THE STRUCTURE OF RURAL HOSPITAL MEDICAL STAFFS

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ABSTRACT

Despite the key role that physicians play in rural hospitals, very little is known about the structure of rural hospital medical staffs. In this paper, we utilize survey data collected from 465 rural hospitals in eight states to describe the configuration of hospital medical staffs. Using Guttman scaling techniques, we find that a hierarchical pattern is present in the data. As active medical staff size increases, specialty capability is expanded in a systematic and predictable way. This has important implications for research on rural hospitals because it means that the "level of specialization" on rural hospital medical staffs can be represented on a single scale in empirical analyses.

INTRODUCTION

The key role that the medical staff plays in determining the services available in rural hospitals and, ultimately, in the financial viability of these institutions and the quality of care they provide has been widely acknowledged. Despite this, there have been no published studies that explicitly analyze the structure of rural hospital medical staffs. In this article, we use survey data collected in eight states to explore the configuration of medical staffs in rural hospitals. We test for the presence of consistent patterns in the addition of specialists as medical staff size grows and we present more detailed data on two key specialties: general surgery and radiology. The findings of our study suggest several potentially important areas for future research.

BACKGROUND

There is a considerable amount of diversity among rural hospitals, and many different approaches have been taken by researchers and policymakers attempting to characterize that diversity in a meaningful fashion. One approach categorizes rural hospitals according to the population of the areas in which they are located. For instance, counties with population densities less than six per square mile have been called "frontier counties" (Popper, 1986) and the hospitals located in such counties termed "frontier hospitals." Berry, et al (1988) have focused research attention on these facilities because of their importance in assuring access to care in sparsely populated rural areas and their presumed financial vulnerability.

Other studies have examined rural hospital outcomes, where the number of beds in the hospital is used as a proxy for hospital scale and by implication, level of

sophistication. For instance, Keeler, et al (1992) concluded that rural hospitals generally provided lower quality care, and that "Quality improved steadily with the size of hospital and the population of the community in which it is located."

In studies undertaken for other purposes, attention has been focused on the grouping of hospitals according to the range of services they offer. Edwards, et al (1972) attempted to develop scope of service indices for all hospitals in the United States, using Guttman scalogram techniques, while Berry (1973) developed matrices that allowed the grouping of hospitals into clusters according to their service configurations. Adams, et al (1991) applied the approach of Edwards et al (1972) to rural hospitals, constructing a service "index" that he used to help explain the choice of hospitals by people living in rural areas. In addition to its usefulness as an analytic construct, the grouping of hospitals by the services they offer can provide insights into how hospitals and regional health care systems can be reconfigured to better serve community needs (Rosenblatt, 1991). And, service availability and population density considerations have been critical concerns in attempts by state and federal governments to define "limited service" alternatives to traditional hospitals in rural areas (Christianson, et al, 1990).

While service availability, community size, service area population density, and number of beds have all been useful in classifying rural hospitals for various analytic purposes, each has its limitations. Certainly, the concept of "ruralness" is not well-defined in the health care literature (Cordes, 1989), and the population density of the hospital's service area, the size of the community in which the hospital is located, and its number of beds may be poor proxies for the capabilities of the institution. Service availability is a

better indicator of what the rural hospital actually does, but it too can be misleading. Most analyses of hospital services mix clinical and non-clinical services in ways that make the results difficult to interpret. For instance, "services" in these analyses often include pieces of equipment (eg. CAT scanners), treatment units (eg. intensive care units) and hands-on care delivered outside of the hospital's walls (eg. a home health agency). More importantly, conclusions about the "presence" or "absence" of a particular "service" may be open to different interpretations. The American Hospital Association annual survey, the standard data source for these analyses, only recently began distinguishing between availability of services or equipment on a full-time basis, versus availability on a regularly scheduled, but part-time, basis. (At present, this is done for CT scanners, MRIs and lithotripters.) This is a particularly important issue for analysis of rural hospitals, where technologies may be present for part of a week, through mobile units.

These limitations suggest that there is room for the development of other approaches to the characterization of rural hospitals. The approach taken in this article- characterizing rural hospitals by the configurations of their medical staffs- does not overcome all of the limitations noted above, and it raises some new issues of measurement, but it does have strong "face-validity". In rural areas there is a close, symbiotic relationship between hospitals and their medical staffs. Hospitals frequently spearhead community efforts to recruit physicians, sometimes providing income guarantees or subsidizing practice costs for new physicians (Burda, 1990). In return, the presence of specialists of certain types can make a critical difference in the financial viability of rural hospitals (Glenn, et al, 1988). Also, the mix of physician specialties on a

rural hospital's staff is a clear indicator of the breadth of medical care available in the facility.

The empirical analysis in this article is divided into three parts. The first section presents relatively complete survey data on the configuration of medical staffs in rural hospitals. In a second section, hierarchical analysis is used to determine if systematic patterns exist in the structure of rural hospital medical staffs, based on these data. The third section explores in greater detail the nature of the relationships between rural hospitals and their surgeons and radiologists.

