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Availability of Anesthesia Personnel in Rural Washington and Montana

Peter J. Dunbar, M.B., Ch.B.,*† Jonathan D. Mayer, Ph.D.,*‡ Meredith A. Fordyce, Ph.C.,§
Denise M. Lishner, M.S.W.,|| Amy Hagopian, M.H.A.,# Ken Spanton, C.R.N.A.,** L. Gary Hart, Ph.D.††

ANESTHESIA has historically been an undersupplied specialty. Health personnel issues used to be dominated by the findings of the 1980 Graduate Medical Education National Advisory Committee study, which suggested that anesthesia would be a balanced specialty for the rest of the century.‡‡ Recent studies, however, have demonstrated that there is an oversupply of all specialists, including anesthesiology.§§||^{1,2} These studies take

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* Both Dr. Dunbar and Dr. Mayer are first authors, having contributed equally, and they are listed alphabetically.

† Assistant Professor of Anesthesiology.

‡ Professor of Geography, Adjunct Professor of Medicine (Infectious Disease), Family Medicine-Health Services.

§ Doctoral Candidate.

|| Associate Director.

Associate Director Community Health Services Development, Family Medicine; Clinical Assistant Professor Health Services, School of Public Health and Community Medicine.

** Certified Registered Nurse Anesthetist.

†† Research Associate Professor, Department of Family Medicine; Director of WWAMI Rural Health Research Center.

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Address reprint requests to Dr. Dunbar: Department of Anesthesiology, Harborview Medical Center, 325 Ninth Avenue, Box 359724, Seattle, Washington 98104-2499. Address electronic mail to: pjdunbar@u.washington.edu

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a "top down" view of health personnel through analysis of national statistics and exploration of subsets of the data by hospital size and rurality. This approach assumes that the databases of the American Hospital Association and the American Medical Association are accurate and do not take into account the presence of certified registered nurse anesthetists (CRNAs), who are the predominant providers of anesthesia care in the smallest and most remote hospitals in the United States. We compared the 1994 master file of the American Medical Association with our local knowledge of the practitioners in the rural areas of Washington state and found numerous small errors. These errors of one or two practitioners made no difference to the analysis of practitioner groups with more than approximately five people, but in the most rural communities the erroneous presence or absence of a single practitioner made a significant difference.

The WWAMI Rural Health Research Center is a federally funded center dedicated to the study of the provision of health care in rural Washington, Wyoming, Alaska, Montana, and Idaho. Earlier studies of surgical and obstetric care in Washington state^{3,4} validated the assumption that anesthesia care was integral to the quality and quantity of care delivered and to the economic viability of rural hospitals, suggesting

‡‡ Report of Graduate Medical Education National Advisory Committee to the Secretary of the US Department of Health and Social Security (GMENAC 1980). Washington, DC, US Government Printing Office, Health Resources and Services Administration, US Department of Health & Human Services, 1980.

§§ Council on Graduate Medical Education Third Report: Improving Access to Health Care Through Physician Workforce Reform: Directions for the 21st Century. Washington, DC, US Government Printing Office, Health Resources and Services Administration, US Department of Health & Human Services, 1992.

|| Council on Graduate Medical Education Fourth Report: Recommendation to Improve Access to Health Care Through Physician Workforce Reform. Washington, DC, US Government Printing Office, Health Resources and Services Administration, US Department of Health & Human Services, 1994.

