Excerpted from: **Wennberg JE.** Dealing with Medical Practice Variations: A Proposal for Action. *Health Affairs.* 1984;3(2):6-32.

The First Step: Monitoring Performance In Hospital Markets

Hospital markets are thus characterized by highly variable rates of use for most specific medical treatments, diagnostic tests, and surgical procedures, and by widely different resource use rates. The actions that are needed pertain to the clinical management and resource allocation decisions in specific hospital markets. The first step is to monitor and distribute information on the per capita performance in local hospital markets so that decision making can be modified when appropriate.

What are the essential features of the monitoring I propose? The necessary data are contained in health insurance records such as Medicare, Medicaid, and Blue Shield claims systems and hospital discharge abstracts similar to those used in the DRG program. Population counts and information on hospital resources, including annual budgets, numbers of facilities and personnel also are needed. For outcome reports, information on survival must be joined to discharge data and to claims data to establish the link between use of medical care, diagnoses, and outcome. Sources for this information exist in many parts of the country and, for the Medicare program, nationwide.

The data should first be used to determine the geographic origin of patients who seek care at specific hospitals. The individual communities of a county or state are then arranged into hospital market areas such that most hospitalizations of local residents occur within area hospitals (and are thus initiated by physicians practicing within the area). Following this strategy, my colleagues and I have defined some 200 hospital markets in the six New England states and over 100 in the state of Iowa. The way the markets are organized assures a close association between the medical care experience of the local population and decisions made by health planners, regulators, local administrators, hospital trustees, clinicians, and, potentially, business coalitions. Since information on resource allocation and service use rates is available from all relevant places where care is given (whether in- or out-of-area), the per capita rates are truly population-based and thus may be validly compared.

What do the reports look like? There are three kinds of reports. One series describes the status of resource allocations to specific communities: the number of hospital beds, expenditures, and hospital personnel or the number of physicians invested, per capita in the health care of the local communities. Exhibit 4 is an example for Boston, Massachusetts and New Haven, Connecticut. Comparisons such as this should be very useful in planning decisions concerning capital expansion projects and in setting hospital budgets under prospective reimbursement plans.

In reviewing the reports, it is important for the reader to understand that virtually all of the hospitalization experience of the resident population is accounted for even if it takes place at hospitals located in other areas. The reports can be used to project the per capita consequences of specific planning or regulatory decisions. They can also be used in cost containment strategies to reduce expenditures in high-cost markets by cutting or stabilizing the size of the local hospital industry as indicated by its contribution to the total numbers of personnel and beds per capita. Variations in these indicators are strongly correlated with per capita expenditures; with this information, hospital administrators and trustees can make a direct connection between plant size and employment complements in their specific hospitals and the variations in the total per capita costs.

The reports inevitably raise issues concerning the relationship between the quality of care and the level of resource investment, particularly if the comparisons are between markets with a high proportion of patients who are treated in a university teaching hospital. In Exhibit 4, most resident hospitali-

Exhibit 4
The Quantity Of Hospital Resources Expended On The Populations Of New Haven, Connecticut And Boston, Massachusetts By Hospitals Providing Resources (1978)

Hospital	Percent of admissions from the local pop.	Beds allocated to local population	Market share	Per Capita Rates [b] Beds	Expend. [a]	Personnel
New Haven, Connecticut (pop. est. 372,900)						
Yale-New Haven Univ. Hosp.	68.3	541.6	54.8	1.5	124	5.5
St. Raphael	86.4	416.6	38.1	1.1	82	3.5
Out-of-area hospital	-	65.0	7.1	0.1	9	0.5
All hospitals	-	1023.2	100.0	2.7	215	9.5
Boston, Massachusetts (pop. est. 732,400)						
Boston teaching hospital	42.6	1828.0	59.0	2.5	322	13.1
Boston community hospital	50.6	843.0	23.3	1.2	84	3.3
Out-of-area hospital	-	524.4	16.7	.7	42	1.8
All hospitals	-	3195.4	100.0	4.4	448	18.2