DATA

The analyses in this article are based on data that were collected through a telephone survey of all rural hospital administrators in eight states of the midwestern and northwestern United States (Minnesota, Iowa, North Dakota, South Dakota, Montana, Idaho, Washington and Oregon). For the purposes of the survey, a rural hospital was defined as any hospital in the eight state region that was not located in a Metropolitan Statistical Area (MSA). As defined by the Office of Management and Budget, an MSA is a county with a city of 50,000 or more residents, or an urbanized area with at least 50,000 people that is part of a county or counties that have at least 100,000 people. The survey of administrators was initiated in June, 1991, and remitted in a response rate of ninety-seven percent. This high response rate means that the findings reported in this article are not affected by response bias.

Survey respondents were asked to report the number of active members of their hospital's medical staff, by seventeen different specialties and an "other" category. The

answers in the "other" category were then recoded, yielding twenty-three categories of physicians. Respondents were also asked to report the number of courtesy and of consulting members of their medical staff in each physician category, according to their own bylaw definitions of consulting and courtesy status. They were also asked to provide more detailed information on the most active general surgeons on their medical staff (up to a maximum of four), including medical staff status, road miles from the hospital to where the surgeon had his or her primary practice, organizational form of the surgeon's practice (solo, multispecialty group, etc), and average number of procedures done per week by the surgeon in the hospital. Detailed information was also collected regarding radiologists on the medical staff. This information included the organizational form and location of the radiologist's practice and the number of days per week at least one radiologist is available in the hospital.

CONFIGURATION OF RURAL HOSPITAL MEDICAL STAFFS

Not surprisingly, the most common type of physician in rural hospitals is the family practice specialist or general practitioner; virtually all active rural medical staffs have these types of physicians, regardless of the size of the staff (Table 1). The second most likely specialist to be found on active medical staffs is the general surgeon. About one-third of rural hospitals with medical staffs of four or fewer have a general surgeon on their active staffs; there is no other specialty that approaches representation in this proportion on small medical staffs. For hospitals with slightly larger active staffs (five to nine physicians), the proportion reporting radiologists (37%), internal medicine specialists (26%), and pathologists (19%) is dramatically larger than for medical staffs with four or fewer

TABLE 1

PERCENT OF RURAL HOSPITALS WITH PHYSICIAN SPECIALTY ON ACTIVE STAFF

	Number of Active Members of Medical Staff						
	0-2 (75)	3-4 (101)	5-9 (107)	10-20 (79)	21-50 (70)	>50 (33)	All (465)
Specialties							
FP or GP	82.7	99.0	100.0	100.0	98.6	100.0	96.8
Internal Medicine	9.3	7.9	26.2	67.1	95.7	100.0	42.2
Pediatrics	1.3	0.0	5.6	17.7	64.3	100.0	21.3
Ob-Gyn	2.7	4.0	4.7	29.1	85.7	100.0	27.3
ENT	0.0	1.0	0.9	5.1	58.6	93.9	16.8
General Surgery	12.0	32.7	60.7	92.4	100.0	100.0	60.9
Orthopedic Surgery	1.3	3.0	1.9	32.9	94.3	100.0	28.2
Anesthesiology	0.0	2.0	3.7	8.9	60.0	100.0	18.9
Radiology	1.3	5.9	37.4	74.7	90.0	100.0	43.4
Pathology	1.3	4.0	18.7	36.7	74.3	100.0	29.9
Ophthalmology	0.0	3.0	1.9	19.0	81.4	100.0	23.7
Cardiology	0.0	1.0	0.9	3.8	14.3	75.8	8.6
Oncology	0.0	0.0	0.0	1.3	17.1	93.9	9.5
Urology	1.3	3.0	5.6	20.3	72.9	100.0	23.7
Gastro-enterology	0.0	0.0	0.0	2.5	14.3	78.8	8.2
Psychiatry	0.0	0.0	1.9	11.4	47.1	81.8	15.3
Neurology	0.0	0.0	0.0	0.0	18.6	90.9	9.2
Podiatrists	0.0	3.0	2.8	3.8	7.1	9.1	3.7
Allergists	0.0	0.0	0.0	1.3	2.9	12.1	1.5
Dermatology	0.0	0.0	0.0	2.5	0.0	33.3	2.8
Emergency Medicine	0.0	0.0	0.0	6.3	11.4	36.4	5.4
Other Surgery	0.0	0.0	0.0	1.3	5.7	45.5	4.3
Other Specialties	0.0	0.0	0.0	3.8	7.1	42.4	4.7

Note: Numbers in ( ) indicate the numbers of hospitals in each category.

physicians. Orthopedic surgeons, ob-gyns, urologists and pediatricians similarly increase in prevalence as active staff size increases to a range from ten to twenty. All thirty-three rural hospitals with more than fifty physicians on their active staffs have at least one general surgeon, orthopedic surgeon, anesthesiologist, radiologist, pathologist, ob-gyn, ophthalmologist, urologist, pediatrician, and internal medicine specialist. Overall, when all rural hospitals are considered irrespective of the size of their medical staffs, sixty-one percent report a general surgeon on staff, followed in prevalence by radiologists (43%), internists (42%), and pathologists (30%). To investigate whether these patterns are heavily influenced by the presence of a few rural facilities that are essentially specialty hospitals, we recalculated the entries in Table 1 after excluding fifty-six hospitals that are classified as "Rural Referral Centers" under Medicare's prospective payment system (Komisar, 1991). While the percentages for some of the less frequently reported specialties declined substantially, the overall pattern of responses for the more commonly reported specialties remained essentially unchanged.