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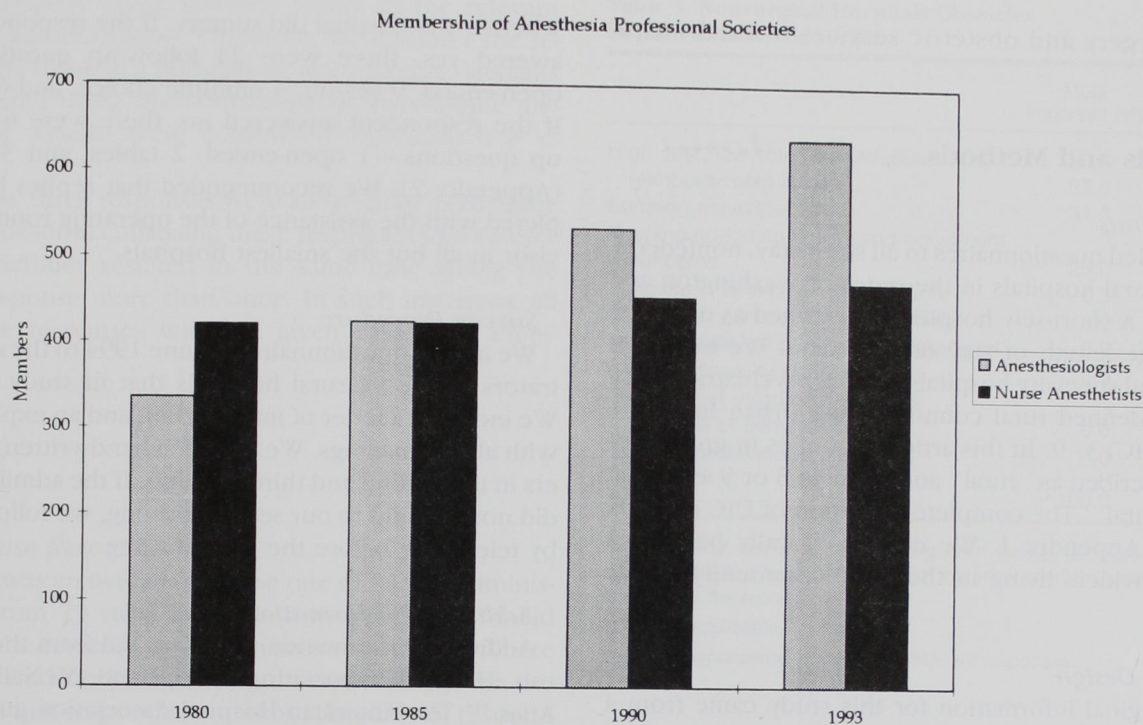


Fig. 1. Total membership of the American Society of Anesthesiologists and the American Association of Nurse Anesthetists in the two states of Washington and Montana were used as a proxy for the numbers of active anesthesia practitioners. Both organizations report that $\geq 90\%$ of all active practitioners are members and that this percentage has not changed in the past 20 yr.

there was a need to study delivery patterns of anesthesia care directly.

Nearly all anesthesia in the United States is administered by anesthesiologists or CRNAs who practice alone or in a team care mode. Rural hospitals frequently depend on CRNAs to provide anesthesia services,^{##5-7} and we hypothesized that small remote hospitals were even more dependent on CRNAs than larger rural hospitals. Therefore, the decreasing numbers of CRNAs graduating during the 1980s may have affected access to surgery in rural areas.⁵ We knew the absolute numbers of anesthesia providers had increased, but it was not clear if physicians had moved into rural areas or if there were local areas of shortage.^{||||1} We did not study practice mode (team or solo) as it was a secondary to the central question of availability of anesthesia personnel (fig. 1).

We deliberately chose to examine anesthesia per-

sonnel from the perspective of the hospital administrator because administrators were the most consistent people in the rural hospital. We knew that many rural hospitals used itinerant medical personnel because 59% of the hospitals we planned to sample used nonlocal emergency room physicians.⁸ We did not survey rural anesthesia providers because they might be working at more than one facility within the community or in another community, which would have made their responses difficult to interpret. We designed this study to provide basic information about who performs anesthesia in rural areas and how much anesthesia is performed. We did not investigate availability of pain management. We examined the perceived influence of the availability of anesthesia personnel on the capability of rural hospitals to include surgery. Finally, we attempted to determine if there were other obstacles to providing anesthesia service or surgery, such as conflicts between and among anesthesia, nursing, and surgical personnel. At the outset of this study, we hypothesized that inadequate availability of anesthesia in-

US Congress, Office of Technology Assessment: Health Care in Rural Areas (publication no. OTA H-434). Washington, DC, US Government Printing Office, 1990.

hibits surgery and obstetric services in rural hospitals.

Materials and Methods

Definitions

We mailed questionnaires to all short-stay, nonfederal, general rural hospitals in the states of Washington and Montana. A short-stay hospital was defined as one with an average length of stay of <30 days. We excluded federal and specialty hospitals such as psychiatric hospitals. We defined rural counties using Urban Influence Codes (UIC) 3-9. In this article, counties in groups 3-7 are described as "rural" and those in 8 or 9 as "small remote rural." The complete definition of UIC codes is given in Appendix 1. We defined "locally based" as those providers living in the same community as the hospital.

