Regional Differences in Surgical Care Based Upon Uniform Physician and Hospital Discharge Abstract Data

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Population based surgical rates for various common surgical procedures were analyzed on a regional basis by examining select uniform hospital discharge abstract data from Wisconsin hospitals. The surgical abstracts of nearly 64,000 procedures were compared to the supply of physicians and showed a significant variation in the rates of common procedures even within rather large planning districts. In general, the volume of surgery correlated with the supply of surgeons. Exceptions were noted; for example, primary appendectomy, tonsillectomy and adenoidectomy (T & A), and inguinal herniorrhaphy did not correlate with the supply of surgeons, but did correlate with the supply of general practitioners. Further, T & A had a strong negative correlation to the supply of ear, nose and throat specialists. Information of this type has significance both for Professional Standard Review Organizations (PSROs) and Health Planning Agencies (HPAs). Further work will be necessary to define optimal surgical rates.

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A NUMBER OF INVESTIGATORS have analyzed population-based, surgical rates.[3,5,7] These researchers have shown rather wide variations in the supply and utilization of surgical services. The purpose of this study was to examine population-based, surgical rates as reflected in an analysis of uniform hospital discharge abstracts and to determine the relationship of these procedures to the supply of different types of physicians and especially to those physicians who operate. The authors were also interested in determining whether additional small select studies would be indicated on the basis of variations identified from the simple abstract information.

The study examined uniform hospital discharge abstract data on all hospital discharges from 146 of the 148 acute care hospitals in the state of Wisconsin for March and September, 1973. Of the original 127,578 abstracts, roughly 35% of the total were surgical and involved nearly 64,000 surgical procedures. The hospital discharge abstract included items such as age, sex, residence, length of stay, diagnoses, procedures, attending physicians and method of payment. Copies of the abstract form are available from the Wisconsin Division of Health upon request. Hospital cooperation was generally excellent and with the exception of two hospitals each of approximately 300 beds, few problems were noted. Approximately half of the abstracts were completed by the hospitals on State Division of Health forms, while the remainder were obtained from hospitals subscribing to computerized record-keeping (PAS, HSD).

Based upon the two month sample, estimated annual surgical discharges were calculated by expanding the 63,757 surgical procedures. In this report the two month regional abstract data were adjusted to be in accordance with known aggregate annual regional volume. For this reason, minor differences from a previous report by these authors are evident.[1] Variable expansion factors were applied to regional data in anticipation of a truer reflection of actual annual utilization. The information on physicians was taken directly from 1973 reports from the Division of Health.[8] For the purposes of this analysis, Wisconsin was divided into the eight, area-wide, health planning regions which existed in 1973. From the viewpoint of P.L. 93-641, these data would require a different aggregation since the regions are not identical. Planning regions and the population within each region are shown in the figure below (Fig. 1).

Using patient residence as the unit of measurement, population-based, age-adjusted, surgical rates were calculated by procedure for each planning area. Correlation coefficients between place of residence and place of occurrence exceed 0.99 for all procedures except hysterectomy which exceeds 0.90. For convenience, rates are expressed per 1,000 population; statistical analysis revealed that the number of abstracts was suf-

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ficiently large that expansion from two to 12 months was statistically acceptable. No information is available to determine how representative March and September are of the remainder of the year. Further, to the extent that Wisconsin residents travel out of state to receive care, the Wisconsin rates will be understated. This problem is most pronounced in the northwest part of the state where many individuals seek care in Minnesota. Data were obtained from the Minnesota Department of Health on the total number of Wisconsin residents receiving in-hospital care in Minnesota, and Wisconsin rates were adjusted upward for these areas along the west side of the state by allocating Wisconsin resident discharges from Minneapolis–St. Paul to Region 6 and those from Duluth to Region 8.

Seven categories of surgical procedures were examined and these and their corresponding ICDA-8 codes are listed in Table 1. With the exception of two categories, *other* and *total*, each of the specifically identified procedures was examined because they were commonly performed, because the indications for these procedures are generally considered to be well established, and because the operations are almost totally performed in hospitals.

The patient data were then compared to regional physician supply data. Chi-square tests of statistical significance were performed comparing areas of above and below average supply of types of physicians to frequency of various procedures. Physician supply per

