

## A New Measure of the Impact of Managed Care on Healthcare Markets

L. Gregory Pawlson, MD; Ernest M. Moy, MD; Joseph I. Kim, MD;  
and Paul F. Griner, MD

**Background:** Most studies of managed care impact have used health maintenance organization (HMO) penetration or index of competition as the marker of managed care impact. However, little empirical evidence has been found to support the validity of these or other measures in current use. In addition, as managed care evolves to forms other than HMOs and managed care penetration in large metropolitan areas approaches 100% of commercially insured patients, the utility of the most commonly used measure, HMO penetration, will decrease still further.

**Objectives:** To provide a preliminary analysis of the use of premiums as a measure of market impact of managed care.

**Study Design:** Retrospective analysis (quartile, correlation, multiple-variable linear regression) of publicly available datasets.

**Methods:** Labor market-adjusted HMO premiums from 3 publicly available sources, for the 56 largest metropolitan areas in the United States, were compared with penetration and index of competition as predictors of the dependent market variable, hospital bed-days per 1000 population.

**Results:** Health maintenance organization premiums in the Federal Employees Health Benefits Program emerged as the best predictor of HMO market impact. Average HMO premiums reported in the Interstudy database and for the Medicare+Choice program also outperformed penetration or index of competition in relating to several commonly available markers of competition such as bed-days per 1000.

**Conclusions:** Premiums charged by HMOs are a useful measure of the impact of managed care on healthcare markets in large metropolitan areas.

(*Am J Manag Care* 2001;7:1069-1077)

egories such as physicians,<sup>1-5</sup> hospitals,<sup>6-10</sup> or other insurers,<sup>11-14</sup> as well as more focused areas such as the quantity of clinical research in academic medical centers.<sup>15</sup> A number of different approaches have been used in these studies to categorize managed care impact. Most of the studies cited used the relatively simple measure of managed care penetration, usually expressed as the proportion of patients enrolled in health maintenance organizations (HMOs). Other more complex measures used include index of competition (IOC)<sup>6,14</sup> or a complex classification using market staging.<sup>16</sup> Little empiric testing of these measures has occurred and most analysis has relied on their face validity (that higher penetration leads to higher impact of managed care).

All of these approaches to quantifying the impact of managed care have major limitations. Penetration, the most widely used measure, is the only one for which there is any empiric evidence of an effect on market parameters such as hospital costs, length of hospital stay (LOS), or hospital bed-days per 1000 population.<sup>1,3,10,11</sup> A major problem with the use of penetration is that an increasing number of large metropolitan areas have HMO market penetration rates exceeding 60% of the total population, and approaching 100% of patients with commercial insurance.<sup>17</sup> Clearly this limits the ability to differentiate

---

From the National Committee for Quality Assurance, Washington, DC (LGP); Association of American Medical Colleges, Washington, DC (EMM, PFG); and George Washington University, Washington, DC (JIK).

Portions of this report were presented at the Annual Meeting of the Society of General Internal Medicine, Boston, MA, May 28, 2000.

Address correspondence to: L. Gregory Pawlson, MD, National Committee for Quality Assurance, 2000 L Street, NW, Suite 500, Washington, DC 20036. E-mail: pawlson@ncqa.org.

**A** growing number of analytic studies in health services have examined the impact of managed care on various healthcare delivery parameters. These studies have examined broad cat-

large metropolitan areas from one another. In addition, the size of metropolitan area and the degree of market penetration are highly correlated.<sup>17</sup> If not adjusted for this confounding variable, the effect of penetration may be due more to the size of metropolitan area than penetration itself. Moreover, there is an increasing problem with defining meaningful differences between HMOs, preferred provider organizations (PPOs) that include disease and utilization management functions, and traditional indemnity insurers that have implemented utilization management including provider profiling. Yet penetration has been defined almost exclusively as HMO penetration. Finally, simply having a high level of HMO penetration in a given area may not create market pressure for change if there is little or no price competition between the HMOs themselves or between HMOs and other forms of managed care similar to HMOs.<sup>14,18</sup> However, HMO penetration (or, even better, managed care penetration, which would include PPOs and other forms of managed care) is still useful, especially to compare smaller metropolitan or rural areas, where HMO penetration still varies widely.

