The subgroup highlighted in this article for illustrative purposes are older adults who live in rural counties. We utilized county-level urban influence codes published by the Economic Research Service of the U.S. Department of Agriculture. The urban influence codes measure rurality by assigning all U.S. counties to a scale ranging from 1 (*the most metropolitan*) to 12 (*the most rural;* U.S. Department of Agriculture, Economic Research Service, 2003). In this study, counties with 9-12 urban influence codes were considered rural.

Calculating the Service Use Index

Figure 1 presents the formula for calculating the service use index. As shown, this formula can be applied to any group or population by gathering available service utilization data and comparing it to population-level data such as the census. Since the service use index represents a standardized measure, it is particularly useful in highlighting differences in service utilization among different groups. From this calculation, a service use index of 1.0 indicates that the group (e.g., older adults in rural counties) received assessments for services at a similar rate to the total population (e.g., older adults in all Kansas counties). An index less than 1.0 indicates that the group received services at a lower rate, and an index greater than 1.0 indicates

For each geographic area, the formula to calculate the service use index is:

$$\text{Service Use Index} = \frac{SR_G / POP_G \quad \text{(Group Ratio)}}{SR_T / POP_T \quad \text{(Population Ratio)}}$$

SR_G: Number of service recipients in a particular subgroup (e.g., older adults in rural counties)

POP_G: Number of people in a particular subgroup

SR_T: Number of service recipients in the total population (e.g., the total older adult population in all counties)

POP_T: Number of people in the total population

Figure 1. Formula for calculating the service use index.

that the group received services at a higher rate than the total population. The further from 1.0 either positive or negative, the higher or lower the group's service utilization is compared to the total population.

To determine the service use index for all counties classified as rural in the state of Kansas, we first calculated a "group ratio" that identified the proportion of older Kansans living in rural areas who received assessments for services. Using the 2004 Kansas Aging Management Information System (KAMIS) data, we first identified the number of adults aged 60 and older living in rural counties who received assessments for HCBS/FE, OAA, and/or SCA services ($n = 10,992$). We divided this number by the number of older adults living in rural counties identified by the 2000 U.S. Census Bureau ($n = 79,603$). The formula to calculate this group ratio is: SR_G divided by POP_G, where SR_G is the number of service recipients in a specific population group and POP_G is the total number of people in that specific population group. In our case example, we divided 10,992 (SR_G) by 79,603 (POP_G) and found that the "group ratio" was 0.138. Table 1 illustrates the calculations for the index of service for adults 60+ who received assessments in rural, midsize, and urban counties.

Table 1

Calculations for Index of Service Use for Older Adults Who Received Assessments for Services by Geographic Category

Geographic Category	# Older Adults Received Assessment (SR_G)	# of Older Adults per Group (POP_G)	Group Ratios & Population Ratio	Index of Service Use
Rural	10,992	79,603	0.138	1.5
Midsize	13,034	130,584	0.100	1.1
Urban	17,050	244,650	0.070	0.8
Total	41,179 (SR_T)	454,837 (POP_T)	0.090	

Note. Calculation for the total number of older adults who received an assessment includes 103 individuals who were assessed but did not have county specified. Calculation for the Index of Service Use is the Group Ratio divided by Population Ratio.

The service use index builds on the group ratio by comparing it to a "population ratio," which, for this example, identifies the proportion of the total older adult population in Kansas who received an assessment for services. Similar to the group ratio, we calculated the "population ratio" by dividing the number of those in the total population who received an assessment ($n = 41,179$) by the number of people in the total population ($n = 454,837$).

The formula to calculate this group ratio is: SR_T divided by POP_T. In our case example, there were 41,179 adults aged 60 years and older who received an assessment for community-based long-term care services through the Kansas AAAs. We divided 41,179 (SR_T) by 454,837 (POP_T) and found that the "population ratio" was 0.09. Lastly, we obtained the service use index by dividing the group ratio (0.138) by the population ratio (0.09), which in this case example is 1.5. This can be then be compared to a service use index of 1.0 for the total older adult population. Therefore, older adults living in rural counties are receiving assessments for state-funded aging services at 1.5 times the rate of all older Kansans. Further, this can be compared to service use of indexes of 1.1 for older adults in midsize counties and 0.8 for older adults in urban counties.

