Effects of Hospital-Based Primary Care Setting on Internists' Treatment of Primary Care Episodes

Marsha Gold

The amount of primary care provided at hospitals is increasing, yet little information exists on the relative costs of this form of care. To address this issue, we compared the treatment resources used by internists practicing in hospital-based and free-standing clinics. The study site was the Kaiser-Permanente Medical Care Program, Oregon Region. To control for case mix, the analysis focused on episodes of six specified conditions: upper respiratory infection, urinary tract infection, hypertension, abdominal pain, chest pain, and physical exam. The California Relative Value Schedule was used to define care intensity by summarizing the clinical, laboratory, and radiology services provided. Results indicate that setting exerts little influence on the intensity of primary care for the episodes studied; care of similar intensity is provided in hospital-based and free-standing settings.

To expand the availability and accessibility of primary care, there is growing interest in encouraging hospitals to become more involved in the

---

This research was supported by Grant No. 1R03 HS 03147-01 from the National Center for Health Services Research, OASH. It was undertaken when the author was affiliated with the Harvard School of Public Health, Boston, Mass. Presented at the 107th Annual Meeting of the American Public Health Association, Health Administration Section, on November 8, 1979, under the title "Relative Intensity of Hospital-Based Primary Care for Episodes of Illness." Revised January 1981. Useful suggestions and critiques were provided by Mark Thompson, Ph.D., as well as by H. Richard Nesson, M.D., Susan Radius, Ph.D., and William Mietlowski, Ph.D. The research was undertaken in collaboration with the Health Services Research Center, Kaiser-Permanente Medical Care Program, Oregon Region, and its director, Merwyn Greenlick, Ph.D. Daniel Azevedo assisted in the operational definition of the episodes studied; Joanne Schwartz provided programming support.

Address communications and requests for reprints to Marsha Gold, Sc.D., Director, Policy Analysis and Program Evaluation, Maryland Dept. of Health and Mental Hygiene, 201 W. Preston St., Baltimore, MD 21201.

0017-9124/81/1604-0383/$02.50/0 Health Services Research

delivery of these services [1, 2]. Private foundations, such as the Robert Wood Johnson Foundation, have sponsored major initiatives to promote hospital-based primary care in community, teaching, and municipal hospitals. The United States Department of Health and Human Services (HHS) considered some activity in this area under Section 328 of the Public Health Service Act. HHS has also initiated a small number of demonstration projects in financially distressed hospitals, with grant funds partly conditional on hospitals' developing improved primary care services. Hospitals also have independently expanded their primary care services, with the result that the number of hospital outpatient visits has more than doubled between 1965 and 1980.

In considering whether to support or expand these activities, costs are of critical concern. Hospital-based primary care offers the potential for improving access to care in underserved areas, yet the comparative costs of hospital-based primary care are uncertain. Largely because of the sophisticated physical plant, acute care focus, and teaching activity at the hospital, there is concern that hospital-based primary care may be more expensive than other forms of primary care. This has led to a desire for more information on how the costs of this type of care compare with those of freestanding settings, such as the independent physician group, private physician office, or community health center.

Unfortunately, little empirical information presently is available on this issue [3]. Analyses have been limited; most have focused on issues of overhead allocation and the costs of the undifferentiated "visit" to a hospital ambulatory clinic. There have been few efforts to compare the level and type of resources used in treatment across settings. This is important because the delivery of primary care potentially involves the application of clinical, laboratory, radiology, drug, or other services across related visits. The amount and mix of services used may influence the cost of care received. These issues typically are omitted when analysis focuses on the cost involved in a single visit to a primary care program.

The physical location of primary care at the hospital may lead to unique forms of physician practice. The hospital is an acute care facility whose major mission is to provide care for inpatients; a complex set of services and technologies is available for this purpose. The orientation and structure of the hospital may affect the content of primary care, resulting in more intensive hospital-based primary care. For example, surrounded by acutely ill patients, the hospital-based physician might be more likely to consider the possibility of a rare condition, leading to additional tests to rule out such a possibility. The added availability of resources at the hospital also may lead to their increased use, resulting in greater use of ancillaries or specialty consultations. Such an effect would be comparable

to the widely cited Roemer hypothesis that increased bed capacity results in increased bed use [4]; it also would be consistent with Acton's findings that time considerations affect price in determining demand for medical services [5].

Many assume that hospital-based primary care incurs higher costs because the hospital draws a sicker set of patients and a more complex case mix. The considerations noted suggest that the location of primary care at the hospital may influence treatment patterns independent of patient and case mix. If present, this type of effect may lead to higher total primary care costs with a shift in primary care to the hospital setting.

Empirical analyses of these issues are difficult to undertake. A thorough analysis requires that differences in patient population, case mix, and providers across settings be controlled. Measures for identifying or detecting differences in these areas are limited, as are the data available for computing measures. Perhaps for these and related reasons, the existing literature provides only limited evidence bearing on these issues. Research by Moscovice [6] has indicated that, in isolated rural areas served primarily by nurses, more intense care may be provided in a hospital-based setting. Studies in nonrural areas have been limited or flawed. One study found less intense antihypertensive care in a traditional clinic of a public teaching hospital than in a neighborhood health center [7]; another found unclear variations in intensity of care when a hospital emergency room was compared to private physician offices [8, 9]. In both these studies, the particular characteristics of each setting that led to the results were not identified. Differences in care location were intermingled with differences in patient population, case mix, provider type, or third-party reimbursement.

This project addressed the question of the relationship between setting and intensity of care. Our intent was to evaluate whether the location of primary care at the hospital affects the amounts and kinds of resources used in treatment. The focus was on examining the role that physical location plays in contributing to differences in intensity between hospital-based and free-standing settings, independent of contamination by effects resulting from differences in financial incentives, teaching activity, or third-party coverage across settings. While empirical evidence is limited, the theoretical considerations previously discussed led us to hypothesize that the physical location of primary care at the hospital would result in more intensive hospital-based care than free-standing care.

Study Site and Design

STUDY SITE

The study site was the Kaiser-Permanente Medical Care Program, Oregon Region (K-P). While this site presents certain unique features, its structure provided improved control over many of the threats to the internal validity of the work, as well as the type of strong data base required for this form of analysis. The implications of this choice of study site for the generalizability of the findings are discussed later.