Tables 2 and 3 are organized similarly to Table 1, but refer to the percent of hospitals having different types of specialists on their courtesy and consulting staffs, respectively. While hospitals were allowed to define participation in these categories to be consistent with their own policies, under the normal use of these terms courtesy staff members are physicians who can admit patients to the hospital but have a primary hospital affiliation elsewhere and consequently admit fewer than some specified number of patients during any given year. In contrast, consulting members of the medical staff do not admit patients to the hospital but can be involved in patient care in an advisory

TABLE 2

PERCENT OF RURAL HOSPITALS WITH PHYSICIAN SPECIALTY ON COURTESY STAFF

	Number of Active Members of Medical Staff						
	0-2 (75)	3-4 (101)	5-9 (107)	10-20 (79)	21-50 (70)	>50 (33)	All (465)
Specialties							
FP or GP	28.0	23.8	15.0	25.3	44.3	59.4	28.2
Internal Medicine	5.4	10.9	9.3	15.2	27.1	21.2	13.6
Pediatrics	2.7	2.0	0.9	8.9	21.4	24.2	7.5
Ob-Gyn	9.3	11.9	12.1	13.9	30.0	12.1	14.6
ENT	1.3	11.9	18.7	38.0	28.6	18.2	19.1
General Surgery	28.0	30.7	26.2	27.3	28.6	27.3	28.2
Orthopedic Surgery	12.0	24.8	28.0	45.6	28.6	18.2	27.1
Anesthesiology	8.0	4.0	4.7	8.9	20.0	12.1	8.6
Radiology	26.7	21.8	20.6	19.0	21.7	15.2	21.3
Pathology	26.7	16.8	24.3	30.4	27.1	18.2	24.1
Ophthalmology	8.0	18.8	15.9	29.1	32.9	15.2	20.0
Cardiology	13.3	20.8	19.6	34.2	35.7	18.2	23.7
Oncology	5.3	5.9	10.3	26.6	31.4	9.1	14.4
Urology	21.3	27.7	25.2	48.1	27.1	9.1	28.2
Gastro-enterology	2.7	9.9	9.3	10.1	15.7	3.0	9.0
Psychiatry	0.0	3.0	7.5	24.1	21.4	30.3	11.8
Neurology	0.0	5.0	9.3	19.0	28.6	12.1	11.6
Podiatrists	0.0	5.9	1.9	6.3	5.7	0.0	3.7
Allergists	0.0	0.0	1.9	0.0	1.4	3.1	0.9
Dermatology	0.0	1.0	1.9	0.0	8.6	6.3	2.4
Emergency Medicine	0.0	1.0	1.9	3.8	10.0	3.1	3.0
Other Surgery	0.0	3.0	1.9	5.1	2.9	9.4	3.0
Other Specialties	0.0	4.0	4.7	3.8	8.6	3.1	4.1

Note: Numbers in ( ) indicate the numbers of hospitals in each category.

TABLE 3

PERCENT OF RURAL HOSPITALS WITH PHYSICIAN SPECIALTY ON CONSULTANT STAFF

	Number of Active Members of Medical Staff						
	0-2 (75)	3-4 (101)	5-9 (107)	10-20 (79)	21-50 (70)	>50 (33)	All (465)
Specialties							
FP or GP	5.3	4.0	7.5	2.5	7.1	15.2	6.0
Internal Medicine	14.7	21.8	18.7	7.6	10.0	9.1	14.8
Pediatrics	5.3	6.9	5.6	5.1	5.7	6.1	5.8
Ob-Gyn	13.3	15.8	27.1	20.3	5.7	3.0	16.3
ENT	12.0	15.8	30.8	38.0	12.9	0.0	20.9
General Surgery	38.7	31.7	31.8	16.5	8.6	9.1	25.2
Orthopedic Surgery	22.7	29.7	43.9	34.2	15.7	0.0	28.4
Anesthesiology	8.0	8.9	8.4	16.5	12.9	9.1	10.5
Radiology	66.2	73.3	47.7	19.0	11.4	9.1	43.1
Pathology	62.7	74.3	58.5	44.3	22.9	6.1	51.1
Ophthalmology	17.3	20.8	34.6	34.2	10.0	3.0	22.8
Cardiology	34.7	37.6	50.5	43.0	28.6	12.1	37.8
Oncology	8.0	11.9	26.2	34.2	27.1	15.2	20.9
Urology	30.7	39.6	51.4	35.4	15.7	0.0	33.8
Gastro-enterology	4.0	13.9	18.7	13.9	14.3	6.1	12.9
Psychiatry	4.0	8.9	13.1	16.5	21.4	12.1	12.5
Neurology	6.7	11.9	21.5	35.4	27.1	9.1	19.4
Podiatrists	0.0	10.9	3.7	2.5	0.0	0.0	3.7
Allergists	0.0	1.0	1.9	2.5	0.0	0.0	1.1
Dermatology	1.3	1.0	3.7	3.8	5.7	3.1	3.0
Emergency Medicine	0.0	0.0	0.0	2.5	0.0	0.0	0.4
Other Surgery	0.0	1.0	1.9	2.5	2.9	3.1	1.7
Other Specialties	1.3	3.0	9.3	10.1	8.6	12.5	6.9