A second variable that has been used to measure HMO impact is the IOC. The derivation of this index requires information about the number of HMOs in a given market and their relative market shares. Index of competition is defined as 1 minus the sum of the squares of each HMO's market share as a proportion of the total HMO market. For example, if there are 2 HMOs in a given market, 1 with a 20% market share and the other with an 80% market share, the IOC would be  $1 - (0.04 + 0.64)$ , or 0.32. At the extremes are an IOC of 0 (a market with 1 HMO with 100% of the HMO market share) and an IOC of nearly 1 (a market with 100 HMOs all with 1% market share would give an IOC of 0.99). The major concern with the use of the IOC is that there is no empiric evidence that a market with a large number of small HMOs has more impact on provider behavior, prices, or other market characteristics than a market that has fewer HMOs with larger market shares. Moreover, the IOC does not take into account the proportion of the population covered by HMOs. Finally, like the use of penetration, the validity of IOC in measuring HMO impact is adversely affected by the growing lack of distinction between HMOs and other types of managed care.

The most sophisticated approach to managed care market classification is that of managed care market staging. The staging approach is the most widely used, and was developed by the University Healthsystem Consortium (UHC), a private group

that supplies data to university hospitals who are members of the UHC. Staging was intended as a way of classifying markets into 4 stages of managed care evolution, taking into account both HMO and provider variables. Yet Burns et al<sup>16</sup> have provided a detailed critique of the use of staging as a variable to classify managed care markets. In brief, they had the following concerns with managed care market staging: (1) the system applies only to markets with UHC member hospitals; (2) the delineation of the 4 stages was not derived from any theoretical or conceptual framework; (3) the indicators that defined the stages were narrowly chosen; and (4) the methodology that was used to derive the market level scores lacked a justification. The authors went on to evaluate the ability of the UHC market classification to identify stages of physician-hospital integration, and found it to be minimal.<sup>16</sup>

The aim of the current study was to explore the use of the HMO premium, using 3 publicly available sources, as indicators of the impact of managed care on healthcare market behavior in large metropolitan areas. Our study hypothesis was that, in large metropolitan areas, premiums would be more highly correlated and be more powerful predictors than penetration in regressions of controllable cost factors in the market such as LOS, hospital beds, and bed-days per 1000. Premium levels have depended on multiple factors including the input costs of administration, the costs of the medical care provided, and the need for margin (profits or retained earnings). Based on the following assumptions, we hypothesized that HMO premium levels reflect, in part, the degree of competition in a market, whether the competition is from other HMOs or other forms of managed care such as PPOs. In a highly competitive market, HMOs would be likely to price their premiums with a small, or even negative, margin, to gain market share; thus premium level, adjusted for the difference in labor costs in a given market, might reflect market competition. Competition, by putting pressure on premiums, would in turn force HMOs to find ways to reduce costs, and especially the most costly part of medical care, hospital stays. Costs could be reduced by reducing either the LOS for a given admission or the number of admissions.

We hypothesized further that these effects would be most marked where penetration of HMOs (and other forms of managed care) is already high, as it is in many large metropolitan areas. Bed-days per

1000 reflects both reductions in LOS and admissions and was thus chosen (from among various aspects of managed care's potential outcomes) for our index-dependent variable related to impact of managed care. In addition, numerous studies of HMO market impact<sup>6,7</sup> have indicated that the most notable way that HMOs have lowered medical costs was by reducing bed-days per 1000. One factor that could distort the relationship between premium and bed-days per 1000 is that low premiums in some areas might reflect lower input costs for labor in regions with lower average wages. Thus we adjusted the premium for regional labor costs. We used the adjustment of two thirds of the total premium based on an estimate of the proportion of medical care and administrative costs that are likely to be related to regional labor costs. Finally, it must be noted that the relationships between bed-days per 1000, penetration, and premium are complex. For example, HMO penetration alone (without price competition) may lower bed-days per 1000, which would result in HMO premiums being lower in areas of high penetration. Thus we thought our study should consider both the correlations and the predictive power of penetration and premiums in our regression analysis. Our major hypothesis for the study was that in large standard metropolitan statistical areas (SMSAs), premiums would correlate better with and better predict bed-days per 1000 (as a primary marker of managed care organization [MCO] impact) than penetration or other commonly used indices.

---

... METHODS ...