The characteristics of the K-P plan have been described extensively in the literature [10]. K-P is a large, established prepaid group practice. During the two-year study period (July 1969 through June 1971), the system provided for the medical care needs of approximately 140,000 people in the Portland metropolitan area, about 15 percent of the Portland SMSA population. The K-P membership includes a number of diverse groups representing various social and economic classes. In 1970, about 84 percent of the membership was enrolled through groups, 7 percent was over 65 years of age, and 4 percent was enrolled through a grant to integrate the medically underserved into the delivery system [11].

K-P offers prepaid full-service benefits within the context of a group practice of medicine. During the study period, primary care was provided by full-time physicians practicing at Bess Kaiser Hospital, a 250-bed acute-care facility, and at five outlying satellite clinics dispersed throughout the Portland metropolitan area. At the hospital, the full range of medical specialties was represented; a broad range of laboratory tests and radiology procedures was available. The other clinics varied in size, but all focused on primary care. Each used the hospital facility for all but routine laboratory procedures; most used the hospital for radiology procedures requiring a radiologist and for other specialized services. Regardless of their clinic locations, all physicians rotated coverage of the hospital emergency room, providing staff coverage for the facility.

DATA SOURCES

Analysis was based upon information from various data bases and sources maintained by the Health Services Research Center at K-P. The primary data source used was the Outpatient Medical Care Utilization Study. This ongoing study involves a five percent random sample of currently enrolled subscriber units. Detailed data on all outpatient medical utilization for study members are abstracted from the medical record following any contact with the K-P system. Most clinical services are coded in aggregate in terms of the type of contact (e.g., initial office visit, telephone call to receive

prescription). Laboratory and radiology procedures are coded individually. The data system is structured to link each procedure recorded to the specific diagnosis for which it was rendered. By definition, primary clinical service codes (i.e., the aggregate service codes referred to above) are assigned to the presenting complaint diagnosis. Related care of any type across contacts is linked through the use of episode codes. During the study period, use of pharmaceuticals was not recorded.

FOCUS ON INTERNAL MEDICINE

The research focused on the internist, the major adult primary care provider at K-P. Thirty-six internists practiced primary care for at least some portion of the study period, and are included in the analysis. All were either board certified in internal medicine (64 percent) or eligible for certification (36 percent). Each served as a general primary care practitioner, although 47 percent had subspecialties. Internists generally were assigned to one or two clinics for ongoing practice. While clinic assignments changed somewhat over time, concurrent rotation among clinics was limited. By and large, clinic assignment was independent of level of specialization, function, or tenure in the system. An exception was that cardiologists tended to be assigned to the hospital. Over the two-year study period, 9 of the 36 internists practiced almost entirely at the hospital clinic, while 27 practiced predominantly in the nonhospital free-standing clinics.

THE UNIT OF ANALYSIS

To control for case mix, six conditions were selected for independent analysis [12]. The conditions were chosen to encompass a range of acute, chronic, symptomatic, and preventive adult care situations, with an emphasis on commonly occurring conditions. The six conditions were upper respiratory infection (URI), urinary tract infection (UTI), hypertension (HYP), abdominal pain (AP), chest pain (CP), and physical exam (PE). These conditions encompass 31 percent of all internist office visits at K-P.

The unit of analysis was the episode of care [13]. Developing an operational definition of an episode of care was one of the most difficult problems faced in the project; the final specifications used were detailed and complex [14]. In general, an episode of care was defined to include all the episode-related care services provided during the study period. Except for hypertension,[1] episodes were selected only if they began during the study period, and started with a clinic visit to an internist for the selected condition.[2] Once identified, episode-related care, except for PE episodes (which involved only a single contact), was tracked until the episode end or end of the study period, whichever came first.[3] Episodes of symptomatic

conditions, i.e., AP and CP, were tracked only until the physician made a definitive diagnosis of disease. This focused the analysis for these conditions on the physician's use of resources in diagnosing ambiguous conditions. All episodes of the six conditions in the five percent sample which met the selection criteria were included. Table 1 displays the final number of episodes selected, including the reductions made in sample size in light of measurement decisions and data constraints, as discussed later.

Table 1. Distribution of Episodes of Care by Disease Condition

Disease Condition	*All Episodes*	*Episodes with Clearly Defined Setting Variable*	*Episodes with Complete Information on All Regression Variables except Household Survey*	*Episodes with Complete Information on All Regression Variables*
Upper respiratory infection	671	652	539	286
Urinary tract infection	185	178	152	90
Hypertension	376	326	270	198
Abdominal pain	184	175	135	85
Chest pain	111	108	88	51
Physical examination	2,473	2,382	1,964	1,321
Total	4,000	3,821	3,148	2,031

MEASUREMENT OF THE DEPENDENT VARIABLE

Intensity of care refers to the level of total resources applied in treatment. The conditions selected for study were treated almost exclusively on an ambulatory basis; there were only 13 hospitalizations among the 4,000 episodes studied. The major measure of care intensity focuses, therefore, on the use of ambulatory care services. The intensity of ambulatory care provided in treating episodes of illness has multiple dimensions. The data set available at K-P provided information on all ambulatory services provided with the exception of pharmaceuticals.

Three components of care intensity were measured: clinical, laboratory, and radiology. The variable used to define intensity is a weighted

measure for all the individual procedures rendered. The weights reflect the differences in the costs involved in providing each procedure [15]. Because actual cost data for individual services were not available, the California Relative Value Schedule (CRVS) units per procedure were used as an alternative.[4]

Overall care intensity was defined as a weighted total of clinical, laboratory, and radiology care. The need for weighting the components arises because the CRVSs for clinical, laboratory, and radiology services are independently derived, leading to differences in the dollar value implicit in a unit of service within each component. Weights, reflecting the average cost per component of service, were based on a 1971 Kaiser survey of prevailing charges in other Portland hospitals, large clinics, independent laboratories, and similar settings.[5] The equation used to compute overall care intensity was as follows:

$$\text{Intensity} = 2.16\ \text{CRVS Clin} + 1.00\ \text{CRVS Lab} + 1.82\ \text{CRVS Rad}$$

In 1971 dollars, this implies a $3.58 value per CRVS unit for the aggregate intensity measure.

