

# DISTRIBUTION OF US ANESTHESIA PROVIDERS AND SERVICES

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*This study describes the correlation between anesthesia providers by type (Certified Registered Nurse Anesthetist [CRNA] or anesthesiologist) and their respective rural or urban distributions across America. Analyses are based on county level data contained in several distinct databases with a given assumption that most providers practice and reside in the same rural or urban designation category.*

*Data reveal that 91.6% (28,569) of active practicing anesthesiologists reside in metropolitan counties and that 8.4% (2,625) reside in nonmetropolitan counties. Of the*

*26,658 active practicing CRNAs, 81.4% (21,701), reside in metropolitan counties as opposed to 18.6% (4,957) in non-metropolitan counties. Overall, analyses indicate that out of a total of 3,140 counties, there are 843 counties in the United States where neither anesthesiologists nor CRNAs reside. Ninety-seven percent (816) of these counties are nonmetropolitan.*

**Key words:** Manpower, medically underserved, nurse anesthetist, rural, workforce.

According to the 2000 Census, nearly one quarter of all Americans reside in non-metropolitan areas.<sup>1</sup> Citizens living in rural areas have been shown to be less healthy and to have higher incidences of trauma, chronic disease, and infant and maternal mortality.<sup>2-4</sup> Furthermore, residents of rural America tend to be older, more impoverished, and possessing less, if any, health insurance. Access to healthcare in rural and underserved areas of the United States has long been a concern of policy makers.

Traditionally, rural areas have suffered from shortages of healthcare professionals, which include anesthesia providers. The demographics of rural communities show a majority of seniors and uninsured individuals in residence. Rural facilities lack commercial insurance payers to subsidize insufficient Medicare payments. Such facilities have operated with fewer resources and alternative funding options and, in most cases, rely on their local communities and government entities to subsidize their continued operations.<sup>5</sup> A report presented by a Medicare Payment Advisory Commission (MedPAC) staff at its March 15, 2001 meeting, provided 3 major pieces of information:

1. Healthcare needs in the rural areas are no different from those of the urban population, particularly in terms of the demand for ambulatory care services.
2. Inpatient services in the rural hospitals exceed their urban counterparts.
3. There are fewer physicians and specialists in the

rural areas and hence an increased reliance on non-physician providers to provide care.

Certified Registered Nurse Anesthetists (CRNAs) are the sole anesthesia providers in at least 65% of the rural hospitals in the United States.<sup>6</sup> The ability of many small rural hospitals to perform surgical procedures, maintain emergency services, and offer obstetrical care is dependent on an adequate supply of CRNAs.<sup>7,8</sup>

In 1996, a workforce analysis revealed that nearly 19% (4,182) of the active membership (22,268) of the American Association of Nurse Anesthetists (AANA) resided in nonmetropolitan counties of the United States. Additionally, 29% of the active practicing CRNAs 55 years of age or older were found to reside in rural counties. Given this age finding, the authors anticipated a potential greater percentage loss of CRNAs from nonmetropolitan areas due to retirement over the next 10 years than in metropolitan areas.<sup>9</sup> Trends in general nursing practice also reveal similar concerns about the steadily increasing mean age of registered nurses and the impact this may have on the projected overall nursing workforce for the 21st century.<sup>10</sup>

The geographic distribution of anesthesiologists and nurse anesthetists varies greatly across rural and urban areas. Anesthesia providers may work alone (solo) or in groups (teams) that may include both anesthesiologists and nurse anesthetists. The composition of these teams, with respect to the ratio mix of nurse to physician anesthesia providers varies across regions, which has an impact on both access to anesthesia services as well as costs. Grundy et al examined

the characteristics of CRNAs with and without anesthesiologists in the care team model. She found that those working without an anesthesiologist practiced in predominantly small or rural communities, were more likely to be male, and were older than those working with anesthesiologists.<sup>11</sup>

The purpose of this study was to examine the distribution of nurse anesthetists and anesthesiologists across the United States. Additionally, this work examined anesthesia delivery patterns by provider across rural-urban classifications with emphasis on nonmetropolitan counties.

## Methods

This descriptive study expresses the correlation between anesthesia provider by type and their respective metropolitan or nonmetropolitan distributions across America. Analyses are based upon county level data contained in 5 distinct databases. The first, a dataset containing 2001 Medicare provider files obtained from the Centers for Medicare and Medicaid Services (CMS), formerly the Health Care Financing Administration (HCFA). This dataset, containing 1,490,982 records was received in ASCII format sorted by unique physician identification numbers. Of the 716,324 physician records identified, 53,449 records were extracted by physician primary specialty code 05 indicating physician anesthesiologists' billing and found to have usable work zip code information. From these anesthesiologist-billing records, all redundancies were eliminated, and 31,712 individual anesthesiologist providers were identified with business zip code data.

