The Substitutability of Outpatient Primary Care in Rural Community Health Centers for Inpatient Hospital Care

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To determine whether outpatient medical care obtained at federally funded rural community health centers (CHCs) in Maine acts primarily as a substitute or as a complement to inpatient care, a study of 36 communities served by CHCs was conducted. The hospital use of CHC users (age- and sex-adjusted admissions, days, and length of stay) was compared with that of nonusers from the same communities in 1980. Statistically lower rates of hospital admissions and days were observed for all CHC patients and for selected groups based on their age, sex, and insurance status (specifically Medicaid or Medicare). Hospital use of CHC community populations was then compared with that of 24 comparison communities without access to CHCs, using multiple linear regression in a pre/post design. The model tested, which included rates of health center use, insurance penetration, poverty, and hospital availability, among other factors, did not detect any differences in hospital use between CHC community and comparison populations. These results and additional data presented on selected hospital diagnoses and insurance coverage suggest that treatment, and hospitalization incentives, of CHC providers may reduce hospitalization. Clinic providers lack the economic, professional, and

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institutional incentives to hospitalize. Additional study to determine the actual substitutability effect is indicated.

Over the last two decades, a number of federal and state health policies have been aimed at two sometimes conflicting objectives—expanding access to health care and reducing the expenditures for health care, particularly inpatient hospital care.

The implementation of Titles XVIII and XIX of the Social Security Act; the Women, Infants, and Children's Program; the Health Underserved Rural Areas Program; the Community Health Centers Program; and, more recently, the National Health Service Corps and the Rural Health Clinic Services Act are examples of national programs designed to increase access to health care by reducing financial or provider barriers to care. At the same time, the federal government has implemented new initiatives to contain costs through the implementation of Medicare prospective reimbursement for hospitals, limits on allowable cost increases, and other regulatory changes in Medicare and Medicaid. Many states have also implemented hospital cost-containment legislation specifically aimed at reducing the costs of hospital care.

It is clear that access to medical care through entitlement programs, such as Medicaid and Medicare, has increased hospital utilization and has aggravated inflation in hospital costs [1]. It is not clear, however, how increased access to outpatient care through federally supported community health centers has affected hospital use and costs. The focus of this study is whether comprehensive outpatient care delivered by community-managed rural health centers in Maine acts as a substitute for or a complement to inpatient hospital care.

Briefly stated, rural community health centers (CHCs) are private, nonprofit fee-for-service health care organizations providing comprehensive services to residents of rural areas who otherwise would have little or no nearby access to primary care or hospital care. Each CHC typically has its own local board of directors, which exercises broad authority on administrative and policy matters such as hiring and compensation of administrative and medical staff, the scope of health services to be offered, office hours, and fee schedules. CHCs have weekend and evening hours to increase accessibility, 24-hour on-call coverage for emergencies, a sliding fee scale for those who otherwise might not afford care, and policies that permit patients to walk in and be seen if needed. Most CHCs employ salaried family physicians

and physician extenders. Physician extenders, who tend to be well accepted by their patients, provide preventive services and increase physician productivity. They do not have hospital practices.

Rural CHCs, which receive funding under Section 330 of the Public Health Service Act, are all located in areas which qualify for funding on the basis of need. To determine need, an Index of Medical Underservice (IMU) is computed for each proposed CHC service area. The index is comprised of four indicators—physician-to-population ratio, infant mortality rate, percent of population over age 65, and percent below the poverty level [2]. According to federal officials, rural areas which have been designated as medically underserved have 24 percent higher hospitalization rates, 33 percent more disability days, and 22 percent more chronic limitations among residents than those in rural areas not so designated [3].

In Maine, 18 of the 32 community health centers are federally certified for reimbursement under the Rural Health Clinics Services Act of 1979. They also receive funding for some assistance from the federal government under Section 330 of the Public Health Service Act. The reimbursement program represents a commitment on the part of the Health Care Financing Administration to reinforce the Section 330 Program of the Bureau of Health Care Delivery and Assistance, recognizing these centers as established elements of the health delivery system.

CHC Substitute Effect

Several published and unpublished studies provide evidence that the comprehensive outpatient health centers, regardless of location, reduce emergency room utilization [4–10]. Several studies also support the view that outpatient care in general is a substitute for inpatient hospital care [11–15]. Studies examining the substitutability of CHC services for hospital inpatient services revealed significantly lower hospital utilization rates among CHC users than among residents of the same area who were not users.

Okada and Wan [16] used household survey data in a before-CHC/after-CHC design to study the impact of five urban CHCs on hospitalization. They found that the rates of hospital admissions and lengths of stay in the CHC area exceeded the national rates (40 percent higher and 53 percent longer, respectively). However, the percentage of CHC users who had been hospitalized was lower than that of users of private physician services or hospital outpatient departments in the

same geographic areas and in the United States as a whole. Additional analyses of this data set by Freeman et al. [17] suggest that selection differences do not account for these findings, although the authors acknowledge having limited data with which to test for selection bias.

Okada and Wan likened their findings to the experiences of prepaid group practices where comprehensive primary care is provided by salaried physicians who have no personal financial incentive to hospitalize patients. They further speculated that CHCs "are able to avoid minor hospitalizations by providing a broad range of services on an ambulatory basis as a result of concentrations of health technology, specialists, and manpower within the CHCs" [16, p. 527].

Studies of low-income populations in urban CHC service areas have had similar results. Bellini et al. [18], who analyzed a sample of hospital medical records and welfare office billings for the Columbia Point area of Boston, reported declines in hospital admissions and days in a sample of families one year and two years after the CHC opened. The results of a study by JRB Associates [19] of Medicaid enrollees in Denver revealed lower per capita hospital admission rates, hospital days per person-year, and average lengths of stay among CHC users as compared to nonusers. These findings persisted across age and sex groupings.