When using these tools, the choice of which groups to examine will be decided by the individual social service agencies. For this study, the state department on aging wanted to further understand the utilization patterns of those who were low income, since some community-based long-term care services specifically target these individuals. Given the expected higher rates of service utilization for those who are low income, the examination of those living in rural counties and who were low income provided further opportunities to understand whether the targeting goals of the agency were being met. Therefore, in order to understand differences in service use by program and income level, we calculated the Service Use Indexes illustrated in Table 2.

Table 2

Index of Service Use for Any Service and Individual Services for Low Income Adults Compared to the Total Older Adult Population by Age and Geographic Category

Geographic Category	Any Service		HCBS/FE		OAA		SCA	
	60+	85+	60+	85+	60+	85+	60+	85+
Rural	1.9	1.1	7.1	3.8	1.6	0.9	2.8	1.6
Midsize	2.6	1.6	6.6	3.8	2.0	1.3	3.0	1.7
Urban	4.4	2.0	9.2	4.1	3.9	1.8	4.0	1.8

Note. HCBS/FE = Medicaid home and community-based services frail elderly waiver; OAA = Older Americans Act services; SCA = Senior Care Act services. The index of service use for the total older adult population is always 1.0.

Table 2 provides the index of service use for adults aged 60+ and 85+ with low income by geographic category and type of service compared to all older adults in Kansas. As presented

in Table 2, rural/low income older adults are relatively underserved if compared to low income populations in either urban or midsize counties. Specifically, adults aged 60+ who were rural and low income received any HCBS/FE, OAA, or SCA service at 1.9 times the rate of the general population in Kansas compared to the rates of adults 60+ with low incomes in midsize (2.6) and urban counties (4.4). Rural adults 85+ who were low income received services at similar rates as the general population (1.1) compared to adults 85+ in midsize (1.6) and urban counties (2.0). For rural adults aged 60+ with low incomes, HCBS/FE services were utilized at a rate 7.1 times the general population, OAA services were utilized at 1.6 times the general population, and SCA services were utilized at 2.8 times the general population.

Mapping and GIS Techniques

After calculating the service use index for each county in Kansas using the calculation as described in Figure 1, we mapped this standardized measure of service utilization for older adults living in each county relative to the total older adult population. We utilized ESRI's ArcMap 10.0 software to create a map that allowed us to examine geographical differences across counties. Figure 2 illustrates differences related to assessments. The shading of counties represents the county's delineation of rural, urban, or midsize with rural counties indicated by the darkest shading. In addition, the counties with the largest circles represent counties with the largest index of service use (1.7 or higher). Therefore, it is possible to look at the number of darkly shaded counties (rural) with a large dot (index of service use of 1.7 or higher) as compared to the number of lightly shaded counties (urban) with a large dot in order to examine the trend in penetration rates. As shown, there was considerable geographical variability in the service use index across counties. Further, the index of service use in most urban counties was less than one (as indicated by the smallest dot), meaning that older adults in these counties were assessed at a rate lower than the state average.
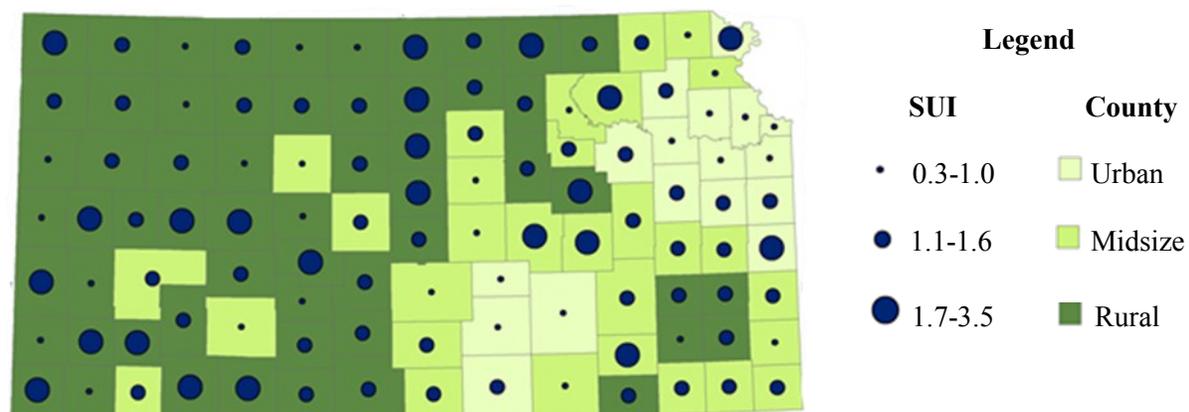