Note: Numbers in ( ) indicate the numbers of hospitals in each category.

capacity. The configurations for these relationships are clearly different than for active staff members, yet appear logical when considered in the context of these distinctions as well as the size of the hospital's active staff. In general, rural hospitals with relatively small active medical staffs are more likely to report the presence of specialties in courtesy or consulting status. Those hospitals with relatively large active staffs are less likely to have specialties on consulting or courtesy status, presumably because most specialties are available through active staff members.

Table 4 presents data on the average number of physicians in different specialties for active medical staffs of different sizes. While the proportion of the active medical staff consisting of family practice physicians or general practitioners declines as the total staff size increases, even for hospitals with an average active staff of thirty-one physicians (the average size of medical staff in the 21-50 range) approximately one-third of staff members are physicians of these types. Although general surgeons are the most frequently reported specialty in rural hospitals, they comprise a relatively small proportion of active hospitals' medical staffs across all size ranges. Overall there are more internal medicine specialists (1.58) on the average rural hospital active medical staff (total size equalling 15.92 members) than there are general surgeons (1.34), reflecting primarily the greater relative importance of internists on medical staffs with more than fifty members. As indicated in Table 4, active medical staffs averaging fourteen members (the average for staffs in the 10-20 range) look quite different from staffs with only seven members (the average in the 5-9 range) as they typically contain at least one general surgeon, radiologist, and internist. As average staff size increases from fourteen to thirty-one, there

TABLE 4

AVERAGE NUMBER OF ACTIVE MEDICAL STAFF PER HOSPITAL

	Number of Active Members of Medical Staff						
	0-2 (75)	3-4 (101)	5-9 (107)	10-20 (79)	21-50 (70)	>50 (33)	All (465)
Specialties							
FP or GP	1.28	2.76	4.64	7.20	9.69	4.52	5.59
Internal Medicine	.09	.09	.33	1.38	3.61	9.82	1.58
Pediatrics	.01	.00	.06	.20	1.26	5.27	.61
Ob-Gyn	.03	.04	.05	.42	1.79	5.55	.76
ENT	.00	.01	.01	.05	.77	2.18	.28
General Surgery	.13	.35	.70	1.46	2.97	5.45	1.34
Orthopedic Surgery	.01	.03	.02	.39	2.21	5.48	.80
Anesthesiology	.00	.02	.04	.10	1.03	5.24	.56
Radiology	.01	.06	.50	1.20	1.94	4.61	.95
Pathology	.01	.04	.20	.49	1.11	2.64	.49
Ophthalmology	.00	.03	.02	.24	1.47	4.24	.57
Cardiology	.00	.01	.01	.04	.19	2.27	.20
Oncology	.00	.00	.00	.01	.20	2.09	.18
Urology	.01	.03	.06	.22	.97	2.45	.38
Gastro-enterology	.00	.00	.00	.03	.16	1.42	.13
Psychiatry	.00	.00	.03	.13	.73	2.70	.33
Neurology	.00	.00	.00	.00	.19	2.00	.17
Podiatrists	.00	.04	.03	.05	.14	.18	.06
Allergists	.00	.00	.00	.01	.03	.15	.02
Dermatology	.00	.00	.00	.03	.00	.61	.05
Emergency Medicine	.00	.00	.00	.13	.30	1.55	.18
Other Surgery	.00	.00	.00	.01	.06	1.15	.09
Other Specialties	.00	.00	.00	.15	.11	2.45	.22
Overall	1.58	3.51	6.70	13.94	30.93	74.02	15.92

Note: Numbers in ( ) indicate the numbers of hospitals in each category.

are striking increases in the average number of orthopedic surgeons, ob-gyns, ophthalmologists and pediatricians.

Tables 5 and 6 present data on average number of physicians by specialty for courtesy and consulting medical staff members of rural hospitals. Overall, there is one courtesy/consulting staff member for each active staff member in rural hospitals. Not surprisingly, the importance of courtesy and consulting staff members for a rural hospital medical staff declines as active staff size increases. This is particularly true for specialties such as radiology, orthopedic surgery, pathology, urology, and cardiology. The proportion of courtesy appointments filled by family practice/general practitioners increases with the size of the active medical staff, while the number with consulting appointments for these physicians is low across all size classes.

