Special Article

GEOGRAPHIC VARIATIONS IN UTILIZATION RATES IN VETERANS AFFAIRS HOSPITALS AND CLINICS

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ABSTRACT

Background In the United States, geographic variation in hospital use is common. It is uncertain whether there are similar geographic variations in the health care system of the Department of Veterans Affairs (VA), which differs from the private sector because it predominantly serves men with annual incomes below $20,000, has a central system of administration, and uses salaried physicians. Thus, it might be less likely to have geographic variations.

Methods We used VA data bases to obtain information on patients treated for eight diseases (chronic obstructive pulmonary disease, pneumonia, congestive heart failure, angina, diabetes, chronic renal failure, bipolar disorder, and major depression). We analyzed their use of hospital and outpatient services by assessing the risk-adjusted numbers of hospital days (the average number of days a patient spent in the hospital per 12 months of follow-up, regardless of the number of hospital stays), hospital-discharge rates, and clinic-visit rates from 1991 through 1995 for the entire system and within the 22 geographically based health care networks.

Results We found substantial geographic variation in hospital use for all eight cohorts of patients and all the years studied. Variations in the numbers of hospital days per person-year among the networks were greatest among patients with chronic obstructive pulmonary disease (ranging from a factor of 2.7 to a factor of 3.1) during a given year and smallest among patients with angina (ranging from a factor of 1.5 to a factor of 2.1). Levels of hospital use were highest in the Northeast and lowest in the West. The variation in the rates of clinic visits for principal medical care among the networks ranged from a factor of approximately 1.6 to a factor of 4.0; variations in the rates were greatest among patients with chronic renal failure and smallest among patients with congestive heart failure. There was no clear geographic pattern in the rates of outpatient-clinic use.

Conclusions There are significant geographic variations in the use of hospital and outpatient services in the VA health care system. Because VA physicians are unable to increase their income by changing their patterns of practice, our findings suggest that their practice styles are similar to those of other physicians in their geographic regions. (N Engl J Med 1999;340:32-9.)

GEOGRAPHIC variation in hospital use across the United States is a persistent finding.[1-4] Contributory causes that have been explored include differences in practice patterns resulting from physicians' uncertainty about how and in what setting to treat certain conditions,[5,6] differences in the rates of inappropriate hospitalizations,[7,8] differences in the supply of hospital and nursing home beds,[9] geographic unevenness in the market penetration of health care organizations (e.g., health maintenance organizations) whose financial incentives prompt different patterns of hospital use,[10] and differences in access to care, resulting in variability in the rates of avoidable hospitalizations.[11-13]

One would expect there to be less geographic variation in hospital use in the Department of Veterans Affairs (VA) health care system than in the private sector.[14] From a sociodemographic standpoint, the VA caseload is relatively homogeneous. Eligibility for care is set by federal law.[15] Honorable discharge from military service is the first prerequisite for eligibility, but not all honorably discharged veterans are entitled to VA care. Veterans with specified conditions or exposures related to their military service and veterans who meet the criteria for low incomes have the highest priority. Other veterans may receive care if they make a copayment and if space is available. The VA system serves veterans but not their dependents, and consequently, most users are men. About a third of those who use the system are over the age of 65,[16] and two thirds of users have annual incomes below $20,000.[17,18] The VA system is highly centralized; therefore, many administrative policies and procedures are uniform across the nation. Facilities share common, centrally mandated administrative, clinical-data, and information systems. Physicians are salaried and cannot increase their in-

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comes by changing their treatment styles or by treating more veterans.

With a congressional appropriation of $15.4 billion in 1994, the VA health care system encompassed about 53,000 acute care beds in 172 hospitals, more than 350 clinics, and 131 nursing home units. After the exclusion of care purchased from the private sector, in 1994 the system recorded 902,000 hospital stays and 32.6 million outpatient visits. Late in 1995, VA facilities were reconfigured into 22 geographically based health care networks (see the Appendix), each consisting of 5 to 10 medical centers and various numbers of clinics and nursing home units,[19-22] to provide incentives for more consistent and predictable quality and to improve access to and the efficiency of care.[23,24] Together with legislation to reform eligibility rules and the initiation of a capitation-based system of resource allocation,[25] the reorganization signified a major overhaul of the VA system.[19-22,26]

We examined historical patterns of the use of health care services in the newly created VA networks to determine whether there were substantial variations in the rates of hospital and clinic use across the United States.