MEASUREMENT OF SETTING

Because physical exam episodes involved only a single visit, a binary variable was used to measure whether the PE was provided at the hospital or the free-standing clinic. For other conditions, the measure of setting was less straightforward. A single episode of care for these conditions potentially involved treatment by several internists in different types of settings. It also may have involved care in other than clinic locations (e.g., telephone, letter, emergency room).

Since the influence of setting on the delivery of care in other locations was expected to be marginal, only care provided in the clinic or emergency room was considered in developing the measure of setting. A reference variable was created to measure the proportion of such care provided in hospital-based settings. The decision to treat setting as a continuous or discrete variable was made after reviewing the frequency distribution of the variable. The number of episodes involving treatment in both settings was too small (six percent) for meaningful analysis on a per-condition basis. As a result, only episodes treated entirely in one or the other setting were analyzed. As with PE episodes, therefore, setting of treatment was measured through a binary variable indicating whether treatment was received in a hospital-based or free-standing setting. The inability to analyze episodes treated in both settings is unfortunate since it precludes an ability to assess

cross-referral and joint care production by hospital-based and free-standing sites linked in an integrated system. However, episodes falling in this category are small in number so that their omission, while unfortunate, does not compromise the relevance of the findings presented here.

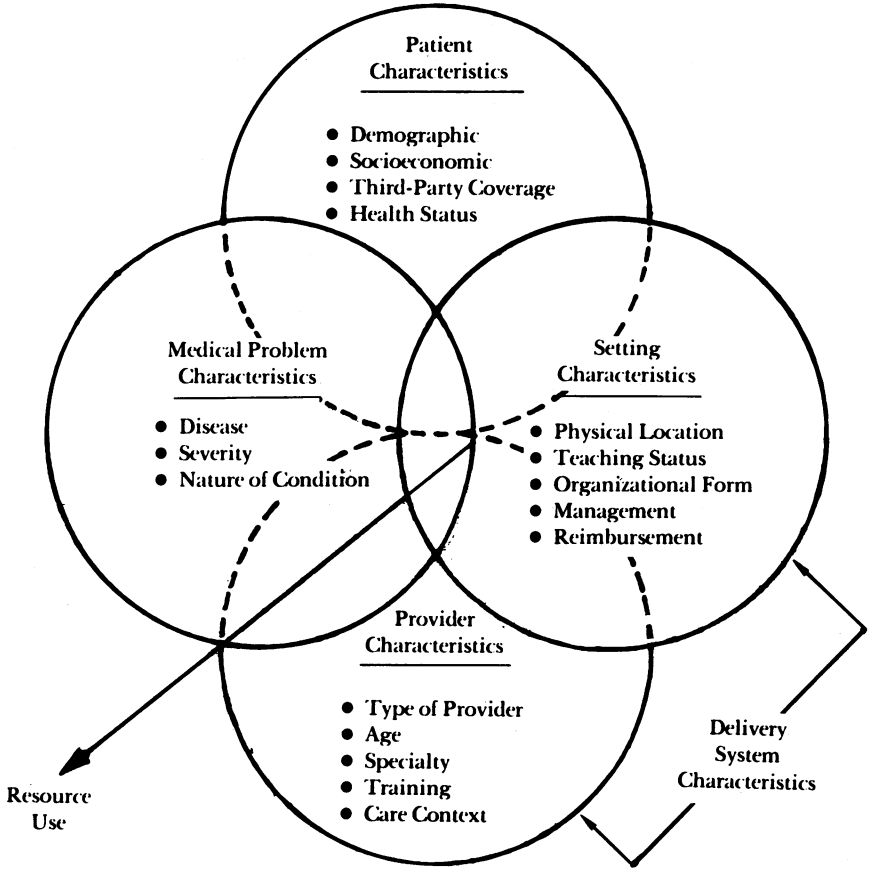

Figure 1. Factors Affecting Use of Resources in Treating Illness

IDENTIFICATION OF CONFOUNDING VARIABLES

To identify confounding variables bearing on analyses of setting and intensity of care, a model of the factors that affect decisions on resource use was constructed. The model as presented in Figure 1 is an elaboration of the framework developed by Moscovice [16]. It explains resource use in terms of the interaction of patient, medical problem, and delivery system characteristics, further distinguishing between provider and setting components of the delivery system. The model was used to identify factors not held constant by project design. For example, the focus on specific types of episodes controlled for inter- but not intra-diagnostic case mix or disease severity. Variables were defined for these and similar factors, and regression analysis was used to adjust as fully as possible for confounding influences not controlled through the design of the project.

Table 2 describes the patient, medical problem, and physician setting variables included in the final specification of the regression model used in the analysis. As physical exam episodes involved only a single contact, a slightly different set of variables was specified for these episodes than for the others. The data defining the variables were obtained from diverse sources. Data on five variables were obtained from the household interview survey involving a subsample of the patients.[6] The variables (i.e., INC, EDUC, RACE, DIST, HEALTH) provide information on socioeconomic status, perceived health status, and distance from care source. Because of the loss of cases inherent in the use of these variables (see Table 1), the analysis was undertaken with these variables omitted (termed "level A"), as well as with them included (termed "level B").

