EXAMINING ALTERNATIVE MEASURES OF MEDICAL UNDERSERVICE FOR RURAL AREAS

EXECUTIVE SUMMARY

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The federal government and many states use indicators to identify areas, populations, or institutions as medically underserved or suffering from a health provider shortage in order to prioritize the allocation of programs or resources. The current, most commonly used measures, the Health Professional Shortage Area (HPSA), and the Index of Medical Underservice (IMU), have been criticized as not being precise enough in identifying underservice or as being inappropriate for the programs which use them (U.S. Department of Health, Education, and Welfare, 1980; Taylor et al., 1994). This study used a theoretical model to construct alternative measures of underservice applicable to whole U.S. counties. One of the new, alternative measures identified 657 whole counties as underserved in 1990, similar to the number of Health Professional Shortage Area designations (717) for 1990. The 1990 National Health Interview Survey (NHIS) is used to compare respondents living in counties designated by the test indices as medically underserved to those who do not live in those counties, to determine how well they identify counties which are medically underserved. There is mixed evidence from the NHIS comparison that any of the proposed indices perform better in nonmetropolitan counties, and little evidence that they do so in metropolitan counties because the county is a particularly inappropriate service area in metropolitan areas. This conclusion follows on past research that the HPSA and IMU methods do not do a good job of differentiating areas according to their degree of underservice. The ability to

identify such problem areas successfully is the key to existing general policy of responding to these areas that has been in place for the past 25 years. It is possible that problems with the methods now used are not technical, and that the concept of medical underservice as an "exception phenomenon" for many geographic areas, as opposed to populations within areas, may be flawed.

In order to target assistance to reduce medical underservice, the federal government has relied upon the Health Professional Shortage Area, and the Index of Medical Underservice methodologies to identify areas eligible to receive assistance under various programs meant to improve access to health care. However, the continued use of both the HPSA and MUA methodologies has been criticized over the past 15 years on four main fronts:

(1) areas designated by these methods do not differ from areas not so designated on key outcomes such as physician visits and health status;

(2) they lack sufficient theoretical justification and basis;

(3) they do not clearly define what it is they seek to measure; and

(4) they are used to designate areas as eligible for programs not related to the original intent of the measures.

These critiques are causing policy makers to explore the potential for the combination of the HPSA and IMU into an improved measure or to create new measures that are applicable to specific program needs. The Health Resources and Services Administration (HRSA) has been studying both the HPSA and IMU methodologies for the past two and a half years with a view toward developing a single methodology for use with all federal assistance programs aimed at improving access in local areas.

In the project described here, a research team from the Cecil G. Sheps Center for Health Services Research at the University of North Carolina at Chapel Hill has undertaken a comprehensive review of the use of the HPSA and MUA methodologies and developed several alternative indices of medical underservice. The first year of our review of the HPSA and IMU methodologies produced the following conclusions:

1. There are some conceptual problems with both the HPSA and MUA methodologies, but changes made to them could have large consequences.

2. Definitions of 'underservice' and 'provider shortage' should be made clear when developing any new methodology.

3. Policy goals of programs should fit the definition of underservice/provider shortage adopted to designate areas eligible for programmatic assistance.

4. The unit of analysis for these types of methodologies may begin to shift away from counties or other localized geographic areas and toward population access to a larger health care delivery system that may be geographically dispersed.

5. The biggest practical issue for any methodology is what data are needed and who is responsible for designation of areas as eligible for assistance using the methodology.

6. Any change in methodology for designating eligible recipients for assistance will probably create winners and losers, making any change politically difficult.

These six conclusions formed the starting point of our efforts to develop an alternative means of designating counties as medically underserved. Our efforts to develop an alternative means of designation were guided by clearly defining the term (defined as systematic access barriers to primary care in this research), suggesting a conceptual model of medical underservice, and testing several representations of this model with LISREL® using 1990 county-level data from the Area Resource File. Respondents to the 1990 National Health Interview Survey (NHIS) living in counties designated as medically underserved by each of the test indices are compared to those respondents living in counties not so designated in order to determine if they differ on several measures of access and need. This research produced five alternative indices of medical underservice (hereafter called the test indices) that have been compared to each other as well as to the HPSA methodology and the IMU.