There are very few studies on the impact of rural CHCs on hospital utilization. Investigators from the National Evaluation of Rural Primary Health Care Programs at the University of North Carolina School of Public Health reported that "analysis of data on users and nonusers of a stratified random sample of 36 closely studied clinics in the National Evaluation Project showed that regular clinic users were less likely to be hospitalized and reported fewer hospital days of care" [20]. No explanation was offered for this finding, although the multivariate analysis of CHC costs and revenues were said to be consistent with "the theory that clinics do triage sicker patients to avoid costs" [20, p. 751]. Other unpublished data on rural CHCs in West Virginia [21] and in Massachusetts [22] suggest lower hospital admissions rates among their users; but the data are incomplete and the results may be due to differences in population characteristics.

METHODOLOGY

Residents of 36 communities served by 14 rural CHCs were selected for this study. Residents of these communities were selected primarily because of the availability of both 100 percent computerized health

center encounter (patient visit) data and 100 percent hospital admissions data on them. The CHC encounter data include patient identifiers, date of birth, age, sex, procedures, diagnoses, and price charged for each health center visit.

Information on the number of inpatient hospital admissions and days for CHC patients in 1980 was obtained by linking 100 percent CHC encounter data to Maine's 100 percent hospital admissions abstract data for 1980 (Uniform Hospital Discharge Data System. For a discussion of the linking methods, see Appendix A). This provided information with which to compute separate rates of hospital admissions for CHC users and persons in the same community who were not CHC users. CHC patients were defined as those persons in the community who had at least one CHC visit during 1980.

Rates of hospital admissions and days per 1,000 population for CHC users and nonusers were calculated for age- and sex-specific groups (males 0–17, 18–44, 45–64, 65–74, 75 + ; females 0–17, 18–44, 45–64, 65–74, 75 +), and these rates were then age- and sex-adjusted using the direct method [23], with the total population of these towns (using 1980 Census data) as standard.

The 36 communities were included in the service area of these 14 CHCs because the number of health center users per 1,000 population for each was greater than 50, a minimum-user standard defining the service area of the health center [9]. The actual number of health center users for these communities ranged from 58 to 784 users per 1,000 population in 1980.

There were 79,405 people living in these communities in 1980, of which 24,991 (32 percent) visited the health center at least once during the calendar year 1980. Fifty-one percent of the population of these communities was female, and 32 percent of the female population was 45 years of age or older. See Table 1 for the age and sex distribution of the user and nonuser populations. From these data it is clear that use of the health center by young males and females (age 0–17) and older males and females (age 75 +) is higher than that of their proportion of the total population. However, young adult males (age 18–44) and middle-age males and females (age 45–64) use the health center less than their proportion of the total population.

To determine whether CHC use substitutes for inpatient hospital use, the rates of hospital admissions and hospital-days for each group (CHC users and nonusers) were evaluated using contingency table analysis. This included evaluating crude and age- and sex-adjusted differences in rates (RD) of hospital admissions and days, computing and evaluating 95 percent confidence limits (CL), and testing for sta-

Table 1: Rural Health Impact Study CHC Area Population by Age and Sex, 1980—Health Center Users and Nonusers as Percent of Population

Sex/Age	*CHC Users (%)*	*CHC Nonusers (%)*	*Total Target (%)*
Males			
0-17	18	15	16
18-44	15	21	19
45-64	4	12	9
65-74	4	3	3
75 +	4	1	2
Females			
0-17	18	14	15
18-44	20	18	19
45-64	6	12	10
65-74	5	3	4
75 +	6	1	3
	100%	100%	100%
Total	(24, 991)	(54, 414)	(79, 405)

tistical significance for stratified data using Mantel-Haenszel techniques [24].

In addition to the within-community evaluation of the residents of 36 communities classified as CHC service areas, 24 comparison communities were selected to evaluate community differences in hospital use for communities with and without access to rural CHCs. The comparison group of communities was selected by four factors:

1. Similar hospital admissions rates. In 1974, prior to the development of CHCs in any Maine community, the admission rates per 1,000 population of the comparison communities were within one standard deviation of the CHC communities.
2. Access to hospitals. Average travel distance from the population center to the nearest hospital was used as an indicator of access. CHC and comparison communities were located at least 15 miles from a hospital.
3. Same hospital service areas. Comparison communities were selected from the same hospital service areas as the CHC communities to avoid selection bias due to variation in hospi-

tal admission patterns unrelated to population differences [25, 26].

4. "Need" for primary health services. CHC and comparison communities had similar IMU scores. Scores, including government-sponsored physicians, were calculated based on 1980 data.

Data on the number of CHC users, CHC encounters (visits), hospital admissions, hospital days, FTE physicians, medical recipients, Medicare recipients, Blue Cross subscribers, food stamp users, unemployed, AFDC recipients, and Supplemental Security Income (SSI) recipients were collected for each of the 60 CHC and comparison communities. Data to measure distance to the nearest hospital (in minutes), occupancy rate of the nearest hospital, number of beds per 1,000 population, and income per capita of each community were also collected. These data were collected because of their suspected contribution, based on other studies, to the use of hospital services. (For more detail on the data used to compute each of these measures, see Appendix B.)

Fifty percent of the 61,367 people living in the comparison communities were female, and 31 percent of them were 45 years or older. Socioeconomic indicators of the CHC and comparison towns were also similar. For example, the 1977 per capita income for the CHC communities was $4,026, while that of the comparison communities was $4,260. Approximately 5.4 percent of the health center town population was on AFDC, and some 2.5 percent were on SSI compared to comparison towns where AFDC and SSI prevalence was 5.4 percent and 2.1 percent, respectively.