RESULTS

CHARACTERISTICS OF EPISODES

The characteristics of the episodes of each type of condition have been reviewed elsewhere [14]. To summarize, except for hypertension, episodes tended to be of brief duration; at least half of the episodes of each condition but hypertension involved only a single visit. Physical exam episodes typically involved both laboratory (93 percent of PEs) and radiology (68 percent of PEs) services. Of the other episodes, 38 percent involved a laboratory test, while 12 percent involved a radiology test. Few episodes involved a referral to a consultant physician (23) or a hospitalization (13). Most episodes did not involve the use of sophisticated ancillary procedures, and the use of repeat tests over the course of the episode was rare. If patients had been billed for the episode-related care involved in treating each

Table 2. Summary of Regression Model Variables Relating to Physicians' Use of Resources in Treating Episodes of Care

Variable Label	*Variable Description*	*Measurement*
PATIENT		
Demographic		
AGE	Patient age at date of first DOV in episode	Actual age in years
SEX	Patient's sex	1 = male, 2 = female
Socioeconomic		
INC	Patient's family income as obtained on household survey	9 groups, low to high
EDUC	Patient's education as obtained on household survey	7 groups, low to high
RACE	Race of head of patient's household as obtained on household survey	1 = white, 2 = nonwhite
Plan Coverage		
PLAN	Patient's coverage class group as of month of first DOV	5 groups, low to high
MONTHS	Number of months since patient joined the plan	Actual number
DIST	Distance of patient from likely care source (hospital if hospital-treated setting, nearest clinic if nonhospital) as obtained on household survey	5 groups, low to high measured in minutes
Health Status		
HEALTH	Patient's perceived health status as obtained on household survey	4 groups, excellent to poor
MEDICAL PROBLEM		
Other than Physical Exam Measures		
ECOMORB	Existence of related comorbidity at any point in the episode	0 = no, 1 = yes
%WALK	Percentage of direct internists' contacts in the episode in which the patient was a walk-in (no appointment)	Actual percentage
%PRESENT	Percentage of direct internists' contacts in the episode in which the episode-related condition treated was the presenting diagnosis	Actual percentage
Physical Exam Measures		
#DIAG	Number of diagnoses, in addition to presenting diagnosis, identified on the first DOV in the episode (regardless of their relation to the disease condition of the episode)	0 through 8
WALK	Whether the patient was a walk-in (no appointment)	1 = appointment, 2 = walk-in

SETTING		
LOCATE	Whether or not the known location direct internist clinic or emergency room contacts in the episode were all treated in the hospital clinic or ER*	1 = nonhospital, 2 = hospital
PHYSICIAN		
Tenure-Role		
YEARSK	Number of years since the physician first joined the Kaiser staff to July 1970†	Number of years (to 1 decimal)
LEADER	Percentage of direct internist contacts in the episode treated by physician defined as a formal leader (holding any of three positions)*	Percentage
Age		
MDAGE	Physician's age as of last birthday before July 1, 1970†	Actual age in years
Specialization		
CERT	Percentage of direct internist contacts in the episode in which the treating physician was board-certified*	Percentage
SPEC	Percentage of direct internist contacts in the episode in which the treating physician was a subspecialist*	Percentage
Training		
MEDSCHL	Research-specialization score for the internist's medical school, defined as a Z-score standardized variable equally averaging the proportion of researchers to all M.D.'s in the physicians graduated from 1960–1967; and the ratio of specialists to general practitioners graduated in the same time period†	Z-score, low to high
RESID	Degree of medical school participation in internist's hospital of last residency based on American Medical Association information	4 grades, 1 = major unit, 4 = no role
Workload		
WORK	Physician's workload defined in terms of total five-percent sample doctor office visits in time period per 100 care days spent†	Actual ratio to nearest whole number

*For the physical exam episodes, variables were defined as simple dichotomies: LOCATE (1 = nonhospital clinic, 2 = hospital clinic); LEADER (1 = no, 2 = yes); CERT (1 = eligible, 2 = certified); SPEC (1 = no, 2 = yes).

†Variable defined by averaging physician characteristics defined on each face-to-face contact in episode, except for physical exam episodes which required no weighting as only a single characteristic.

episode of illness, the average charge incurred (in 1971 dollars) would have been as follows: URI, $19.33 (5.4 CRVS units); UTI and HYP, $26.13 each (7.3 CRVS units); AP, $33.29 (9.3 CRVS units); CP, $23.27 (6.5 CRVS units); and PE, $45.82 (12.8 CRVS units).

Table 3. Overall Intensity of Care for Episodes by Setting of Treatment, by Disease Condition

Disease Condition	*Hospital*	*Nonhospital*	*F*	*Sig.*
Upper respiratory infection	5.11 (189)	5.18 (463)	0.057	0.81
Urinary tract infection	6.31 (40)	6.78 (138)	0.289	0.59
Hypertension	6.62 (69)	6.90 (257)	0.039	0.84
Abdominal pain	6.74 (39)	9.84 (136)	4.483	0.04
Chest pain	7.54 (32)	5.64 (76)	3.213	0.08
Physical exam	12.70 (514)	12.77 (1,868)	0.370	0.54

Note: Numbers in parentheses are the episode counts used in computing the statistics.

BIVARIATE RELATIONSHIP BETWEEN SETTING AND CARE INTENSITY

Table 3 presents data that bear on the relationship between setting of treatment and overall intensity of care. The largest differentials in care intensity between settings are found for the symptomatic conditions (i.e., AP and CP). Abdominal pain episodes treated at the hospital tended to receive about one-third less intense care, while the reverse held true for chest pain episodes. Urinary tract infection also tended to receive care of different intensity at the hospital than at the free-standing clinics, but differentials were not statistically significant at the 0.05 level. The intensity of care provided for the other conditions was similar in hospital-based and free-standing settings.

As shown in Table 4, the variation in care intensity across settings reflected almost entirely the variation in the use of laboratory or radiology services. Laboratory care rendered in the two settings was different ($p \leqslant 0.10$) for three of the six conditions. The hospital-based clinic treatment involved less intensive laboratory care for urinary tract infection and ab-

Table 4. Intensity of Clinical, Laboratory, and Radiology Services for Episodes by Setting of Treatment, by Disease Condition

	CRVS Clinical			*CRVS Laboratory*			*CRVS Radiology*			*Episode Base*	
	H	*NH*	*Sig.*	*H*	*NH*	*Sig.*	*H*	*NH*	*Sig.*	*H*	*NH*
URI	2.10	2.06	0.62	0.21	0.33	0.02	0.20	0.22	0.78	189	463
UTI	1.77	2.05	0.21	1.71	2.04	0.24	0.43	0.17	0.31	40	138
HYP	1.73	1.95	0.55	2.25	1.52	0.13	0.35	0.64	0.33	69	257
AP	1.56	1.55	0.99	0.39	0.97	0.07	1.64	3.03	0.05	39	136
CP	1.66	1.33	0.15	2.13	1.17	0.01	1.00	0.88	0.72	32	76
PE	Not applicable*			2.72	2.63	0.23	1.33	1.42	0.09	514	1,868

H = hospital, NH = nonhospital.