Policy Review

Since their introductions in 1974 (IMU) and 1978 (HPSA), the two indicators have undergone some minor changes in their structure but they remain basically the same as when they were first applied. The HPSA measure has been changed formally by legislation and regulation to include a prioritization process while the MUA has remained essentially a ranking system for counties with a liberal cut-off level for qualification as a medically underserved area. The HPSA depends largely on the physician-to-population ratio but the threshold level of one primary care physician to 3,500 people in a "rational medical service area" can be modified down given high levels of need indicated by infant mortality, poverty or other factors. The HPSA designation process has been largely a locally initiated process with the federal Division of Shortage Designation, Bureau of Primary Health Care, HRSA responding to applications and requiring areas to re-apply after three years of designation. The Division was reported to have significant lag times in the application and appeals process during the recent past but has cut turnaround time for decisions to 30 days in most instances. The designation process created a need for a response on the part of state- and local-level officials who sought designation to support needed primary care services in selected communities. Officials in certain states and localities

became adept at identifying and supporting applications with timely and appropriate data while other localities were unable to cope as effectively with the process. This created a situation where certain areas of the nation were more likely to have designations than others independent of the actual local situation.

The number of areas designated as MUAs remained fairly stable over the period 1974 to 1995; there has not been a comprehensive designation of counties since 1981 and fairly few changes in the listing of MUAs are made every year through application to the Division. There has been substantial change in the number of HPSA areas, populations, and facilities designated, with a steady upward trend in the total appearing since 1990. A significant number of designations have been continuous or "chronic." Fifteen percent or 352 nonmetropolitan and four percent or 30 metropolitan counties have been designated every year since 1978. Another 458 partial nonmetropolitan and 259 metropolitan counties have been designated more or less permanently. Seven hundred forty-seven counties or 24 percent of all counties have never been designated.

## Table I: Persistence of Designation by Location of Counties

	Nonmetropolitan Number (percent)	Metropolitan Number (percent)
Chronic Whole	353 (15%)	30 (4.1%)
Chronic Partial	458 (19.5%)	259 (33%)
NonChronic	997 (42.5%)	250 (33.8%)
Never Designated	535 (22.8%)	212 (28.7%)
Total	2,343 (100%)	751 (100%)

The IMU is a score assigned to an area based on four factors: population-to-primary care physician ratio, population over 65, infant mortality rate, and percent of population below poverty. The scoring system assigns a pre-determined weight to each item for a county or a designated area and those areas which have a score of 62 or lower are designated. The designation status of a county or portion of a county on the HPSA and IMU measures often does not agree. In 1980 123 nonmetropolitan and 6 metropolitan counties had an Index of Medical Underservice score below 62 but had never been designated as HPSAs. In 1990 these numbers dropped to 82 nonmetropolitan and no metropolitan counties, showing that a number of counties which appear to have problems based on the IMU have never been designated as a HPSA, again pointing out the importance of local initiative in HPSA designation.

Construction of a Theoretically Driven Measure of Underservice

A conceptual model of medical underservice was developed to guide the statistical quantification of this phenomenon (Figure 1). The adopted definition of medical underservice allows for the existence of one or many access barriers, as well as allowing flexibility in the size of the population (unit of analysis) for which medical underservice is the focal problem. Potentially, the unit of analysis could range from the individual to an entire nation. The key elements in describing a health care delivery system, regardless of the unit of analysis, are the provision of services to those who need them, often expressed as demand, the available resources to meet need/demand or the health system infrastructure, and the degree to which a population can access those resources.

Figure 1: Conceptual Model for Determination of Underservice
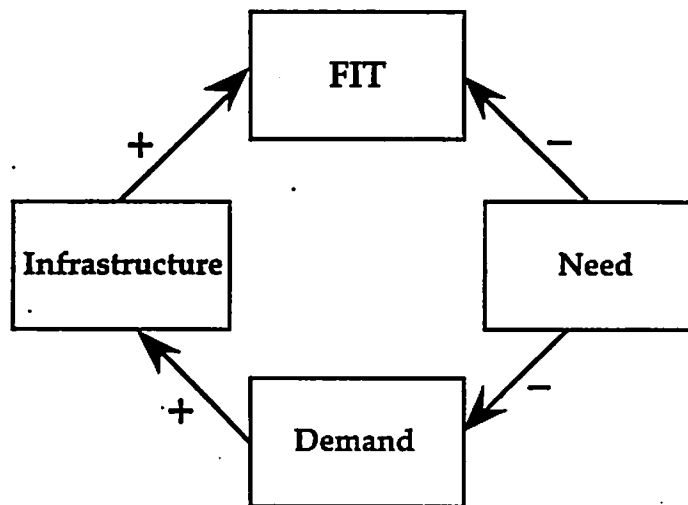
Note: Signs show hypothesized direction of influence.