The overall study design used secondary data analysis of existing, publicly available, databases. A few new derived variables were developed (see below). The major dataset used was the Interstudy HMO database.<sup>19</sup> Variables of interest were assembled into a single Excel spreadsheet using data extracted from the multiple spreadsheets that constituted the Interstudy database. The datasets were matched using the data field for SMSA. Key variables extracted from the Interstudy database included average commercial HMO premiums reported in a given market area, penetration, LOS, bed-days per 1000, and hospital beds per 1000. We also used the 1996 schedule of Medicare HMO payments (the average adjusted per capita cost [AAPCC]), which is available on the Health Care Financing Administration (HCFA) website (<http://www.hcfa.gov/stats/hmorates/aapccflt.htm>).

These data could not be matched directly to the Interstudy database because HCFA uses counties rather than SMSAs as the unit of AAPCC analysis. Therefore, matching was done manually using a listing of SMSA codes and a listing of counties making up a given SMSA. We also calculated the unweighted average of full HMO premiums for the Federal Employees Health Benefits Program (FEHBP) reported in the *Washington Consumers' Checkbook*.<sup>20</sup> Premium variables were adjusted for prevailing SMSA area wage index by using the US Department of Labors' wage index, and matching of SMSA codes to the Interstudy database.

To allow quartile ranking as well as statistical analysis, we selected the 56 largest SMSAs, which included all SMSAs with more than 1 million persons plus Jacksonville, FL (996,000), and Louisville, KY (994,000). We developed a quartile ranking for each key independent variable for the 56 SMSAs. We confined our analysis to the 56 largest metropolitan areas, largely because in the Interstudy database as the size of the SMSA decreased below 1 million, the number of HMOs reporting premiums decreased and the number of missing data elements increased. In addition, as we noted, managed care penetration alone may still be an important marker of managed care impact in these smaller SMSAs.

It is important to note that our study includes the total set of the 56 largest SMSAs rather than just a sample. With the entire "population" of cities included, direct comparisons for this group based on population rather than statistical methods are valid. However, we used correlation and multiple variable linear regression, using SAS for Windows, to examine the strength of relationships between the independent variables noted in our hypothesis and the dependent variable of bed-days per 1000.

A number of new variables were created from existing data, including the following:

*Penetration With No Uninsured.* Because persons without insurance are by definition not directly part of the insurance market, their inclusion in this measure would tend to dilute the apparent impact of managed care. Therefore, we created a new variable with the numerator being the number of persons enrolled in HMOs and the denominator the population of the SMSA minus the number of uninsured in that SMSA.

*Rival-to-Dominant HMO Ratio.* As another way to explore the concept of the IOC, we created the variable rival-to-dominant HMO ratio. The rival-to-dominant ratio in the Interstudy database indicates the number of HMOs with 30% or greater market

**Table 1A.** Correlation Analysis

Variable	Penetration	Days per 1000	Interstudy Premium	AAPCC	Checkbook Premium
Penetration	1.00				
Bed-days per 1000	-0.13	1.00			
Interstudy premium	-0.39	0.32	1.00		
Medicare-AAPCC	-0.43	0.16	0.39	1.00	
FEHBP premium	-0.37	0.39	0.54	0.22	1.00

Dependent variable = Bed-days per 1000.

AAPCC = average adjusted per capita cost; FEHBP = Federal Employees Health Benefits Program.

share (dominant) and the number with market shares between 15% and 30% (rival) in a simple numerical ratio. This ratio is a potential measure of market impact of HMOs. However, because this ratio can have a zero in the numerator or denominator, it cannot be averaged or summed. We created a new ratio that was  $(1 + \text{number of rival HMOs}) \div (1 + \text{the number of dominant HMOs})$ , which created a non-linear ratio that in our dataset ranged from 7 (6 rivals with no dominants) to 0.33 (2 dominants and no rivals).

*HMOs per 100,000.* We adjusted the number of HMOs for the size of the population to allow relative comparison of the number of HMOs in areas like New York or Los Angeles with those of smaller cities. This variable was created to explore the possibility that a larger number of HMOs relative to the population of an area might be an indicator of a more competitive market.

The key independent variables examined in the quartile, correlation, and regression studies included the 3 variables noted above plus HMO penetration, both including and excluding uninsured persons, the IOC, and the 3 labor market-adjusted HMO premiums (Interstudy, FEHBP, and Medicare-

AAPCC). As noted previously, the primary dependent variable we used was hospital days per 1000 as reported in the Interstudy database.