Survey Design

The original information for this study came from a survey of rural hospital administrators. Therefore, our study reflects the perceptions of the administrators. The survey instrument rephrased many of the key questions more than once in an attempt to obtain as much objective information as possible. Both closed- and open-ended questions were used in this questionnaire. The open-ended questions encouraged administrators to express opinions that reflected their specific circumstances and asked for their top three concerns in order of importance. For hospitals in which surgery was performed, information was collected on types of anesthesia providers, types and volumes of surgery, and other related concerns of administrators. For hospitals in which surgery was not performed, information about obstacles to surgery, potential recruitment of surgical personnel, and concerns of administrators was collected. Further, we asked questions about staffing issues tangential to anesthesia to assess the relative importance of anesthesia staffing in the overall picture.

The Rural Health Research Center team developed the questionnaire through an iterative process that included a literature review. The pilot questionnaire was then pretested on five rural hospital administrators in Idaho and was revised accordingly. The final questionnaire was four pages long. The first question asked

whether the hospital did surgery. If the respondent answered yes, there were 24 follow-up questions—5 open-ended, 9 yes/no, 4 multiple choice, and 6 tables. If the respondent answered no, there were 6 follow-up questions—1 open-ended, 2 tables, and 3 yes/no (Appendix 2). We recommended that replies be completed with the assistance of the operating room supervisor in all but the smallest hospitals.

Survey Procedure

We mailed questionnaires in June 1994 to the administrators of the 92 rural hospitals that fit study criteria. We included a letter of introduction and an explanation with all our mailings. We included handwritten reminders in the second and third mailings. If the administrator did not respond to our second mailing, we followed up by telephone before the third mailing.

Additional Information

Additional information was obtained from the American Hospital Association⁹ and Rand McNally Road Atlas.^{***} The American Hospital Association guide supplied information concerning hospital average daily census, hospital bed size, ownership type, and geographic location (county and state). Town population was obtained from Rand McNally, based on the United States census and updates. In addition, information regarding whether surgery was performed in the 13 nonrespondent hospitals was obtained through telephone calls to the hospitals.

Preparation of Data

We tabulated multiple choice and numerical data for analysis. Follow-up calls to the hospital administrators clarified contradictory replies within questionnaires. We analyzed the content of responses to the open-ended questions, and each open-ended reply was classified in a content analysis. For example, one question yielded the following categories: cost volume concern, surgeon availability, and in-service training. In this way, the open-ended responses were able to be compared and analyzed.

Statistical Analysis

Standard two-tailed *t* tests and chi-square tests were used with a 0.05 significance criterion when making bivariate comparisons. Although the number of respondents was relatively small and the associated statistical power is consequently low, the response rate (86%) in

*** Rand McNally: 1994 Road Atlas. Skokie: Rand McNally, 1994.

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this descriptive study includes nearly all the relevant hospital administrators. Therefore, we consider the results to be those of a population, not a sample. Medians were tested using the nonparametric two-sample median test. Results were considered significant if $P < 0.05$.

Because three responses were allowed for each open-ended question, collapsing these responses into categories sometimes resulted in the same case giving the same response more than once. In such instances, all duplicate responses within a given case were eliminated.

Results

Response Rate

There was an overall response rate of 85.9%. Administrators from 79 rural hospitals responded and 13 did not. All the returned questionnaires were usable. There were no statistically significant differences between the hospitals that responded and those that did not respond regarding number of beds, daily census, town population, performance of surgery, or rurality. In a few instances, answers crucial to our analysis were omitted and surveyors called an administrator for clarification after they had returned the questionnaires.

Nonsurgical Hospitals

There were 17 responding nonsurgical hospitals. Surgery was not performed in 22.8% of the eligible rural hospitals in the two states being studied (including both survey respondents and nonrespondents). The 17 responding nonsurgical hospitals had a significantly smaller median number of beds (14 *vs.* 34), daily census (2 *vs.* 10), and town population (1,000 *vs.* 3,000) ($P < 0.05$). Two administrators indicated that their hospital would begin supporting surgery in the next year, but they were not actively recruiting surgeons or anesthesia personnel. Administrators' reasons for not performing surgery in response to the question "What are the three most important obstacles to the provision of surgery at your hospital (in order of importance)?" are presented in table 1.