A second database containing usable residence zip code information for actively practicing CRNAs (26,658) in 2001 across the United States was obtained from the American Association of Nurse Anesthetists Membership and State Associations and Information Systems Department, Park Ridge, Ill.

The third dataset, also acquired from the American Association of Nurse Anesthetists Membership and State Associations and Information Systems Department, contained usable business zip code information for 11,651 CRNAs representing 44% of actively practicing CRNAs from the previously cited usable residence zip code data obtained from the 2000 Membership Survey.

A fourth zip code dataset of active practicing anesthesiologists (31,194) was constructed from the active member classification information contained in the 2001 Directory of Members of the American Society of Anesthesiologists, Park Ridge, Ill.

The fifth dataset, obtained from the US Department of Agriculture, entitled "Rural-Urban Continuum

Codes for Metro and Nonmetro Counties," forms a county classification scheme distinguishing metropolitan counties by population size and nonmetropolitan counties by degree of urbanization or proximity to metropolitan areas.<sup>12</sup> A total of 3,140 US counties were categorized according to degree of urbanization by the rural-urban classification scheme. These codes range from "0" to include central counties of metropolitan areas of 1 million population or more to "9" that includes completely rural or fewer than 2,500 urban population, not adjacent to a metropolitan area. Counties coded 0 to 3 are designated as metropolitan counties and those coded 4 to 9 are designated as nonmetropolitan counties (Table 1).

The US Office of Management and Budget groups all counties and county equivalents according to their official "metropolitan" status. Metropolitan areas are comprised of core areas containing a large population nucleus, together with adjacent communities having a high degree of economic and social integration with that core. In this study, the terms "nonmetropolitan" and "rural" will be used synonymously. It should be recognized, however, that the terms "urban" and "rural" have multiple definitions across government agencies.

These data were analyzed to reveal the distribution of nurse and physician anesthesia providers across counties classified by rural-urban designations. Descriptive statistics were employed to generate tabular representations of the dataset. The numbers of anesthesia providers residing in each of the rural-urban designated categories were tabulated and contrasted with each other. Zip code information from the CMS dataset also was examined to reveal the distribution of anesthesiologist primary business locations across counties classified by rural-urban designations.

Several research questions were posed:

1. What is the distribution of anesthesiologists and nurse anesthesia providers across the rural-urban continuum by place of residence?
2. What is the distribution of anesthesiologists and nurse anesthesia providers across the rural-urban continuum by place of business?
3. Are there counties in the United States that are devoid of anesthesiologists, nurse anesthetists, or any anesthesia providers?

## Findings

The data reveals that 91.6% (28,569) of active practicing anesthesiologists in the United States reside in metropolitan counties and that 8.4% (2,625) reside in nonmetropolitan counties. Of the 26,658 active practicing nurse anesthetists in our sample, 81.4% (21,701) reside in metropolitan counties as opposed to

**Table 1. Rural-urban continuum codes\***

Code	
<b>Metropolitan counties</b>	
0	Central counties of MAs of 1 million population or more
1	Fringe counties of MAs of 1 million population or more
2	Counties in MAs of 250,000 to 1 million population
3	Counties in MAs of fewer than 250,000 population
<b>Nonmetropolitan counties</b>	
4	Urban population of 20,000 or more, adjacent to an MA
5	Urban population of 20,000 or more, not adjacent to an MA
6	Urban population of 2,500 to 19,999, adjacent to an MA
7	Urban population of 2,500 to 19,999, not adjacent to an MA
8	Completely rural or fewer than 2,500 urban population, adjacent to an MA
9	Completely rural or fewer than 2,500 urban population, not adjacent to an MA

\*Adjacency was determined by physical boundary adjacency and a finding that at least 2% of the employed labor force in the nonmetropolitan county commuted to metropolitan central counties.

MA indicates metropolitan area.

18.6% (4,957) in nonmetropolitan counties (Table 2).

When examining the CMS database for place of employment, anesthesiologist-reported business zip code data indicated that of the 53,449 total records submitted, 90.5% (48,371) identified their business address in a metropolitan county as opposed to 9.5% (5,078) in a nonmetropolitan county. These 53,449 records were submitted by a total of 31,722 individual anesthesiologists. Many anesthesiologists listed more than one business address. When examining the first business address listed by individual anesthesiologist providers, 90.8% (28,804) indicated a metropolitan county and 9.2% indicated a nonmetropolitan county. It is assumed that providers listed their primary business address first before listing other business addresses.

Places of employment for CRNAs were examined from the available membership survey data. Of the 11,651 CRNAs reporting business addresses, 80.2% were found to lie in metropolitan counties and 19.8% in nonmetropolitan counties. These data closely reflect the CRNA residence data.