The second year of this project began with a review of general literature on need and utilization of primary health care as the basis for the development of a theoretical model of underservice. The literature pointed to three general factors that could be measured at the community level as describing underservice: Infrastructure, Need, and Demand. Examples of the variables used to represent these concepts include: for Need—percent of population over 65, crude mortality rates, percent below poverty, per capita income; for Infrastructure—primary care providers, medical specialists; and for Demand—percent population college-educated, percent with white collar jobs. For the purposes of this project, all of the variables related to the individual county since these data were the most readily available and most variables were drawn for the year 1990, or the closest year available to 1990. The project recognized that rational service areas were often parts of counties or multiple counties, but this estimation is an

initial effort to develop several alternative indices that would need much fine tuning to make them practically applicable nationally before they would be useful as resource allocation tools.

A model containing the three factors believed important in defining underservice was estimated using the LISREL (structural equations) technique to obtain quantitative estimates of the degree of "fit" between the health system (Infrastructure) and the local population (Need and Demand). The degree of "fit" between these is how access problems, the essence of medical underservice, are defined in this research.

Several alternative models based on the conceptual model depicted above in Figure 1 were estimated and counties were ranked according to the factor scores (summary statistics) produced by the LISREL estimation to produce several relative indices of medical underservice. Figure 2 shows the three statistical models which produced the three test indices of medical underservice (TIMUA, TIMUB, TIMUC). Counties falling into the bottom quartile for nonmetropolitan and the bottom decile for metropolitan counties on the relevant factor scores were classified as "medically underserved." These cut-points were chosen because they approximated the cut-points used in scales to determine underservice in the HPSA and MUA systems. The test index which performs the best on the NHIS criteria (TIMUB) identified 73 metropolitan and 584 nonmetropolitan counties as underserved for a total of 657 counties. This compares to a total 717 HPSA and 757 MUA whole counties designated in 1990. Table 2 shows the number of counties designated by TIMUA, TIMUB, TIMUC, HPSA and IMU.

Figure 2: Path Diagram of the 3 LISREL® Model Estimates

Model 1: TIMUA

Model 2: TIMUB

Model 3: TIMUC
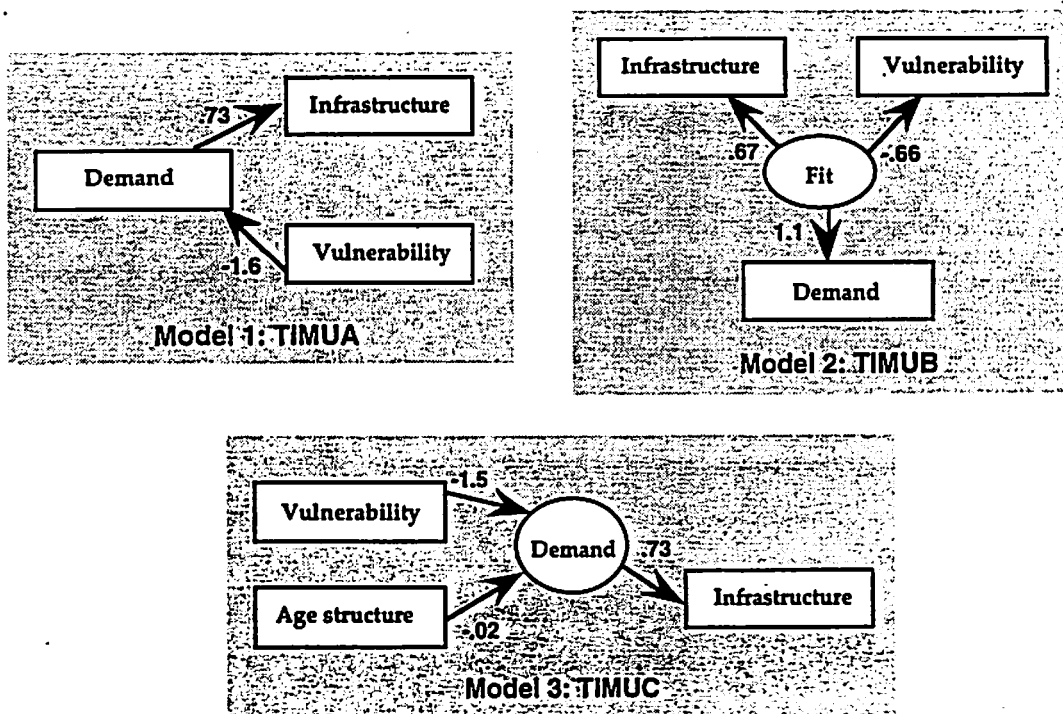
Table 2: Number of Counties Identified by Test Indices A–C, HPSA and IMU