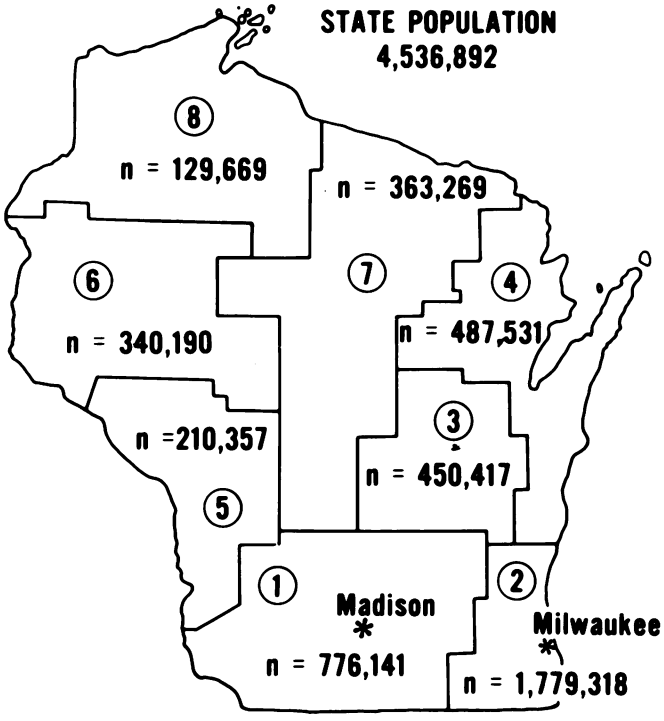

FIG. 1. This figure shows Wisconsin Health Planning Regions and resident population in 1973.

TABLE 1. *The Procedures Examined in this Study as Well as Their ICDA–8 numbers*

Examined Procedures	ICDA–8
Cholecystectomy	43.5
Hysterectomy	69.1–69.7
Inguinal hernia repair	38.2–38.3
Primary appendectomy	41.1
Tonsillectomy and adenoidectomy	21.1–21.2
Other	Residual (excluding letter-coded procedures)

1,000 population and total procedures are shown in Table 2.

You will notice that the southern portion of the state has a higher supply of total surgeons than the northern part of the state. The specialty of physicians was based upon self-proclaimed specialty status. The table also shows that the northern part of the state is not particularly deficient in the supply of general practitioners, while the Milwaukee area is below average when compared to the rest of the state. Comparisons were also made between procedures and the supply of internists.

Results

A breakdown of the various procedures is shown in Table 3. Total surgical procedures per 1,000 population showed a state mean of 90 with a range from 73 to nearly 100. Hysterectomy rates ranged widely from just over two to over 3⅓. The state average is below that of some prepaid group practice programs in this country, but well above the rate in England. Appendectomy rates also showed significant variation but the average in Wisconsin is near the lower end of the rate noted by Lewis in Kansas.[3] Tonsillectomy and adenoidectomy (T & A) showed considerable variation and will be discussed in detail later in this paper.

How did the frequency of procedures compare to the supply of different types of doctors? These data are shown in Table 4. Statistically significant positive correlations were noted between the supply of general surgeons and the frequency of total surgical procedures, hysterectomy, and others. Significant positive correlations were also noted between internists and total procedures and hysterectomy. However, when the supply of general practitioners was compared to total procedures and cholecystectomy, significant negative correlations were seen. An examination of the data for primary appendectomy, T & A, and inguinal hernia repair shows that the frequency has a significant negative correlation to the supply of general surgeons and a significant positive correlation to the supply of general practitioners. Further, the T & A data shows a strong negative correlation to the supply of ear, nose and throat specialists. The total volume of

TABLE 2. *Distribution of Specialists and Procedures by Wisconsin Districts, 1973*

Planning District	Observed Procedures	Specialty per 1,000 Population Wisconsin, 1973				
		General Practitioners	Internists	General Surgeons	ENT Specialists	Total Surgeons
State total	63,757	0.24	0.11	0.09	0.016	0.28
1	12,078	.27	.15	.10	.019	.34
2	27,178	.19	.14	.10	.018	.32
3	4,313	.28	.09	.08	.020	.24
4	6,282	.27	.06	.09	.012	.23
5	3,458	.24	.15	.09	.019	.31
6	3,566	.32	.05	.06	.006	.13
7	5,654	.24	.10	.07	.017	.26
8	1,028	.27	.03	.06	0	.13

the procedures which were shown to be correlated positively with GP supply represents less than 10% of all procedures.

Discussion

A number of interesting issues are raised as a result of these data. In general, the work supports that of others which states generally that the greater the supply of surgeons, the greater the number of operations which will be noted. However, exceptions were noted, *e.g.* cholecystectomy, inguinal herniorrhaphy, primary appendectomy and T & A. Also noteworthy was the inverse relationship between T & A and the supply of ENT specialists. Overall, the variation in rates between planning districts was not as great as has been noted by some researchers and the mean rates for the state are neither exceptionally high nor low.

Are general practitioners in Wisconsin doing too many appendectomies, hernia repairs and T & A's? These data neither answer the question of who is actually doing the operating in the areas analyzed, nor does it show whether citizens in the higher rate areas are less healthy than those in the lower rate areas (or more healthy for that matter). However, the correlations do raise some questions which deserve further examination, questions which are not easily raised without uniform hospital abstract data.