RESULTS

CHC USER/NONUSER HOSPITAL ADMISSIONS, DAYS, AND LENGTH OF STAY

Among the population of CHC users in 1980, there were 2,871 hospital admissions. Among the population of non-CHC users from the CHC communities, there were 10,949 hospital admissions in 1980. (See Table 2 for a breakdown of hospital admissions by age and sex.) Compared to the age and sex distribution of hospital admissions for the total population of these communities, a higher proportion of hospital admissions for CHC users occurred among the younger population (males age 0–17 and females age 0–17 and 18–44). The opposite is true

Table 2: Rural Health Impact Study CHC Area Population by Age and Sex, 1980—Hospital Admissions as a Percent of CHC Users and Nonusers

Sex/Age	*CHC Users (%)*	*CHC Nonusers (%)*	*Total Target (%)*
Males			
0-17	16	11	12
18-44	9	10	10
45-64	7	10	9
65-74	6	7	7
75 +	3	6	5
Females			
0-17	16	8	10
18-44	27	23	24
45-64	8	10	10
65-74	5	7	6
75 +	3	8	7
	100%	100%	100%
Total	(2, 871)	(10, 949)	(13, 820)

in the distribution of hospital admissions among non-CHC users. Thus, as Table 1 shows, CHCs are serving the young and the elderly populations at somewhat higher proportions than their proportions in the communities. But, from data in Table 2, it is among the elderly population that CHCs have their greatest effect on the distribution of hospital admissions.

This is evident in the analysis of rates of hospital admissions by age. The rate of hospital admissions for CHC users compared to nonusers was lower for each age group, with the largest differences observed among the elderly population age 65 + (see Table 3).

The pooled age-adjusted rate of hospital admissions for CHC users is significantly lower than the admissions rate for nonusers (χ^2 = 1,385; $p < .001$). The maximum likelihood estimate of the rate difference (RD) for age-stratified data was 71 admissions per 1,000 population with an upper 95 percent confidence limit of 75 and a lower limit of 67 admissions per 1,000 population.

Statistically significant differences were also observed in the adjusted rates of hospital days per 1,000 population between CHC

Table 3: Rural Health Impact Study Target Area Population by Age, 1980—Hospital Admissions Rates per Thousand, Males and Females, CHC Users and Nonusers

Age	*CHC Users*	*CHC Nonusers*
Males and females		
0-17	101	136
18-44	121	165
45-64	167	177
65-74	137	439
75 +	71	1,197
Age-adjusted total	122	227

Rate difference = 71; 95 percent confidence limits 67-75.

$\chi^2 = 1{,}385$; $p < .0001$ (one-tail test).

Table 4: Rural Health Impact Study CHC Area Population by Age, 1980, Hospital Days per Thousand Population, Males and Females—Rate of CHC Users and Nonusers

Age	*CHC Users*	*CHC Nonusers*
Males and females		
0-17	345	547
18-44	532	804
45-64	1,239	1,317
65-74	1,352	4,021
75 +	740	12,301
Age-adjusted total	682	1,603

Rate difference = 605; 95 percent confidence limits = 593-625.

$\chi^2 = 40{,}804$; $p < .0001$.

Table 5: Rural Health Impact Study CHC Area Population by Age, 1980—Average Length of Stay/CHC Users and Nonusers

	Days per Stay	
Age	*CHC Users*	*CHC Nonusers*
Males and females		
0–17	3.41	4.04
18–44	4.40	4.86
45–64	7.43	7.43
65–74	9.86	9.16
75 +	10.42	10.27
Age-adjusted total	5.36	5.66

users and nonusers of these communities (see Table 4). Again, in all age groups CHC users experienced lower rates of hospital days with the largest differences between elderly CHC users and nonusers. This pattern was observed regardless of sex, with the exception of the rate for females age 45–64. For this age group, the rate of hospital days per 1,000 population was slightly higher for CHC users compared to nonusers (1,380 days per 1,000 population to 1,320 days, respectively).

The age-adjusted average daily length of a hospital stay was only 5 percent higher for the population of hospital users who also were CHC users in 1980 (see Table 5). The difference is not statistically significant. Unlike the pattern of observations in hospital admissions and days, the elderly population of rural CHC users experienced slightly longer hospital stays than elderly nonusers.

This difference was not uniform for each sex. For male hospital users age 65–74, the length of stay for CHC hospital users was higher than for non-CHC hospital users (10.73 days versus 8.87 days, respectively), while for males age 75 + it was lower (9.56 days versus 10.40 days, respectively). For female CHC hospital users, length of stay was lower among the 65–74 age group and higher for the 75 + age group compared to females who were not CHC users (8.76 days versus 9.45 days, and 11.13 days versus 10.17 days, respectively.)

PREVENTABLE HOSPITALIZATIONS

There are certain diagnoses where greater proportional differences were expected in the rate of hospital admissions and hospital-days between CHC users and nonusers. These are diagnoses (including

diabetes mellitus, chronic obstructive pulmonary disease, coronary heart disease, stroke, pneumonia, bronchitis, and low birth weight) where treatment and other secondary prevention measures of associated conditions have been effective in preventing hospitalizations [27, 28].

Rates of hospital admissions and hospital days per 1,000 population were computed for these diagnoses for both populations, and evaluated for proportional and rate differences. Proportional differences observed were indeed greater and the rate differences were statistically significant between CHC users and nonusers (see Table 6). CHC users were almost three times less likely to be hospitalized than persons who did not use the centers. CHC patients also experienced less than half the rates of hospital days per 1,000 population for these selected diagnoses than CHC nonusers from these communities.