METHODS

Data Sources and Utilization Measures

We analyzed VA hospital use for the years 1991 through 1995. We used encrypted Social Security numbers to link the VA patient-treatment file, which contains abstracts on all patients discharged from all VA hospitals; the VA outpatient-clinic file, which contains records for every outpatient visit to a VA facility; and the VA beneficiary identification record locator system death file, which lists deaths that occurred through September 30, 1995. The death file lists all deaths regardless of the place of death and is 90 to 95 percent complete.[27] The use of non-VA services is incompletely recorded in these data bases and therefore was not analyzed.

We calculated discharge rates, the numbers of hospital days (the average number of days a patient spent in the hospital per 12 months of follow-up, regardless of the number of hospital stays), the rates of outpatient visits for principal medical care, and the rates of clinic visits for ancillary services. The outpatient-clinic file records clinic "stops," which are defined as any encounters a patient has with a provider in a facility. One visit can encompass multiple stops — for example, to a physician, a nurse educator, and an electrocardiographer. We categorized clinic stops, or visits, in nonoverlapping groups. An outpatient visit for principal medical care is one involving comprehensive, longitudinal care and is a proxy for primary care during the years of the study. All other stops were categorized as being for ancillary services, which include consultations for one-time or short-term services or tests. For the two categories of psychiatric diagnoses that we analyzed, we also computed the rates of visits to psychiatric clinics. Visits for dialysis were excluded from the calculation of the rates of visits for chronic renal failure, because there are extreme variations in the extent to which veterans use Medicare-reimbursed dialysis services instead of VA dialysis services. To compute the rates of clinic visits, we counted the number of days on which a visit included at least one stop in a category.

Cohorts of Patients

We analyzed eight cohorts of patients (Table 1). In 1994 these cohorts accounted for 20 percent of the inpatient caseload and 17 percent of the outpatient caseload.

Because the aim was to compare the rates of hospital and clinic use among the networks over time, the patients in each cohort needed to be as clinically similar as possible at enrollment. During the study years, the outpatient-clinic file did not include information on diagnoses, making it impossible to enroll patients at the time of their initial diagnosis. However, the patient-treatment file does record diagnoses, and the first hospitalization for a chronic condition often signifies that a disease has become severe. The first VA hospitalization for the condition of interest was used as the enrollment date. Basing enrollment on hospitalization meant that patients who were not admitted to a VA hospital during the study years were not enrolled. To estimate the bias that this introduced, we calculated the proportion of VA patients who were hospitalized during the period. Nearly half (1,577,743 of 3,427,312, or 46 percent) of regular VA users were eligible for enrollment because they had one or more hospitalizations from 1991 through 1995. Of this pool of eligible subjects, 280,799,

TABLE 1. DISEASE CATEGORIES AND THE NUMBERS OF PATIENTS IN EACH COHORT AT THE START OF EACH YEAR OF THE STUDY, 1991–1995.*

CATEGORY (CODE OR GROUP)	1991	1992	1993	1994	1995
			no. of patients		
Chronic obstructive pulmonary disease (DRG 88)	20,076	23,922	27,941	31,140	33,695
Pneumonia (DRG 89–91)	21,316	25,775	29,816	33,489	37,234
Congestive heart failure (DRG 127)	18,195	21,789	24,677	27,198	29,190
Angina (DRG 140, 143)	43,921	56,331	67,226	77,055	85,666
Diabetes (DRG 294, 295)	19,472	24,334	28,881	32,924	36,178
Chronic renal failure (ICD-9-CM code 585)	7,394	8,632	9,498	10,169	10,804
Bipolar disorder (ICD-9-CM code 296.0, 296.1, 296.4, 296.5–296.8, 296.81, 296.82, 296.89)	13,001	16,648	19,853	22,826	25,563
Major depressive disorder (ICD-9-CM code 296.2, 296.3, 298.0)	16,692	21,636	26,225	30,477	34,537

*Patients were identified according to the diagnosis-related group (DRG) or with codes from the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM)[28] that indicated the discharge diagnosis. Patients were dropped from the cohort when they died, and new patients were added as they met enrollment criteria.

or 17.8 percent, met the diagnostic criteria for enrollment in a cohort.

