Medicare Physician Payment Reform: Its Effect on Access to Care

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This study analyzed a specific indicator condition, congestive heart failure (CHF), to see if there is evidence that physician payment reform (PPR) has had an effect on access to care for Medicare beneficiaries. If there was a decrease in access to ambulatory care services associated with PPR, one would expect to see an increase in hospitalizations for CHF in the period after PPR was implemented. This analysis examined the trend in rates of hospitalization for CHF for the overall Medicare population and for selected vulnerable subgroups. No significant discontinuity was found in hospitalizations for CHF with the implementation of PPR.

INTRODUCTION

The Medicare program provides health care coverage, including coverage for physician services, for more than 35 million of America's most vulnerable citizens. A central program concern is the extent to which there are barriers that may impede beneficiaries' access to needed care. Such barriers can come from a variety of sources, including incentives implicit in payment policies.

The Omnibus Budget Reconciliation Act of 1989 enacted important changes in the way Medicare pays for physician services. Specifically, beginning in 1992, this legislation (1) mandated a fee schedule that was designed to shift payments from procedural services to evaluation and management services; (2) set limits on the amount physicians could charge above the fee schedule; and (3) established a process to set target growth rates for expenditures for physician services (U.S. Department of Health and Human Services, 1994).

These changes produced a complex set of new incentives for physician services. On the one hand, increasing fees for evaluation and management services should encourage physicians to provide ambulatory care. On the other hand, increasing copayments for these same services could discourage patients from seeking care.[1] The latter effect may be mitigated in part, however, by the availability of supplemental insurance coverage. The limits on balance billing could increase access by reducing beneficiary liability for charges above the fee schedule or decrease access by discouraging physician participation.

Because of such complexity, it is important to monitor the effect of PPR on access to physician services for Medicare beneficiaries. Of particular concern is whether PPR has inadvertently reduced access to important ambulatory care services.

There are a number of approaches to monitoring access. One approach is to study "indicator" conditions (Billings et al., 1991; Robert Wood Johnson Foundation, 1993; Rutstein et al., 1976). These are medical conditions on which one would expect the effects of PPR, if present, to be most apparent. In examining access to ambulatory care services, one important indicator condition for the Medicare population is CHF.

The appropriate management of congestive heart disease requires consistent and

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[1]Medicare beneficiaries are responsible for a copayment of 20 percent of the Medicare-approved amount. With an increase in Medicare fees, the copayment amount will also increase.

ongoing monitoring of the condition by a physician. If a patient does not receive adequate monitoring, adverse health events are more likely to occur. For example, if a patient does not receive appropriate evaluation and management services, a hospitalization for CHF becomes more likely (Institute of Medicine, 1993; Physician Payment Review Commission, 1995).

This study focused on patterns of hospitalization for CHF in the Medicare population to determine possible effects of PPR on access to primary care services. If there was a decrease in access, one would expect to see an increase in hospitalizations for CHF following the implementation of PPR (i.e., if Medicare patients were less able to obtain the required monitoring, the adverse event would be more likely to occur). On the other hand, if there was equal or greater access to ambulatory care services with PPR, one would expect to see no change or a decrease in hospitalizations for CHF. This study analyzes the trend in rates of hospitalization for CHF from 1987 through 1993, to see if there is a discontinuity associated with the implementation of PPR.

A few prior studies have examined the early effects of PPR on access (U.S. Department of Health and Human Services, 1993, 1994; Physician Payment Review Commission, 1993, 1994). However, these studies largely provide descriptive analyses of changes in access measures occurring around the implementation of PPR. They have not sufficiently estimated the extent to which the policy change produced a discontinuity in existing trends, as is required for a thorough evaluation. The present study begins to fill this gap.

A number of subgroups in the Medicare population may be particularly vulnerable to changes in access to physician services. Beneficiaries who tend to be physically frail or socioeconomically disadvantaged, or who live in areas where the supply of physicians tends to be low may be especially vulnerable to changes produced by PPR. An evaluation of PPR therefore needs to be especially concerned with decreases in access for such vulnerable groups. Thus, the results of this analysis are presented not only for the overall Medicare population, but also for subgroups that would be expected to be especially vulnerable to changes in access, including very old beneficiaries, beneficiaries living in non-metropolitan areas, and black beneficiaries.

METHODS

Calculation of Rates of Hospitalization for CHF

To calculate rates of hospitalization for CHF in the Medicare population, data from Medicare administrative files were used. Data for the numerator of the rates (i.e., the number of hospitalizations for CHF) came from the Medicare Provider Analysis and Review (MEDPAR) files. MEDPAR contains a summarized record of hospital claims for all Medicare hospitalizations in a given calendar year. These records include up to five diagnosis codes.

Numerators of rates were obtained by extracting and counting all MEDPAR records for which the principal diagnosis was CHF. As suggested by the Institute of Medicine (1993), the following codes from the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) were used to identify CHF cases: 428, 402.01, 402.11, 402.91, and 518.4. Cases with the following surgical procedure codes were not included: 36.01, 36.02, 36.05, 36.1, 37.5, and 37.7.[2]

Only hospitalizations for beneficiaries 65 years of age or over were included in the

[2]These codes include percutaneous transluminal coronary angioplasty, aortocoronary bypass, heart transplantation, and pacemaker insertion/removal procedures.

counts. The counts were restricted to this population because it represents the bulk of all Medicare beneficiaries (approximately 90 percent), and issues of access to care for the Medicare population under 65 years of age are often quite different from those for the aged. Records for members of health maintenance orgnizations (HMOs) were also eliminated from the counts because the reporting of hospitalizations of this group is known to be incomplete.

At the time of this writing, complete data for Medicare hospitalizations were only available through 1993. There is a lag between the discharge of a Medicare beneficiary from a hospital and the submission and final adjudication of the hospital claim. The MEDPAR file used to obtain the count of hospitalizations for 1993 included all claims processed through September 1994. HCFA estimates that 98-99 percent of all claims for a calendar year are processed and included in MEDPAR by 9 months after the end of the calendar year.

The denominators for the rates used were obtained from Medicare enrollment files. These files contain a separate record for all beneficiaries entitled to Medicare benefits at any time during a given calendar year. The records include information on the demographic characteristics of the beneficiary, monthly flags on Part A and Part B entitlement and HMO enrollment, and the like. For the denominator counts, Medicare beneficiaries on the enrollment files were differentially weighted by the proportion of the unit of time (in this case calendar quarter, explained later) that they were (1) alive and age 65 or over, (2) entitled to Part A benefits, and (3) not a member of an HMO. Population counts for the denominators were formed by summing the weighted beneficiary records.