MEDICARE AND MEDICAID CENTER PATIENTS

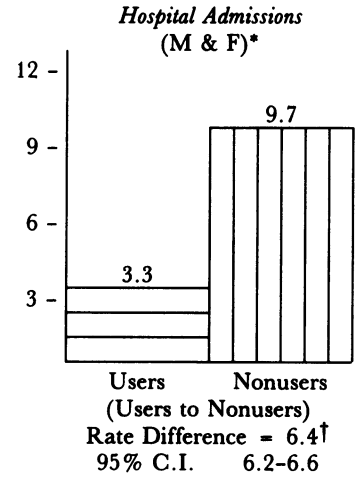
Medicare recipients who use the CHCs consume a disproportionate share of the hospital admissions and days compared to other health center patients. In 1980, only 13 percent of CHC patients were Medicare recipients, while 16 percent of all hospital admissions and 31 percent of all hospital days were for CHC Medicare recipients. However, both Medicare and Medicaid recipients who did not use the CHCs were more likely to be hospitalized than Medicare and Medicaid CHC users. Medicare recipients who were not CHC users had two and one-quarter times the hospital admissions of Medicare CHC users (RD = 236; $\chi^2 = 361$; $p < .001$). Medicaid recipients who were not CHC users had two-thirds more hospital admissions than Medicaid CHC users (RD = 104; $\chi^2 = 104$; $p < .001$).

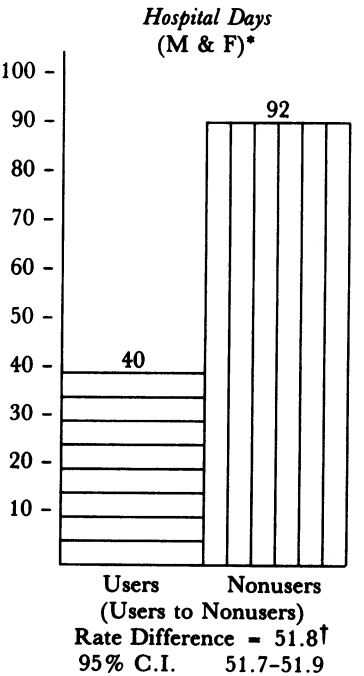
The difference in hospital admissions for Medicare and Medicaid CHC users resulted in significantly fewer hospital-days for these patients compared to Medicare and Medicaid recipients who were not CHC users. A twofold difference in the rate of hospital days per 1,000 population was observed among Medicare and Medicaid CHC users compared to Medicare and Medicaid recipients who were not CHC users (RD = 2,162, $\chi^2 = 3,249$, $p < .001$; and RD = 825, $\chi^2 = 1,211$, $p < .001$, respectively).

COMMUNITY-LEVEL ANALYSIS: CHC ACCESS AND NONACCESS

These findings demonstrate that patients of rural CHCs in Maine had fewer hospital admissions and spent fewer days in the hospital, but had

Table 6: Adjusted Hospital Admissions and Days per 1,000 Population for Selected Diagnoses by Health Center Users and Nonusers





*Adjusted for age and sex by direct method.
†Significant at the .01 level (one-tail test).

about equal lengths of stay in comparison with persons from the same communities who did not use the CHCs for outpatient care. However, are these differences large enough to lower rates of hospital admissions and hospital days for CHC communities compared to similar communities with no access to CHCs?

To test this, a before/after design was used with multiple linear regression analytic techniques. The purpose of the analysis was to determine if rates of hospital admissions and days for the 36 CHC community populations were lower than the 24 comparison communities without access to CHCs.

The basic model used to test the before/after design of this study is one which uses the after-period hospital use rate of each community (e.g., hospital admissions and hospital-days per 1,000 population) as the outcome adjusted for the hospital use rate in the before period. The independent variables in the model were selected after evaluating bivariate correlation matrixes, which included predictors of hospital admissions and days based on the literature and the hypothesis to be tested. The model is:

Hospital admissions/ days per 1,000 population for 1980	=	Constant +
		Hospital admissions/days per 1,000 population for 1974 +
		Medicaid recipients per 1,000 population for (1980) +
		Medicare recipients per 1,000 population (1980) +
		Blue Cross subscribers per 1,000 population (1980) +
		Hospitals beds per 1,000 population (using the nearest and most frequently used hospital) +

Minutes to nearest hospital (using road type and distance) +

Food stamp recipients per 1,000 population (1980) +

Clinic users per 1,000 population (1980).

Earlier models were run with health clinic users per 1,000 population included as a dummy variable rather than a measured (linear) variable. This was done by dichotomizing communities as either a CHC service area (1) or a non-CHC service area (0). Later models also included health center visits per 1,000 population as an independent variable in place of clinic users per 1,000 population. These model differences did not alter results. (For a description of each variable used in the model, see Appendix B.)

The purpose of adjusting the after-period hospital use rates by the before-period rate was to remove the effects of community, cultural, and other confounding factors, for which data are unavailable, operating in each town. The remaining factors are used to explain the change or differences in the use of the hospital. The adjustment was not forced, however; stepwise regression with the Statistical Package for the Social Sciences (SPSS) was used, which permitted the before-period hospital use rates to enter the equation if they proved statistically significant.

There was no observed (statistical) difference in the rates of hospital admissions or hospital days per 1,000 population as a result of access to or increased use of a CHC by the area population (see Tables 7 and 8). Except for hospital admissions for those persons age 45 and over, the principal factor explaining variation in hospital admission rates in 1980 was the rate of community residents covered by Medicaid (the more Medicaid recipients per 1,000 population in the community, the more hospital admissions per 1,000 population, adjusted for 1974 hospital admissions). The principal factors explaining variations in hospital-days per 1,000 population was the rate of Medicaid recipients per 1,000 population and (except for the model for those age 45 and over) the rate per 1,000 population receiving food stamps. The more Medicaid and food stamps recipients per 1,000 population, the more hospital-days used per 1,000 population.