Are additional small select studies desirable on the basis of these data? We feel that a review of a random sample of pathology reports of appendices removed for acute appendicitis from regions 2 and 8 might be worthwhile (Table 3). Certainly, hospitals in regions 2 and 8 might wish to review these data themselves. Secondly, one could advocate an experimental second opinion program for T & A in region 4 and compare it at a later date to rates in region 3. This might not be necessary since Wennberg documented that simply bringing information of this type to the attention of the medical societies resulted in dramatic decreases in T & A in one high rate area in Vermont.[6] It is apparent that information such as this is of importance to HPAs, PSROs, third parties and practicing health professionals.

Another valuable aspect of population based data of this type is its ability to determine what percentage of the population in an area receives services within that region. This is of importance to HPAs and PSROs.

TABLE 3. *Regional Age-adjusted Surgical Rates per 1,000 Population, Wisconsin, 1973*

Patient's District of Residence	All Procedures	Procedure					
		Primary Appendectomy	Cholecystectomy	Ing. Hernia Repair	Hysterectomy	T & A	All others
State totals	90.07	1.58	2.57	3.22	3.07	3.99	74.26
1	80.16	1.73	2.11	2.86	2.86	3.88	66.60
2	91.27	1.19	2.51	3.06	3.36	3.92	77.19
3	99.20	1.86	2.90	3.79	2.57	5.34	82.53
4	79.52	1.51*	2.73	3.22*	2.81	5.97	62.93
5	89.69*	1.99	2.66	3.67	2.58	2.87	75.44
6	73.03	1.68*	2.42	3.09*	2.11	2.92	55.65
7	81.95	1.70	2.14	2.88	2.98	2.54	69.69
8	76.87	2.56	2.28	2.78	2.04	3.32	49.80

* Rate not significantly different ($P \leq .05$) from average of the rest of state.

This study showed that 95% of procedures performed in Wisconsin on residents of the Milwaukee and Oshkosh areas, respectively, were performed in hospitals within those districts. This would suggest that sample studies of hospital care within these districts could be considered representative of care received by the general population of those regions. Patient migration for some procedures was noted in some areas and a sample of certain types of hospital cases within these regions would have less relationship to the resident population.

Beyond adjusting the data for age, this study made no attempt to determine the degree to which the population of Wisconsin is homogeneous and one must be cautious before assuming that the frequency of surgical procedures should be comparable across the state. Theoretically, if one were dealing with a homogeneous population and diseases for which surgical operations are scientifically the best mode of treatment, the frequency of procedures should be constant across similarly sized subunits of the population. However, in this study statistically significant variations were noted and future research could meaningfully compare the mortality and morbidity rates between areas in the state where these 'natural' experiments are going on in terms of the frequency of surgical procedures and where population variables are otherwise comparable. What might one anticipate the results of such work to be? The goal could and should be the generation of scientifically sound *optimal* rates for the various surgical procedures in defined populations. How would one define an optimal surgical rate?

An optimal surgical rate for a given surgical procedure would be that rate which achieves the greatest reduction in mortality and morbidity when compared to the natural history of the disease and the success of alternative non-operative therapies. This approach of linking to outcomes to determine appropriate surgical rates would be far more desirable than basing estimates upon community averages or upon some other basis not related to scientifically generated outcome data. The importance of outcome data has been stressed by others.[2,4]

In conclusion, the authors hope that society will be interested in investing the financial resources necessary to determine scientifically optimal surgical rates rather than moving directly to rigid administrative and regulatory programs. Control programs generated strictly in the search for cost containment at the front end could end up costing both more money and creating greater human misery.

TABLE 4. *Comparison of Surgical Procedures between Regions with Above and Below State Average of Physicians*

Type of Procedure	Procedures per 1,000 Population by Specialty			
	General Practitioner	General Surgeon	Internist	ENT
All procedures				
Above†	82.6	87.9	88.0	
Below†	91.3	80.2	83.6	
Direction	—[a]	+[a]	+[a]	
Cholecystectomy				
Above	2.47	2.39	2.41	
Below	2.51	2.56	2.56	
Direction	—[a]	—[a]	—[a]	
Hysterectomy				
Above	2.62	3.21	3.16	
Below	3.36	2.59	2.59	
Direction	N.S.	+[a]	+[a]	
Inguinal hernia				
Above	3.16	3.00	3.05	
Below	3.06	3.24	3.24	
Direction	+[a]	—[a]	—[a]	
Primary appendectomy				
Above	1.75	1.35	1.40	
Below	3.92	1.75	1.75	
Direction	+[a]	—[b]	—[a]	
T & A				
Above	4.46	3.91	3.83	3.89
Below	3.92	4.33	4.83	4.53
Direction	+[a]	—[a]	—[a]	—[a]

† "Above" indicates those regions in which the number of physicians per 1,000 population is above the average for the state as a whole; "below" signifies the opposite of this.

[a] Means significant at $p \leq 0.0005$. [b] Means significant at $p \leq 0.05$.

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