Figure 2. County-level service use indexes on assessments for adults aged 60 and older in rural, midsize, and urban counties compared to the total population aged 60 and older. Overall index of service use for adults 60+ = 1.5 in rural counties; 1.1 in midsize counties; 0.8 in urban counties.

Mapping the service use index by county made it possible to visualize the geographic locations with high and low service utilization for older adults in each county relative to all older adults. GIS techniques provide an important tool for quickly and efficiently visualizing these differences in utilization across counties, which was informative for raising awareness of differences in service utilization.

In our case example, we utilized county as a meaningful measure of geography due to the geographic boundaries assigned to each AAA and the division of work within most AAAs by county. However, the specific geographic area of interest (e.g., county, census tracts, or other socially constructed community boundaries) should be determined carefully by the agency staff using the service use index. If assigned arbitrarily, practitioners and administrators could make inferences that lead to erroneous conclusions. One concern worth noting regarding the aggregation of individual level data into spatial patterns was identified as the "modifiable areal unit problem" by Openshaw (1984). Hayward and Parent (2009) found that poverty rates were statistically different based on how area units were divided (i.e., county vs. tract vs. district). In analysis of other variables, we saw greater variability between counties than was seen at the AAA and state-level. Given the potential for vastly different interpretations of geographical phenomenon, the agency has to decide whether political boundaries such as counties are meaningful or whether more detailed boundaries need to be defined in order to provide meaningful results.

While the county level of specificity was very useful for the examination of trends looking at service utilization by rurality, the methods and techniques described in this article could easily be used to examine service utilization within smaller (or larger) geographic areas—as well as to examine a vast array of services and population. For example, if AAAs have baseline data by county for members of racial or ethnic minority groups, it might be useful to examine the service use index at the level of census tract or city. The reasoning for looking at the smaller areal units would be that interventions and outreach strategies are often implemented at that level and then expanded outward to the county and eventually to the entire AAA. The service providers are the people who can determine the meaning and implications of data that highlights differences in service utilization.

Benefits of the Service Use Index and Mapping Using GIS Techniques

The tools presented in this article (i.e., the service use index and mapping using GIS techniques) can benefit researchers, practitioners, community leaders, and policymakers in many ways. By using agency service data and publically accessible census data, this tool provided an easy to understand method for communicating to service agencies and policymakers the utilization of services of a specific group relative to the larger population. By mapping the service use index in each county, it was possible to visualize and quickly identify counties with higher utilization rates as well as counties with lower rates, which indicates a need to look more closely at service utilization in those areas. County-level service use indexes and a statewide map provided a valuable starting point for discussions with AAA case managers. Thus, one of the primary benefits of the tools presented in this article (i.e., the service use index and mapping) is that they are easily understood by social workers, community leaders, and policymakers. Further, these tools can be used by social workers to provide preliminary answers about whether services are reaching their intended target groups.