PATTERNS IN MEDICAL STAFF COMPOSITION

Tables 1-6 suggest that, as the medical staff of a rural hospital increases in size, the addition of new specialties to the staff may follow a systematic pattern. In this section, we examine this hypothesis using Guttman scaling techniques. As noted above, Edwards, et al (1972) and Adams, et al (1991) used these techniques to test for hierarchical patterns of service provision in rural hospitals. In a more closely related study, Lawlor and Reid (1981) used data from the AMA's 1975 masterfile to determine if hierarchical patterns existed in the location of specialists across all counties in the United States, testing hypotheses generated from "regional economics" theories.

To explain the Guttman approach, it is useful to imagine ordering rural hospital medical staffs according to their "level of specialization." The existence of a particular

TABLE 5

AVERAGE NUMBER OF COURTESY MEDICAL STAFF PER HOSPITAL

	Number of Active Members of Medical Staff						
	0-2 (72)	3-4 (95)	5-9 (105)	10-20 (74)	21-50 (57)	>50 (6)	All (409)
Specialties							
FP or GP	.92	.93	.36	1.37	2.39	4.59	1.34
Internal Medicine	.14	.18	.17	.51	.79	.61	.35
Pediatrics	.03	.03	.01	.13	.39	.55	.13
Ob-Gyn	.15	.13	.16	.28	.80	.45	.29
ENT	.01	.15	.26	.56	.50	.24	.28
General Surgery	.40	.57	.51	.48	.60	.55	.52
Orthopedic Surgery	.21	.35	.58	.89	.67	.42	.52
Anesthesiology	.08	.06	.05	.14	.61	.18	.17
Radiology	.57	.53	.58	.66	.61	.27	.56
Pathology	.41	.32	.46	.96	.63	.39	.53
Ophthalmology	.09	.28	.31	.65	.54	.33	.36
Cardiology	.29	.56	.52	1.20	.79	.33	.64
Oncology	.08	.06	.18	.41	.60	.15	.24
Urology	.24	.43	.46	.76	.50	.12	.45
Gastro-enterology	.04	.23	.13	.16	.20	.03	.15
Psychiatry	.00	.04	.09	.33	.44	.64	.20
Neurology	.00	.06	.12	.34	.47	.18	.18
Podiatrists	.00	.09	.02	.09	.11	.00	.06
Allergists	.00	.00	.02	.00	.01	.03	.01
Dermatology	.00	.01	.02	.00	.10	.06	.03
Emergency Medicine	.00	.01	.03	.15	1.00	.27	.20
Other Surgery	.00	.04	.02	.06	.04	.30	.05
Other Specialties	.00	.05	.06	.14	.24	.03	.09
Overall	3.66	5.11	5.12	10.27	13.03	10.72	7.35
Avg. Courtesy/Avg. Active	2.32	1.46	.76	.74	.42	.14	.46

Note: Numbers in ( ) indicate the numbers of hospitals in each category.

TABLE 6

AVERAGE NUMBER OF CONSULTANT MEDICAL STAFF PER HOSPITAL

	Number of Active Members of Medical Staff						
	0-2 (72)	3-4 (95)	5-9 (105)	10-20 (74)	21-50 (57)	>50 (6)	All (409)
Specialties							
FP or GP	.19	.08	.21	.08	.31	.67	.20
Internal Medicine	.28	.32	.30	.14	.23	.12	.25
Pediatrics	.08	.09	.06	.06	.13	.09	.08
Ob-Gyn	.20	.26	.45	.38	.10	.03	.27
ENT	.16	.21	.48	.65	.30	.00	.34
General Surgery	.65	.67	.63	.30	.23	.18	.49
Orthopedic Surgery	.24	.53	.64	.77	.37	.00	.49
Anesthesiology	.11	.19	.13	.29	.53	.18	.23
Radiology	1.28	2.23	1.63	.95	.41	.15	1.30
Pathology	.96	1.30	1.35	1.08	.69	.12	1.04
Ophthalmology	.20	.32	.58	.85	.23	.03	.42
Cardiology	.73	1.02	1.53	1.95	.89	.45	1.19
Oncology	.08	.17	.30	.67	.34	.24	.30
Urology	.40	.59	.77	.63	.24	.00	.51
Gastro-enterology	.04	.26	.32	.23	.23	.18	.22
Psychiatry	.04	.12	.17	.20	.41	.36	.19
Neurology	.11	.13	.35	.68	.57	.33	.35
Podiatrists	.00	.11	.05	.03	.00	.00	.04
Allergists	.00	.01	.02	.03	.00	.00	.01
Dermatology	.01	.01	.05	.04	.06	.03	.03
Emergency Medicine	.00	.00	.00	.14	.00	.00	.02
Other Surgery	.00	.01	.02	.05	.04	.12	.03
Overall	5.77	8.73	10.22	10.61	6.42	3.44	8.16
Avg. Consultant/Avg. Active	3.65	2.49	1.53	.76	2.21	.05	.51