*Physical exam episodes had almost no variation in use of clinical services (99.7 percent of all episodes coded "Complete Physical Exam" as only procedure).

dominal pain episodes and more intensive laboratory care for chest pain episodes. Radiology services were an important treatment resource for only three conditions: AP, CP, and PE. Differences in care intensity for radiology services were found for two of these conditions, AP and PE. In both cases, hospital-based care was less intense. For both laboratory and radiology services, analyses based on measures of CRVS radiology, and those based on the use or nonuse of services (not presented), resulted in similarly patterned results.

Overall, these findings provide little indication that intensity of care varies between hospital-based and free-standing clinics. Twenty-three tests of differences in care intensity by setting were computed, using CRVS measures for episodes of the six conditions. Of these, six were measures of overall intensity, while seventeen were measures of intensity for components of care. Seventeen to 18 percent of each of these groups of tests (or one and three tests, respectively) showed differences in treatment intensity by setting which were significant at the 0.05 level. These percentages are beyond what one might expect purely by chance, but they are not overwhelmingly so ($p \leq 0.26$).

Nor does the evidence indicate that hospital-based primary care is more intense. Three of the four statistically significant CRVS tests reflect situations where the hospital-based primary care setting provided less intense care than the free-standing primary care settings. For five of the six conditions, the overall intensity of care provided at the hospital was less intense than in the free-standing clinics, although the variations tended to be small in magnitude and lacking in statistical significance.

Because five free-standing primary care clinics were grouped in the analysis, it is possible that the aggregate analysis obscures individual relationships on intensity of care across clinics. Two issues are of major concern: (1) whether individual free-standing primary care clinics varied in intensity from the hospital-based clinic, and (2) whether the free-standing clinics have individual styles of practice such that it might have been inappropriate to group them for analysis. To explore these issues, data on the first physician office visit in the episode were used to identify the specific clinic of treatment, and various statistics were computed. As described elsewhere, these analyses indicate that few pairwise differences in intensity existed across clinics. There was also very low concordance across intensity measures by each clinic, suggesting that the individual clinics did not have unique styles of practice intensity to differentiate them from one another [14].

Table 5. Summary of Bivariate and Multivariate Analysis Findings on the Relationship Between LOCATE and Selected Measures of Intensity for Episodes, by Disease Condition

	Bivariate		*Multivariate*					
			Level A			*Level B*		
				LOCATE			*LOCATE*	
	H-NH	*Sig. of F*	R^2	*Beta*	$R^2\Delta$	R^2	*Beta*	$R^2\Delta$
URI§								
TCRVS	-0.07	0.81	0.25‡	0.01	0.00	0.29†	0.04	0.00
CRVS Clin	+0.04	0.62	0.39‡	0.04	0.00	0.49‡	0.03	0.00
CRVS Lab.	-0.12	0.02†	0.06†	-0.08*	0.01	0.13‡	0.14†	0.01
UTI§								
TCRVS	-0.47	0.59	0.28‡	0.04	0.01	0.43‡	-0.04	0.01
CRVS Clin.	-0.28	0.83	0.53‡	0.04	0.01	0.65‡	-0.00	0.02
CRVS Lab.	-0.33	0.24	0.12	-0.04	0.00	0.23	0.03	0.00
HYP§								
TCRVS	-0.28	0.84	0.36‡	0.01	0.00	0.41‡	-0.02	0.00
CRVS Clin.	-0.52	0.50	0.47‡	-0.03	0.00	0.52‡	-0.08	0.01
CRVS Lab.	+0.73	0.13	0.13‡	0.09	0.01	0.17†	0.09	0.01
AP								
TCRVS	-3.10	0.04†	0.23‡	-0.19†	0.05	0.41†	-0.19	0.04
CRVS Clin.	+0.01	0.99	0.80‡	-0.04	0.00	0.79‡	-0.05	0.01
CRVS Lab.	-0.58	0.07*	0.13	-0.18*	0.02	0.25	-0.02	0.00
CRVS Rad.	-1.39	0.05†	0.23‡	-0.17*	0.04	0.39†	-0.21	0.07
CP								
TCRVS	+1.90	0.08	0.58‡	-0.11	0.01	NP	NP	NP
CRVS Clin.	+0.33	0.15	0.90‡	-0.13‡	0.01	NP	NP	NP
CRVS Lab.	+0.96	0.01‡	0.29†	-0.08	0.02	NP	NP	NP
CRVS Rad.	+0.12	0.72	0.26	-0.04	0.00	NP	NP	NP
PE§§								
TCRVS	-0.07	0.54	0.08‡	-0.00	0.00	0.07‡	-0.00	0.00
CRVS Lab.	+0.09	0.23	0.10‡	0.06*	0.00	0.07‡	0.05	0.00
CRVS Rad.	-0.09	0.09*	0.04‡	0.05*	0.00	0.05‡	-0.04	0.00

Note: The multivariate model used is an ordinary least squares regression. Two sets of regressions were performed. In the first set (Level A), the independent variables controlled were LOCATE, AGE, SEX, PLAN, MONTHS, ECOMORB, %WALK, %PRESENT, YEARSK, LEADER, MDAGE, CERT, SPEC, MEDSCHL, RESID, and WORK. In the second set (Level B) all the preceding variables were controlled, as well as INC, EDUC, RACE, DIST, and HEALTH.

*Sig. at 0.10

Continued

Table 5 (continued)

†Sig. at 0.05
‡Sig. at 0.01
NP = not presented since there were only 51 episodes with complete information available in level 3 regression.
H-NH = mean hospital-mean nonhospital (+ = hospital more intense, - = hospital less intense).
$R^2\Delta$ = proportion of total variance explained by LOCATE.
§ = Radiology intensity not presented since few episodes involved radiology care.
§§ = CRVS Clinical not presented since there was little variation in clinical services used for PE.

REGRESSION RESULTS

The tables which follow summarize the results of the regressions undertaken to analyze the independent effect of setting on intensity of care. Because of space limitations, only a limited number of statistics can be presented. However, the full results of regressions on overall care intensity are included in Table 7, and the results of other regressions are available [14].