	TIMUA	TIMUB	TIMUC	IMU, 1990	HPSA, 1990	HPSA, 1992
TIMUA	230					
TIMUB	229	657				
TIMUC	51	51	51			
IMU, 1990	177	430	42	757		
HPSA, 1990	149	379	31	422	717	
HPSA, 1992	147	380	31	421	588	722

Note: Each cell shows the number of counties identified by each of the methods which define the cell. The off diagonal cells in the table show the number of counties identified by both of the methods which intersect in that cell. For instance, row 1 column 1 shows that 230 counties are identified as medically underserved by TIMUA.

The designation pattern based on TIMUB identified several geographic areas where communities may not have been aggressive in obtaining HPSA designation. Areas of central Kentucky, west Texas, northern Missouri and southern Iowa were identified by the FIT method as being potentially severely undeserved but not designated as HPSAs (see Map 3).

Use of the NHIS To Assess Test Indices

To externally validate the results of each method for every county in the nation would require developing a survey instrument to measure medical underservice in a sample of counties in the U.S. and comparing the result to those reported in this research. The cost of such an effort would be very large and time consuming and is not practical. In order to try and provide some information concerning the reasonableness of the proposed methods, the 1990 National Health Interview Survey is used. The respondents to the 1990 NHIS who live in counties identified as medically underserved by each of the test indices are compared to those respondents living in counties not so identified on several measures believed to be associated with medical underservice. This is done in order to determine if, in the aggregate, these groups of respondents who differ by whether they lived in a county designated as medically underserved by a particular test index also differ on several measures of need, demand, and access to care—the essence of medical underservice.

This use of the NHIS is conceptually similar to Kleinman and Wilson's use of the NHIS to evaluate the degree to which the Index of Medical Underservice measured medical

underservice (Kleinman and Wilson, 1977). Because of the sample design of the NHIS, nothing can be said regarding a *particular* county and its classification as medically underserved or not, as designated by any of the proposed indices. However, the NHIS comparison does provide valuable information. If the alternative designation methods are valid, we would expect respondents to the NHIS who lived in counties identified as medically underserved to differ from those who do not. If they do differ significantly on measures that are thought to be related to access to care and medical underservice then this is evidence that the indices developed in this research represent a reasonable means of identifying medical underservice.

Four types of indicators are used to compare respondents to the 1990 NHIS who live in nonmetropolitan counties designated as medically underserved to respondents who did not: 1) access/utilization of care; 2) health status; 3) income/poverty; and 4) racial variables. Table 3 summarizes this comparison for nonmetropolitan respondents as designated by the three test indices of medical underservice.

There are few differences found between respondents designated by any of the test indices and those not designated on the three utilization/access measures used for comparison. However, respondents living in nonmetropolitan counties designated by TIMUB are more likely to report not having visited a physician in the past year, and those in counties designated by TIMUC report significantly fewer physician visits in the past year. More consistent differences are detected using the health status/need indicators from the NHIS. Respondents in counties designated by TIMUA and TIMUB are more likely to report fair or poor health status as well as being unable to perform their major activity (such as work or attending school). However, no differences are found for any of the test indices on the total number of conditions reported or the total number of chronic conditions. Using the income/poverty indicators, respondents living in nonmetropolitan counties designated by TIMUB are more likely to report family incomes below poverty, and those living in nonmetropolitan counties designated by TIMUA and TIMUB are more likely to report family incomes less than $20,000. The racial comparison indictors show large differences between respondents living in counties designated by TIMUA and TIMUB but not TIMUC. For the TIMUA comparison, 44.5% of the respondents living in nonmetropolitan designated counties are black while 8.14% of those not in nonmetropolitan designated counties are black. For TIMUB, the same comparison is 31.5% versus 5.8%.