Overall, analyses indicate that there are 843 counties in the United States where neither anesthesiolo-

**Table 2. The rural-urban distribution of anesthesia providers**

Rural-urban codes	National	
	No. of anesthesiologists	No. of CRNAs
0-3 Metropolitan	28,569 91.6%	21,701 81.4%
4-9 Nonmetropolitan	2,625 8.4%	4,957 18.6%

gists nor CRNAs reside. Ninety-seven percent (816) of these counties are nonmetropolitan. There are 825 counties in America where CRNAs reside but anesthesiologists do not. Ninety percent (740) of these counties are nonmetropolitan. Of the 130 counties where there are no CRNAs residing but anesthesiologists do live, 78.5% (102) are nonmetropolitan and 21.5% are metropolitan.

## Discussion

Findings confirm a maldistribution of anesthesia providers to more urban areas of the United States, most notably among anesthesiologists where only 8.4% of the workforce reside in nonmetropolitan counties compared with 18.6% of the nurse anesthesia workforce. A possible limitation of this study is an assumption that anesthesia providers practice within the same rural-urban county designation where they reside. To address this concern, authors randomly sampled 500 CRNAs from the cohort of 11,651 who identified both a business and residence zip code. A 95.8% correlation was found where CRNAs worked and resided in the same metropolitan or nonmetropolitan designation. Furthermore, when examining the CMS database for place of employment, anesthesiologist-reported business zip code data indicated that of the 53,449 total records submitted, 90.5% (48,371) identified their business address in a metropolitan county as opposed to 9.5% (5,078) in a nonmetropolitan county. These data closely reflect the geographic distribution of anesthesiologists by residence where 91.6% (31,194) of active practicing anesthesiologists in the United States reside in metropolitan counties. Additionally, available CRNA business zip code data closely mirrors CRNA residence data related to the urban-rural continuum designation. These findings are consistent with studies showing that CRNAs provide the majority of anesthesia services in rural America.<sup>13</sup> In spite of these attempts to address the issue of providers working and residing in similar geographic

areas, it is impossible to be completely certain that this assumption holds true in all cases and is so noted as a limitation in working with these type of data.

Despite a more than doubling in the national supply of anesthesiologists in the United States since 1980, the primarily urban geographic distribution of anesthesiologists has changed little.<sup>14</sup> Furthermore, it is noted that very substantial, unrealistic enhancements to surgical caseloads would be needed in many instances to offset the perceived negative influences to rural locations to attract anesthesiologists, and it is unlikely that the relatively low numbers of anesthesiologists in rural America will change significantly.<sup>15,16</sup>

There continues to be considerable debate about the appropriate mix of anesthesia providers, both anesthesiologists and CRNAs, to meet the healthcare needs of urban and rural settings.<sup>17,18</sup> Policy makers now confronted with rising healthcare costs are examining not only the most cost-effective models to deliver care but also models that assure high quality and access to care.

On November 13, 2001, CMS published in the *Federal Register* its ruling allowing a state governor to notify CMS in writing of the state's desire to be exempt from the Medicare Part A supervision requirement for nurse anesthetists after the governor.<sup>19</sup>

- Consults with the state's boards of medicine and nursing,
- Determines that opting out of the requirement is consistent with state law, and
- Decides that it is in the best interests of the state's citizens.

Under the existing CMS policy, hospitals using CRNA services must document physician supervision of the CRNA in order to receive Medicare payment. This reimbursement supervision requirement has proven to be problematic especially in states that have no similar supervision requirement(s) related to CRNA practice or licensure. Also, supervising physicians perceive additional liability as a result of performing supervisory functions over CRNAs. As of December 2002, and at the time this study was completed, 6 states—Nebraska, New Hampshire, Iowa, Idaho, Minnesota, and New Mexico—have chosen to opt out of the CMS federal supervision requirement.\* In each of these cases, governors have determined that it was in the best interests of their citizens to enable CRNA practice by removing barriers that might impede the same. Access, cost, and quality of anesthesia care are 3 common concerns cited by policy

makers in evaluating the needs of their constituents.<sup>20,21</sup>

When looking at the distribution of providers across the 6 states opting out of the Part A supervision requirement in aggregate, nurse anesthetists outnumber anesthesiologists by a ratio of 1.36 CRNAs to 1 anesthesiologist (1,975 to 1,451). The residence data in these states also reveals that CRNAs are more predominantly distributed in nonmetropolitan (rural) counties than their anesthesiologist counterparts. Of the 1,975 CRNAs, 33.7% (665) reside in nonmetropolitan communities and 66.3% (1,310) in metropolitan counties. In contrast, of the 1,451 anesthesiologists in these same 6 states, 16.7% (242) reside in nonmetropolitan areas and 83.3% (1,209) in metropolitan counties (Table 3). These data support an assertion by these investigators that access to anesthesia healthcare in rural and underserved areas of these 6 states favors a less restrictive CRNA practice environment.