... RESULTS ...

Tables 1A and 1B display the results of the correlation and multiple variable regression analyses. The FEHBP premium variable produced the highest level of correlation (0.39) with bed-days per 1000. The positive direction of the correlation indicates that higher premiums are associated with higher bed-days, and lower premiums with lower bed-days. Penetration produced a relatively weak correlation with bed-days per 1000 (-0.13), but the correlation was in the expected (negative) direction. As we expected, there was a relatively strong inverse correlation between penetration and the various premium variables (0.37-0.43). The premium variables showed a relatively high positive correlation (0.54) between the Interstudy and FEHBP premiums and a lower, but still positive correlation between these premiums and the Medicare-AAPCC (0.39 and 0.22). The FEHBP premium was the only significant predictive variable in the linear regression on bed-days per 1000 ( $P < .05$ ) (Table 1).

In single variable regressions (not shown) the 2 other premiums and penetration resulted in probabilities that were just short of significant (at the  $P = .05$  level) in predicting bed-days per 1000. A similar analysis (not shown) using IOC, HMOs per 1000, and rival-to-dominant ratio,

**Table 1B.** Multiple Variable Regression Analysis

Variable	Parameter Estimate	Standard Error	T for HO: Parameter = 0	Probability > [T]
Intercept	-457.95	468.45	-0.098	0.33
Penetration	125.45	265.96	0.47	0.64
Interstudy premium	2.41	2.46	0.98	0.33
Medicare-AAPCC	0.19	0.45	0.41	0.68
FEHBP premium	4.29	2.08	2.05	0.04

Dependent variable = Bed-days per 1000.

T = T value; HO = hypothesis; AAPCC = average adjusted per capita cost; FEHBP = Federal Employees Health Benefits Program.

regression on bed-days per 1000 did not come close to reaching statistical significance. The results using penetration were not affected by whether penetration was defined as HMO members per total population or HMO members per insured population.

**Table 2** displays the quartile rankings sorted on FEHBP premium for a selected group of variables. The data shown were sorted from lowest to highest on labor-market adjusted FEHBP premium and then divided into quartiles. The FEHBP premium (last column) ranges from \$153.19 in Oakland, CA, to \$224.12 in Louisville, KY.

**Table 3** illustrates the interquartile variations of selected variables. Of interest is that LOS and bed-days per 1000 increased in each quartile (LOS = 6.06, 6.44, 7.13, 7.27; bed-days per 1000 = 677, 781, 916, 947). Similar quartile analysis using Medicare-AAPCC, Interstudy premium, penetration alone, and penetration first and then FEHBP premium (data not shown) as the sort variables produced a similar, inverse trend in LOS and bed-days per 1000, but with inconsistencies in the trend or smaller variation of the dependent variables by quartile. Sorting by quartiles on other variables such as IOC, HMOs per 10,000 persons, rival-to-dominant ratio, operating margin, or medical-loss ratio (ie, the proportion of total premium paid out for medical claims) did not produce any consistent effect on bed-days per 1000 or LOS by quartile (analysis not shown).

---

... DISCUSSION ...

The correlation and regression results obtained by using the FEHBP premium are consistently higher than those obtained with the other premiums, or other tested independent variables including penetration and IOC. Although this preliminary study does not provide any conclusive evidence of the direction of causality, the results suggest that the labor market-adjusted HMO premium may reflect more accurately the overall impact that HMOs have had on costs and utilization in the given market. This inference rests on its higher correlation and regression result with the indicator-dependent variable of bed-days per 1000. Clearly, the use of premium to infer managed care impact will be less useful in small cities or in rural areas where penetration, and thus HMO influence, are likely to be minimal.