Notes The estimates for the resources allocated to the New Haven and the Boston populations are made by multiplying the amount of resources provided by each hospital by the percent of admissions that are from the local population (column 2). For example, 542 of the Yale-New Haven University Hospital's total complement of 793 beds are used by the residents of New Haven. The estimate for the total numbers of beds is obtained by summing column 3 which, it will be noted, includes beds from out-of-area hospitals that provided services to the population of New Haven. For comparative purposes, we are particularly interested in per capita rates. The exhibit shows these for beds, numbers of personnel, and inpatient expenditures. All rates are corrected for boundary crossing.
[a] For inpatient services.
[b] Beds and personnel per 1,000 population, expenditures per person.

zations are to well-known hospitals and it might be assumed that per capita costs in each market would be quite high. This is not the case. The New Haven market area ranks in the middle third of all market areas in Connecticut, largely because of its relatively low total numbers of beds and personnel per capita. Contrast this to the situation in Boston where the per capita expenditures are more than double: in New Haven, in 1978, the estimate was $215; in Boston it was $448. The beds allocated to the population of Boston number 4.5 per 1,000 while in New Haven they number only 2.7. The number of employees per 1,000 shows about a twofold variation.

The differences in resource use depicted in Exhibit 4 are apparent only when directly measured. They are not intuitively known by those on the scene - I have asked clinicians who have practiced in both Yale and Harvard teaching hospitals to estimate the per capita expenditures in each market. Their answers indicate they have no awareness of the magnitude of the difference; what is more surprising, many do not accurately guess which of the two markets is the more expensive. Nor can the differences be appreciated through the use of traditional indicators of performance, whose validity as measures of market consumption rates depend on the degree to which they correlate with the per capita market rates. Small area research indicates their virtual independence. For example, among the hospital markets of a state, the occupancy rates of local hospitals, their average lengths-of-stay, and such measures of efficiency as the number of patients treated per bed (properly weighted to measure each hospital's relative

Exhibit 5
Rates For Cystoscopies Among Maine Medicare Enrollees By Urology Market Area Of Residence (1976-1977)

Urology market area	Enrollees [a]	Number of examinations	Rate [b]	Ratio to state average	Percent of enrollees with one or more examination
Portland	43,192	1,641	3.8	1.33*	2.8
Bangor	29,814	857	2.9	1.00	1.8
Lewiston	16,397	328	2.0	.70*	1.5
Augusta	9,920	235	2.4	.83*	1.7
Waterville	12,886	201	1.5	.54*	1.2
Biddeford	8,212	315	3.8	1.34*	2.6
Rumford	3,895	232	5.9	2.08*	3.9
Presque Isle	6,361	143	2.9	.78*	1.6
Skowhegan	4,203	95	2.3	.79	1.6
Ellsworth	2,805	68	2.4	.85	1.5
Caribou	5,757	125	2.2	.76*	1.8
Calais	1,969	23	1.2	.41*	1.0
State	156,325	4,478	2.86	1.00	2.0

Note: The count of the number of cystoscopic examinations is made from the claims history files of the Medicare program obtained from the carrier, using the appropriate procedure codes to select the relevant records. Reimbursements (not shown) are also tabulated from the claims records. The population counts are for all Medicare enrollees who were in the Part B program in 1977. The percent with one or more cystoscopy is determined by counting enrollees with cystoscopic examinations, rather than number of services.

[a] Enrollee person-year.

[b] per 1,000 enrollees.

contribution to the total experience) show little relationship with per capita number of beds or patient days, inpatient expenditures, and reimbursements per capita.

A second series of reports is concerned with the utilization of specific services for surgical and diagnostic procedures and for causes of admission. Exhibit 5 gives an example for diagnostic procedures, showing the rate of use of cystoscopic examination among Medicare residents in twelve Maine markets defined for urology services (1976-1977). The exhibit is based on claims data from the Medicare Part B program and the Medicare enrollment file. Note that the cystoscopic rate in the Rumford market is more than double the rate for the state as a whole, while in the Waterville market it is only about 54 percent of the average. The range of variation for the volume component (the per capita use rate, given in the exhibit as the standardized procedure rate) varies by a factor of more than four while the efficiency component -(the average reimbursement per cystoscopy not shown in the exhibit) -varies by less than 20 percent. This is typical of most surgical and diagnostic procedures and illustrates the importance of taking the volume into account in the design of cost containment efforts. The information also raises questions concerning the effectiveness and efficacy of the various practice styles. Note that in Rumford, nearly 4 percent of enrollees has cystoscopic examinations, while in Waterville and Calais about one percent of enrollees were examined. What are the risks and benefits of these different patterns of use for this technology? We simply don't have a good answer to that question at this time.