The NHIS comparisons reveal mixed results regarding the ability of the test indices to identify counties that differ from those which are not designated on measures believed associated with medical underservice. In particular, consistent differences in the use of physician services, a measure often considered the ultimate indicator of access were not found. This agrees with earlier research that has generally concluded that the HPSA and IMU do not do a particularly good job of differentiating areas with access problems from those without problems. The ability to

identify geographically distinct groups that are believed to have particular problems in obtaining needed medical services has been central to U.S. health policy efforts to improve access to care. The HPSA and IMU indicators have been used for 20 years to designate areas eligible for resources designed to improve access in spite of evidence that they are not particularly good tools for this purpose. This research has sought to develop a theoretically driven measure of medical underservice that might prove more successful in designating medically underserved counties, but this effort also has been disappointing in its ability to identify areas which differ clearly on the most basic measures of access.

Conclusions

1. There are objective, theory driven ways to identify variations in areas, but they do not consistently differentiate counties based on measures believed associated with medical underservice.

2. The alternative Index B performs similarly to HPSA and MUA in identifying areas with high needs and higher levels of poverty.

3. The methods developed are not appropriate for metropolitan areas, where the county as unit of analysis is too large.

4. Data availability, particularly the unit of analysis that is available, is a large factor in determining the ability to make changes in the present means of designating local problem areas, and may contribute to the inability to produce measures which clearly identify medical underservice.

5. Medical underservice may exist as a small area geographic phenomenon, but efforts to develop methods that convincingly quantify its existence have not been developed in the past or by this research.

6. It is possible that medical underservice is not a small-area phenomenon and is best considered as a symptom of the way the U.S. organizes and finances health services, rather than as areas which represent exceptions.