Rates of hospitalization for CHF were calculated by dividing the number of hospitalizations obtained from MEDPAR by the population counts obtained from the enrollment files.

A pooled cross-sectional and time-series data base was used for the analysis of the change associated with PPR.[3] Thus, rates of hospitalization for CHF were calculated on a quarterly basis for the period 1987 through 1993 separately by geographic area of the United States. To obtain stable rates, particularly for potentially vulnerable subgroups, it was necessary to use census division as the geographic area. Thus, for this analysis, quarterly data on rates of hospitalization for CHF by census division for a 5-year baseline period (1987-91) and for 2 years following the implementation of PPR (1992-93) were used. This yields a total of 252 observations for analysis (7 years x 4 quarters x 9 census divisions). There are 180 pre-PPR observations and 72 post-PPR observations.

Model Specification

As already noted, the purpose of the analysis is to determine if there is a change in the rate of hospitalization for CHF associated with the implementation of PPR. To estimate this effect, we specified a model that attempts to account for rates of hospitalization for CHF in terms of PPR implementation and a number of additional covariates.

In brief, the dependent variable in the model is the rate of hospitalization for CHF. The focal independent variable is a term that identifies observations before and following the implementation of PPR. The parameter estimate associated with this term indicates the difference in the average rate of hospitalization for CHF before and after implementation of PPR. The model also includes a number of terms that stat-

[3]To statistically detect an effect of PPR, it is necessary to have a sufficient number of unique data points. To obtain a reasonable number of observations, a pooled cross-sectional and time-series data structure was adopted.

istically adjust for effects that could confound the estimate of the impact of PPR.

First, the model includes a term that represents the linear trend in rates of hospitalization for CHF. Without controlling for the existing trend, one could mistakenly attribute a difference in rates before and after PPR to the impact of PPR, when in fact the difference simply represents a continuation of the existing trend. For example, prior research indicates that older beneficiaries have particularly high rates of hospitalization for CHF (U.S. Department of Health and Human Services, 1992). The concentration of older beneficiaries in the Medicare population is becoming more pronounced over time. Because of this long-term demographic change, one might expect hospitalization for CHF to be increasing over time. Without statistical control, one could mistakenly attribute a difference in the rate of hospitalization for CHF to the effect of PPR, when in fact the difference simply reflects an ongoing demographic trend.

Second, hospitalizations for CHF are more likely to occur during certain periods of the year (e.g., winter). Therefore, to appropriately account for rates of hospitalization for CHF, it is necessary to include a series of terms in the model that account for seasonality.

Finally, it is widely recognized that there is often pronounced geographic variation in rates of hospitalization for many medical conditions. This variation may reflect factors such as geographic differences in practice patterns, environmental factors, concentrations of high-use subgroups, etc. Therefore, to appropriately account for variation in rates of hospitalization for CHF, it is also necessary to include a series of terms in the model that represent geographic areas. The data base used includes quarterly rates of hospitalization for CHF by census division. An examination of the data indicated that rates for census divisions are roughly comparable within census regions. Thus, for purposes of parsimony, the model includes a series of terms designed to capture variation between census regions.

The parameters of the model were estimated from the pooled cross-sectional and time-series data already discussed, using weighted least-squares regression. The size of the Medicare population varies by census division and, to a much lesser extent, by quarter. Weights were used in the regression to allow for these differences. The weight applied to each observation was the ratio of the denominator of the rate for that observation to the average denominator across all observations. This weighting was used to give appropriate emphasis to areas that represented larger portions of the Medicare population. Standard errors of the estimates were generated by a Taylor-series approximation that accounts for potential serial correlation in the error terms of the time series (Shah et al., 1993).[4] The focus is to see if there is a discontinuity in the time series of hospitalization for CHF associated with the implementation of PPR.

RESULTS

Overall Medicare Population

Table 1 presents a demographic profile of hospitalization for CHF in 1993 for the total United States. Several points are worthy of note as background. First, there are a large number of hospitalizations for CHF in the Medicare population (659,634 hospitalizations, for a rate of 2,153 per 100,000 Medicare beneficiaries). Second, older Medicare beneficiaries are much more

[4]Standard errors were estimated using SUDAAN, with census divisions defined as the primary sampling units (PSUs) and quarters defined as the observations within the PSUs.

Table 1

Rates of Hospitalization for Congestive Heart Failure (CHF) for Medicare Beneficiaries, by Demographic Group and Selected Characteristics: United States, 1993

Characteristic	Total		85 Years of Age or Over		Non-Metropolitan[1]		Black Persons	
	Rate per 100,000	Rate Ratio	Rate per 100,000	Rate Ratio	Rate per 100,000	Rate Ratio	Rate per 100,000	Rate Ratio
All Beneficiaries	2,153	[2]	4,612	[2]	2,255	[2]	3,164	[2]
Age								
65-74 Years	1,309	[3]	[2]	[2]	1,344	[3]	2,473	[3]
75-84 Years	2,767	2.11	[2]	[2]	2,857	2.13	3,803	1.54
85 Years or Over	4,612	3.52	[2]	[2]	4,722	3.51	4,849	1.96
Race								
White	2,100	[3]	4,630	[3]	2,212	[3]	[2]	[2]
Black	3,164	1.51	4,849	1.05	3,478	1.57	[2]	[2]
Other or Unknown	1,709	0.81	3,766	0.81	1,884	0.85	[2]	[2]
Sex								
Male	2,253	[3]	4,943	[3]	2,292	[3]	3,052	[3]
Female	2,086	0.93	4,488	0.91	2,228	0.97	3,234	1.06
Metropolitan Status								
Metropolitan, Large Core	2,115	[3]	4,646	[3]	[2]	[2]	3,212	[3]
Metropolitan, Other	2,082	0.98	4,424	0.95	[2]	[2]	2,994	0.93
Non-Metropolitan, Adjacent	2,378	1.12	4,933	1.06	[2]	[2]	3,157	0.98
Non-Metropolitan, Non-Adjacent	2,255	1.07	4,722	1.02	[2]	[2]	3,478	1.08
Region and Division								
Northeast:								
New England	2,162	1.51	4,513	1.33	1,931	1.53	2,642	1.08
Middle Atlantic	2,500	1.75	5,397	1.59	2,592	2.05	3,263	1.33
Midwest:								
East North Central	2,429	1.70	4,968	1.46	2,243	1.78	3,694	1.50
West North Central	2,023	1.41	4,293	1.26	2,088	1.65	3,274	1.33
South:								
South Atlantic	2,105	1.47	4,589	1.35	2,584	2.05	2,866	1.17
East South Central	2,652	1.85	5,485	1.61	2,956	2.34	3,451	1.41
West South Central	2,352	1.64	4,796	1.41	2,561	2.03	3,297	1.34
West:								
Mountain	1,286	0.90	3,005	0.88	1,506	1.19	[4]	[4]
Pacific	1,431	[3]	3,397	[3]	1,263	[3]	2,456	[3]

[1]Data are for beneficiaries living in non-metropolitan areas that are not adjacent to any metropolitan area.
[2]Value is not applicable.
[3]Indicates that the group serves as the reference group for rate ratios.
[4]Too few admissions for CHF to produce a stable estimate.