Importantly, the use of this tool by itself clearly will not indicate whether services are adequate or what factors may be influencing utilization patterns. Rather, the service use index is a tool that can help motivate and focus examination of patterns of service utilization. By examining service utilization at different levels of specificity, social service agencies can learn a great deal about the different groups who utilize their services and the geographic patterns of service utilization (Higgs, 2009). After calculating the service use index and displaying these data on maps, stakeholders should carefully examine specific conditions in geographic areas in order to understand the variations noted on the map. This examination could facilitate a better understanding of how to define the communities utilizing specific services, which Coulton (2005) identifies as an important component for enabling change. Additionally, it could ensure that the aggregation of individual level data into spatial patterns is not resulting in a skewed understanding of service utilization patterns, as cautioned by Openshaw (1984) and demonstrated by Hayward and Parent (2009).

Useful practice and outreach strategies identified in geographic areas already serving a comparatively higher proportion of individuals in a particular group could be used to inform social work practices in areas with lower utilization rates (e.g., Dulin et al., 2010; Han & Stone, 2007; Queralt & Witte, 1998; Wong & Hillier, 2001). Service agencies can identify areas that warrant further study to determine potential factors influencing the lower utilization rates (e.g., Arcury et al., 2005). Additionally, since the service use index does not reflect differences in the actual need for services or the proportion of individuals who would benefit from services, social workers and administrators should draw on their knowledge of service needs and expected trends in service utilization for particular groups to make conclusions about the adequacy of service access and utilization. Thus, the calculation and mapping of the service use index provides social service agencies with a useful tool for identifying areas that need further exploration to determine factors influencing service utilization.

Especially at times when social service budgets are tightening, health and social service agencies need strategies for understanding the services provided by their agency and identifying any differences in service utilization among groups they serve (McLafferty, 2003). The service use index coupled with GIS techniques provides a way for agencies to identify differences in service utilization and effectively illustrate findings to staff, the community, funding agencies, and policymakers. This information can be used to help policymakers more quickly identify areas where subgroups may be underserved and, when combined with practice knowledge, can be yet another tool to help garner funding for services to groups in need.

Monitoring Service Use

In this case example, we calculated the community-based long-term care service use index for older adults living in rural counties relative to the total older adult population at one point in time. This creates baseline data that can be used in the future to determine changes in service utilization rates for this particular group of older adults relative to the total population. Once baseline data are collected, the calculation of the service use index on a regular basis can alert service providers to changes that may occur as the population of older adults increases or decreases in number within a particular geographic area. Additionally, this follow-up analysis can be used to understand the outcome of reductions or additions to service agency budgets. We

plan to complete a follow-up analysis of service utilization among this group now that the 2010 Census data are available.

The lag in census data updates was a limitation for our study in that the census information was somewhat dated. However, changes in the census as a mechanism for collecting information about population characteristics now means numbers will be reported more frequently. With the Census Bureau's implementation of the American Community Survey in 2005, population characteristics and other information previously collected on the decennial census long form are now available on a yearly basis. These yearly updates of population characteristics will increase the accuracy of the data and the viability of the service use index as a meaningful measure of service utilization for agencies, communities, and policymakers. The collection of accurate longitudinal data on service utilization patterns will be valuable for agencies, communities, and policymakers.

Conclusion

This conceptual article presented a cross-sectional examination of service agency data combined with census data to create a service use index and provide baseline data for the AAAs as they continue to work to improve services to older adults. This application of GIS technology using maps can enhance delivery, administration, and evaluation of social services. Examining the service use index at a future date will help agencies determine whether and how service use has changed. Our intent in writing this article was to demonstrate how a service use index could be calculated, mapped, and tracked over time to provide social workers with new tools to improve service delivery to older adults in a wide variety of service arenas. Further, service providers and policymakers across fields of service and target populations can use the techniques explicated in this article for calculating and mapping service use to illustrate geographic variations in service usage as a first step in developing policies and programs to reduce service gaps and disparities.

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