The FEHBP premium has the advantage of being the rate offered to federal employees by HMOs in a given region, for a standard set of benefits. The relatively standard benefits available to federal employ-

ees decreases the problem of widely varying HMO benefits provided to commercial accounts. The Medicare-AAPCC premiums and FEHBP premiums are published prior to the start of an insurance year, whereas the Interstudy data are retrospective and publication lags the premium use by nearly a year. Moreover, the Interstudy premium uses premium data that are self-reported and defined as the HMO's estimate of the "average" premium they charge commercial customers. Thus Interstudy premiums may vary from area to area, not only because of competition, but because of which HMOs or the number of HMOs that report premium data to Interstudy in any given period or how they defined their average premium. The Medicare-AAPCC premiums are derived from data on the costs for Medicare patients who are NOT enrolled in HMOs in a given region. Given the relatively low average Medicare HMO penetration (16%) and the small proportion of patients older than 65 years in a given market, the impact of Medicare HMO premium on providers is likely to be considerably smaller than that of the commercial market (average 42% penetration in our sample). In addition to these findings, our quartile analysis provided further inferential data that FEHBP premium has validity as a measure of impact of a competitive HMO market on providers. The clustering of California cities in the highest quartile may be reflective of the highly competitive nature of that market.<sup>18</sup> Just as interesting was the relatively low quartile ranking of several cities like Boston and Rochester (both in the third quartile), which had high penetration levels (50% and 73%) and were in the top quartile when ranked on penetration alone. In these latter cities, local market factors, such as strong provider organizations, and limited use of capitation may have prevented HMOs from having the same impact on medical care utilization (as bed-days per 1000) that occurs in more competitive areas.<sup>18</sup> The number of physician group failures in the California market may be further evidence of a greater market impact of managed care in those cities relative to areas such as Boston or Rochester, which had higher premiums relative to the level of penetration.

As with any indirect measure of a concept such as the impact of HMOs on markets, there are inherent problems with the proposed use of premiums, including the following:

1. Premium rates for a given year are based on cost data that are 12 to 18 months old and may not reflect current market conditions. Thus the rate of change of provider payments or premium might

**Table 2.** Quartile Rankings Sorted on FEHBP Premium for Selected Variables

MSA Name	Population (1996)	HMOs per 100,000	Index of Competition	Rival-to-Dominant Ratio
<b>First Quartile</b>				
Oakland, CA	2,247,000	0.534	0.719	1.000
San Jose, CA	1,601,600	0.749	0.585	1.000
San Francisco, CA	1,688,900	0.888	0.681	1.000
Los Angeles-Long Beach, CA	9,245,300	0.238	0.856	5.000
Phoenix-Mesa, AZ	2,606,000	0.384	0.851	5.000
San Diego, CA	2,722,700	0.441	0.787	1.500
Riverside-Anaheim, CA	5,678,300	0.546	0.813	3.000
Fort Lauderdale, FL	1,420,500	0.774	0.831	5.000
Sacramento, CA	1,509,400	0.795	0.684	1.000
Las Vegas, NV-AZ	1,205,100	0.581	0.615	1.500
Miami, FL	2,039,800	0.833	0.874	5.000
Nashville, TN	1,107,600	0.903	0.843	6.000
Detroit, MI	4,319,700	0.255	0.763	2.000
Seattle, WA	2,221,600	0.405	0.621	0.500
<b>Second Quartile</b>				
Denver, CO	1,851,700	0.702	0.664	1.000
New York, NY	8,707,500	0.241	0.811	4.000
Jacksonville, FL	994,900	1.005	0.844	5.000
Houston, TX	3,739,400	0.321	0.657	1.000
Chicago, IL	6,323,900	0.364	0.832	4.000
Orlando, FL	1,416,700	0.776	0.812	2.000
Minneapolis-St. Paul, MN	2,737,400	0.292	0.581	0.333
Fort Worth-Arlington, TX	1,529,000	0.719	0.779	1.500
Washington, DC-MD-VA	4,537,400	0.375	0.809	3.000
Philadelphia, PA-NJ	4,954,300	0.303	0.775	1.000
Indianapolis, IN	1,358,400	0.663	0.732	0.333
Kansas City, MO-KS	1,670,900	0.898	0.837	5.000
Austin-San Marcos, TX	1,010,700	0.792	0.330	1.000
Dallas, TX	2,993,800	0.468	0.821	4.000
<b>Third Quartile</b>				
Rochester, NY	1,088,700	0.184	0.380	1.000
New Orleans, LA	1,317,600	0.987	0.841	5.000
San Antonio, TX	1,479,200	0.608	0.633	1.500
Memphis, TN-AR-MS	1,077,100	0.650	0.732	2.000
Salt Lake City-Ogden, UT	1,211,800	0.660	0.806	5.000
Charlotte-Gastonia-Rock Hill, NC-SC	1,295,500	1.235	0.818	5.000
Pittsburgh, PA	2,203,700	0.318	0.448	1.500
Portland-Vancouver, OR-WA	1,730,500	0.636	0.759	2.000
Oklahoma City, OK	1,024,000	0.781	0.784	1.500
Boston, MA	3,369,300	0.386	0.755	4.000
Atlanta, GA	3,481,500	0.345	0.800	2.000
Tampa-St Petersburg, FL	2,200,300	0.682	0.760	1.500
Baltimore, MD	2,479,000	0.645	0.889	5.000
Nassau-Suffolk, NY	2,653,000	0.377	0.708	7.000
<b>Fourth Quartile</b>				
Raleigh-Durham-Chapel Hill, NC	1,008,000	1.091	0.675	0.667
Cincinnati, OH-KY-IN	1,596,200	0.752	0.721	1.500
Cleveland, OH	1,941,100	0.721	0.811	0.500
Bergen-Passaic, NJ	1,309,500	0.687	0.756	1.500
Norfolk-Virginia Beach-Newport News, VA-NC	1,549,400	0.581	0.824	2.000
Newark, NJ	1,853,400	0.755	0.784	4.000
Milwaukee-Waukesha, WI	1,457,300	0.755	0.802	1.500
Hartford, CT	1,219,000	0.902	0.784	2.000
Monmouth-Ocean, NJ	1,050,900	0.761	0.758	1.500
Greensboro-Winston-Salem-High Point, NC	1,014,300	0.690	0.706	1.500
Columbus, OH	1,446,800	0.829	0.556	1.000
Middlesex-Somerset-Hunterdon, NJ	1,083,200	0.831	0.784	1.500
St. Louis, MO-IL	2,571,100	0.545	0.840	5.000
Louisville, KY-IN	990,600	0.505	0.569	0.33