The defining discharge was the discharge used to assign a patient to a cohort and determine the enrollment date. Patients were eligible only if they had not been hospitalized at a VA facility for any of the eight conditions in the two years before their defining discharge. However, to ensure that the cohorts enrolled in 1991 were large enough for the study to have statistical precision, we allowed patients in this group to have been given a defining discharge between 1988 and 1991. New enrollees were added each year. Once enrolled in a cohort, patients remained there until death or September 30, 1995, and could not be switched to another cohort, even if they had been hospitalized for other conditions. Patients who had multiple stays during the year in which they became eligible for the study were assigned to a group by random selection among their qualifying diagnoses. For example, if a patient had three stays for angina and one for diabetes during 1993, he would have a 75 percent chance of being assigned to the angina cohort. In a separate analysis of utilization rates in nine rather than eight cohorts for the years 1992 through 1996, we also excluded veterans who, though known to be alive, did not use VA services for two consecutive years. We presumed that they had switched to non-VA care. We found the same geographic patterns of use. The data on patients with heart failure have been reported elsewhere.[29]

Utilization rates were analyzed according to the person-time at risk. For as long as they were in a cohort, patients were analyzed with respect to inpatient and outpatient use of VA services and time at risk for such usage. The number of days spent in the hospital was subtracted from time at risk to determine the rate of use of outpatient services.

Statistical Analysis

Because we wanted to examine variations in utilization rates that were attributable to the process of care or the VA system, we adjusted the rates to control for variations attributable to patient factors outside the control of the medical care system. Factors the system can change (e.g., the number of beds) were deliberately omitted from the models because we did not want to control for them. Our approach[30,31] was disease-specific. It adjusted within each cohort for differences in physiologic reserve, measures of social support (based on age, sex, race, and marital status), and the type and complexity of the patients' conditions (principal diagnoses within diagnosis-related groups, the number of coexisting conditions, and the number of body systems — endocrine, hematologic, neurologic, circulatory, respiratory, digestive, genitourinary, and musculoskeletal — affected by the coexisting conditions). We used covariates related to the defining discharge to adjust the risk at the time a patient was enrolled, and we updated risk profiles after each 24 months in the study, using data from the most recent hospitalization.

Analysis of covariance[32] was used to adjust for the patients' characteristics and to estimate the means of the utilization measures according to the network for each year. The patients' characteristics were the demographic and clinical variables described above plus the fiscal year of entry into the cohort. The unit of analysis was the individual patient. The models were tested for interaction between the networks and the patients' characteristics. The average use of services per person was transformed to the average use of services per person-year at each network. The ranks of the networks were based on the average rates of use per network per year.

Pearson, Spearman, and intraclass correlations were used in the analysis. The Pearson and Spearman correlation coefficients measure the closeness of a linear relation between a pair of random variables, X and Y, and can range from −1 to 1. If r denotes the correlation, then r^2 is the proportion of variation in Y that is explained by X. If Y increases as X increases, the correlation is positive; if Y decreases as X increases, the correlation is negative. The Pearson correlation coefficient is used in cases in which the distribution of X and Y is normal according to the bivariate distribution, whereas the Spearman correlation coefficient is based on the ranks of the values of X and Y and may be used with any ordered data. Intraclass correlation was used to describe patterns of the use of health services in VA networks over time and among diagnoses. Intraclass correlation is used when a single variable, Y, is measured in the members of groups. The total variance of Y is the sum of the variance within groups and among groups. The intraclass correlation coefficient is the ratio of the variance among groups to the total variance. It can range from 0 to 1, and as it approaches 1, the intraclass correlation increases, because most of the variance of Y is among groups, leaving very little variation within the groups.

Adjustment of the mean values for the networks on the basis of the patients' characteristics did not make a large difference in the average rates of use per network, but it did make a small difference for a few networks. For example, for the Albany, New York, network, risk adjustment decreased the number of hospital days for the patients with chronic obstructive pulmonary disease from 31.50 to 30.44 days per person-year in 1991. The Pearson correlation coefficient between the adjusted and the unadjusted number of hospital days ranged from 0.993 to 0.997 during the five years studied, which indicated that risk adjustment had little effect on the differences between the network means and the overall mean.

RESULTS

Hospital Use

The variation in the number of hospital days per person-year among the 22 networks ranged from a factor of 1.5 to a factor of 3.0 (Table 2). The variation in this rate within a given year was greatest among the patients with chronic obstructive pulmonary disease (ranging from a factor of 2.7 to a factor of 3.1) during the five-year period and smallest among the patients with angina (ranging from a factor of 1.5 to a factor of 2.1). Discharge rates had less within-year variation than the number of hospital days (ranging from a factor of 1.2 to a factor of 1.7).