Table 7: Hospital Admissions (Multiple Linear Regression Results) (N = 60)

Dependent Variable (Rates per 1,000 Pop.)	*Constant*	*Hospital Adm. 1974 per 1,000 Pop.*†	*Medicaid per 1,000 Pop.*	*Medicare per 1,000 Pop.*	*Blue Cross per 1,000 Pop.*	*Beds per 1,000 Pop.*	*Minutes to Hospital*	*Food Stamp Users per 1,000 Pop.*	*Clinic Users per 1,000 Pop.*†	R^2
All hospital admissions, 1980	18.01 (1.03)‡	.67*** (6.40)	.34*** (3.50)	NS	NS	NS	NS	NS	NS	.57
Male admissions, 1980	43.90** (2.89)	.48*** (5.63)	.26** (2.50)	NS	NS	NS	NS	NS	NS	.43
Female admissions, 1980	-31.83 (-1.34)	.58*** (5.15)	.34** (2.59)	NS	.13** (3.03)	NS	NS	.06** (2.60)	NS	.61
Hospital admissions, 1980 < 45	12.22 (0.86)	.73*** (7.47)	.34*** (4.17)	—	NS	NS	NS	NS	NS	.60
Hospital admissions, 1980 ≥ 45	102.98** (3.81)	.51** (5.51)	NS	NS	NS	-.24** (-3.25)	NS	NS	NS	.43

*Significant at the .05 level (two-tail test).
**Significant at the .01 level (two-tail test).
***Significant at the .001 level (two-tail test).
NS = Not Significant.
†Age- and sex-specific measures are used in the age- and sex-specific equations.
‡t-Scores are in parentheses.

Table 8: Hospital Days (Multiple Linear Regression Results) (N = 60)

Dependent Variable (Rates per 1,000 Pop.)	*Constant*	*Hospital Adm. 1974 per 1,000 Pop.*†	*Medicaid per 1,000 Pop.*	*Medicare per 1,000 Pop.*	*Blue Cross per 1,000 Pop.*	*Beds per 1,000 Pop.*	*Minutes to Hospital*	*Food Stamp Users per 1,000 Pop.*	*Clinic Users per 1,000 Pop.*†	R^2
Total hospital days, 1980	-47.45 (-0.40)‡	.40*** (4.20)	2.62*** (3.73)	NS	.53* (2.23)	NS	NS	.44*** (3.50)	NS	.67
Male days, 1980	237.26* (2.15)	.30*** (3.32)	3.16*** (3.72)	NS	NS	NS	NS	.32* (2.01)	NS	.49
Female days, 1980	-171.30 (-1.03)	.39*** (3.73)	2.24* (2.34)	NS	.91* (3.08)	NS	NS	.60*** (3.43)	NS	.59
Days 1980, < 45	70.15 (1.08)	.59*** (5.96)	1.18** (2.50)	—	NS	NS	NS	.26** (2.88)	NS	.57
Days 1980, ≥ 45	915.77** (3.46)	.33*** (3.70)	4.51** (3.34)	NS	NS	-1.63** (-2.77)	NS	NS	NS	.49

†Age- and sex-specific measures are used in the age- and sex-specific equations.
‡t-Scores are in parentheses.
*Significant at the .05 level (two-tail test).
**Significant at the .01 level (two-tail test).
***Significant at the .001 level (two-tail test).
NS = Not Significant.

ANALYSIS OF COMMUNITIES WITH CHCs PRIOR TO 1977

Reduction in an area's hospital admissions due to use of CHCs may take longer than a few years. To determine this, regression models similar to that cited earlier were evaluated with data from those areas served by CHCs that began operating prior to 1977. This allows for a time lag of at least three years for the changes to occur. There were 19 CHC communities in all. A set of ten comparison areas matched geographically to these CHC areas was included in this analysis.

Results were similar to regression models using all 60 CHC and comparison communities. Variation in adjusted hospital admission rates were explained almost exclusively by increases in proportion of insurance coverage (primarily Medicaid) in a community. The rate of CHC use in a community did not enter the equation.

ANALYSIS OF HIGH-USER COMMUNITIES

In his study of the impact of health center use on hospital emergency room use, McBean [9] observed that rural communities with higher CHC use tended to use hospital emergency rooms less than those with lower CHC use. A similar analysis using hospital admissions and days as outcomes was repeated in this study. There were 23 high-use CHC communities (defined as 200 or more CHC users per 1,000 population). These were matched with 11 comparison communities, making a total of 34 towns for analysis. The results observed were not substantially different from the results of regression models using all 60 communities. CHC use was not associated with differences in hospital use.

DISCUSSION

The findings presented indicate clearly that patients of rural CHCs experience significantly fewer hospital admissions and hospital days but do not have shorter stays in the hospital than persons in the same communities who are not CHC users. These results support a substitutability effect. However, the rates of hospital admissions and days for community populations with access to a CHC were not significantly different than rates for a set of comparison rural communities without access to rural CHCs. These results compromise the substitutability argument.

These results were similar to those found by Okada and Wan [16] in their study of urban CHCs using survey data. The key question is

what the differences represent—reduced hospital use due to CHC access or simply differences in hospital use due to factors not directly related to CHC services or providers. The remainder of this article is a discussion of three factors which support one interpretation or the other.

1. *There are disincentives to hospitalize among health center providers due to institutional barriers, practice patterns, and economic considerations of both providers and health centers.*

Midlevel practitioners are used extensively by rural CHCs in Maine. However, they do not have staff privileges at hospitals, thereby creating a disincentive for them to hospitalize their patients. The practice orientation of family physicians and midlevel practitioners who make up almost all of the medical staff at these health centers is toward treating patients on an outpatient basis rather than in the hospital. There is no economic incentive to the provider, the patient, or the health center when health center patients are hospitalized. Hospital admitting fees, for example, do not accrue to the health provider—most are salaried—or to the health center.