Table 5 summarizes the project findings on the independent effect of setting in determining intensity of care. Using the liberal criterion of a setting coefficient (i.e., LOCATE) which is significant at the 0.10 level or better in regressions undertaken with or without household interview survey variables, the hospital-based primary care setting would appear to have the following effects on intensity of care when such care is contrasted with the free-standing setting: (1) less intense laboratory care for URI; (2) less intense laboratory and radiology care for AP; (3) less intense clinical care for CP; and (4) more intense laboratory care, but less intense radiology care, for PE. In only one case (AP) are these influences sufficiently strong to influence the overall intensity of care for the episode. Furthermore, setting appears to explain only small proportions of the variation in intensity of care provided. Only for AP is more than two percent of the variation in intensity determined by setting, and here only two to five percent of the variation is explained. Similar conclusions are reached using logarithmically transformed measures of intensity, as well as alternative measures of intensity components less subject to concerns about skewedness (e.g., use or nonuse of services).

In the bivariate analysis, the hospital-based setting appeared to exert a substantial influence on the intensity of AP and CP care, leading to less intense care for the former and more intense care for the latter. The

regression results suggest these effects are of little practical significance. After removing the influence of confounding variables, setting appears to exert only a small influence at most over AP episode treatment. Any intensity-enhancing effects of the hospital-based setting on CP episode care appear attributable entirely to confounding influence.

Overall, the variables considered in the regression model accounted for 8 to 58 percent of the variation in overall intensity of care. The independent variables explained a substantial proportion of the variation in clinical service intensity and a far lower proportion of the variation in ancillary service intensity. Table 6 summarizes the regression results to identify those variables that have the strongest influence on intensity of care. Individual independent variable coefficients are highlighted whose effects are statistically significant at the 0.10 level.

Considerations bearing on the nature of the medical problem exerted the largest influence over the care received. The most powerful predictor of care intensity was whether the condition was the presenting complaint for the visit. In part this reflects measurement, since primary clinical procedures are assigned to the presenting complaint. It also indicates, however, the larger costs associated with treating the major patient complaint rather than associated, and perhaps incidental, illness. As expected, the existence of comorbidity also led to greater intensity of care. To the extent that they influenced intensity at all, nonscheduled contacts tended to result in care of lesser intensity. Whether this reflects a basic difference in episode severity for conditions treated with and without appointments, or a difference in physicians' approaches to scheduled and unscheduled care, is unclear.

Patient age was the most salient of all the patient variables considered. The influence of age on intensity of care tended to be positive, but this varied with the condition and type of service considered. This suggests that physicians regard patient age as a reflection both of over all health status and of likely complications or disease states, the latter leading to different age effects across the conditions. This latter explanation also may explain the similarly patterned, though more limited, effects of sex on intensity.

The other variables had a much more restricted influence over care intensity. It is particularly interesting to note that physician age, training orientation, level of subspecialization, and workload appear to determine very little of the care provided, despite the fact that these variables are a central focus in much of the ongoing utilization research. This is consistent with the results of other research [17–19] and suggests a need for more sophisticated models of physician decision-making.

Table 6. Summary of Regression Model Coefficients Significant at the 0.05 and 0.10 Levels in Regressions on CRVS Measures of Intensity for Episodes, by Direction of Relationship, Type of Measure, and Disease Condition

	TCRVS						*CRVS Clin.*					*CRVS Lab.*						*CRVS Rad.*		
	URI	*UTI*	*HYP*	*AP*	*CP*	*PE*	*URI*	*UTI*	*HYP*	*AP*	*CP*	*URI*	*UTI*	*HYP*	*AP*	*CP*	*PE*	*AP*	*CP*	*PE*
Setting																				
LOCATE											-	-			(-)		+	(-)		-
Patient																				
AGE		(+)		+		+	+		(+)			-		-			+	+		+
SEX		+					-	(+)	(+)				(+)							-
INC						+														
EDUC	+			(+)			+		(+)	(+)		+						(+)		
RACE							+	(+)												
PLAN						+														+
MONTHS					-	-			(-)		(-)						-		-	(-)
DIST												+			(+)			(-)		
HEALTH																				
Medical Problem																				
ECOMORB	+	+	+			NA	+	+	+	+		(+)		+	(+)		NA			NA
%WALK		-				-		-		(-)							-			
%PRESENT	+	+	+	+	+	NA	+	+	+	+	+	(+)	+	+			NA		+	NA
Physician																				
YEARSK												-								
LEADER												+								+
MDAGE			(-)						(-)							(-)	(-)			
CERT					+	-			+							+	-			
SPEC																	-			
MEDSCHL					(+)	+											(+)		(+)	
RESID				-		+						-					+			
WORK			(+)						(+)			-				(+)				

Note: The multivariate model used is an ordinary least squares regression. Two sets of regressions were performed. In the first set (Level A), the independent variables controlled were LOCATE, AGE, SEX, PLAN, MONTHS, ECOMORB, %WALK, %PRESENT, YEARSK, LEADER, MDAGE, CERT, SPEC, MEDSCHL, RESID, and WORK; in the second set (Level B) all the preceding variables were controlled, as well as INC, EDUC, RACE, DIST, and HEALTH.

+ indicates a positive relationship between the variable and the measure, while - indicates a negative relationship. Where no parentheses are used, the coefficient, either on level 2 or 3, was significant at ≤ 0.05. Where parentheses are used, the coefficient, either on level A or B, was only significant at between 0.10 and 0.05. For CP episodes, only level 2 regressions are used to determine significance, since there were only 51 cases with complete information on level 3 variables. PEs are excluded from CRVS Clinical since there was little variation in clinical services received for PE episodes. URI, UTI, and HYP episodes are excluded from CRVS Radiology since few episodes of these conditions involved radiology services.

