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The zip (postal) code difference: methods to improve identification of rural subgroups

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ABSTRACT

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Over the past decade national policymakers have grappled with the increasingly difficult issue of implementing programs which sustain the viability of the rural health care system. The set of problems that are of major concern to these decisionmakers include: (1) the shifts in the utilization patterns away from the rural health care delivery system; (2) the impact of modification in the health care reimbursement system which disproportionately favors urban health systems; and, (3) the continuing difficulty in affecting the disproportionate supply of health providers in urban areas compared to rural settings.

The complex nature of health services research demands a multidisciplinary approach especially on sociocultural problems such as rural health delivery. Effective analysis in health care crosses many disciplinary boundaries such as medicine, nutrition, economics, sociology, and public health among others disciplines. A major concern to many of these rural health research analysts is the ad hoc treatment of the rural populace in federal and state health policy decisionmaking. The key to understanding the variance in treatment of rural health can be appreciated by reviewing the accuracy of rural definitions.

In the present study, a refined rural definition is proposed which will assist research analysts in providing greater information on the distribution of rural health care services. A preliminary analysis of the proposed definitions indicates that a more precise measurement of rural provides greater accuracy in determining the medical needs of rural areas.

Adaptation of the concept will benefit the decisionmaking process through improvements in the methodological approach to rural health research. State legislators, regional and state planning agencies, federal funding agencies, foundations, and other programs involved in support of rural life program will be better able to assess the impact of programs through use of the new definition. Finally, a refined typology for rural will also effect other research endeavors and appears to be generalizable to research on other pertinent rural delivery issues such as transportation, education, and regional planning.

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INTRODUCTION

The continuing escalation of health care costs has been a dramatic, unresolved problem throughout the United States requiring the joining of medical, legal and social science experts to develop policies to contain these costs. Many of these cost containment strategies have unintentionally undercut the fragile rural health care safety net through the implementation of health care policies directed primarily at the urban health care delivery system. Vague definitions used to designated rural areas contribute significantly to the problem of adequately determining medical needs assessments for rural areas. For example, the ability to provide a minimum acceptable emergency medical service within a geographic areas is not accurately assessed using the residual definition of rural implied by the Unites States Census urban-rural definition. In addition, accurately assessing te shortage of medical services in rural counties is not possible if it is assumed that very sparsely populated areas, that are often unable to sustain even basic services due to insufficient numbers of people, are similar to rural counties immediately adjacent to large urban areas.

It is the intent of this study to assist planners and decisionmakers in rural health policy in determining the appropriate and most accurate rural definition for their respective regions. By reviewing current rural definitions used in health policy decisionmaking, we argue that greater specificity is needed so as to capture the geographic diversity of the rural sector. Underlying this concern for greater rigor in defining rural areas, is the fear expressed by many advocates of rural health that the ad hoc designation of rural areas has contributed to the inherent urban bias in health policy. Thus, a first step in addressing this more general rural health problem is re-examining selected rural definitions and evaluating those that hold the greatest promise in providing accurate information on the rural health care delivery system. Key to addressing this latter point is selecting those rural definitions that best illustrate the distribution, hence access to, health care services.

Rural definitions for populations have been generally treated as residual definitions where areas not designated as urban were by default rural. Such an approach is rooted in criteria adapted by the United States Census Bureau which defines rural in relation to urban criteria. Explicitly the definition states that:

> "urban and rural are type-of-area concepts rather than specific areas outlined on maps. As defined by the Census Bureau, the urban population comprises all persons living in urbanized areas (UAs) and in places of 2500 or more inhabitants outside UAs. The rural population consists of everyone else. Therefore, a rural classification need not imply farm residence or a sparsely settled area, since a small city or town is rural as long as it is outside a UA and has fewer than 2500 inhabitants." (Census of Population and Housing, 1980).

Another common definition of rural which also uses the residual approach is the United States Department of Labor designation of Metropolitan Statistical Areas (MSAs). The definition describes an MSA as:

> "a geographic area consisting of a large population nucleus - a census-defined urbanized area – together with adjacent communities that have a high degree of economic and social integration with that nucleus." (Bureau of the Census, 1986).