Table 3

NHIS Comparison of Nonmetropolitan Respondents Living in Designated Counties

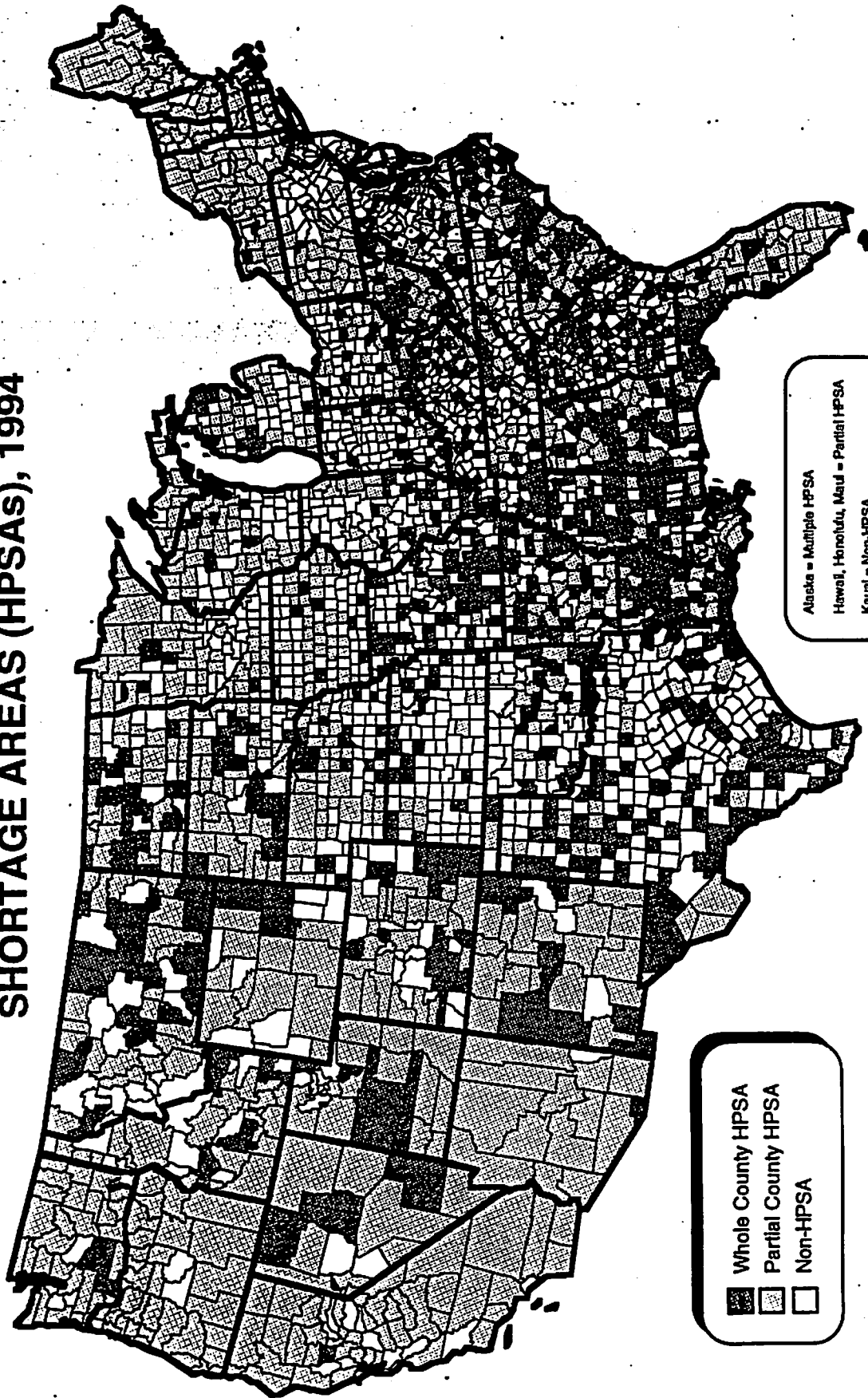| NHIS Variable	TIMUA	TIMUB	TIMUC
Use of Care/Access			
Percent Reporting: Never Seen a Physician	0.31% vs. 0.14% $X^2=0.31$	0.11% vs. 0.15% $X^2=0.31$	0.00% vs. 0.15 $X^2=1.46$
Percent Reporting: No Physician Visits in Past 12 Months	29.7% vs. 23.7% $X^2=2.88$	26.9% vs. 23.4%** $X^2=6.61$	27.3% vs. 23.8% $X^2=0.41$
Mean Number of Physician Visits in Past 12 Months	7.36 vs. 7.65 $t=-0.17$	10.0 vs. 7.28 $t=1.52$	3.29 vs. 7.66** $t=-7.16$
Health Status/Need			
Percent Reporting: Fair or Poor Health Status	20.3% vs. 11.8%* $X^2=5.79$	18.7% vs. 11.0%** $X^2=28.19$	21.2% vs. 12.0% $X^2=1.94$
Percent Reporting: Unable to Perform Major Function	9.3% vs. 4.8%* $X^2=4.61$	7.4% vs. 4.6%** $X^2=10.65$	9.6% vs. 4.9% $X^2=0.90$
Percent Reporting: Needs Help Performing Major Function	13.9% vs. 10.0% $X^2=1.44$	12.5% vs. 9.8% $X^2=3.09$	27.3% vs. 23.8% $X^2=0.90$
Mean Number of Self Reported Conditions	0.92 vs. 0.89 $t=0.33$	0.93 vs. 0.88 $t=0.57$	0.71 vs. 0.89 $t=-1.5$
Mean Number of Self Reported Chronic Conditions	0.83 vs. 0.78 $t=0.42$	0.83 vs. 0.78 $t=0.83$	0.65 vs. 0.79 $t=-1.75$
Income/Poverty			
Percent Reporting: Family Income Below the Poverty Level	25.6% vs. 14.3% $X^2=1.96$	27.4% vs. 12.6%** $X^2=17.14$	32.5% vs. 14.5% $X^2=0.73$
Percent Reporting: Family Income Less Than $20,000	57.0% vs. 41.4%* $X^2=4.71$	55.5% vs. 39.7%** $X^2=18.49$	48.0% vs. 41.8% $X^2=0.22$
Demographic Factors			
Proportion Black	44.5% vs. 8.14%* $X^2=4.06$	31.1% vs. 5.8%** $X^2=11.74$	43.86% vs. 8.95% $X^2=0.83$
Proportion Nonwhite	44.7% vs. 10.3%* $X^2=3.82$	36.6% vs. 7.4%** $X^2=13.06$	43.9% vs. 11.1% $X^2=0.78$