Table 7. Multiple Regression of Resource Use Model Variables on Overall Care Intensity (TCRVS) for Episodes, Levels 2 and 3 of Model, Standardized Solution, by Disease Condition

	URI		*UTI*		*HYP*		*AP*			*PE*	
	Level A	*Level B*	*Level A*	*Level B*	*Level A*	*Level B*	*Level A*	*Level B*	*CP§*	*Level A*	*Level B*
Multiple R^2	0.25†	0.29†	0.28†	0.43†	0.36†	0.41†	0.23†	0.41*	0.58†	0.08†	0.07†
Adjusted R^2	0.23	0.24	0.19	0.26	0.32	0.34	0.13	0.21	0.49	0.08	0.05
N	539	286	152	90	270	198	135	85	88	1,964	1,321
LOCATE	0.01	0.02	0.04	-0.04	0.01	-0.02	-0.19*	-0.19	-0.11	-0.00	-0.00
AGE	0.04	0.07	-0.03	0.26	-0.08	-0.05	0.27†	0.11	0.13	0.21†	0.18†
SEX	-0.04	-0.07	0.12	0.24*	0.06	0.04	-0.01	-0.09	-0.09	-0.01	0.00
INC		0.04		0.12		0.06		-0.03			0.07*
EDUC		0.14*		0.10		-0.06		0.08			-0.01
RACE		0.05		0.12		0.05		-0.14			-0.02
PLAN	-0.03	0.00	0.01	-0.01	-0.03	-0.08	-0.03	0.04	0.09	0.09†	0.11†
MONTHS	-0.02	-0.07	-0.05	-0.05	-0.07	-0.08	-0.02	-0.00	-0.23*	-0.06†	-0.07*
DIST		0.03		-0.01		0.01		0.15			0.03
HEALTH		0.09		0.06		0.06		0.19			-0.01
ECOMORB	0.32†	0.33†	0.28†	NV	0.21†	0.20†	0.11	0.16	-0.11	NA	NA
%WALK	-0.01	0.01	-0.26*	-0.08	-0.01	0.04	-0.05	-0.03	0.02	-0.06†	-0.06†, ‡
%PRESENT	0.41†	0.41†	0.57†	0.67†	0.54†	0.56†	0.23*	0.30*	0.65†	0.03	0.03†
YEARSK	-0.03	-0.05	-0.06	-0.23	0.08	0.04	0.08	0.11	-0.12	0.01	0.03
LEADER	-0.01	0.05	0.02	0.13	0.02	0.07	-0.06	-0.14	0.13	0.04	0.03
MDAGE	0.03	0.09	0.03	0.24	-0.12	-0.18	0.16	0.25	-0.05	-0.01	-0.01
CERT	0.00	-0.02	-0.02	0.13	0.04	0.05	0.01	-0.12	0.20*	-0.09†	-0.08*
SPEC	0.02	0.05	-0.06	0.04	0.06	0.05	0.07	0.12	0.10	-0.02	-0.03
MEDSCHL	-0.04	-0.09	-0.09	-0.19	-0.06	0.01	-0.06	0.04	0.18	0.05	0.05*
RESID	-0.03	-0.06	-0.09	-0.16	-0.05	-0.05	-0.20*	-0.10	-0.15	0.07†	0.07*
WORK	0.00	-0.01	0.01	0.05	0.14	0.13	0.04	0.01	0.05	0.04	0.02

*Sig. $\leq$ 0.05
†Sig. $\leq$ 0.01
NV = no variance
‡Variables WALK rather than %WALK; coefficient is for #DIAG rather than %PRESENT (only PEs that were presenting complaint were selected).
§Level B regressions not presented since there were only 51 episodes with complete information on all variables.

Discussion

The findings indicated that, contrary to expectations, the physical location of primary care at the hospital did not affect the intensity of care provided for the episodes studied. Hospital location may have contributed to selected reductions in intensity, but these effects were small and perhaps unique to the particular conditions in which they were found. On balance, the care provided in the hospital-based and free-standing clinics was similar in intensity. This conclusion is supported regardless of the test, measure, regression specification, or transformation employed. We speculate that these findings may be attributable to the nature of primary care. The range of technology appropriate to most primary care situations appears limited, with costs largely influenced by the patient decision to seek treatment. The typical physician decision may be whether to order a common laboratory or radiology test which can be carried out in all but the most restricted primary care settings. Under these conditions, the availability of the sophisticated hospital facility may be irrelevant to the physician.

This research was undertaken in a prepaid system. From the perspective of generalizability, the most critical issue is probably whether results obtained in a prepaid system have meaning in fee-for-service settings. The incentives faced in prepaid group practice vary markedly from those in the fee-for-service system; whether these incentives lead to substantially different care in prepaid than in fee-for-service systems is less clear. It appears well-established that prepayment serves to lower hospital use [20, 21], particularly when group practice is involved [22]. Whether prepayment serves to alter the content of primary care received, and particularly to reduce its variability from that found in the fee-for-service system, is far less clear. In a recent comprehensive review of the literature on health maintenance organizations (HMOs), Luft [23] concluded: "In terms of the mix of services, the data suggest that the content of ambulatory visits in HMO's is not particularly different from that in the average fee-for-service visit.... HMO's appear to have no less variability within their settings than do FFS groups...." These conclusions do not dismiss the concern over generalizability. They do, however, support the extension of the results obtained to similar clinic comparisons in the fee-for-service system.

Both the hospital-based and free-standing clinics studied here tended toward large, multispecialty forms of practice characterized by an extensive range of resources. Neither involved any teaching activity. From the perspective of physical location, an extension of these results to comparisons involving a hospital-based setting and a solo practitioner's office or a small group may be unwarranted, particularly if the resources readily available to the practice are severely curtailed (e.g., in isolated or rural areas). Applica-

tions to situations involving physicians still in training also may be inappropriate. Similarly, the extension of these results to less common primary care conditions is unclear, particularly in those rare instances where the condition suggests extensive use of medical resources [14]. Since these conditions may generate a disproportionate share of primary care costs, this is an important restriction on the potential generalizability of the results.

It is also important to note that this project evaluated only the role played by physical location in affecting intensity of care. In our current medical care system, a shift to hospital-based primary care typically involves an increase in level of teaching activity, a change in third-party reimbursement procedures, and an alteration in the methods used to remunerate physicians (e.g., to salaried arrangements) or exert managerial control. These factors may influence the intensity of care provided, differentiating the hospital-based and the free-standing clinics.