NOTES: Data are for Medicare beneficiaries 65 years of age or over who were not members of a health maintenance organization. Rates represent the number of admissions for which CHF was the principal diagnosis per 100,000 beneficiaries. Subgroup counts may not add to the total because of missing data.

SOURCE: Health Care Financing Administration: Medicare Provider Analysis and Review file and Denominator file, 1993.

likely to experience a hospitalization for CHF. The rate of hospitalization for beneficiaries 65-74 years of age is 1,309 per 100,000, compared with 2,767 per 100,000 for beneficiaries 75-84 years of age (rate ratio of 2.11), and 4,612 per 100,000 for beneficiaries 85 or over (rate ratio of 3.52). Third, black persons are more likely than white persons to be hospitalized for CHF. The rate for black beneficiaries was 3,164 per 100,000, compared with 2,100 per 100,000 for white beneficiaries (rate ratio of 1.51). Fourth, rates varied by geographic area. In particular, rates for census divisions in the West Region were substantially lower than for other areas. Finally, differences in rates by sex and metropolitan status tend to be relatively small.

As for the temporal trend in hospitalization for CHF, Table 2 provides data on quarterly rates of hospitalization for 1987-93 for the total United States. Figure 1 pre-

Table 2

Rates of Hospitalization for Congestive Heart Failure (CHF) for Medicare Beneficiaries, by Demographic Group and Year and Quarter: United States, 1987-93

Year and Quarter	Total		85 Years of Age or Over		Non-Metropolitan[1]		Black Persons	
	Rate per 100,000	Percent Change[2]	Rate per 100,000	Percent Change[2]	Rate per 100,000	Percent Change[2]	Rate per 100,000	Percent Change[2]
Pre-Physician Payment Reform								
1987								
Quarter 1	527	(3)	1,151	(3)	543	(3)	697	(3)
Quarter 2	477	(3)	1,021	(3)	511	(3)	624	(3)
Quarter 3	425	(3)	908	(3)	441	(3)	573	(3)
Quarter 4	493	(3)	1,055	(3)	497	(3)	687	(3)
1988								
Quarter 1	547	3.8	1,213	5.4	563	3.7	741	6.3
Quarter 2	488	2.3	1,037	1.6	509	-0.4	663	6.3
Quarter 3	422	-0.7	908	0	437	-0.9	584	1.9
Quarter 4	507	2.8	1,093	3.6	511	2.8	722	5.1
1989								
Quarter 1	543	-0.7	1,206	-0.6	563	0.0	765	3.2
Quarter 2	481	-1.4	1,031	-0.6	510	0.2	684	3.2
Quarter 3	417	-1.2	911	0.3	437	0.0	599	2.6
Quarter 4	505	-0.4	1,087	-0.5	518	1.4	714	-1.1
1990								
Quarter 1	542	-0.2	1,199	-0.6	558	-0.9	776	1.4
Quarter 2	501	4.2	1,078	4.6	529	3.7	689	0.7
Quarter 3	440	5.5	951	4.4	456	4.3	620	3.5
Quarter 4	518	2.6	1,112	2.3	533	2.9	718	0.6
1991								
Quarter 1	567	4.6	1,243	3.7	581	4.1	808	4.1
Quarter 2	528	5.4	1,119	3.8	549	3.8	740	7.4
Quarter 3	457	3.9	967	1.7	482	5.7	648	4.5
Quarter 4	547	5.6	1,172	5.4	549	3.0	787	9.6
Post-Physician Payment Reform								
1992								
Quarter 1	583	2.8	1,248	0.4	594	2.2	856	5.9
Quarter 2	555	5.1	1,164	4.0	565	2.9	797	7.7
Quarter 3	493	7.9	1,056	9.2	506	5.0	705	8.8
Quarter 4	559	2.2	1,166	-0.5	559	1.8	813	3.3
1993								
Quarter 1	595	2.1	1,282	2.7	624	5.1	866	1.2
Quarter 2	553	-0.4	1,175	0.9	585	3.5	810	1.6
Quarter 3	448	-9.1	959	-9.2	472	-6.7	660	-6.4
Quarter 4	557	-0.4	1,198	2.7	574	2.7	827	1.7

[1]Data are for beneficiaries living in non-metropolitan areas that are not adjacent to any metropolitan area.
[2]Percent change from the same quarter of the previous year.
[3]Indicates that the entry is not applicable.

NOTES: Data are for Medicare beneficiaries 65 years of age or over who were not members of a health maintenance organization. Rates represent the number of admissions for which CHF was the principal diagnosis per 100,000 beneficiaries.

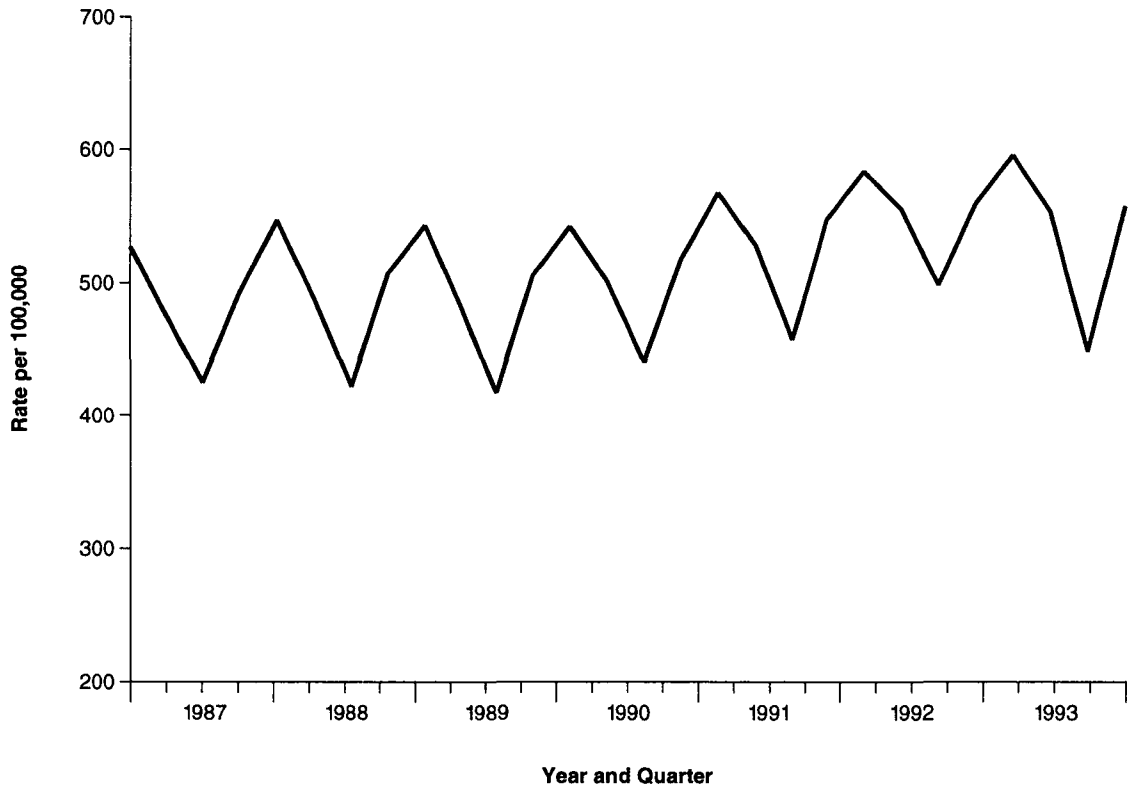
SOURCE: Health Care Financing Administration: Medicare Provider Analysis and Review files and Denominator files, 1987-93.