These analytical definitions provide exclusion selection criteria to define rural areas and focus primarily on town size criteria applied uniformly at the zip-, census tract-, and county-level. In addition to these definitions, there are an array of programmatic definitions used by decisionmakers to facilitate access to federal funds by selected target groups in rural areas. As an example, the Farmers Home Administration uses three general population categories to define rural depending on the purpose of the program (i.e. less than 2500, 2500–10000, and 10000–50000 population). In some cases, further refinements have been adapted for specific programs such as the FHA rural housing loan program criteria where rural is defined as areas of population less than 10000 and also communities of 10000–20000 population not located in a metropolitan statistical area.

Similar to the analytical definitions, federal urban program definitions implicitly define rural through the application of exclusion criteria (Giford and Ingrams, 1986). For example, criteria used for the distribution of Urban Block Grants uses exclusion criteria when defining the population eligible for funding under the program.

Other approaches to rural definitions that are less entrenched in the Federal statistical and bureaucratic norms include ecological, occupational, economic, and sociocultural definitions. Ecological definitions rely on population density measures as a defining measure of rural (GPO, 1983). Geographic isolation combined with low population density is generally considered a necessary criteria for rural.

Occupational and economic definitions of rural are characterized by the extent to which various occupational or economic categories contribute to the economic infrastructure of a defined area (Bender et al., 1985). A recent extension of the occupational approach in defining rural was developed by the United States Department of Agriculture (USDA). In the USDA model, the standard nonmetropolitan county classification is further subdivided according to the common employment characteristics of the county. The study developed seven county groups based on the dominant economic contributor to the local economy and an eighth group which represented a mixed contribution by the identified sectors. The county groups include: (1) farming dependent, (2) manufacturing dependent, (3) mining dependent, (4) specialized government, (5) persistent poverty, (6) federal lands; and (7) destination retirement.

A final methodology which is used to define rural but which is not widely applied in research is the sociocultural definition. The definition focuses on the relationship between the social system of a community and the 'rural culture'. Since sociocultural definitions rely on popular perceptions of rural behaviors and values that typify rural communities and exhibit a high degree of variability with little ability to develop a gradient measure, this approach provides only limited utility in health services research.

Given these three definitions, the most empirically useful and complementary definition to established analytical and programmatic definitions is the ecological definition. The ecological approach allows for gradient measures of rural which contrasts with the use of dichotomous measures commonly used in analytical definitions. The application of an ecological approach should, therefore, result in a more precise measurement of the geographic diversity of the rural population.

The work of Frank Popper has clearly illustrated the successful application of an ecological definition to an important subset of the rural population. Popper, in his article "The Strange Case of the Contemporary American Frontier", adapts a 19th-century population frontier measure of six people per square mile (2.56 km^2) or less and adjusts it to the county level (Popper, 1984). Popper refers to frontier as "an area that at most can be marginally cultivated with the agricultural technologies of the time." Although not useful for our purposes, this general definition underlies his population density measure.

Using this method, he isolated a subset of county-level, rural areas which are now commonly referred to as 'frontier'. In applying the measure, Popper calculated that there are 394 frontier counties representing 45% of the continental land mass of the United States with a total population of 2.239 million people or less than 1% of the American population.

Popper's measure, however, does not provide for gradients of rural which exist for many of the counties defined in his study. The distinction appears on the surface to represent a substantial limitation to Popper's work due to the extensive variability of county size across the nation. For example, the average size of counties from a geographic perspective increases substantially as one moves from east to west. An additional problem is that some 'frontier' counties contain metropolitan communities surrounded by large expanses of geography where no population resides.

Popper's re-appraisal of the American frontier combined with the inaccuracies of programmatic and analytical definitions of rural areas has stimulated interest among policymakers to consider gradient definitions of rural based on his suggestions. In particular, the term frontier has been promoted by some rural health policymakers in an effort to alleviate perceived biases in healthy policy decisions based on urban exclusion definitions and to

promote access to Federal health programs specifically targeted for rural communities. For example, the United States Department of Health and Human Services adopted the frontier concept under their guidelines for approving federal assistance to Community Health Centers (Section 330 of the Public Health Service Act). The expansion of the rural definition to include the frontier concept was proposed in order to implement a specific rural strategy within the Bureau of Health Care Delivery and Assistance (BHCDA) for a population in need of services.