Note: Numbers in ( ) indicate the numbers of hospitals in each category.

specialty on a medical staff is equivalent to a positive response to an item on a scale indicating level of specialization. The hypothesis is that a positive response will occur for a given specialty only if positive responses have been observed for more commonly reported specialties. For example, rural hospital medical staffs would have a radiologist only if they also have the two more commonly reported specialties of family practice/general practice and general surgery. By the same logic, all hospitals that reported internists could also be assumed to have family practice/general practitioners, general surgeons, and radiologists on their staffs. If this pattern were extended over all specialties, with no deviations, a perfect hierarchy would exist in rural hospital medical staffs. That is, a scale could be constructed that would rank rural hospitals without error according to the level of specialization of their medical staffs.

Table 7 orders the rural hospitals in our data set by the number of specialties represented on their medical staffs, for the seventeen most commonly reported specialties. The numbers in the table indicate the percent of hospitals with a given number of specialties on their medical staffs that report a specific specialty. For instance, fifty-five hospitals have medical staffs with three specialties, and 74.5% of these hospitals have a general surgeon on staff. While there is clearly a hierarchical pattern to the data, a perfect hierarchy does not exist. This, of course, is likely to always be the case in empirical applications of Guttman scaling, so that the question is whether the degree of deviation from a perfect hierarchy is sufficient to reject the hierarchical model as an adequate representation of the configuration of rural hospital medical staffs.

TABLE 7

PERCENT OF HOSPITALS WITH PHYSICIAN SPECIALTY ON ACTIVE STAFF

Number of Specialties (number of hospitals)	1 (131)	2 (81)	3 (55)	4 (40)	5 (18)	6 (17)	7 (17)	8 (11)	9 (9)	10 (10)	11 (12)	12 (11)	13 (11)	14 (8)	15 (8)	16 (8)	17 (18)	All (465)
FP or GP	93.9	97.5	98.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	90.9	100.0	100.0	100.0	100.0	96.8
General Surgery	3.1	61.7	74.5	85.0	94.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	61.2
Radiology	0.8	3.7	47.3	77.5	77.8	76.5	82.4	81.8	100.0	90.0	91.7	100.0	100.0	100.0	100.0	100.0	100.0	43.5
Internal Medicine	2.3	16.0	21.8	45.0	83.3	88.2	100.0	100.0	100.0	100.0	91.7	100.0	100.0	100.0	100.0	100.0	100.0	42.4
Pathology	0.0	6.2	18.2	42.5	33.3	29.4	52.9	36.4	77.8	60.0	75.0	100.0	100.0	100.0	100.0	100.0	100.0	30.3
Orthopedic Surgery	0.0	2.5	3.6	17.5	22.2	35.3	52.9	63.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	28.1
Ob-Gyn	0.0	4.9	7.3	5.0	16.7	41.2	76.5	54.5	88.9	90.0	83.3	90.9	100.0	100.0	100.0	100.0	100.0	27.5
Urology	0.0	3.7	5.5	15.0	11.1	17.6	29.4	54.5	66.7	40.0	83.3	90.9	100.0	100.0	100.0	100.0	100.0	23.7
Ophthalmology	0.0	1.2	3.6	2.5	16.7	23.5	47.1	63.6	66.7	60.0	75.0	100.0	100.0	100.0	100.0	100.0	100.0	23.7
Pediatrics	0.0	2.5	1.8	2.5	16.7	35.3	23.5	27.3	55.6	80.0	75.0	81.8	72.7	100.0	100.0	100.0	100.0	21.5
Anesthesiology	0.0	0.0	7.3	5.0	5.6	11.8	11.8	36.4	22.2	50.0	58.3	81.8	81.8	100.0	100.0	100.0	100.0	19.0
ENT	0.0	0.0	1.8	0.0	0.0	23.5	0.0	27.3	11.1	40.0	66.7	63.6	90.9	87.5	100.0	87.5	100.0	16.6
Psychiatry	0.0	0.0	7.3	0.0	11.1	11.8	23.5	18.2	11.1	40.0	58.3	54.5	72.7	75.0	50.0	50.0	100.0	15.4
Oncology	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	10.0	0.0	9.1	36.4	62.5	75.0	100.0	100.0	9.4
Neurology	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	0.0	10.0	16.7	9.1	9.1	50.0	87.5	100.0	100.0	9.2
Cardiology	0.0	0.0	1.8	2.5	11.1	0.0	0.0	9.1	0.0	20.0	8.3	0.0	18.2	12.5	62.5	75.0	100.0	8.5
Gastro-enterology	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.2	0.0	10.0	16.7	18.2	27.3	12.5	25.0	87.5	100.0	8.1

One measure of how well the data fit a hierarchical structure is the "coefficient of reproducibility" (CR), as proposed by Guttman. The CR is defined as one minus the ratio of errors (observed responses that do not correspond to the ideal scale pattern) to total number of responses (McIver and Carmines, 1981). Guttman suggests that a score of .9 or greater indicates "acceptable" reproduction. Since extreme values tend to inflate the CR, the six least frequently mentioned specialties were eliminated from analysis, yielding a relatively conservative test statistic. The resulting CR, calculated for active members of hospital staffs and the seventeen specialties contained in Table 7, is .92. This suggests that rural hospital medical staffs can be ordered on a Guttman scale, with their level of specialization represented by a single scale score.