FEHBP = Federal Employees Health Benefits Program; MSA = metropolitan statistical area; HMO = health maintenance organization;

... Managed Care Impact on Healthcare Markets ...

Average LOS	Beds per 1000	Bed-Days per 1000	Penetration Persons With Insurance	Adjusted Interstudy	Adjusted Medicare	Adjusted FEHBP
5.88	2.18	542	0.417	\$105.45	\$364.33	\$153.19
5.11	2.33	527	0.629	\$100.32	\$364.32	\$155.47
6.48	3.11	755	0.530	\$103.24	\$417.71	\$156.88
5.86	2.82	615	0.555	\$109.68	\$426.99	\$157.50
5.17	2.70	568	0.333	\$148.93	\$597.26	\$164.32
5.66	2.21	507	0.437	\$124.69	\$457.17	\$164.42
4.86	2.37	455	0.517	\$109.27	\$392.00	\$164.68
7.07	4.06	853	0.196	\$113.22	\$626.34	\$166.25
5.74	2.35	601	0.707	\$107.30	\$429.74	\$168.90
7.23	2.77	710	0.256	\$152.42	\$577.82	\$168.96
7.62	4.25	1001	0.666	\$116.81	\$499.81	\$169.44
6.18	4.75	1047	0.208	\$150.39	\$495.02	\$170.07
7.10	3.03	779	0.271	\$141.43	\$505.24	\$170.70
4.85	2.25	517	0.240	\$126.72	\$489.25	\$178.97
5.57	2.70	568	0.345	\$112.74	\$459.78	\$179.71
9.86	4.36	1345	0.249	\$139.38	\$366.07	\$181.96
6.35	3.22	739	0.413	\$139.56	\$408.81	\$182.68
6.26	3.76	744	0.223	\$137.43	\$663.37	\$183.13
6.73	4.21	1013	0.221	\$132.88	\$557.68	\$183.13
5.93	3.39	700	0.287	\$134.23	\$633.90	\$184.55
6.05	2.63	622	0.439	\$151.95	\$612.11	\$184.96
5.64	2.68	532	0.201	\$147.33	\$467.15	\$186.82
6.14	2.42	610	0.351	\$159.33	\$488.47	\$187.09
7.64	4.00	1121	0.430	\$142.52	\$472.92	\$187.76
6.61	4.48	1033	0.209	\$159.77	\$504.53	\$188.14
7.01	3.90	851	0.272	\$138.60	\$497.85	\$191.81
4.71	2.03	466	0.362	\$138.57	\$426.82	\$191.85
5.69	2.85	589	0.234	\$150.02	\$542.06	\$191.97
11.18	4.05	1301	0.735	\$144.46	\$516.38	\$192.04
7.06	4.79	1029	0.257	\$123.58	\$533.16	\$192.72
6.33	3.08	655	0.210	\$148.68	\$578.16	\$193.85
7.62	4.65	1131	0.268	\$141.07	\$585.48	\$194.42
5.02	2.49	503	0.431	\$121.82	\$492.96	\$195.71
6.71	2.91	724	0.140	\$148.30	\$431.19	\$195.93
8.11	5.88	1589	0.394	\$133.10	\$399.14	\$196.14
4.84	2.36	489	0.543	\$122.33	\$402.77	\$197.12
6.46	3.69	860	0.211	\$139.73	\$575.46	\$197.12
6.82	3.54	945	0.506	\$165.09	\$474.13	\$197.12
6.20	3.15	737	0.212	\$122.85	\$539.88	\$201.34
6.52	3.93	835	0.492	\$142.02	\$528.18	\$202.93
6.61	3.20	889	0.331	\$162.87	\$561.59	\$202.99
10.38	3.75	1136	0.307	\$156.78	\$663.28	\$204.74
7.18	3.92	1091	0.243	\$148.11	\$543.66	\$206.18
6.28	3.64	813	0.293	\$133.28	\$403.04	\$207.65
6.56	4.62	1052	0.244	\$133.41	\$542.61	\$208.44
8.17	3.82	1130	0.142	\$142.62	\$644.50	\$209.29
6.66	2.75	656	0.210	\$131.87	\$635.25	\$214.11
8.17	4.94	1367	0.293	\$150.24	\$548.74	\$215.79
6.24	3.24	828	0.417	\$169.88	\$524.96	\$215.84
8.04	2.59	699	0.243	\$145.59	\$457.29	\$216.73
7.80	3.34	944	0.140	\$147.32	\$502.03	\$217.51
7.82	3.89	1011	0.200	\$143.43	\$650.70	\$217.73
6.08	3.20	794	0.290	\$145.25	\$482.11	\$217.78
8.91	2.85	850	0.263	\$145.12	\$395.01	\$219.13
7.15	4.52	998	0.377	\$118.07	\$391.87	\$220.84
6.74	3.64	1027	0.411	\$159.90	\$489.37	\$224.12