Networks showed substantial consistency in their particular patterns of hospital and clinic use among the cohorts as well as over time (Table 3). For example, the intraclass correlation coefficient of the networks' rankings for hospital days during the five years ranged from 0.84 to 0.94 for the eight diagnoses.

In all five years, the levels of hospital use were highest among networks in the Northeast and lowest among networks in the West. For example, among the patients with chronic obstructive pulmonary disease in 1995, the number of hospital days was 20.7 per person-year in the Albany, New York, network and 6.8 per person-year in the San Francisco network — a difference of more than a factor of 3.0. In general, the same pattern of hospital use was observed for the other cohorts.

In 1995 the bed supply in the VA system ranged from 3.5 per 1000 Category A veterans (Category A veterans are those entitled to VA care) in the Portland, Oregon, network to 7.4 per 1000 in the Baltimore network. Supply was significantly correlated with the number of hospital days per person-year in all cohorts, with Spearman correlation coefficients

TABLE 2. RISK-ADJUSTED RATES OF HOSPITAL AND CLINIC USE AMONG THE 22 VA NETWORKS IN 1991, 1993, AND 1995.

VARIABLE*	1991		1993		1995	
	MEAN	RANGE	MEAN	RANGE	MEAN	RANGE
			rate/person-year			
Chronic obstructive pulmonary disease						
Hospital days	17.5	11.5–30.4	15.3	9.4–25.6	12.1	6.7–20.7
Discharges	1.51	1.31–1.79	1.31	1.09–1.49	1.09	0.78–1.32
Clinic visits for principal medical care	5.8	4.8–8.2	5.3	4.4–7.6	5.0	4.1–7.2
Clinic visits for ancillary services	12.2	9.7–17.6	12.1	10.5–17.1	12.9	10.1–18.7
Pneumonia						
Hospital days	16.2	12.0–22.9	13.8	8.3–19.8	11.1	7.5–16.1
Discharges	5.8	4.8–8.2	5.3	4.4–7.6	5.0	4.1–7.2
Clinic visits for principal medical care	4.5	3.4–6.4	4.1	3.4–5.8	3.9	3.1–5.3
Clinic visits for ancillary services	12.0	9.0–17.1	11.8	8.5–15.9	12.5	8.9–16.4
Congestive heart failure						
Hospital days	19.0	15.5–27.7	16.4	11.0–22.9	13.2	9.0–19.8
Discharges	1.68	1.56–2.03	1.42	1.22–1.71	1.21	0.99–1.42
Clinic visits for principal medical care	6.3	5.3–8.7	5.6	4.7–7.7	5.2	4.3–6.7
Clinic visits for ancillary services	13.9	10.7–19.5	13.6	9.3–19.7	14.1	9.9–19.3
Angina						
Hospital days	9.1	7.1–10.3	7.8	5.6–8.9	6.6	4.2–8.6
Discharges	1.10	1.01–1.19	0.90	0.75–1.01	0.79	0.60–0.95
Clinic visits for principal medical care	5.2	4.4–7.5	4.7	3.9–6.7	4.6	3.8–6.0
Clinic visits for ancillary services	12.3	10.4–16.8	12.2	10.2–17.4	13.2	10.9–18.6
Diabetes						
Hospital days	13.0	9.4–17.9	11.9	8.8–15.4	10.0	6.5–15.8
Discharges	1.08	0.94–1.16	0.95	0.84–1.10	0.82	0.71–0.96
Clinic visits for principal medical care	5.4	4.4–8.3	4.9	4.1–7.3	4.7	3.9–6.4
Clinic visits for ancillary services	13.8	11.0–20.2	13.8	10.8–21.9	14.8	12.0–21.4
Chronic renal failure						
Hospital days	26.3	16.9–36.4	21.0	14.6–32.7	16.8	11.1–25.5
Discharges	1.86	1.59–3.01	1.45	1.21–1.67	1.26	0.91–1.50
Clinic visits for principal medical care	5.0	2.7–11.0	4.3	2.2–9.0	3.5	2.4–8.3
Clinic visits for ancillary services	20.6	10.0–32.6	19.7	7.9–39.0	19.3	9.3–37.0
Bipolar disorder						
Hospital days	26.0	15.6–36.5	21.9	14.7–28.8	18.2	10.9–26.5
Discharges	1.19	0.91–1.45	1.01	0.83–1.13	0.93	0.76–1.09
Clinic visits for principal medical care	2.2	1.4–3.0	2.1	1.6–2.9	2.1	1.6–2.9
Visits to psychiatric clinics	11.1	5.7–19.8	10.4	6.6–19.0	10.0	5.9–19.3
Clinic visits for ancillary services	11.5	8.0–16.8	11.6	8.5–17.3	13.1	9.6–18.7
Major depressive disorder						
Hospital days	24.8	17.9–35.1	19.2	14.0–27.4	15.3	9.5–24.2
Discharges	1.20	1.02–1.44	1.00	0.85–1.15	0.88	0.73–1.06
Clinic visits for principal medical care	2.6	1.6–3.6	2.4	1.8–3.1	2.5	1.8–3.2
Visits to psychiatric clinics	10.8	6.7–19.4	9.3	5.1–16.7	9.2	5.8–16.3
Clinic visits for ancillary services	11.6	8.3–19.0	11.7	8.5–16.1	13.0	9.5–19.5