sents these data graphically. Several points for the overall Medicare population are apparent. First, there is a strong seasonal component to hospitalization for CHF. Rates were consistently high in the first quarter, dropped in the second and third quarters, and then rose again in the fourth quarter (though not as high as observed in the first quarter).

In addition, there appears to be an overall upward trend in hospitalizations for CHF. With some exceptions, there was an increase in the rate of hospitalization from the rate observed in the same quarter of

Figure 1

Rates of Hospitalization for Congestive Heart Failure (CHF) for Medicare Beneficiaries, by Year and Quarter: United States, 1987-93



NOTES: Data are for Medicare beneficiaries 65 years of age or over who were not members of a health maintenance organization. Rates are the number of admissions for which CHF was the principal diagnosis per 100,000 beneficiaries.

SOURCE: Health Care Financing Administration: Medicare Provider Analysis and Review files, 1987-93.

the previous year. This trend appears to accelerate somewhat beginning around 1990. This corresponds roughly with the introduction of techniques (e.g., widespread use of thrombolytic agents) that improved the probability of survival of patients suffering acute myocardial infarction (AMI). One partial interpretation of the acceleration in CHF hospitalizations could be that since more patients are surviving AMIs, the population at risk of later hospitalization for CHF may be increasing during this period.

In general, rates of hospitalization for CHF were higher after implementation of PPR than before. In the first year after implementation, rates of hospitalization for CHF increased by 2.8 percent, 5.1 percent, 7.9 percent, and 2.2 percent, for quarters one through four, respectively. In the second year after implementation, rates leveled off in three of the four quarters (the first quarter of 1993 was 2.1 percent higher than 1992, the second and fourth quarters were about the same as 1992) but were still higher than in the year prior to implementation. However, there was a marked decline in the third-quarter rate in 1993 (9.1 percent below the corresponding 1992 rate); this rate is slightly lower than the corresponding rate in the year before implementation of PPR (a rate of 448 per 100,000

Table 3

Model of Hospitalization for Congestive Heart Failure (CHF) for Medicare Beneficiaries

Independent Variable	Regression Coefficient	Standard Error	*t*	*p*
Physician Payment Reform	0.024	0.017	1.45	0.184
Covariates				
Trend	0.004	0.001	4.61	0.002
Seasonality:				
Quarter 1	0.071	0.006	12.16	0.000
Quarter 2	-0.022	0.012	-1.80	0.109
Quarter 3	-0.170	0.006	-28.51	0.000
Geographic Area:				
Northeast Region	0.341	0.066	5.14	0.001
Midwest Region	0.313	0.079	3.98	0.004
South Region	0.297	0.078	3.80	0.005
$R^2 = 0.74$				

NOTES: Dependent variable is the natural logarithm of the rate of inpatient admission for CHF per 100,000 Medicare beneficiaries. Unit of observation is calendar quarter/census division combinations. Regression coefficients were estimated using weighted least-squares regression; standard errors were estimated by a Taylor-series approximation that allows for serial correlation in the error. The fourth quarter serves as the reference group for seasonal effects; the West Region serves as the reference group for geographic-area effects. Data are for Medicare beneficiaries 65 years of age or over who were not members of a health maintenance organization.

SOURCE: Health Care Financing Administration: Medicare Provider Analysis and Review files and Denominator files, 1987-93.

in the third quarter of 1993, compared with a rate of 457 per 100,000 in 1991).

As to the question of whether the differences associated with the implementation of PPR represent a significant discontinuity from the existing trend in hospitalization for CHF, Table 3 presents the regression results for the model based on the cross-sectional time-series data discussed previously.[5] The model includes rates of hospitalization for CHF as the dependent variable. As already noted, the overall trend in hospitalization accelerated in 1990. To obtain a linear form for the trend for estimation purposes, the dependent variable was transformed by taking the natural logarithm of the rates. The model attempts to predict the log rates on the basis of terms representing implementation of PPR, a linear trend, seasonality, and geographic area.[6] In this form, the regression coefficients can be interpreted as percentage differences in the rate of hospitalization for CHF.[7]

First, note that the model does a good job of fitting the data. Slightly less than three-fourths of the variation in rates of hospitalization for CHF is accounted for by the variables included in the model ($R^2 = 0.74$).[8]

Most importantly, though, the regression indicates a very small effect associated with the implementation of PPR. The regression coefficient estimating the effect of PPR is 0.024. This coefficient represents the degree to which the rate after implementation of PPR deviates from what would have been expected based on the existing trend. The estimate indicates that, controlling for the existing trend, the rate of hospi-

[5]Correlations, means, and standard deviations for the variables included in the model are available from the author upon request.

[6]Differences in practice patterns, environmental factors, concentrations of high-use subgroups, and so on are captured in part by the terms representing the trend and geographic areas. An anonymous reviewer asked why an urban-rural variable was not added to the regression model. I estimated a model that included the "percent of the population living in non-metropolitan areas" as a covariate, and the effect of this variable was not statistically significant. To address the issue of the separate effect of PPR in rural areas, I estimated the model separately for beneficiaries living in non-metropolitan areas. A discussion of the results of that analysis can be found in the section "Medicare Beneficiaries Living in Non-Metropolitan Areas."