The interest in refining the definition of rural to include Popper's formulation is not only evident at the federal policy level, but also at the state level. In legislation adopted by the 1987 Montana State Legislature explicit reference to frontier areas was made in defining a new type of health facility, the Medical Assistance Facility (MAF) (Montana Legislative Council, 1987). Other similar efforts to include consideration of the unique characteristics of frontier areas are evidenced in California and Utah where the health service departments are increasingly concerned with the delivery of health services in these unique areas.

METHODS

Population and area data for the state of California were obtained from Dr. Jeffrey Gould of the School of Public Health at the University of California–Berkeley who aggregated census tract data to the zip (postal) code level. There were a total of 2332 zip codes within the state before dropping recoded zip codes. Recoded zip codes refer to post office box zip codes and zip codes that are new since the 1980 census. After dropping duplicate zip codes from post office boxes and recoding of new zip codes to their prior population base, there were 1506 zip codes in California. Of these zip codes 336 were dropped, 115 of which crossed county boundaries and 56 identified with '00' which indicates a city such as Los Angeles, but no specific land area or population. Due to problems in coding, a significant number of the missing zip codes were from San Bernadino county.

Using the 1980 population census and the number of square miles in the zip code, a population per square mile was calculated for each zip code. The lowest population density range in the typology was designated as a frontier area with less than six people per square mile according to the definition developed by Popper (1984). The next rural population density ranges selected were 'rural', 6–15 people per square mile; and, "semi-rural', 16–30 people per square mile. The ranges were selected as representative of non-frontier and non-urban population density ranges after conferring with Robert Van Hook, Executive Director of the National Rural Health Association. Zip codes with a density of more than 30 people per square mile were

considered urban for the purposes of the study. Approximately 27% of the California zip codes examined in the study fell into the proposed population density ranges.

For comparative reasons, California summary county data was also needed. The data on county population density measures was obtained from the *California Almanac* (California Department of Finance, 1986–87).

Elison (1986) suggests a larger population density measure of more than six but less than 100 people per square mile to define rural. Elison uses the same Popper population density measure to define frontier. The appropriateness of the larger rural population density range in contrast to the smaller ranges for rural and rural fringe examined in our study merits future empirical analysis.

The first question addressed in the study was the distribution of rural subgroups in California. Counties were classified as frontier, rural semi-rural, and urban on the basis of overall county population density and classified on an individual zip code level. The later point was to provide greater detail to the Popper definition. A second concern addressed the need to identify the relative distribution of the population within the defined rural subgroups (i.e., where were the most rural people living?). As a result, the second question introduced a population-based component to the definition of rural which allowed for a greater degree of specification in determining the density of rural subsets within a county. Finally, we were interested in determining if particular rural subgroups tended to be the dominate type for certain counties. Through such an analysis we were able to address the issue of geographic area concentration.

After isolating the rural divisions within California counties, we were concerned with the differences in access to hospital care by the three rural types. Access to hospital care was defined as the relative geographic distance from a facility based on the rural type of a zip code area. Two specific questions addressing the access issue were: (1) What was the average distance from the patient zip code to the nearest hospital zip code by rural type (i.e., frontier, rural, and semi-rural)?; and (2) What was the proportion of people within each rural type by distance to the hospital? The second question provided an opportunity to focus on the distance to a hospital within particular zip codes. One would expect that, on average, frontier patients would travel further to the hospital and that a higher percentage of these patients would be concentrated in the larger travel distance categories.

MEASUREMENT RESULTS AND DISCUSSION OF RURAL HEALTH CARE ACCESS

An analysis of both county and zip code level data indicate that over 99% of the California population is concentrated in urban areas. Thus, California

TABLE 1

Percentage of zips classified on the basis of overall county and individual zip codes by rural-urban type

Urban	Frontier	Rural	Semi rural
Number zips			
County			
1380	3	61	62
Individual			
1192	100	105	109
% Population			
County			
99.12	0.016	0.350	0.510
Individual			
98.44	0.190	0.590	0.780
% Land area			
County			
79.8	1.0	12.1	7.1
Individual			
48.2	22.3	18.3	11.2

as compared to a more rural state such as North Dakota cannot be classified as a predominately rural state. However, the total rural population in California is considerably larger than the rural population in North Dakota. In fact, the rural subgroups within these two different states could exhibit similar characteristics if a more refined ability to define rural was available.