*Hospital days is the average number of days a patient spent in the hospital per 12 months of follow-up, regardless of the number of hospital stays. Discharges is the average number of hospital stays per cohort member during 12 months of follow-up, regardless of the number of hospital days. Ancillary services include consultations for one-time or short-term services or tests.

ranging from 0.57 to 0.76. The occupancy rates (the average daily census divided by the bed count) reflected systemwide overcapacity and ranged from 64.6 percent in the Portland, Oregon, network to 80.6 percent in the Bronx, New York, network.

Outpatient-Clinic Use

The variation in the rates of clinic visits for principal medical care among the networks ranged from a factor of approximately 1.6 to a factor of 4.0 (Table 2). The within-year variation in this rate was greatest among patients with chronic renal failure (ranging from a factor of 3.5 to a factor of 4.0) and smallest among patients with congestive heart failure (a factor of 1.6). The within-year variation in the rates of clinic visits for ancillary services among the networks was similar to that for the rates of clinic visits for primary medical care (ranging from a factor of 1.6 to a

TABLE 3. CONSISTENCY OF VA NETWORKS' RANKINGS FOR THE INTENSITY OF THE USE OF INPATIENT AND OUTPATIENT HEALTH CARE SERVICES OVER TIME AND AMONG DIAGNOSES.*

VARIABLE	HOSPITAL DAYS	CLINIC VISITS FOR PRINCIPAL MEDICAL CARE
	correlation coefficient	
Use over time according to diagnosis, 1991–1995		
Chronic obstructive pulmonary disease	0.94	0.71
Pneumonia	0.90	0.80
Congestive heart failure	0.91	0.73
Angina	0.84	0.83
Diabetes	0.86	0.82
Chronic renal failure	0.89	0.79
Bipolar disorder	0.87	0.95†
Major depressive disorder	0.84	0.92†
Use during specific years among diagnoses		
1991		
Medical diagnoses	0.78	0.73
Psychiatric diagnoses	0.72	0.85†
1993		
Medical diagnoses	0.84	0.75
Psychiatric diagnoses	0.94	0.92†
1995		
Medical diagnoses	0.90	0.73
Psychiatric diagnoses	0.92	0.94†

*The intraclass correlation coefficient was used for the analysis. Hospital days is the average number of days a patient spent in the hospital per 12 months of follow-up, regardless of the number of hospital stays.

†The rate of visits to psychiatric clinics was measured.

factor of 4.9). The rates of visits to psychiatric clinics among the networks differed by a factor of approximately 3.0 for both cohorts of patients with psychiatric disorders for all five years.

The geographic pattern of the use of outpatient services for principal medical care was not as distinct as that for hospital use. Two northeastern networks had the highest rates of use for all disease categories (third or fourth quartile) in most years of the study, mirroring the intensity of the level of hospital use in these networks. In contrast, several western networks consistently had the highest rates of clinic use, exactly the opposite of their levels of hospital use — a finding suggesting that outpatient services were being substituted for inpatient services. Table 4 shows the extent to which the rates of clinic use and hospital use were complementary in 1995. If outpatient services were being substituted for inpatient care, networks with low numbers of hospital days should have had high rates of clinic visits. To look for evidence of such a substitution throughout the VA system, we calculated the Spearman correlations for the numbers of hospital days and the rates of clinic visits for principal medical care in 1995 according to the cohort. The numbers of hospital days were inversely related to the rates of clinic visits for principal medical care, but none of the differences were significant. Thus, the null hypothesis of the absence of an association could not be rejected (data not shown).