LOS = length of stay.

**Table 3.** Interquartile Variations of Selected Variables

SMSA Name	Population (1996)	HMOs per 100,000	Index of Competition	Rival-to-Dominant Ratio	Average LOS	Beds per 1000	Bed-Days per 1000	Penetration Persons With Insurance	Adjusted Interstudy	Adjusted Medicare	Adjusted FEHBP
All	2,323,955	0.63	0.74	2.50	6.73	3.40	830	0.34	\$137.16	\$504.24	\$190.90
Low premium (half)	2,979,982	0.58	0.74	2.56	6.25	3.14	729	0.36	\$131.93	\$490.88	\$175.55
High premium (half)	1,667,929	0.67	0.73	2.45	7.20	3.66	931	0.31	\$142.39	\$517.60	\$206.26
Lowest premium (quartile)	2,829,536	0.59	0.75	2.75	6.06	2.94	677	0.43	\$122.13	\$474.50	\$164.98
Second lowest quartile	3,130,429	0.57	0.73	2.37	6.44	3.33	781	0.30	\$141.74	\$507.25	\$186.11
Third lowest quartile	1,900,800	0.61	0.72	3.14	7.13	3.68	916	0.36	\$140.91	\$520.13	\$197.44
Highest premium quartile	1,435,057	0.74	0.74	1.75	7.27	3.64	947	0.27	\$143.86	\$515.08	\$215.08

SMSA = standard metropolitan statistical area; HMO = health maintenance organization; LOS = length of stay; FEHBP = Federal Employees Health Benefits Program.

be a better reflection of market pressures on providers than any static measure.

2. Because West Coast markets clustered in the top quartile of our analysis, some of the effect may be an “east versus west” effect. An analysis was done with West Coast cities removed (not shown). Although that analysis reduced the degree of correlation and spread of variables in the quartile analysis, it did so to a small, nonsignificant degree.
3. No causal relationship can be proved. Thus it is not certain if low premiums are the cause or the result of lower bed-days per 1000. As we discussed earlier, we believe there is ample evidence to suggest that competition may create pressure for lower premiums, which then result in reductions in admissions and LOS.
4. Penetration alone is still a useful and powerful marker of HMO impact, especially in smaller SMSAs.