Summary and Conclusions

A considerable amount of information is required before we understand fully how the location of primary care services at the hospital may influence the cost of care. Better information is required on unit cost of care across settings; differences in case mix; variation in treatment patterns; and effects of a hospital location for primary care on other services provided, including such costly items as hospitalizations. The effects resulting from the physical setting also need to be distinguished from those resulting from inconsistent incentives or other differences between hospital-based and free-standing settings.

The present study addresses only a small portion of these concerns. The data are based on an intensive effort focusing on the cost impact of potential variation in treatment patterns across hospital-based and free-standing settings. The findings suggest that, other things being equal, the location of primary care at the hospital will have little measurable impact on the intensity of care provided for common primary care conditions. These conditions tend to require limited medical services which typically are available at most primary care sites.

These findings may not extend to rarer but costly primary care conditions. They also may not apply when financial or other incentives encourage different practices at the hospital. The results are based on data from a single prepaid system and must be applied cautiously to other systems. The analysis presented provides an important data point in what may eventually become a more complete information base for making informed decisions on hospital-based primary care.

NOTES

1. Because hypertension was considered an ongoing, chronic condition, all episodes of hypertension that received any treatment during the study period were selected.
2. By the nature of disease, episodes of care may include treatment for multiple related diagnoses. To ensure that the episodes analyzed reflected the conditions selected, a listing was generated of all contacts constituting each episode, with selected variables on each contact, particularly the diagnosis treated. A small number of episodes appeared to reflect other than the six conditions selected, and were eliminated from the final set of episodes analyzed. By and large, however, the episodes selected appeared, from the ICDA codes, to reflect treatment for the six conditions studied.
3. Since the focus of the analysis was on internist behavior, care provided by other than internists was not included. Project data indicate that few of the episodes studied (nine percent non-PE episodes, two percent all episodes) involved care by other than internists.
4. Parallel unweighted measures of each dimension of care also were developed. The weighted and unweighted measures are highly correlated and led to similar results. This suggests that the possible inadequacy of the CRVS does not present a major threat to the validity of the results.
5. Because reliability was a concern, conversion factors also were approximated from two other available data sources on Medicare prevailing charges and Oregon welfare payments. Although the conversion factors varied with the data source used, overall intensity scores were highly correlated across measures [14].
6. The household survey involved all subscriber units in the five-percent sample who were enrolled for the full two-year period of 1969 and 1970. A completion rate of 92 percent was achieved with information on 1,529 subscriber units. (In July 1970, there were 2,480 active subscriber units in the sample.)

REFERENCES

1. Bryant, J. et al. *Community Hospitals and Primary Care.* Cambridge, Mass.: Ballinger Publishing Co., 1976.
2. Williams, S., S. Shortell, W. Dowling, et al. Hospital-sponsored primary care group practices: A developing modality of care. *Health and Medical Care Services Review* 1:1, 1978.
3. Gold, M. Hospital-based versus free-standing primary care costs. *Journal of Ambulatory Care Management* 2:1, 1979.
4. Somers, A. and H. Somers. *Health and Health Care: Policies in Perspective.* Germantown, MD.: Aspen Systems Corporation, 1977.
5. Acton, J.P. *Demand for Health Care Among the Urban Poor, with Special Emphasis on the Role of Time.* Rand Corporation Report R-1151-OEO, Santa Monica, Calif., 1973.
6. Moscovice, I. A method for analyzing resource use in ambulatory care settings. *Medical Care* 15:1024, 1977.
7. Gorry, G.A., M. Richard, B. Price, et al. Care for hypertensives in a neighborhood clinic and a hospital outpatient department: A comparison. *Journal of Ambulatory Care Management* 1:41, 1978.

8. Lees, R., R. Steele, and R. Spasoff. Primary care for nontraumatic illness at the emergency department and the family physician's office. *Canadian Medical Association Journal* 114:333, 1976.
9. Steele, R., R. Lees, B. Latchman, et al. Cost of primary health care services in the emergency department and the family physician's office. *Canadian Medical Association Journal* 112:1096, 1975.
10. Saward, E.W., J.D. Blank, and M. Greenlick. Documentation of twenty years of operation and growth of a prepaid group practice plan. *Medical Care* 6:231, 1968.
11. Saward, E.W., J.D. Blank, and H. Lamb. *Some Information Descriptive of a Successfully Operating HMO.* DHEW Pub. No. (HSM) 73-13011. Washington, D.C.: U.S. Government Printing Office, 1973.
12. Kessner, D.M., C.E. Kalk, and J. Singer. Assessing health quality: The case for tracers. *New England Journal of Medicine* 288:189, Jan. 1973.
13. Solon J., J. Feeney, S. Jones, et al. Delineating episodes of medical care. *American Journal of Public Health* 57:401, 1967.
14. Gold, M. *Relative Intensity of Hospital-Based Primary Care.* Doctoral dissertation, Harvard School of Public Health, 1979.
15. Donabedian, A. *Aspects of Medical Care Administration: Specifying Requirements for Health Care.* Cambridge, Mass.: Harvard University Press, 1973.
16. Moscovice, I. *Development of a Method for the Analysis of Resources in an Ambulatory Care Setting.* Doctoral dissertation, Yale University, 1976.
17. Donabedian, A. *Needed Research in the Assessment and Monitoring of the Quality of Medical Care.* DHEW Pub. No. (PHS) 78-3219. Washington, D.C.: U.S. Government Printing Office, 1978.
18. Ross, C. and R. Durb. Quality of outpatient pediatric care: The influence of physicians' background and work environment on performance. *Journal of Health and Social Behavior* 19:348, 1978.
19. Sang-O, R. Relative importance of physicians' personal and situational characteristics for quality of patient care. *Journal of Health and Social Behavior* 18:10, 1977.
20. Donabedian, A. An evaluation of prepaid group practice. *Inquiry* 6:3, 1969.
21. Roemer, M. and W. Shonick. HMO performance: The recent evidence. *Milbank Memorial Fund Quarterly* 51:271, 1973.
22. Gaus, C., B. Cooper, and C. Hirschman. Contrasts in HMO and fee for service performance. *Social Security Bulletin* 39:3, 1976.
23. Luft, H. *Health Maintenance Organizations.* New York: John Wiley-Interscience, 1981.