[7]An anonymous reviewer correctly pointed out that because of the semilogarithmic form, to interpret the regression coefficient as percent change, one should take the antilog of the regression coefficient (to the base e) minus 1. For small percent changes, the values of this computation will not differ from the regression coefficient, but for larger ones, they will. Because the focal estimates in this analysis are small, I simply present the actual regression coefficients, with the interpretation that they represent a percent difference.

[8]A large part of the explanatory power of the model comes from the seasonal component of CHF hospitalizations.

talization for CHF after implementation of PPR was, on average, only 2.4 percent higher than before implementation. This difference is not large enough to be statistically significant.[9] Indeed, the term representing the implementation of PPR contributes little to the predictive power of the model. The inclusion of this term only increased the explained variance by 0.1 percent, compared with a model including only the trend, seasonality, and geographic areas.

It is also interesting to note that the model confirms other patterns observed in the descriptive analysis. There is a statistically significant, positive trend in hospitalizations for CHF. Coefficients estimating seasonality indicate that rates of hospitalization are significantly higher in the first quarter than in the fourth quarter (the fourth quarter was the reference group for the seasonality effects), second-quarter rates were not different from the fourth quarter, and third-quarter rates were significantly lower than for the fourth quarter. Rates were higher in the Northeast, Midwest, and South than in the West (the West Region was the reference group for the geographic effects).

In sum, the estimates derived from the regression suggest that the implementation of PPR on average did not have a substantial impact on hospitalization for CHF in the overall Medicare population.[10]

Very Old Medicare Beneficiaries

For the most part, the demographic pattern of hospitalization for CHF observed in the overall Medicare population also applied for beneficiaries 85 years of age and over (Table 1). Differences in rates of hospitalization for CHF by gender and metropolitan status also tend to be relatively small in this older age group, and rates for census divisions in the West Region were lower than for other areas. The pattern by race was different, however. In the overall Medicare population, hospitalizations for CHF for black persons were about 50 percent higher than for white persons (rate ratio of 1.51); in the Medicare population age 85 or over, rates were roughly comparable for both races (rate ratio of 1.05). The higher rate among black persons in the total population thus largely reflects a higher rate among younger beneficiaries (ratio of black to white persons is 2.03 for those aged 65-74 years, and 1.41 for those aged 75-84 years).

The general pattern of quarterly rates of hospitalization for CHF noted previously for the overall Medicare population is also apparent in the very old Medicare population (Table 2 and Figure 2). There is a strong seasonal component to hospitalization for CHF that is even more pronounced than in the overall population, and there appears to be an overall upward trend that seems to accelerate somewhat beginning around 1990. Rates following the implementation of PPR are higher than observed before implementation, with the exception of the third quarter of 1993.

Table 4 presents the regression results, using the same model specification described previously. The model does a good job of fitting the data for Medicare

[9]It can be argued that statistical inference is not necessary in this context because there is a census of Medicare hospitalizations for CHF in this period. I chose the more conservative approach of doing inference because I adopted the view that I was attempting to estimate the parameters of an underlying probabilistic process, and these data represent one realization (i.e., sample) of that process.

[10]This overall effect reflects somewhat smaller and larger changes in specific geographic areas. For the interested reader, ordinary least-squares regression coefficients and t values for the effect of PPR within each census division are as follows: New England, $b = 0.045$, $t = 1.91$; Middle Atlantic, $b = 0.064$, $t = 3.30$; East North Central, $b = 0.027$, $t = 1.33$; West North Central, $b = -0.013$, $t = -0.62$; South Atlantic, $b = 0.065$, $t = 2.51$; East South Central, $b = 0.034$, $t = 2.45$; West South Central, $b = 0.033$, $t = 1.59$; Mountain, $b = -0.025$, $t = -0.93$; Pacific, $b = -0.070$, $t = -1.74$. The reader should interpret statistical significance in this application with caution; the R^2 values for these models are extremely high (generally 0.9 and greater), so even small differences can be significant. The issue of area-specific effects of PPR is discussed in the summary.

Table 4

Model of Hospitalization for Congestive Heart Failure (CHF) for Medicare Beneficiaries 85 Years of Age or Over

Independent Variable	Regression Coefficient	Standard Error	*t*	*p*
Physician Payment Reform	0.010	0.015	0.68	0.519
Covariates				
Trend	0.004	0.001	4.83	0.001
Seasonality:				
Quarter 1	0.094	0.007	14.39	0.000
Quarter 2	-0.026	0.013	-1.90	0.094
Quarter 3	-0.167	0.010	-17.58	0.000
Geographic Area:				
Northeast Region	0.269	0.068	3.94	0.004
Midwest Region	0.214	0.073	2.95	0.018
South Region	0.232	0.067	3.49	0.008
$R^2 = 0.71$				

NOTES: Dependent variable is the natural logarithm of the rate of inpatient admission for CHF per 100,000 Medicare beneficiaries. Unit of observation is calendar quarter/census division combinations. Regression coefficients were estimated using weighted least-squares regression; standard errors were estimated by a Taylor-series approximation that allows for serial correlation in the error. The fourth quarter serves as the reference group for seasonal effects; the West Region serves as the reference group for geographic-area effects. Data are for Medicare beneficiaries 85 years of age or over who were not members of a health maintenance organization.

SOURCE: Health Care Financing Administration: Medicare Provider Analysis and Review files and Denominator files, 1987-93.

beneficiaries 85 years of age or over. The variables included in the model accounted for more than 70 percent of the variation in rates of hospitalization for CHF ($R^2 = 0.71$).

The regression indicates a very small effect associated with the implementation of PPR in the very old Medicare population. The regression coefficient estimating the effect of PPR is 0.010. Thus, after adjusting for the existing trend, the rate of hospitalization for CHF after implementation of PPR was only 1.0 percent higher than before implementation. This difference is not large enough to be statistically significant. As was the case for the overall Medicare population, the term representing the implementation of PPR contributes little to the predictive power of the model. The inclusion of this term increases the explained variance by less than 0.1 percent, compared with a model including only the trend, seasonality, and geographic areas.