To explore this conclusion further, a "coefficient of scalability"(CS) was calculated. The CS arises from the observation that the total reproducibility "...can be no less than the sum of the proportion of responses in the modal category for each item in the scale, divided by the number of items...[it] reflects the reproducibility of a series of items based only on knowledge of the item marginal distributions." (McIver and Carmines, 1981). The CR measures the ability of the hierarchical ranking of the Guttman scale to predict the presence of a particular specialty, in comparison to predictions based on the marginal frequencies alone, and is defined as one minus the ratio of the number of scale errors to the number of marginal errors. CS equals one if the scale predictions are perfect and zero if the scale does not improve on predictions based on marginal probabilities, with values greater than .6 arbitrarily taken to indicate acceptable scalability (McIver and Carmines,

1981). The CS for active rural hospital medical staffs is .65, again suggesting that rural hospitals can be scaled according to their level of specialization.

In further analyses, Guttman scaling techniques were also applied to data on physician specialty, regardless of nature of medical staff affiliation (active, consulting, courtesy). When all types of affiliation are combined, rural hospital medical staffs are less satisfactorily represented by a hierarchical ordering. In this case, the CR equals .84, while the CS equals .44, both below generally accepted criterion levels. Interestingly, excluding consulting appointments from the analysis (focusing only on active plus courtesy appointments) results in stronger support for the hierarchical hypothesis, with a CR of .89 and a CS of .59.

MEDICAL STAFF PARTICIPATION BY GENERAL SURGEONS AND RADIOLOGISTS

As Table 7 indicates, general surgery and radiology are the most frequently represented specialists on rural hospital medical staffs beyond family practice/general practice. Their presence on even very small medical staffs suggests their importance to rural hospitals. In this section we present more detailed survey data that focuses on these two specialties.

General Surgery

The presence of a general surgeon can be critical to the perceived viability of rural acute care hospitals. Glenn, et al (1988) assert that, "Valid or not, the public tends to view some surgical capability as integral to its definition of what constitutes a community, acute care hospital." As implied in this statement, there are likely to be various degrees of surgical capability on rural hospital medical staffs. Even surgeons listed as active medical

staff members may spend only part of the week at the hospital and may not have their primary practice in the community in which the hospital is located.

Table 8 presents data on the most active surgeon for rural hospitals reporting that a surgeon was on their medical staff in an active, courtesy, or consulting status. These surgeons typically have a solo practice or are members of multi-specialty groups. In hospitals with active medical staffs of four or fewer, the most active surgeon is likely to have a courtesy or consulting (rather than active) medical staff appointment. The average number of surgical procedures performed each week by the most active surgeon ranges from 1.9 where active medical staffs contain two or fewer physicians to 9.4 for medical staff sizes of from ten to twenty.

Perhaps the most interesting finding in the data on general surgeons relates to the location of the surgeon's primary practice. Clearly, where medical staffs are small (eg have less than ten members), the surgeon who performs most of the surgery at the hospital does not live in the community where the hospital is located. Even for active medical staffs of from five to nine members, the average distance between the primary practice site of the most active surgeon and the rural hospital is seventeen miles. This is consistent with Glenn, et al's (1988) statement, based on Missouri data, that "...competition from an excess of surgeons in larger communities is prompting the less well-established surgeon to travel to rural hospitals." Glenn, et al (1988) see several disadvantages to the reliance of rural hospitals on "itinerant surgeons," suggesting that these surgeons will have "...less vested interest in seeing the local medical community thrive," provide limited financial benefits to a rural hospital, and "...project an image of

TABLE 8

MOST ACTIVE SURGEON ON MEDICAL STAFF

	Number of Active Members of Medical Staff						
	0-2 (75)	3-4 (101)	5-9 (107)	10-20 (79)	21-50 (70)	>50 (33)	All (465)
Number of Hospitals with Surgeons	56	82	98	78	70	33	417
Average Distance (miles)	41.6	32.0	17.2	4.6	1.3	0.1	17.0
Practice Type (%)							
Solo	46.3	47.5	45.4	35.9	28.6	31.3	40.1
Multi-Specialties	37.0	35.0	36.1	42.3	48.6	46.9	40.1
Single-Specialty	14.8	12.5	14.4	16.7	22.9	21.9	16.5
Hospital Based	1.9	5.0	4.1	5.1	----	----	3.2
Staff Status (%)							
Active	16.1	40.2	66.3	93.6	100.0	100.0	67.9
Courtesy	35.7	26.8	16.3	3.8	----	----	14.6
Consult	48.2	32.9	17.3	2.6	----	----	17.5
Average Procedures per Week	1.9	2.9	6.3	9.4	8.6	8.7	6.1

Note: Numbers is ( ) indicate the numbers of hospitals in each category.

instability." They also note that the American College of Surgeons forbids its members from engaging in itinerant surgery.