Availability of anesthesia personnel was never listed as the most important reason for not performing surgery, although it was mentioned by 37.5% of the administrators.

Table 1. Nonsurgical Hospitals Obstacles to the Provision of Surgery

	Most Important (%)	Mentioned (%)
High cost, low volume, inadequate reimbursement issues	37.5	68.8
Surgeon nonavailability	31.3	56.3
Keeping adequate facility and equipment concerns	25.0	56.3
Difficulty in obtaining accreditation	6.3	6.3
Anesthesia personnel nonavailability	0.0	37.5
Nonavailability of other skilled personnel	0.0	12.5
Small community size/place	0.0	12.5
Bias against using rural services because of perceptions	0.0	6.3
Other (miscellaneous obstacles)	0.0	6.3
Total*	100.0	NA

Percentage of respondents indicating each reason as most important is placed in the first column. Percentage that mentioned the reason anywhere is shown in the second column.

NA = not applicable.

* The 16 respondents produced 42 different responses.

Surgical Hospitals

There were 62 responding surgical hospitals.

Surgical Volume and Market. Of the 62 reporting hospitals that performed surgery, 44 had one or two operating rooms, 12 had three to five, and 3 had more than five (median, 2). Most of the hospitals were supported by a small number of surgeons living locally (median, 5). There were few visiting surgeons (median, 2), and these data were skewed by a few rural hospitals that had granted courtesy privileges to the entire surgical staffs of affiliated metropolitan hospitals. Hospitals supported an average of 40 inpatient (median, 11) and 68 outpatient (median, 24) procedures per month. There was a local outpatient surgery facility unrelated to the hospital in 21% of the towns, and in 43% of these facilities anesthesia personnel were being used.

Obstetric Anesthesia. Eighty-seven percent of the hospitals performing surgery delivered obstetric care, and 76% did cesarean sections. Nine administrators reported that a shortage of anesthesia personnel affected their ability to deliver obstetric care. Three administrators specifically reported that lack of an epidural service limited obstetrics. No administrator reported obstetric anesthesia to be one of their top concerns.

Supply of Anesthesia Personnel. The 62 hospitals had 89 anesthesiologists and 124 CRNAs associated

Table 2. Distribution of Anesthesia Personnel

Location Status of Providers	MD Anesthesiologists (n = 89)	CRNAs (n = 124)
Practice status (%)		
Local	92.1	69.4
Visiting	7.9	30.6

with them. Of these, 82 anesthesiologists and 86 CRNAs resided locally. Surgery occurred on significantly more days per month in hospitals with anesthesiologists compared with those with only CRNAs. Forty-six percent of the anesthesiologists practiced in the same hospitals as CRNAs, but we do not know if that was in care team mode. Anesthesiologists were present in 36% of rural (UIC 3–7) counties, but the CRNAs were the sole providers of anesthesia service in the UIC 8 and 9 counties. Anesthesiologists in rural areas were more likely to live locally than CRNAs (table 2). Administrators reported a total of 7 visiting anesthesiologists and 38 visiting CRNAs (there may have been some double counting). The ability to find coverage for leaves of absence was proportional to the daily census.

Presence of Anesthesia. To test our secondary hypothesis that availability of anesthesia was most crucial to the smallest hospitals, we divided our rural hospitals by UIC. The small remote rural hospitals were significantly less likely to have local anesthesiologists and significantly more likely to have visiting CRNAs than other rural hospitals ($P < 0.001$; table 3).

Larger rural hospitals were significantly more likely to have only anesthesiologists, but small remote rural hospitals were more likely to have only CRNA coverage. We analyzed the data using the hospital as the unit of analysis. Figure 2 shows the types of anesthesia providers, both local and visiting, that serve the 62 responding hospitals by UIC. They had an average of 1.5 operating rooms and billed an average of 6,191 operating room minutes per month. The figure also illustrates the extremely rural nature of our sample (fig. 2).

Impressions of Administrators. Few administrators ranked the availability of anesthesia personnel as being one of the three most important issues facing rural surgery over the next decade (table 4). The most important issues were related to reimbursement and surgeon nonavailability, with the nonavailability of anesthesia personnel mentioned as

most important by only 2% of the administrators and mentioned at all by only 15.7% of the administrators (table 4).