Exhibit 6
Admissions To Hospital For Medical Back Problems (DRG 243)
And For Dental Extractions And Restorations (DRG 187)
Number Of Cases Above (+) Or Below (-) Expected, Based On State Average
Nine Most Populated Maine Hospital Markets (1980-1981)

	Back Problems			Dental Extractions		
Market areas	**Admissions Observed -Expected** [a]	**Standard Rate**	**Reimburs. Observed -Expected** (x$1000)	**Admission Observed -Expected** [a]	**Standard Rate**	**Reimburs. Observed -Expected** (x$1000)
Portland	-567.1*	.58	-1,048	- 149.8*	.49	-122
Bangor	-61.9	.91	-108	_81.9*	.48	-66
Lewiston	-283.9*	.59	-503	- 108.2*	.29	-87
Augusta	+ 162.8*	1.32	+288	-42.0*	.60	-33
Waterville	+ 150.6*	1.37	+267	-55.1*	.43	-44
Biddeford	-74.0*	.81	-131	+88.6*	2.10	+71
Brunswick	-10.3	.96	-18	+ 115.9*	2.90	+93
Rockland	+2.7	1.01	+5	+60.0*	2.30	+48
Farmington	-74.0*	.66	-131	-37.7*	.24	-30
All Other	1755.1*	1.27	+1,339	+172.1*	1.18	+140

Note: The input to the table is hospital discharge data, maintained by the Maine Health Information Center and population data from the 1980 census, DRG-specific reimbursement rates are estimated using charge data from the Maryland Hospital Cost Commission for 1980. Column 2 gives the actual number of cases observed among residents of each market area subtracted from the expected number. A plus means more cases than expected, a minus, less. An asterisk indicates that the difference is statistically significant ($p<.01$). The expected number is the age-adjusted number of cases that would have occurred to area residents if the state rate had applied. The standardized utilization rate gives the age-adjusted rate for each area expressed as a ratio to the state average. Reimbursements above or below expected are estimated by multiplying the average charge for these DRGs for Maryland by the number of cases above or below expected.
[a] Observed minus expected, standardized to state average = 1.00
*Significant ($p<.0l$)

Similar tables have been generated from Medicaid and Blue Shield programs for use in feedback to Maine physicians. Under the feedback strategy I suggest, tables such as these should be generated by third-party carriers for all commonly used diagnostic and therapeutic procedures.

Hospital discharge data should also be used to generate age-adjusted utilization experiences for specific causes of admission or surgical procedures. Exhibit 6 illustrates an example of a report useful for feedback in a DRG-based prospective reimbursement program designed to draw attention to the importance of admission policies. Note that for medical back problems (DRG 243), the rate in the Portland and Lewiston hospital market areas is less than 60 percent of the average, while in the Augusta and Waterville area it is more than 30 percent higher than the average. Portland area residents experienced over 560 fewer cases than expected, based on the state average. The cost implications of the variations in admission rate for DRG-based reimbursement programs are illustrated in the exhibit. Over the two-year period, reimbursements for the Portland population under a DRG reimbursement program would be over $1 million less than expected, based on the state average. In Waterville and Augusta, their combined excess in reimbursements would be $500,000 more than expected. If the Portland use rate were the standard, outlays for medical back admissions in Maine in 1980-81 would have been $7.7 million. If the Waterville rate were the standard, $18.2 million would have been expended. Such displays should be

used in DRG programs to bring the variance to the attention of practicing physicians, hospital administrators, and other interested parties. The importance of admission rates in determining expenditures is clearly revealed in this exhibit: more than 63 percent of the causes of hospitalization have admission rates that are more variable than medical back problems.