DISCUSSION

Our analysis revealed significant geographic variation in the use of inpatient and outpatient services in the VA system in each of the five years studied. The networks showed great consistency in their patterns of care over time and among cohorts.

Geographic variation in the use of VA services is an intriguing finding. We thought that the patterns of use would be fairly similar throughout the system because of the sociodemographic homogeneity of the patient population, the centralized administrative structure of the system, and the fact that its physicians are salaried. Differences in the prevalence of disease cannot be used to explain the variations because the rates of use were analyzed within cohorts. However, because our data came from data bases, we may not have been able to identify and therefore to adjust completely for differences in the severity of disease among the 22 VA networks. Our system of risk adjustment should have minimized the influence of cross-sectional demographic differences or differences in the rates of coexisting conditions.

In the nonfederal sector, hospital capacity (the number of beds per 1000 persons) appears to be the strongest influence on the levels of use of inpatient services.[33] The bed supply in the VA system was correlated with the use of VA hospitals, but occupancy rates were low across the United States, indicating substantial overcapacity in the system. We did not examine the influence of other VA-related and non–VA-related supply factors, such as the distance to a VA facility from a patient's home, the number of physicians per capita in the population, or the type and availability of non-VA medical services in an area. The variation cannot be explained on the basis of financial incentives, because they were uniform across the nation. All VA physicians were salaried, and all VA facilities use the same system of resource allocation and reimbursement.

A study of surgical-procedure rates in small areas of the United States, Norway, and Britain found that there were variations in the levels of use within systems that were independent of their method of organization or financing of medical care.[34] Our study provides insights into physicians' behavior in the United States, because the VA system is perhaps the only nationwide health care system in this country that employs physicians who are unable to maximize their revenue by changing their patterns of practice. Thus, within-year variations in the rates of use of VA