* Statistically significant at .05
** Statistically significant at .001

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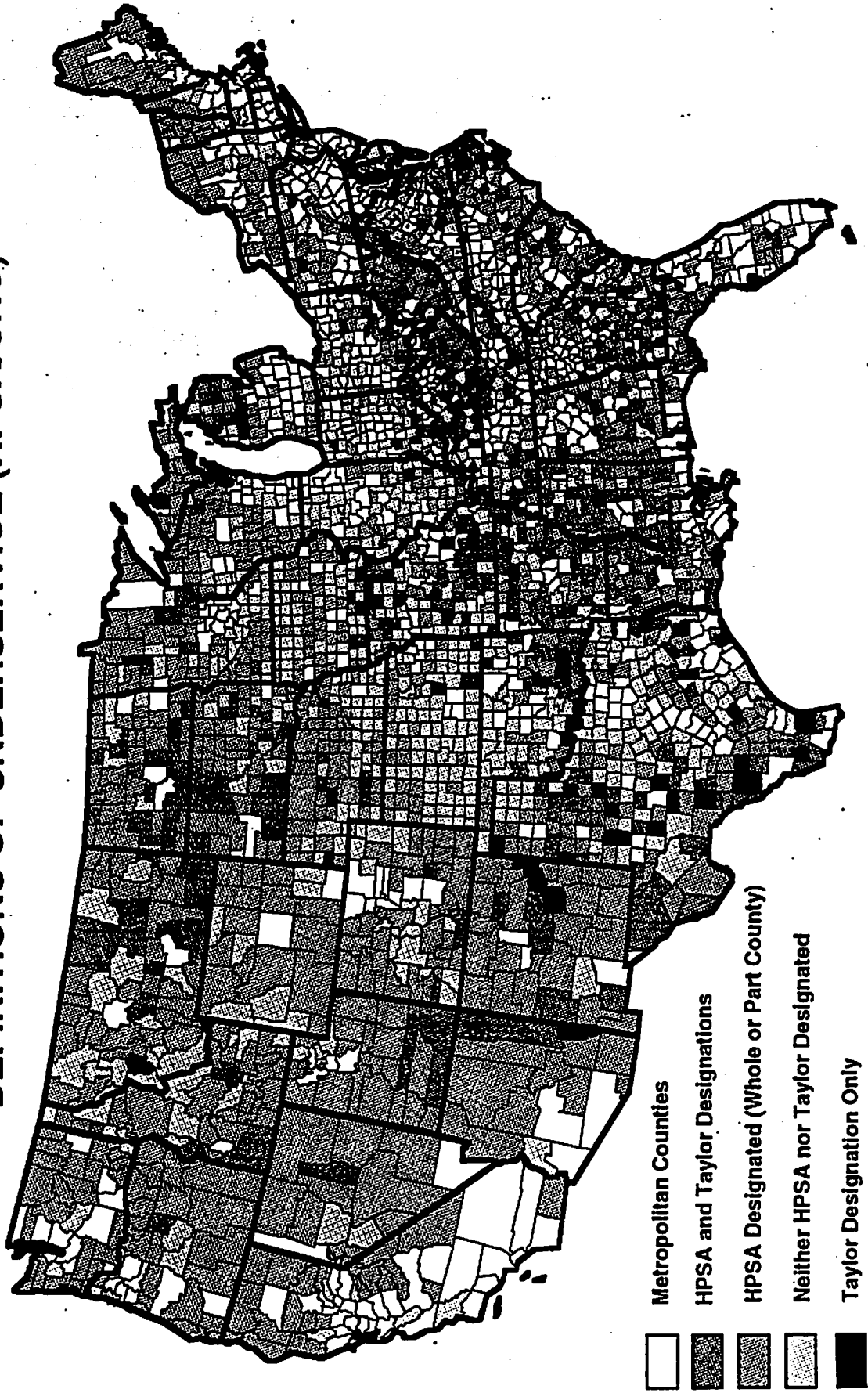
Map 2

PRIMARY CARE HEALTH PROFESSIONAL
SHORTAGE AREAS (HPSAs), 1994

Alaska = Multiple HPSA

Hawaii, Honolulu, Maui = Partial HPSA

Kauai = Non-HPSA

Puerto Rico = Multiple HPSA

Whole County HPSA
Partial County HPSA
Non-HPSA

Map 3

COMPARISON OF ALTERNATIVE
DEFINITIONS OF UNDERSERVICE (HPSA/UNC)

Metropolitan Counties

HPSA and Taylor Designations

HPSA Designated (Whole or Part County)

Neither HPSA nor Taylor Designated

Taylor Designation Only