Federal- and state-mandated cost-reimbursement systems for federally subsidized CHCs is a disincentive to hospitalization, since the CHC receives the same payment for an inpatient visit or admission as it does for a visit at the center. Overall costs related to hospital visits are not great enough to increase significantly the rate per visit. However, the number of CHC patient visits may be adversely affected by an inpatient practice. If the CHC receives the same payment for all visits, it is much more efficient to see patients at the center rather than spending time in travel to and from the hospital. Reimbursement is also tied to outpatient productivity standards, which can be adversely affected by hospital visits. In addition, an active hospital practice usually obligates the physician to committee membership and other nonpatient care activities which do not directly generate revenues for the CHC.

2. *Preventive service and continuity of care available at CHCs may actually reduce hospital use.*

Federally subsidized health centers offer both medical and nonmedical preventive services, e.g., diabetes education and hypertension control and follow-up services. Providers at many of these health centers, unlike private fee-for-service physician offices in rural areas, directly

provide a range of structured nonmedical prevention services. These include the model Ambulatory Diabetes Education and Follow-Up for diabetics; Early and Periodic Screening, Diagnosis, and Treatment; nutritional counseling; smoking cessation; mental health; and home health care services—services which, some studies have shown, reduce hospital visits or length of stay for patients who use them. For example, studies have documented that secondary prevention through education and follow-up may reduce hospital visits by as much as one-third [27, 28]. Evidence in this study from the comparison of hospital admissions and days per 1,000 population for selected diagnoses suggests that this may be a factor here, too.

3. *Selection differences in the two populations—users and nonusers of rural CHCs—may result in healthier people using CHCs and less health in people going to non-CHC providers or not getting care.*

Are health center users among those in the population who are generally healthier or have less severe medical problems than persons who do not use the health center? A similar argument was used by early critics of HMOs to explain differences in hospital use of HMO subscribers compared to traditional insurance subscribers. The data available for this study on the population and disease characteristics of the two groups do not provide conclusive evidence. The purpose of the age and sex adjustment to the hospital use rates is to remove confounding due to these differences in the two populations. However, the question of disease and severity differences in the two populations is more difficult to evaluate.

With few exceptions, the diagnostic category for the hospital admission of CHC users compared to nonusers provides no evidence of differences in illness patterns between the two populations that would lead to significant differences in hospital admissions and days (see Table 9). There were fewer hospital admissions for malignant neoplasms, respiratory disease, and cardiovascular disease among CHC users than among nonusers. These are diagnoses which consume large amounts of hospital resources and often require repeated visits; yet, medical management and provider hospitalization incentives can be factors both in the number of hospital admissions and in length of stay per admission for these diagnoses categories. Indeed, the length of stay data presented in Table 5 suggest that severity of illness among CHC hospital users, like HMO hospital users, may be equal to or greater than that for nonusers.

There is no evidence that the health centers are seeing patients for

Table 9: Distribution of 1980 Inpatient Hospital Admissions by Categories of Diagnostic Groups Health Center Users and Nonusers as a Percent of Hospital Admissions

	Health Center Towns	
Diagnostic Groups	*Center Users*	*Center Nonusers*
Newborns	12.1%	9.1%
Infections	1.1	1.7
Malignant neoplasms	3.3	5.0
Benign neoplasms	0.7	1.1
Thyroid/endocrinology, nutrition and metabolism	2.1	2.6
Mental	4.5	3.1
Nervous	1.5	1.2
Eye	0.4	1.7
Cardiac/cerebrovascular	8.5	9.3
Other circulatory	1.6	2.0
Ear/nose/throat	4.0	2.6
Respiratory	5.0	6.8
Oral	1.1	0.5
Digestive	10.3	10.3
Urinary	2.3	2.3
Male-genital	0.8	1.2
Female-genital	4.9	3.7
Pregnancy	12.6	10.7
Skin/tissue/breast	1.2	1.7
Musculoskeletal	4.5	5.6
Congenital/perinatal	1.7	1.0
Signs/symptoms	6.8	4.7
Fractures,dislocations sprains	4.0	4.1
Injuries	3.8	4.6
Special admissions	1.3	3.3
Totals	100.1%	99.9%

Table 10: Ten Most Prevalent Outpatient Diagnoses for Health Clinic Users and U.S. Ambulatory Care Users—1980

Health Center Users Diagnosis	*Percent of Total Visits*	*U.S. Ambulatory Care Users Diagnosis*	*Percent of Total Visits*
Hypertension	9%	Normal pregnancy	4.6%
Medical exam (no diagnosis)	7	Hypertension	4.4
URI/Pharyngitis	6	Health supervision of infant or child	3.0
Otitis media (internal/external)	6	Medical exam (no diagnosis)	2.8
Laceration	4	Acute upper respiratory infections	2.6
Sprain/Strain	3	Otitis media (internal/external)	2.0
Diabetes mellitus	3	Neurotic disorders	2.0
Dermatitis	3	Diseases of sebaceous glands	1.8
Allergy	3	Follow-up exams	1.7
Atherosclerotic heart disease	2	Diabetes mellitus	1.7
Totals	46%	Totals	26.6%

Sources: Cooperative Information Project, Dartmouth Medical School, 1980; and National Center for Health Statistics. 1980 Summary, National Ambulatory Medical Care Survey.

conditions less likely to result in hospitalization than those presented by patients of other ambulatory care providers. Since no data are available on the diagnoses of outpatient visits of non-CHC users in these communities, an evaluation of disease status cannot be made. However, as Table 10 indicates, the percentage of total visits for hypertension and diabetes is twice as high among CHC users, based on data from the National Ambulatory Medical Care Survey, as it is among patients of all other providers in the United States. There is also a larger percentage of visits to these health centers for otitis media (internal/external), atherosclerotic heart disease, and upper respiratory infection (URI)/pharyngitis. While comparisons between these two different data bases are only suggestive, hospitalization associated with many of these conditions can be avoided or reduced if providers monitor their progression.