TABLE 4. RATES OF HOSPITAL AND CLINIC USE AMONG THE 22 NETWORKS FOR FOUR COHORTS IN 1995.*

NETWORK OFFICE	CHRONIC OBSTRUCTIVE PULMONARY DISEASE		CONGESTIVE HEART FAILURE		DIABETES		MAJOR DEPRESSIVE DISORDER	
	HOSPITAL DAYS	CLINIC VISITS FOR PRINCIPAL MEDICAL CARE	HOSPITAL DAYS	CLINIC VISITS FOR PRINCIPAL MEDICAL CARE	HOSPITAL DAYS	CLINIC VISITS FOR PRINCIPAL MEDICAL CARE	HOSPITAL DAYS	VISITS TO PSYCHIATRIC CLINIC
	rate per person-year (quartile)							
Boston	16.6 (4)	7.2 (4)	13.4 (3)	6.7 (4)	11.8 (4)	6.4 (4)	17.6 (3)	13.4 (4)
Albany, N.Y.	20.7 (4)	5.5 (4)	19.8 (4)	5.5 (3)	15.8 (4)	5.0 (3)	20.6 (4)	16.2 (4)
Bronx, N.Y.	16.7 (4)	5.1 (2)	18.0 (4)	5.4 (2)	12.7 (4)	5.1 (3)	24.2 (4)	16.3 (4)
Pittsburgh	17.9 (4)	4.9 (2)	17.0 (4)	5.3 (2)	11.1 (3)	4.6 (2)	21.0 (4)	9.5 (3)
Baltimore	15.2 (4)	5.6 (4)	14.2 (3)	5.7 (4)	12.7 (4)	4.9 (3)	15.8 (3)	11.3 (2)
Durham, N.C.	12.8 (3)	4.2 (1)	15.9 (4)	5.0 (2)	10.6 (3)	4.0 (1)	11.2 (1)	5.8 (1)
Atlanta	14.4 (3)	4.1 (1)	14.2 (3)	4.3 (1)	10.6 (3)	4.1 (1)	17.8 (4)	6.5 (1)
Bay Pines, Fla.	11.6 (2)	4.7 (2)	12.5 (2)	4.7 (1)	9.7 (2)	4.5 (2)	13.9 (2)	7.4 (3)
Nashville	12.2 (3)	5.2 (2)	14.3 (4)	5.5 (3)	10.7 (3)	4.7 (2)	13.0 (2)	5.8 (1)
Cincinnati	12.5 (3)	5.5 (3)	13.7 (3)	5.5 (3)	11.2 (4)	5.0 (3)	15.2 (2)	7.6 (3)
Ann Arbor, Mich.	12.1 (3)	4.6 (2)	12.8 (3)	5.0 (2)	9.2 (2)	4.5 (2)	17.7 (3)	6.6 (2)
Chicago	10.6 (2)	5.2 (2)	12.7 (2)	5.1 (2)	9.8 (2)	4.9 (3)	18.3 (4)	9.9 (2)
St. Paul, Minn.	10.3 (2)	5.5 (3)	11.6 (2)	5.9 (4)	7.7 (1)	5.0 (3)	15.3 (3)	8.5 (3)
Omaha, Nebr.	11.5 (2)	5.5 (3)	12.6 (2)	5.2 (2)	10.2 (3)	4.5 (2)	15.8 (3)	8.8 (2)
Kansas City, Mo.	10.8 (2)	4.1 (1)	13.4 (3)	4.8 (1)	10.0 (3)	4.1 (1)	15.9 (3)	8.7 (3)
Jackson, Miss.	10.3 (2)	4.3 (1)	12.6 (2)	4.4 (1)	8.7 (2)	3.9 (1)	11.5 (1)	6.2 (1)
Dallas	12.0 (3)	4.3 (1)	12.3 (2)	4.7 (1)	9.7 (2)	4.2 (1)	13.9 (2)	8.7 (1)
Phoenix, Ariz.	9.1 (1)	5.3 (3)	10.4 (1)	5.5 (3)	7.5 (1)	5.1 (4)	12.4 (1)	6.6 (1)
Denver	9.4 (1)	5.3 (3)	9.6 (1)	6.0 (4)	7.2 (1)	5.4 (4)	15.0 (2)	10.8 (2)
Portland, Oreg.	8.1 (1)	4.9 (2)	10.0 (1)	5.7 (3)	6.7 (1)	4.9 (2)	9.5 (1)	10.6 (4)
San Francisco	6.7 (1)	6.3 (4)	9.0 (1)	6.4 (4)	6.5 (1)	5.9 (4)	12.4 (1)	12.8 (4)
Long Beach, Calif.	8.8 (1)	5.6 (4)	10.0 (1)	5.7 (3)	8.0 (2)	5.5 (4)	13.7 (2)	11.2 (3)
VA system	12.1	5.0	13.2	5.2	10.0	4.7	15.3	9.2

*Quartile 1 indicates the lowest utilization rate. The quartiles were based on rates before rounding. Each VA network consists of 5 to 10 medical centers and various numbers of clinics and nursing home units. Hospital days is the average number of days a patient spent in the hospital per 12 months of follow-up, regardless of the number of hospital stays. The category of clinic visits for principal medical care is a proxy for clinic visits for primary care.

hospitals may simply reflect geographic differences in doctors' opinions of the optimal approach to and setting for patient care.

It may be that VA physicians simply have practice styles that are similar to those of other physicians in their geographic regions. Indeed, the geographic pattern of within-year variation in the use of VA hospitals mirrors that in the nonfederal sector. Data from the population-based National Hospital Discharge Survey indicate that for men in the four U.S. Census regions in 1993, the rates of hospital discharge varied by a factor of 1.65 (they were highest in the Northeast and lowest in the West), whereas the numbers of hospital days varied by a factor of 2.09 (again being highest in the Northeast and lowest in the West).[4] This pattern and magnitude are similar to what we found in the VA health care system. Among the cohorts that we analyzed, the variation in the discharge rates ranged from a factor of 1.2 to a factor of 1.7 among the networks and the variation in the numbers of hospital days ranged from a factor of 1.5 to a factor of 3.0, with rates in the Northeast always higher than those in the West. For the past three decades, the National Hospital Discharge Survey has shown that the West has the lowest rate of hospital use in terms of discharge rates as well as in terms of the numbers of days.[1,4] The Northeast has had the highest numbers of hospital days since 1984 and the highest discharge rates since 1988.