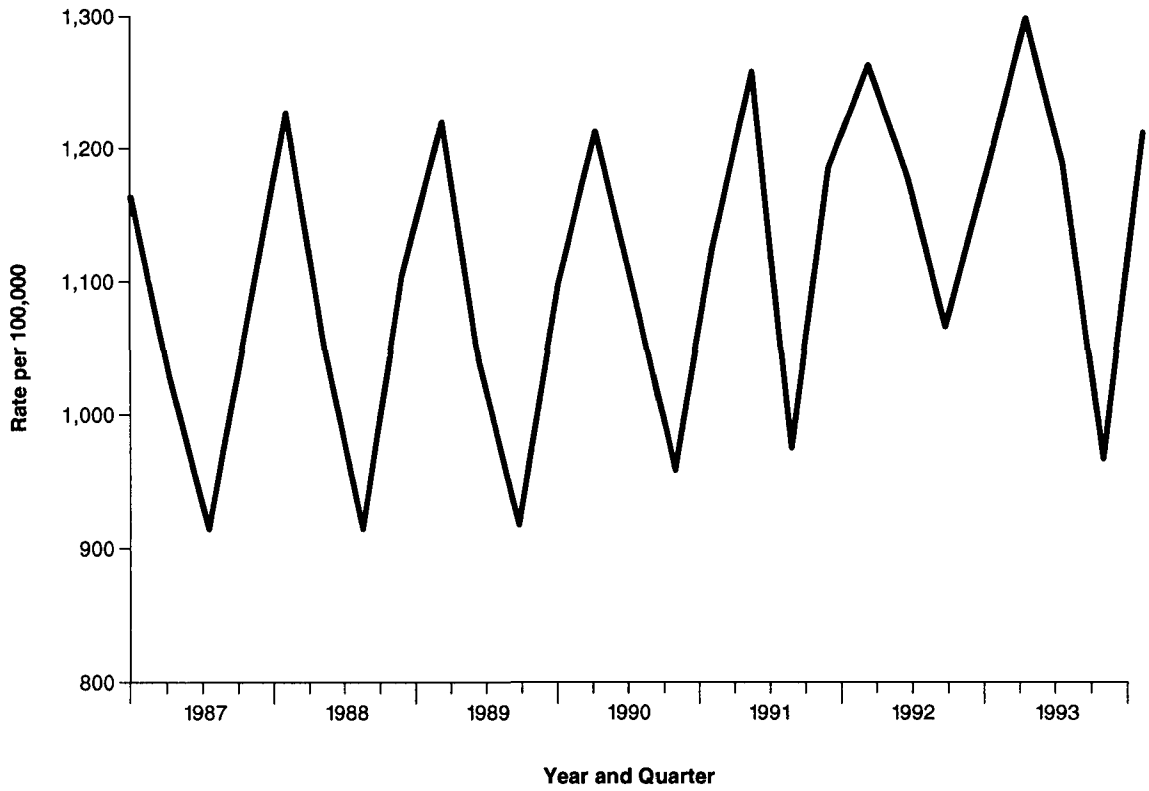
The pattern of results for the covariates included in this model is similar to that observed in the model for the overall Medicare population.

Medicare Beneficiaries Living in Non-Metropolitan Areas

The non-metropolitan classification used here is based on rural-urban continuum codes developed by the U.S. Department of Agriculture. This coding system subdivides the standard Bureau of the Census metropolitan/non-metropolitan county coding system into 10 subdivisions (Butler, 1990). There are six non-metropolitan categories, based on population size and proximity to a metropolitan area. Previous research on access to physician services in Medicare has distinguished non-metropolitan areas that are adjacent to a metropolitan area from those that are not adjacent to a metropolitan area (U.S. Department of Health and Human Services, 1993, 1994). The concern is that access especially may be a problem for beneficiaries who live in non-metropolitan areas that are not adjacent to a metropolitan area. The analysis that follows is for this population (i.e., Medicare beneficiaries living in non-metropolitan areas that are not adjacent to a metropol-

Figure 2

Rates of Hospitalization for Congestive Heart Failure (CHF) for Medicare Beneficiaries 85 Years of Age and Over, by Year and Quarter: United States, 1987-93



NOTES: Data are for Medicare beneficiaries 85 years of age or over who were not members of a health maintenance organization. Rates are the number of admissions for which CHF was the principal diagnosis per 100,000 beneficiaries.

SOURCE: Health Care Financing Administration: Medicare Provider Analysis and Review files and Denominator files, 1987-93.

itan area).[11] Hereafter, this group is simply referred to as "non-metropolitan."

The demographic pattern of hospitalization for CHF for this population is very similar to that of the overall Medicare population (Table 1). However, rate ratios in the South Region were higher than observed for the total population. Quarterly rates of hospitalization for CHF for this population were very similar to the overall Medicare population (Table 2 and Figure 3).

Table 5 presents the regression results. The model does a very good job of fitting the data for this population. More than 85 percent of the variation in rates of hospitalization for CHF is accounted for by the variables included in the model ($R^2 = 0.87$).

As was observed for the overall Medicare population and for very old beneficiaries, the regression indicates a very small effect associated with the implementation of PPR in the Medicare population living in non-metropolitan areas. The regression coefficient estimating the effect of PPR is 0.018, indicating that, on average, the rate of hospitalization for CHF after implementation of PPR was only 1.8 percent higher than before implementation, after adjusting for the existing trend. This difference is not large enough to be statist-

[11]Specifically, this group includes beneficiaries living in counties with rural-urban continuum codes of 5, 7, or 9 (Butler, 1990).

Table 5

Model of Hospitalization for Congestive Heart Failure (CHF) for Medicare Beneficiaries Living in Non-Metropolitan Areas

Independent Variable	Regression Coefficient	Standard Error	*t*	*p*
Physician Payment Reform	0.018	0.010	1.83	0.105
Covariates				
Trend	0.005	0.001	3.51	0.008
Seasonality:				
Quarter 1	0.090	0.006	15.72	0.000
Quarter 2	0.015	0.008	1.92	0.092
Quarter 3	-0.143	0.007	-20.60	0.000
Geographic Area:				
Northeast Region	0.373	0.075	5.00	0.001
Midwest Region	0.324	0.048	6.76	0.000
South Region	0.513	0.046	11.17	0.000
$R^2 = 0.87$				

NOTES: Dependent variable is the natural logarithm of the rate of inpatient admission for CHF per 100,000 Medicare beneficiaries. Unit of observation is calendar quarter/census division combinations. Regression coefficients were estimated using weighted least-squares regression; standard errors were estimated by a Taylor-series approximation that allows for serial correlation in the error. The fourth quarter serves as the reference group for seasonal effects; the West Region serves as the reference group for geographic-area effects. Data are for Medicare beneficiaries 65 years of age or over who were not members of a health maintenance organization, and who lived in non-metropolitan areas that were not adjacent to any metropolitan area.

SOURCE: Health Care Financing Administration: Medicare Provider Analysis and Review files and Denominator files, 1987-93.

ically significant. As was seen previously, the term representing the implementation of PPR contributes little to the predictive power of the model. The inclusion of this term increases the explained variance by less than 0.1 percent.