Anesthesia staffing was relatively low on the list of administrators' personnel concerns; surgeon availability, call coverage, skilled nursing, technical, and reimbursement issues were reported as being of greater concern. Only 8% of the administrators rated nonavailability of anesthesia personnel as their most important personnel issue (table 5).

When asked directly if they would do more surgery if they had more anesthesia available, 85% of administrators said no. The same number (85%) said it would not affect their ability to do obstetrics. In towns with populations of $<3,000$, however, 21.2% reported that surgery could be increased if they had more anesthesia personnel compared with 3.6% of administrators in larger towns ($P = 0.10$).

There were few conflicts reported between or among anesthesia personnel, physicians performing surgery, and operating room personnel. Respondents were permitted to list more than one problem. They are

Differences in anesthesia coverage providers (*i.e.*, needs and preferences; $n = 5$)

Table 3. Characteristics of Rural Versus Small Remote Rural Hospitals that Perform Surgery

	Rural (n = 34)	Small Remote Rural (n = 28)	Statistical Significance* (P values)
Surgical volume (mean procedures/month)	170.3	37.3	0.002
No. of operating rooms (mean)	2.8	1.5	0.002
Operating minutes per hospital (mean)	13,856	6,191	0.065
Hospital average daily census (mean)	30.3	9.3	0.002
Hospital anesthesia personnel availability (%)†			
Local anesthesiologist	47.1	7.1	0.002
Visiting anesthesiologist	14.7	3.6	0.296
Local CRNA	64.7	71.4	0.771
Visiting CRNA	11.8	46.4	0.006

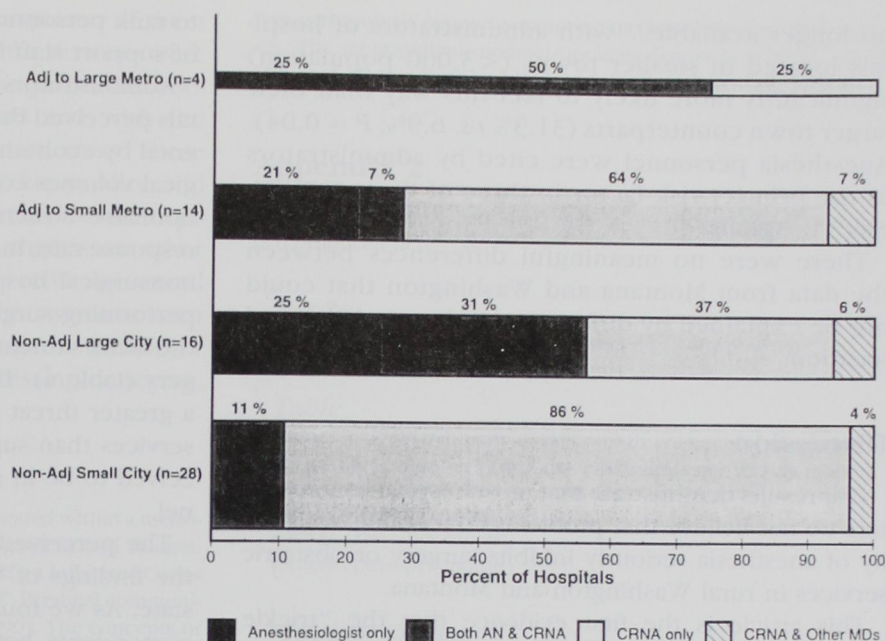
The numbers of hospitals for each category may vary slightly because of missing data.

* Test of differences between rural and small remote rural.

† Percentages add to more than 100% because a hospital may have two or more of the provider types available.

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Fig. 2. Anesthesia provider staffing of hospitals by Rural Urban Coding (RUC). The width of the bars is proportional to the number of hospitals in each RUC (the widest bar represents the most rural hospitals). The percentage of hospitals staffed by physicians (MDs) alone, certified registered nurse anesthetists (CRNAs) alone, both, or neither is indicated by the shading.



Scheduling/personnel turnover (n = 4)
 Communication/role problems (n = 3)
 Problematic personal behaviors/personality conflicts (n = 2); and
 Other assorted problems (n = 3).

None of the hospital administrators reported conflicts between anesthesiologist and CRNAs. Hospital

administrators in larger hospitals (*i.e.*, with more beds) reported more interpersonal problems than their smaller hospital counterparts. All the administrators rated the care provided in their anesthesia departments as either good or very good.