Insurance coverage has been documented as a source of increased hospital use. Data on insurance coverage of health center users show

levels comparable to coverage of the state population. The insurance coverage among CHC users who were hospitalized was not significantly different from that of other persons hospitalized in the community (90 percent versus 93 percent, respectively). However, compared to a group of 20 primary care practices in rural Vermont and New Hampshire, CHC users in Maine are less likely to be self-pay patients (10 percent versus 23 percent, respectively) and are more likely to have some form of coverage, in particular Medicaid (16 percent versus 9 percent, respectively).

It is possible that a selection bias could exist in the CHC population used for this study. The concern here is how well these patients represent the entire population of CHC users in Maine and elsewhere, since the only communities eligible for the study were those with access to CHCs that had automated encounter and hospital abstract data. As in most cases of selection bias, the effect of this difference is difficult to estimate on the study results. All CHCs had an opportunity to automate their patient data and most that were receiving 330 funding chose to do so in light of federal common reporting requirements. The centers that automated their patient data base vary in size and geographic location. There is no evidence that they are more efficient than the other 330 sites not automated by 1980. If there are differences in the provider or patient populations of the 14 centers included in the study, they only have the effect of limiting the generalization of results.

CONCLUSIONS

It is clear that users of rural CHCs in Maine have significantly lower rates of hospital admissions and hospital-days per 1,000 population than do residents of the same communities who are not CHC users. These results were observed for each age group evaluated, for Medicaid and Medicare populations, and for populations hospitalized with diagnoses where the aggressive treatment of associated conditions could make hospitalization preventable. At the same time, there were no observable differences in the adjusted length of stay between hospitalized CHC users and nonusers, while among the elderly populations, length of stay was slightly longer for CHC users.

It is unclear, however, why these rate comparisons occur. Available information suggests that the combination of provider and practice-setting characteristics—including economic and noneconomic factors—permit providers to practice more conservative medicine, thereby reducing hospital admissions of CHC users. However, one

would have expected these reductions to result in lower overall hospital rates for these communities—particularly for the communities with high CHC use. Yet this was not observed in the data comparing rates of hospital admissions and days for rural communities with access to CHCs to rates for similar communities without CHC access. A possible explanation of the differences in results is that there are population differences among those who use rural CHCs—on the whole, they are at less risk of hospitalization because they are healthier. Yet because length of stay is equal or slightly longer among the older age groups who are using CHCs, it is our conclusion that CHCs are having a substitutive effect and are reducing the hospital use of their patient populations. This effect appears similar to the effect HMOs have on their patient population. With no incentives to hospitalize, providers put off hospitalization for those patients whose conditions can be treated on an outpatient basis. However, if conditions clearly warrant hospitalization, then the hospital stay of CHC patients does not differ from that of non-CHC patients.

This explanation raises questions about the selection and use of comparison communities in this study. These particular communities may not be appropriate for this analysis due either to the method of selection and/or to the penetration rate of the CHCs on the community (not large enough to show an effect statistically). If the latter is correct, the explanation that health centers are having a substitutive effect on hospital use is viable. However, without additional study of population and disease-severity differences among CHC users and nonusers, definitive conclusions cannot be made.

APPENDIX A

CLINIC ENCOUNTER DATA AND HOSPITAL DISCHARGE LINKING PROCESS

In order to compare the rates of inpatient hospital admissions, days, and length of stay between CHC users and nonusers, clinic encounter data were linked with hospital abstract data. The hospital discharge data base contains the date of birth of the patient, the sex of the patient, the community geographic location code of the patient, and the dates of admission and discharge from the hospital. The ambulatory care data base contains the data of birth, the sex of the patient, and the geographic location code that identifies the minor civil division in Maine where the patient lives. The linking was done as follows:

Records from the hospital and clinic encounter data sets for 1980

were matched by keying on date of birth, sex, and geographic location code. This file was then sorted by computer in that sequence. If the date of admission, date of birth, and sex corresponded in each data base, a match was determined to have occurred.

The health clinic experiences of those who had not had a hospital discharge were also entered into the linked file. The hospital-discharge attributes for those individuals obviously had no data in them. The SPSS file was then created and debugged. The clinic user data file contained almost 25,000 records (persons), which provided the following information:

- Identification number
- Age
- Geographic residence code
- Health center identification
- Number of health clinic encounters for 1980
- Primary Payer for first health center visit for 1980
- Charge for first health center visit
- Diagnoses for up to 12 health center visits, 1980
- Number of hospital visits for 1980
- Number of hospital days for 1980
- Principal diagnoses, pay source, and procedures for up to six hospital discharges in 1980.

The linked CHC-use, hospital-use file of CHC users provided information with which to calculate insurance-specific and age- and sex-adjusted rates of inpatient hospital admissions and days for clinic and nonclinic users from the 36 CHC communities. CHC-user hospital rates were calculated directly from the linked data file of clinic users. CHC-nonuser rates were calculated by subtracting out clinic-user hospital use and population data from the total target area data. This left a file of population and hospital use data for nonclinic users, and rates of inpatient hospital admissions and hospital expenditures/days were then calculated for this population.

Extensive verification was then conducted on the file. This was accomplished by rechecking the computer program used to obtain the linked file, pulling records on a random basis, and checking these records against CHC files.

APPENDIX B

DESCRIPTION AND SOURCE OF DATA FOR VARIABLES USED IN THE REGRESSION MODELS

Number of minutes to the nearest hospital, 1980, is calculated using guidelines regarding medically underserved areas in the *Federal Register* 43(6), January 10, 1978.

Hospital occupancy rate for each community was measured by using the occupancy rate of the hospital used most by community residents from data in the AHA *Guide to the Health Care Field, 1980.*

Number of beds per 1,000 population in 1980 is from the AHA *Guide to the Health Care Field, 1980.* This measure was computed using the closest hospital to each community.