The pattern of results for the other effects included in the model is very similar to that observed in the model for the overall Medicare population. There were significant trend, seasonal, and geographic differences in hospitalization for CHF.

Black Medicare Beneficiaries

Patterns of hospitalization for CHF in 1993 in the black population were roughly similar to those of the overall Medicare population (Table 1). Rates were higher in older age groups, and census divisions in the West Region were lower than for other areas, though these differences were not as pronounced as observed for the total population. Differences in rates by gender and metropolitan status were relatively small. The general pattern of quarterly rates of hospitalization noted for the overall population is also apparent in the black population (Table 2 and Figure 4).

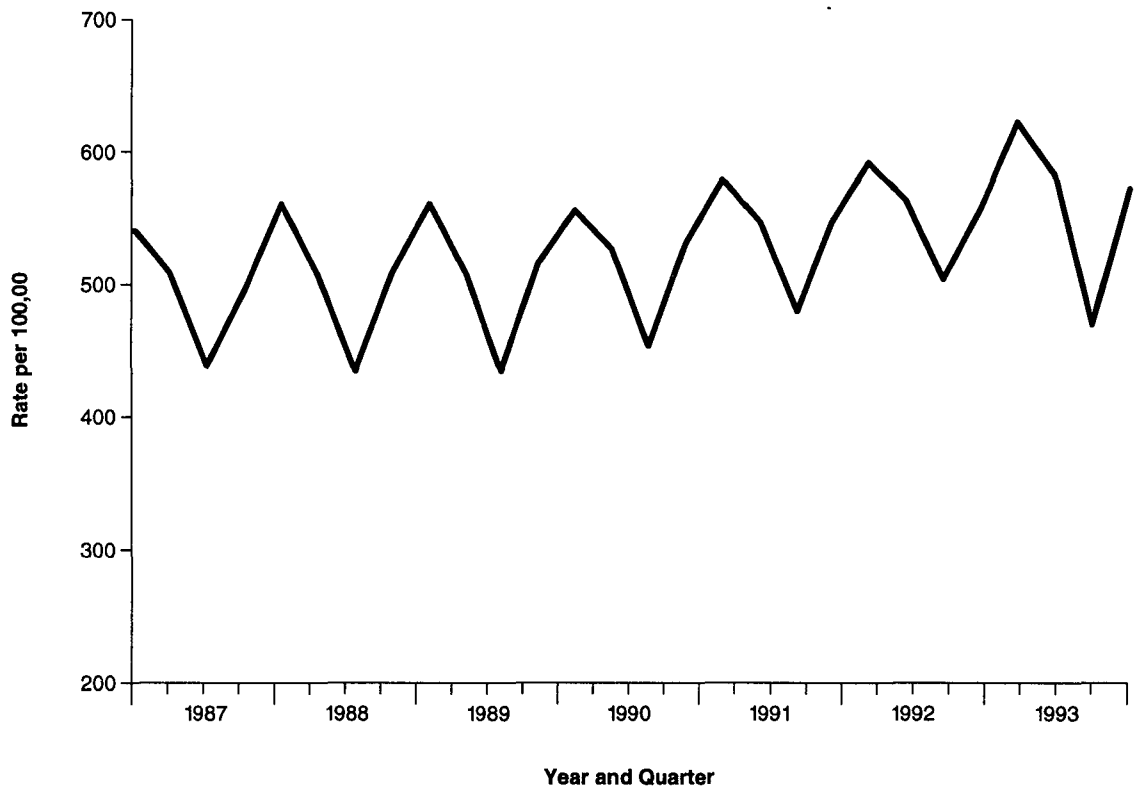
Table 6 presents the regression results for the model for the black population.[12] The model did a good job of fitting the data. It accounted for almost three-fourths of the variation in rates of hospitalization for CHF in this group ($R^2 = 0.74$).

The regression indicates a small effect associated with the implementation of PPR among black persons. The regression coefficient estimating the effect of PPR is 0.029. Thus, after controlling for the existing trend, the rate of hospitalization for CHF after implementation of PPR was only 2.9 percent higher than before implementation in this potentially vulnerable subgroup. Allowing for potential error in estimation, this difference is not large enough to be statistically significant. The inclusion of this term increased the explained variance by only 0.3 percent.

[12]It was necessary to combine the Mountain and Pacific Census Divisions for black beneficiaries because there were so few admissions for CHF in the Mountain Division.

Figure 3

Rates of Hospitalization for Congestive Heart Failure (CHF) for Medicare Beneficiaries Living in Non-Metropolitan Areas, by Year and Quarter: United States, 1987-93



NOTES: Data are for Medicare beneficiaries 85 years of age or over who were not members of a health maintenance organization. Rates are the number of admissions for which CHF was the principal diagnosis per 100,000 beneficiaries. "Non-metropolitan" means living in areas that are not adjacent to any metropolitan areas.

SOURCE: Health Care Financing Administration: Medicare Provider Analysis and Review files and Denominator files, 1987-93.

Note that there was a significant positive trend in hospitalization for CHF among black beneficiaries that was somewhat more pronounced than observed in the previous groups. The same general pattern of seasonal effects was observed, except that the difference between the second and fourth quarters was large enough to be statistically significant in this case. Unlike the other groups, only the Midwest Region was significantly different from the West Region in this subpopulation.

SUMMARY AND CONCLUSIONS

Physician payment reform altered the way Medicare pays physicians. Of particular concern to Congress and the Administration is whether these changes affected access to care for Medicare beneficiaries. Of special concern is whether the implementation of PPR reduced access to physician services for potentially vulnerable subgroups.

This study did not reveal a notable discontinuity with the implementation of PPR. After controlling for the existing trend, rates of hospitalization for CHF after the

Table 6

Model of Hospitalization for Congestive Heart Failure (CHF) for Black Medicare Beneficiaries

Independent Variable	Regression Coefficient	Standard Error	*t*	*p*
Physician Payment Reform	0.029	0.022	1.31	0.232
Covariates				
Trend	0.007	0.001	6.90	0.000
Seasonality:				
Quarter 1	0.067	0.010	6.46	0.000
Quarter 2	-0.039	0.015	-2.53	0.039
Quarter 3	-0.178	0.017	-10.49	0.000
Geographic Area:				
Northeast Region	-0.006	0.023	-0.26	0.802
Midwest Region	0.141	0.029	4.90	0.002
South Region	-0.029	0.036	-0.80	0.450
$R^2 = 0.94$				

NOTES: Dependent variable is the natural logarithm of the rate of inpatient admission for CHF per 100,000 Medicare beneficiaries. Unit of observation is calendar quarter/census division combinations. Regression coefficients were estimated using weighted least-squares regression; standard errors were estimated by a Taylor-series approximation that allows for serial correlation in the error. The fourth quarter serves as the reference group for seasonal effects; the West Region serves as the reference group for geographic-area effects. Data are for black Medicare beneficiaries 65 years of age or over who were not members of a health maintenance organization.