Almost one fifth (19.4%) of the administrators considered their surgery programs to be "at risk of being

Table 4. Issues Facing Rural Surgery in the Next Decade

	Most Important (%)	Mentioned (%)
High cost, low volume, inadequate reimbursement issues	47.1	76.5
Surgeon nonavailability	31.4	47.1
Other (miscellaneous issues)	5.9	15.7
Competition	5.9	11.8
Reputation and quality	3.9	21.6
Anesthesia personnel nonavailability	2.0	15.7
Nonavailability of other skilled personnel	2.0	9.8
Personnel conflicts	2.0	2.0
Training	0.0	5.9
Access/geography	0.0	2.0
Total*	100.2	NA

NA = not applicable.

* The 51 respondents produced 106 different responses.

Table 5. Staffing Concerns for Surgical Hospitals

	Most Important (%)	Mentioned (%)
Surgeon nonavailability	24.0	30.0
Coverage/call/scheduling	22.0	52.0
Nonavailability of other skilled personnel (excluding anesthesia personnel)	22.0	46.0
High cost, low volume, inadequate reimbursement issues	20.0	36.0
Anesthesia personnel nonavailability	8.0	12.0
Keeping adequate facility and equipment concerns	2.0	8.0
Personnel conflict	2.0	4.0
Training/credentialing	0.0	18.0
Other (miscellaneous concerns)	0.0	6.0
Total*	100.0	NA

NA = not applicable.

* The 50 respondents produced 106 different responses.

no longer available," with administrators of hospitals located in smaller towns (<3,000 population) significantly more likely to feel this way than their larger town counterparts (31.3% vs. 6.9%; $P = 0.04$). Anesthesia personnel were cited by administrators as the primary risk factor in three of these ten "at-risk" hospitals.

There were no meaningful differences between the data from Montana and Washington that could not be explained by differences in hospital size and location.

Discussion

Our results demonstrate that most hospital administrators do not believe that problems concerning availability of anesthesia seriously inhibits surgery or obstetric services in rural Washington and Montana.

This article is the first evidence that the "trickle down" of specialists and subspecialists reported recently^{†††} is having a perceptible effect at a local level. For instance, Montana, which is mostly rural, has increased the number of anesthesiologists from <5 per 100,000 population in 1970¹⁰ to 11 per 100,000 in 1993.¹¹ Comparison of the distribution of anesthesiologists between 1970 and 1993 shows that Montana, the Dakotas, Colorado, Nevada, Arizona, Utah, New Mexico, and Wyoming all have increased numbers of anesthesiologists relative to the population.^{10,11} This suggests that our results may be generalizable to these areas, but further study is needed at a local level for the extrapolation required to test this result for the country as a whole.

Our study methodology is important because the emphasis is on the perceived need of a community rather than comparison of health personnel statistics against benchmark norms. Therefore, we used the information from and the opinions of the hospital administrators to determine whether they believed that they were short of anesthesia personnel. To reduce subjective bias, we attempted to get at the information through more than one question or combination of questions. For example, in response to one question, 15% of the respondents said they would do more surgery if they had more anesthesia help. A separate question forced the respondents

to rank personnel concerns, resulting in the availability of support staff being cited as a more crucial concern.

Administrators of both surgical and nonsurgical hospitals perceived that the availability of surgery was threatened by economic concerns tied to relatively small surgical volumes coupled with high fixed costs. The questionnaire structure, intended to assure the highest response rate, made a direct comparison of surgical and nonsurgical hospitals difficult, but the reasons for not performing surgery (table 1) were strikingly similar to the factors threatening the continuing availability of surgery (table 4). These economic factors appeared to be a greater threat to the continued existence of surgical services than supply of personnel. Surgeons were perceived to be in shorter supply than anesthesia personnel.