Per capita income for each community is based on estimates from the U.S. Bureau of the Census, using 1980 figures.

Number of total FTE physicians practicing in each community in 1980 is from the 1980 Bureau of Health Planning and Development (Maine Department of Human Services) Physician Resource Inventory Surveys.

Prevalence of food stamp, AFDC, and supplemental security income (SSI) use for each community for 1980 is from data from Maine State Planning Office (MSPO) census reports. *Statistical Reports*, SIS-1, 2, and 5.

Prevalence of Medicare and Medicaid participants in each community in 1980 is based on data from the Maine State Planning Office *Statistical Reports*, SIS-5, December 1980.

Proportion of unemployed for each area for 1980, male and female, is taken from 1980 labor force estimates from Maine Department of Manpower Affairs.

Blue Cross/Blue Shield subscribers per 1,000 population for each community for 1980 is from data furnished by Blue Cross of Maine and from census data tape SIS-5, December 1980.

REFERENCES

1. Davis, K., and C. Schoen. *Health and the War on Poverty: A Ten-Year Appraisal.* Washington, DC: The Brookings Institution, 1978.
2. Designation of medically underserved areas and population groups. *Federal Register* 40:40315, 1975.
3. National Association of Community Health Centers, Inc. *Forum Guidebook: Sixth Annual Policy and Issues Forum.* Washington, DC, 1981.
4. Ullman, R., J. A. Block, N. C. Boatright, et al. Impact of a primary care group practice on emergency room utilization at a community hospital. *Medical Care* 9:723, September 1978.
5. Salber, E. J., et al. Utilization of services at a neighborhood health center. *Pediatrics* 47:415, February 1971.
6. Hochheiser, L. I., K. Woodward, and E. Charney. Effect of the neighborhood health center on the use of pediatric emergency departments in Rochester, New York. *New England Journal of Medicine* 285:148, July 15, 1971.
7. Gold, M. R., and R. G. Rosenberg. Use of emergency room services by the population of a neighborhood health center. *Health Services Reports* 89:65, January-February 1974.
8. Sanofsky, P. A. Emergency Room Utilization and Primary Health Care for Children of the Urban Poor: A Case Study of a Municipal System. Dissertation presented to the Florence Heller Graduate School for Advanced Studies in Social Welfare, Brandeis University, August 1974.
9. McBean, A. M. An Evaluation of the Impact of Four Rural Health Centers on the Use of Emergency Room Services. Medical Care Development, Inc., Augusta, Maine, September 16, 1976.
10. Medical Care Development, Inc. An Evaluation of Rural Community Health Center Impact on Hospital Emergency Department Use. Augusta, Maine, November 1980.
11. Freiberg, L., Jr. Substitution of outpatient care for inpatient care: Problems and experience. *Journal of Health Politics, Policy and Law* 3:479, Winter 1979.
12. Berk, A. A., and T. C. Chalmers. Cost and efficacy of the substitution of ambulatory for inpatient care. *New England Journal of Medicine* 304:393, February 12, 1981.
13. Berki, S. E., and M. L. Ashcraft. On the Analysis of Ambulatory Utilization: An investigation of the roles of need, access and price as predictors of illness and preventive visits, *Medical Care* 17:1163, December 1979.
14. Brewer, W. R., and M. A. Freedman. Causes and implications of variation in hospital utilization. *Journal of Public Health Policy* 3:445, Fall 1982.
15. Davis, K., and L. B. Russell. The substitution of hospital outpatient care for inpatient care. *Review of Economics and Statistics* 54:109, May 1972.
16. Okada, L. M., and T. T. H. Wan. Impact of community health centers and Medicaid on the use of health services. *Public Health Reports* 95:520, November-December 1980.
17. Freeman, H. E., K. J. Kiecolt, and H. M. Allen, II. Community health centers: An initiative of enduring utility. *Milbank Memorial Fund Quarterly/ Health and Society* 60(2):245-267, 1982.

18. Bellini, S. S., H. J. Gerger, and C. D. Gibson. Impact of ambulatory health care services on the demand for hospital beds. *New England Journal of Medicine* 280:808, April 10, 1969.
19. JRB Associates. *Final Report for Denver Neighborhood Health Program Cost-Effectiveness and Utilization Evaluation*. Englewood, Colorado: JRB Associates, 1982.
20. Wagner, E. G., C. G. Sheps, et al. National Evaluation of Subsidized Rural Primary Care Programs: Major Findings and Policy Considerations. Unpublished Manuscript, 1984.
21. Associated Clinics of Appalachia. Practice Analysis: New River Health Association. Unpublished Manuscript, September 1985.
22. Deering, G. E., C. H. Collier, J. R. Penn, et al. Impact of a Rural Family Health Center on Hospital Utilization. Unpublished Manuscript, 1975.
23. Kleinman, J. C. Infant mortality. *Statistical Notes for Health Planners* 2, July 1976.
24. Miettinen, D. Estimability and estimation in case-referent studies. *American Journal of Epidemiology*, 103:226-35, 1976a.
25. Wennberg, J. E., and A. Gittelsohn. Health care delivery in Maine: I. Patterns of use of common surgical procedures. *Journal of the Maine Medical Association* 66(5):123-149, May 1975.
26. Wennberg, J. E., A. Gittelsohn, and D. Soule. Health care delivery in Maine: II. Conditions explaining hospital admission. *Journal of the Maine Medical Association* 66(10):255-269, October 1975.
27. Nobrega, F. T., I. Krishnan, R. K. Smoldt, et al. Hospital use in a fee-for-service system. *Journal of the American Medical Association* 247:806, February 12, 1982.
28. Maine Diabetes Control Project. *Reimbursement Pilot Study for the Ambulatory Diabetes Education and Follow-up (ADEF) Program: Final Report*. Augusta, ME, November 1983.