Determining the true validity of premiums or any other proposed measure of market impact is not a simple task. Future studies should include more market impact measures such as provider self-perceptions of competitive “stress,” hospital failures, or practice consolidations. Such studies could provide more direct evidence of the utility of premiums as a measure of MCO market impact. Also useful are the in-depth studies of healthcare markets such as those produced by the Center for the Study of Health

Systems Change,<sup>18</sup> which provide narrative descriptions of some of the variables. Despite these cautions, our results indicate that labor market-adjusted HMO premiums may be a useful measure of market impact and may provide a substantial improvement over the use of penetration, IOC, or more complex measures such as market staging in large SMSAs.

... REFERENCES ...

1. Escarce JJ, Polsky D, Wozniak GD, Pauly MV, Kletke PR. Health maintenance organization penetration and the practice location choices of new physicians: A study of large metropolitan areas in the United States. *Med Care* 1998;36:1555-1566.
2. Hadley J, Mitchell JM. HMO penetration and physicians' earnings. *Med Care* 1999;37:1116-1127.
3. Hadley J, Mitchell JM, Sulmasy DP, Bloche MG. Perceived financial incentives, HMO market penetration, and physicians' practice styles and satisfaction. *Health Serv Res* 1999;34(1 pt 2):307-321.
4. Simon CJ, Dravone D, White WD. The effect of managed care on the incomes of primary care and specialty physicians. *Health Serv Res* 1998;33(3 pt 1):549-569.
5. Wholey DR, Burns LR, Lavizzo-Mourey R. Managed care and the delivery of primary care to the elderly and the chronically ill. *Health Serv Res* 1998;33(2 pt 2):322-353.
6. Gaskin DJ, Hadley J. The impact of HMO penetration on the rate of hospital cost inflation, 1985-1993. *Inquiry* 1997;34:205-216.
7. Anderson GF, Zhang N, Worzala C. Hospital expenditures and utilization: The impact of HMOs. *Am J Manag Care* 1999;5:853-864.
8. McCue MJ. Association of HMO penetration and other credit quality factors with tax-exempt bond yields. *Inquiry* 1997;34:217-227.



**9. Robinson JC.** HMO market penetration and hospital cost inflation in California. *JAMA* 1991;266:2719-2723.

**10. Robinson JC.** Decline in hospital utilization and cost inflation under managed care in California. *JAMA* 1996;276:1060-1064.

**11. Joesch JM, Wickizer TM, Feldstein PJ.** Does competition by health maintenance organizations affect the adoption of cost-containment measures by fee-for-service plans? *Am J Manag Care* 1998;4:832-838.

**12. Kane RL, Friedman B.** State variations in Medicare expenditures. *Am J Public Health* 1997;87:1611-1619.

**13. Wickizer TM, Feldstein PJ.** The impact of HMO competition on private health insurance premiums, 1985-1992. *Inquiry* 1995;32:241-251.

**14. Wholey DR, Christianson JB, Engberg J, Bryce C.** HMO market structure and performance: 1985-1995. *Health Aff (Millwood)* 1997;16(6):75-84.

**15. Moy E, Mazzaschi AJ, Levin RJ, Blake DA, Griner PF.** Relationship between National Institutes of Health research awards

to US medical schools and managed care market penetration. *JAMA* 1997;278:217-221.

**16. Burns LR, Brazzoli GJ, Dynan L, Wholey DR.** Managed care, market stages, and integrated delivery systems: Is there a relationship? *Health Aff (Millwood)* 1997;16(6):204-218.

**17.** Managed care outlook. HMO penetration tops 70% in largest HMO markets. *Manag Care* 1999;8(2):60.

**18.** *Community Reports: Health System Change.* Washington DC: Center for the Study of Health Systems Change; Fall 2000.

**19.** HMO Database IG62 Interstudy. Boston, MA: Division of Resources, Interstudy.

**20.** *Washington Consumers' Checkbook: Checkbook's Guide to Health Insurance Plans for Federal Employees.* 17th ed. Washington, DC: Washington Center for the Study of Services; 1996.