SOURCE: Health Care Financing Administration: Medicare Provider Analysis and Review files and Denominator files, 1987-93.

implementation of PPR on the average did not differ substantially from rates observed before implementation. This result held for the overall Medicare population, as well as for the very old, for beneficiaries living in non-metropolitan areas, and for black beneficiaries. At least for this indicator condition, there is not evidence that the implementation of PPR had a serious impact on access to physician services for Medicare beneficiaries.

Several limitations of this analysis should be kept in mind. First, the results presented here focus on a single condition. It is possible that hospitalization for CHF is unusually resilient to changes in payment policy. Future work needs to expand monitoring efforts by examining trends in rates of hospitalization for other conditions that would be expected to be sensitive to the adequacy of ambulatory care.

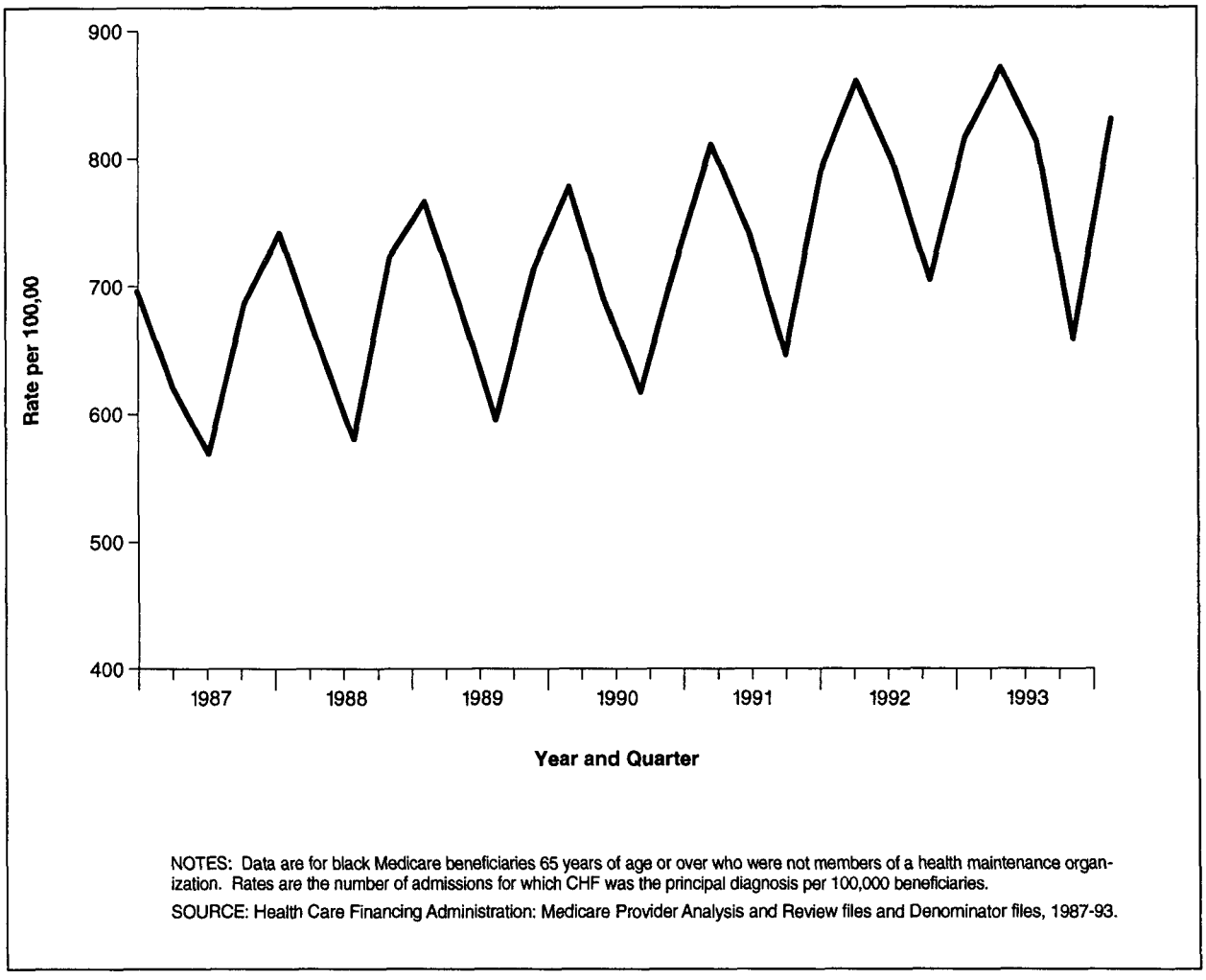
Second, PPR has been in effect for a short period of time. Thus, it is not yet possible to draw final conclusions about the impact of PPR, because it is too early to fully model possible intervention effects. For example, one cannot currently capture delayed effects or long-term changes in the trend of hospitalizations. Only through long-term monitoring can we fully evaluate the effect of payment reform on access to physician services. In addition, as data on more post-PPR time periods become available, it will be possible to reduce the effects of collinearity and more clearly separate potential reform effects from the existing trend.

Third, in a pre-post trend-adjusted analysis as used here, much depends on how well the model captures the unknowable "true" trend. It is not certain that the specification used reflects the optimal functional form. Similarly, the model included a fairly simple set of covariates. It is always possible that omitted variables could influence the magnitude and/or statistical significance of the estimate of the effect of PPR.

Finally, note that the present analysis focused on whether, on average, there was a decrease in access associated with the implementation of PPR. There may be larger or smaller effects in specific geographic areas. Future monitoring efforts need to thoroughly explore potential area-specific effects of payment reform.

Figure 4

Rates of Hospitalization for Congestive Heart Failure (CHF) for Black Medicare Beneficiaries: United States, 1987-93



NOTES: Data are for black Medicare beneficiaries 65 years of age or over who were not members of a health maintenance organization. Rates are the number of admissions for which CHF was the principal diagnosis per 100,000 beneficiaries.

SOURCE: Health Care Financing Administration: Medicare Provider Analysis and Review files and Denominator files, 1987-93.

An appropriate evaluation of the effects of PPR requires that access be studied from multiple perspectives; this study should be understood as one look at the implications of the policy change. Nevertheless, the results presented here provide evidence that there was not a substantial reduction overall in access for Medicare beneficiaries as a result of physician payment reform.

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