Radiology

Radiology is the second most common specialty present on the active medical staffs of rural hospitals. For medical staffs of nine or fewer active members, radiology services are overwhelmingly provided by radiologists practicing primarily outside of the community in which the hospital is located (see Table 9). For these smaller medical staffs, radiology coverage is available for fewer than three days per week, usually on a consulting basis. The provision of radiology services through a group practice located at the hospital (a common organizational arrangement in urban hospitals) becomes the dominant organizational form for service provision only after the active medical staff reaches twenty-one or more members. Even then, a substantial proportion of hospitals (22.9) report that radiology services are provided by radiologists from outside of the community in which the hospital is located. In this respect, radiology is similar to general surgery in small rural hospitals.

CONCLUSIONS

This article has presented, for the first time, relatively detailed descriptive data on the configuration of rural hospital medical staffs, based on a large sample of rural hospitals. An analysis of medical staff composition, as it relates to medical staff size, suggests that a hierarchical pattern is present. As medical staff size increases, specialty capability is expanded in a systematic and predictable way. This has important implications for research on rural hospitals because it means that the "level of

TABLE 9

RADIOLOGIST PARTICIPATION ON MEDICAL STAFFS

	Number of Active Members of Medical Staff						
	0-2 (75)	3-4 (101)	5-9 (107)	10-20 (79)	21-50 (70)	>50 (33)	All (465)
Staff (average number per hospital)							
Active	0.01	0.06	0.50	1.20	1.94	4.61	0.95
Courtesy	0.57	0.53	0.58	0.66	0.61	0.27	0.56
Consult	1.28	2.23	1.63	0.95	0.41	0.15	1.30
Types of Practice (%)							
Group at hospital	----	----	2.0	5.1	40.0	75.8	13.9
Group in local community	----	----	1.0	3.8	8.6	24.2	4.2
Group outside community	50.9	68.2	61.8	36.7	20.0	----	45.4
Solo at hospital	7.5	3.4	14.7	38.0	21.4	----	15.8
Solo in local community	1.9	----	----	5.1	1.4	----	1.4
Solo outside community	39.6	27.3	20.6	11.4	2.9	----	18.1
Others	----	1.1	----	----	5.7	----	1.2
Coverage (average days per week)	1.01	1.56	2.89	4.68	5.67	6.45	3.28

Note: Numbers in ( ) indicate the numbers of hospitals in each category.

specialization" on rural hospital medical staffs can be represented on a single scale. This scale value can be utilized as a predictor variable in studies of rural hospital financial viability, patient outcomes, and other measures of performance. For example, in the study by Keeler, et al (1992) quality-of-care criteria and sickness adjusted outcomes could be examined in light of a rural hospital's level of specialization. Also, factors that influence the "level of specialization" of a rural hospital can be explored using multivariate analysis, with the scale value as the dependent variable.

The analysis in this article also points out the importance of going beyond aggregate, dichotomous measures in future analyses of rural hospital medical staffs. For example, simply knowing that a specialty is represented on the hospital's active medical staff does not mean that a specialist is present in the hospital on a daily basis. Relatively common specialties are represented on the active medical staffs of rural hospitals by physicians who do not live in the community where the hospital is located and spend only a few days a week practicing at the hospital. The possible negative implications of these "itinerant" relationships for rural hospitals, as posed by Glenn, et al (1988), as well as their possible benefits, deserve careful research attention.

While several potentially fruitful avenues for future research relating to rural hospital medical staffs exist, data limitations will make this research difficult to carry out. To the best of our knowledge, there is no single source that provides longitudinal data of any type on rural hospital medical staffs. Certainly, the detailed data on medical staff arrangements that are needed to fully understand the evolution in the provision of specialty services in rural hospitals are not collected on a regular basis. Thus, it will be

necessary for future research to rely primarily on special surveys of samples of rural hospitals, such as employed in this study. While these surveys provide useful "snapshots" of rural hospitals at specific points in time and in specific geographic areas, they are much less useful for "trend analysis".

Even "one-time" surveys designed to gather information on rural hospital medical staffs may not be entirely successful if low response rates raise the issue of potential "response bias". Our experience is that telephone interviews are the most efficient way to collect detailed, and sometimes sensitive, medical staff data. Although mail surveys of hospital administrators would appear to be less expensive, low initial response rates typically result in substantial expenditures on follow-up telephone interviews in order to minimize potential response bias. This dissipates the perceived cost advantage of mail surveys and raises issues of comparability for data collected through mixed mail and telephone interviews.

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