One potential explanation for the geographic variation in hospital use is variation in the use of ambulatory care services. If ambulatory care is substituted for hospital care, then areas with lower-than-average rates of hospital use should have higher-than-average rates of ambulatory care use. A strength of our study is the use of linked files to examine outpatient as well as inpatient use in the cohorts. The data suggest that some VA networks in the West may substitute ambulatory care for hospital care, but this is not so for the entire system. Some northeastern networks had high rates of ambulatory care visits as well as high rates of hospital use. Analyses of Medicare data have

not supported the view that outpatient services are substituted for inpatient care; in fact, regions with high levels of reimbursement for outpatient care tend to have high levels of reimbursement for hospital care as well.[3,33] In addition, the National Ambulatory Medical Care Survey for 1991 showed that people in the Northeast (where hospital use is highest) have the highest number of doctors' office visits per person per year: 3.1, as compared with 2.8 in the Midwest and West and 2.3 in the South.[35]

Our study has several limitations. Variations in admission practices will bias any outcome measure based solely on hospitalized patients.[36] Because we based enrollment on hospitalization, the severity of illness in a cohort may not be uniform among the networks if admission practices among the networks differ. The average severity of disease within a cohort may also have changed over the years of the study among the networks. This could have occurred if the risk of death differed among the networks because of differences in the quality or appropriateness of care that they provided. Within-year or secular differences in the severity of disease among the cohorts might also account for the geographic variations in the levels of use. However, we observed the same pattern of geographic variation in the VA system in the years 1992 through 1996 when we repeated the analyses using a modified strategy for enrollment.[29]

Another limitation is that we did not study the rates of use of non-VA hospitals or clinics. Geographic or temporal differences in the rates of use of such services within the cohorts could affect or even explain our findings. Data on the extent to which veterans using VA services also use non-VA care are sparse, and there are no nationwide data on the extent to which dual use varies across the country. Such analyses could be performed by linking VA and Medicare data, but it would mean that two thirds of the patients who use VA facilities (those 65 years of age or younger) would be left out. However, in New York and New England in the mid-1980s, only 4.2 percent of veterans who were over 65 years of age and who were hospitalized for a surgical procedure in the VA system were readmitted to a non-VA hospital within six months after the procedure.[37] Finally, we studied variation in utilization at the network level, which may have led to an underestimation of geographic variation. Variation appears to be greatest, at least in the nonfederal sector, at the level of the hospital-service area.[33]

In its examination of one of the few national health systems in the United States (certainly its largest), our study adds further support to the contention that it is something about the medical care system — not something about patients — that causes regional differences in utilization rates.

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APPENDIX

Network Office*	Region Covered
Boston	Conn., Me., Mass., N.H., R.I., Vt.
Albany, N.Y.	N.Y., Pa.
Bronx, N.Y.	N.J., N.Y.
Pittsburgh	Del., N.J., N.Y., Ohio, Pa., W.Va.
Baltimore	Md., Pa., Va., W.V., Washington, D.C.
Durham, N.C.	N.C., S.C., Va., W.Va.
Atlanta	Ala., Ga., S.C.
Bay Pines, Fla.	Fla., Ga., Puerto Rico
Nashville	Ark., Ga., Ind., Ky., Miss., Ohio, Tenn., Va., W.Va.
Cincinnati	Ind., Ky., Ohio
Ann Arbor, Mich.	Ill., Ind., Mich., Ohio
Chicago	Ill., Ind., Mich., Minn., Wis.
St. Paul, Minn.	Iowa, Minn., Nebr., N.D., S.D., Wis., Wyo.
Omaha, Nebr.	Ill., Iowa, Kans., Mo., Nebr.
Kansas City, Mo.	Ark., Ill., Ind., Kans., Ky., Mo.
Jackson, Miss.	Ala., Ark., Fla., La., Miss., Mo., Okla., Tex.
Dallas	Okla., Tex.
Phoenix, Ariz.	Ariz., Colo., N.M., Okla., Tex.
Denver	Colo., Idaho, Kans., Mont., Nebr., Nev., N.D., Utah, Wyo.
Portland, Oreg.	Alaska, Calif., Idaho, Mont., Oreg., Wash.
San Francisco	Calif., Hawaii, Nev.
Long Beach, Calif.	Calif., Nev.

*In some cases a network covers only part of a state. Each network includes 5 to 10 medical centers and various numbers of clinics and nursing home units.

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