The perceived shortage of rural surgeons confirmed the findings of Williamson *et al.*³ in rural Washington state. As we found no difference in the perceptions of respondents between Washington and Montana, this may be a widespread concern. A full discussion of the appropriateness of rural surgical care and the risk benefits of volume-sensitive surgeries^{12,13} is beyond the scope of this article, but outcomes for common surgeries and obstetric procedures were equivalent in rural and urban areas of in general¹⁴ and in Washington state in particular.^{15,16} Nevertheless, local rural residents often bypass local hospital services in favor of obtaining care in distant urban tertiary hospitals.¹⁷ The availability of anesthesia for obstetrics was not a major concern of responding rural hospital administrators. The questionnaire directly addressed obstetric care in three questions, and the open-ended questions gave opportunity for comment, but there were only three responses regarding obstetric anesthesia.

Rural hospitals have a significant influence on the local economy of rural areas and for their hinterlands.¹⁸⁻²⁰ Therefore, a rural hospital that is threatened with closure or drastic reduction in size or scope of services may have a significant negative effect on rural economic well-being. What is unclear, however, is the degree to which the availability of rural surgical services influences the viability of rural hospitals, and, less directly, the economic status of rural communities. We can presume that the present level of availability of anesthesia personnel cannot be considered a threat to the viability of the rural economy in the states we studied.

This survey of administrators in rural Washington and Montana hospitals shows that surgery was available in

††† Orkin FK: The geographic distribution of anesthesiologists during rapid growth in their supply (abstract). *ANESTHESIOLOGY* 1994; 81:A1295.

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most rural hospitals (although almost a quarter of them had no surgery provided). Hospital administrators were primarily concerned with the economic problems associated with providing surgical services and with the perception of a deficit of surgeons in rural areas. These problems were reported more often for smaller and more remote rural hospitals. Small remote rural hospitals were more dependent on CRNAs than were other rural hospitals. There currently appears to be no overall shortage of anesthesia providers in the two-state area examined in this study; shortages of surgeons and other professionals ranked as much more pressing concerns.

Appendix 1

This study defines "rural" as any county not located within a metropolitan area as defined by the Office of Management and Budget. Rurality was further distinguished by the 1993 Urban Influence Codes (UIC) of the Department of Agriculture (Parker T: Personal communication. Department of Agriculture. February 1996). The concepts of rural and urban are problematic as counties designated as metropolitan (or urban) may contain areas with a distinctly rural character, and nonmetropolitan (or rural) counties may contain sizable urban areas. The newly developed UIC help to determine the degree of rurality among the nonmetropolitan counties by defining each county in terms of adjacency to metropolitan areas, both large and small, and by the population of the largest city or town within the county. Because of the relatively small number of hospitals in this study, the hospitals were divided into two groups based on the UIC. The UIC groups numbered 3-7 were combined into a group henceforth referred to as "rural," and those numbered 8 and 9 formed a group referred to as "small remote rural."

1993 Urban Influence Codes

Metropolitan (Grouping Code: Not Applicable)

1. Large—Central and fringe counties of metropolitan areas of ≥ 1 million population
2. Small—Counties in metropolitan areas of < 1 million population

Nonmetropolitan (Grouping Code: Rural)

3. Adjacent to a large metropolitan area with a city of $\geq 10,000$
4. Adjacent to a large metropolitan area without a city of $\geq 10,000$
5. Adjacent to a small metropolitan area with a city of $\geq 10,000$
6. Adjacent to a small metropolitan area without a city of $\geq 10,000$
7. Not adjacent to a metropolitan area and with a city of $\geq 10,000$

Nonmetropolitan (Grouping Code: Small Remote Rural)

8. Not adjacent to a metropolitan area and with a city of 2,500-9,999 population
9. Not adjacent to a metropolitan area and with no city or a city with a population $< 2,500$

Adjacent counties are physically adjacent to one or more metropolitan service areas and have $\geq 2\%$ of the employed labor force in the

nonmetropolitan county commuting to central metropolitan counties. The metropolitan-nonmetropolitan definition is based on the Office of Management and Budget definition (June 1, 1993).

Appendix 2

The questionnaire had four types of questions. One of each type is reproduced here.

Yes/No

Question 1: "Is any surgery performed in your hospital?"

Table

Question 5: "How many days a month are each of the following used? (average number of full day equivalents per 28 day month)"

MD/DO (Days per month)
CRNAs (Days per month)
Others (Days per month)

Multiple Choice

Question 20: "How would you rate the quality of care provided by your anesthesia personnel?"

Very Good
Good
Average
Poor
Very Poor

Open-Ended

Question 21: "What are the three most important *staffing issues* that your surgery department faces (in order of importance)?"

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