Our analysis revealed that the disaggregation of the data at the zip code level, therefore, provides a superior delineation of rural subgroups within a state and can assist in identifying hidden rural segments of more urban counties. Using zip code level data we concluded that 6.64% of California zip codes were frontier areas; 6.90%, were rural; and, 7.24%, were semi-rural. Table 1 illustrates that not only do the total number of zip codes within each rural subgroup increase but the proportion of rural residents in each category and the land area increases with the more refined zip code measure. Therefore, a zip code level measure is preferable for identifying rural subgroups since it allows for intracounty diversity and a better approach for assessing the relative contribution of rural areas within counties of the state.

Table 2 illustrates the distribution of frontier areas within selected counties. These areas represent the spectrum from highly urbanized to very remote counties. The relative percent of the total state population contributed by these frontier areas is noted. For example, urban Riverside County (i.e. 97% urban population) has the same percentage of the state's frontier

TABLE 2

Percentage of county population in frontier zips and percentage of state populations in frontier zips for selected counties

County	% County pop in frontier zip	% State pop in frontier zip
Fresno	0.30	0.00006
Madera	1.00	0.000179
Mendocino	1.81	0.00005
Mono	29.98	0.0001
Riverside	*0.63*	*0.0002*
San Diego	0.06	0.00005
Santa Clara	0.01	0.000008
Siskiyou	*11.27*	*0.0002*

residents as the very remote Siskiyo county (i.e. 55.5% urban and 11% frontier population). The data clearly suggests that by relying solely on county designations as the method for determining rural subgroups we may gloss over important contributions to the frontier population by non-rural designated counties.

The precise measurement of rural areas is a critical concern in determining geographic access to acute care services which are traditionally provided in hospitals. The use of finer gradient measures for rural and urban subsets illustrates that gross county measures as suggested by Popper are inaccurate in capturing rural and remote areas in very urban counties and ignore population concentrations in towns of more rural counties. Chart I compares the county versus individual zip code level measure for average distance to the nearest hospital by rural subgroups. The average distance to the hospital for frontier residents is as anticipated greater. An analysis of the zip code data for rural and semi-rural areas, however, reveals only marginal differences in travel distance to the hospitals. Clearly, the issue of geographic access to hospital care can be better defined using finer gradient measures such as individual zip codes.

Identifying areas on the basis of individual zip codes may be particularly useful for targeting specific issues. Chart II illustrates the urban and frontier average distance to the nearest hospital using the county-based and individual zip code-based measures. Although the overall magnitude of average distance is higher for frontier residents, the distribution of distance travelled changes considerably according to the type of measurement technique. A much flatter bell shaped curve is derived from using zip code-based data which suggests greater variation than suggested by the county level measure.

CONCLUSION AND POLICY IMPLICATIONS

Important caveats can be derived with respect to reliance on county level population measures for determining specific rural types. First, gross county measures for rural subgroups appears to oversimplify the geographic location of the population. Gross county measures also tend to result in erroneous generalizations about the county's population based on a analysis of the population within that subcategory. Second, a zip code level rural typology provides greater information than county level designations. The greater clarity of the definition allows for a more comprehensive description of rural county populations and rural subsets within urban counties. Third, as suggested from the analysis of the California data, many counties are comprised of a combination of rural subgroups rather than a single type. Although counties may exhibit a general tendency toward a particular rural subgroup, there are often significant variations that merit further analysis or imply a combination of rural subgroup codes for a county. Finally, the extent to which a county is classified more frontier than rural may depend on the relative proportion of the population which live within that rural subgroup.

The issue of defining the rural populace is critical in developing sound rural health policy. By focusing on gradations of rurality as opposed to a homogeneous definition, rural health policy issues can become more clearly defined. For example, frontier areas may require a different federal policy to sustain the viability of services provided in these regions as compared to larger semi-rural areas.

Future research in this area should focus on both the unit of analysis and include a distance dimension. One issue that is not addressed in the present study is a measure of the distance to an urbanized area. Such a variable would clarify our understanding of the relative distance of rural subgroups such as frontier regions to highly urbanized areas. For example, one could include the criteria of distance to a high population density area (e.g., 500 people/square mile) and calculate the zip code distributions within a state and county. Such an approach would enhance the exactness of the proposed measuring device and possibly prevent problems such as the inappropriate combination of resort areas that are accessible to urban populations with truly geographically remote areas.

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