Dental extractions are among the most variable of causes of admission. Note in Exhibit 6 the more than tenfold range in variation in the standardized utilization rates among the nine individually listed markets in the exhibit. Per capita reimbursements under a DRG program would range from a low of $180 per 1,000 population to a high of $1,860. If the practice style in the Augusta area were the standard for the state, the costs in Maine for this service performed in the in-hospital setting would be about $375,000; if the practice style for Brunswick were the standard, the reimbursements would be ten times higher, or about $3.7 million. Decreasing the use of hospitals for such high-variation procedures offers the potential for large reductions in the cost of hospital care. Reports such as these that identify points where savings can be realized should be used in cost-containment efforts.

A third series of reports is concerned with outcomes. As I have indicated, the practice style factor can play an important role in clinical decision making because the scientific evidence on the consequences of using particular treatments is ambiguous or incomplete. Estimates of survival and complication rates following the use of specific treatments for representative populations are frequently not available, even though they are essential for the evaluation of the common practices of medicine as well as for new technology. Claims data offer an inexpensive means for closing this information gap.

Claims data can be used, for example, for evaluating survival prospects or the probability of a secondary operation following the initial treatment of hypertrophy of the prostate by prostatectomy. I have used the Medicare claims data for such purposes in Maine, finding that the mortality rate in the year following prostatectomy was considerably higher than predicted by most of the published literature. The probability of undergoing a second prostatectomy was also quite high, reaching 13 percent by the end of the fifth year. As illustrated below, such information can help physicians deal with the uncertainties revealed by the practice variation phenomenon, leading to a fuller understanding of the consequences of particular decisions and motivating physicians to take the necessary additional steps to improve the scientific basis of medical practice. Reports based on claims data for analysis of survival and complication rates should become routinely available for technology assessment and the evaluation of the consequences of the natural experiments that derive from the medical practice variation phenomenon.

Is it possible to feedback information to physicians efficiently? Although this idea was first proposed by William Farr and Florence Nightingale well over 100 years ago, recent advances in computer technology, biostatistics, and epidemiology only now make it feasible to produce routinely the reports I am suggesting here. Furthermore, the necessary data are becoming available in many parts of the country. Large, computerized, population-based data files, comprised of hospital discharge records and health insurance claims, now exist in the public and private sectors. Several large states- California, Maryland, Massachusetts,

New Jersey, New York, and Iowa-now have state statutes that require hospitals to submit information on the cases they treat to publicly controlled data bases. Public use data bases have been key in our efforts to initiate feedback in the state of Maine. In the late 1970s, primarily under the leadership of David Smith, Alice Russell, and David Soule, the public use of hospital discharge data became a reality with the founding of the Maine Health Information Center.

American corporations, particularly large employers such as the American Telephone and Telegraph company, are beginning to access their own records as a means for managing employee benefit packages. But for purposes of monitoring the activities of local markets, corporate data bases, used by themselves, have severe limitations because, as a rule, no single corporation has enough employees to allow for valid statistical inferences on practice variations in specific hospital markets. Rather, corporations and business or labor coalitions that want to use hospital market data in their cost-containment strategies should support the development of public data bases on a regional or statewide basis, as exemplified by the Maine Health Information Center. They could also promote information feedback by using their influence as large purchasers of care to insist that third-party carriers publish reports on expenditures and service use rates in local hospital markets (such as shown in Exhibit 5). Using claims pooled from all Blue Cross accounts, John Putnam of Maine Blue Cross has shown how that organization can provide very important information on variations.

Because of its national coverage and the richness of its data base, the Medicare program offers the best immediate opportunity to implement feedback in all parts of the country. The federal government now requires each hospital to record uniform information on the costs, reasons for hospitalization, and treatments for each hospitalization paid for under the Medicare program. When this information is linked to claims data under the Medicare Part B program and to patient registration files, a registry is created of the medical care events and certain outcomes for virtually the entire population of the United States who are sixty-five years and older. The many problems for public policy concerning the equity and outcome of care that are illustrated by the variation phenomena, as well as the federal government's own need for effective cost containment, lead me to recommend that this very important national resource be used for this purpose.