A question remains as to why other states at this time have not adopted a similar policy requesting the Medicare exemption. Social and political barriers place limits on competition among various classes of healthcare providers that until more recently have drawn little attention. Rosenbach and Cromwell have reported that anesthesia is a traditional nursing function that has been replaced, in fair part, by physicians over the past 20 to 25 years.<sup>22</sup> Furthermore, there are significant cost implications to the wrong provider input mix in anesthesia, simply because of the tremendous differences in cost between nurse and physician providers. Three states, two with relatively large urban populations (New York, California, and Indiana), were arbitrarily selected (representing east, west, and central United States) and examined in aggregate to contrast with the 6 states that have opted out of the CMS supervision regulations. In these 3 states, anesthesiologists outnumber CRNAs by a ratio of 4.2 anesthesiologists to 1 CRNA (8,291 to 1,973). While the rural-urban distribution still demonstrates that more CRNAs reside in nonmetropolitan regions than anesthesiologists (8.7% to 3%), these 3 states have proportionately less of their citizens dependent on rural healthcare than do the 6 states earlier discussed that have chosen to opt out of the Part A requirement.

No studies to date show a difference in anesthesia outcomes or quality of care based solely on the type of anesthesia provider (anesthesiologist or CRNA).

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\* A total of 12 states have now opted out of the CMS federal supervision requirement. By yearend 2003, 5 additional states opted out: Alaska, Kansas, North Dakota, Oregon, and Washington. At press time, it was reported that Montana opted out on January 23, 2004.

**Table 3. The rural-urban distribution of anesthesia providers in Nebraska, New Hampshire, Iowa, Idaho, Minnesota, and New Mexico\***

Rural-urban codes	No. of anesthesiologists	No. of CRNAs
0-3 Metropolitan	1,209	1,310
	83.3%	66.3%
4-9 Nonmetropolitan	242	665
	16.7%	33.7%

\*A total of 12 states have now opted out of the Centers for Medicare and Medicaid Services federal supervision requirement: Kansas in March 2003; North Dakota, Washington, and Alaska in October 2003; Oregon in December 2003; and Montana in January 2004.

Moreover, no studies reveal a correlation between patient acuity levels, anesthesia care needs, and type of anesthesia provider required. While significant differences in mean income (cost) are noted between CRNAs and anesthesiologists, the influence of third party payers, especially nonfederal entities, mask the direct costs to the consumer. Hence, access to anesthesia services for rural populations may be a policy factor influencing the use of CRNAs.

### Summary

The geographic distribution of anesthesiologists and nurse anesthetists varies greatly across rural and urban areas confirming a maldistribution of anesthesia providers to more urban areas of the United States, most notably among anesthesiologists. Data reveal that 91.6% (28,569) of active practicing anesthesiologists reside in metropolitan counties and that 8.4% (2,625) reside in nonmetropolitan counties. Of the 26,658 active practicing CRNAs, 81.4% (21,701) reside in metropolitan counties as opposed to 18.6% (4,957) in nonmetropolitan counties. Overall, analyses indicate that out of a total of 3,140, there are 843 counties in the United States where neither anesthesiologists nor CRNAs reside. Ninety-seven percent (816) of these counties are nonmetropolitan.

It is recognized that especially in anesthesia, physicians and nurses share complementary roles with a great degree of substitutability.<sup>23</sup> Managed care incentives include increased cost sharing with consumers where efficiency, outcomes, productivity, and reimbursement are variables of central concern along with access when considering providers of healthcare services. Nurse anesthesia practice across America may not be defined so much by CRNA abilities or qualifications (what they are capable to do), but instead by

practice policies, especially at the state or institutional levels, that prescribe practice (what they are permitted to do) often predicated by actual or perceived need. Public policy is set to meet the needs of constituents and thus policy makers are strongly influenced by these groups. When looking at the distribution of anesthesia providers across varied geographic locales, one may choose to speculate about the nature of anesthesia practice patterns. Where populations are most dependent upon the anesthesia services of CRNAs, such as in rural America, public policy often favors eliminating barriers to CRNA practice. Clearly, this is a suggested area for further study. Studies that describe more objective models of anesthesia delivery focusing on access and the most efficient use of anesthesia practitioners are lacking. Best evidence models need to move away from the traditional hierarchical structures built around stereotypical doctor/nurse relationships and instead focus on creating partnerships where incentives for high quality outcomes and cost effectiveness are paramount.

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