Managed Care in Dental Markets: Is the Experience of Medicine Relevant?

John B. Hernandez, PhD; Ian Coulter, PhD; Dana Goldman, PhD; James Freed, DDS, MPH; Marvin Marcus, DDS, MPH

Abstract

Objective: *This paper reports on factors that predict the market penetration and growth into the market of both medical and dental managed care, and the relationship between the two.* ***Methods:*** *Using data from the National Association of Dental Plans, the Interstudy Competitive Edge HMO Census, and the Area Resource File from 1987–95, we created an analytic data base covering the dental HMO market, the medical HMO market, dentist and physician supply, and regional market characteristics. Simple correlation analysis and multivariate linear regression using ordinary least-squares techniques were used to predict medical HMO penetration and dental HMO penetration in each state during 1994 and 1995.* ***Results:*** *The results show that although the penetration of dental HMOs has been modest when compared to medicine, its growth is predictable by the same factors, and closely follows the pattern found in medical markets.* ***Conclusions:*** *Despite the observed relationship between medical and dental HMO penetration rates, there are potential barriers to managed care in the case of dentistry that may explain the slower growth to date, and that may ultimately decide the extent of managed care penetration into the dental market. [J Public Health Dent 1999;59(1):24-32]*

Key Words: dental managed care, managed care markets, HMO market penetration.

As the dental profession approaches the 21st century, it finds itself increasingly affected by, and therefore responding to, the demands of the marketplace (1). In many ways dentistry, among the health professions, is exceptionally sensitive to market forces (2), as witnessed by the reduction in the number of enrolled dental students. Third party payers also have emerged as important market forces affecting the practice of dentistry (3,4). From 1967 to 1996 the proportion of dental expenditures covered by dental insurance increased from less than 5 percent to 54 percent (5,6).

Dental coverage, while an attractive benefit for the patient, historically has been considered a bad risk by traditional insurers and employers because of the highly discretionary nature of many dental services that makes them highly susceptible to overutilization and cost escalation (7,8). In fact, it can be argued that the classic justification for insurance—namely, to protect individuals against catastrophic loss by spreading risk across a large population—does not apply for preventive or routine services. Although such arguments are legitimate, failure to cover these services discourages provision of highly effective disease prevention, health promotion, and health maintenance services and instead encourages emphasis on less cost-effective services to combat disease after active onset. As a result, coverage for routine services in general and for dental services has expanded; however, insurers and employers have transferred more of the financial risks to providers, patients, or both. This trend has included the development of contractual provider networks, funding mechanisms involving capitation (9,10), and increased copayments under a variety of managed care systems. For their part, these approaches in some cases have resulted in underutilization and minimal care in some capitation plans and overtreatment in preferred provider organizations (11-17).

Initially, the introduction and growth of dental insurance in dentistry contributed to the economic well being of dentists (1). Traditional indemnity plans, however, provided few incentives for the patient or the dentist to control costs because the employer met the premium of the former while the insurance company covered the fees of the latter. In response to escalating costs and financial risks, employers pressured insurance companies to develop innovative plans that would control health care costs. The result was a confusing array of new plans involving various administrative and financial arrangements with patients and providers (HMOs, PPOs, EPOs, IPAs, RVUs, etc.).

These plans implemented new levels of coinsurance, deductibles, and benefit ceilings for patients on the one hand, and negotiated contracts with providers involving discounted fees, capitation, utilization review, and provider networks on the other hand (18). Where high copayments and low maximums were introduced, more of the risk was transferred to the patient. Where the payment was capitated and the dentist was paid per patient and not per service, the risk was transferred to the dentist (19). A major result of these changes is that dental practice is less autonomous and more complex (20). In the future we can expect to see an increasing influence of third parties on the practice of dentistry. By the late 1980s, alternative delivery systems provided care to less

Send correspondence and reprint requests to Dr. Coulter, UCLA School of Dentistry, 10833 Le Conte Avenue, PO Box 951668, Los Angeles, CA 90095-1668. E-mail: coulter@rand.org. Drs. Coulter, Hernandez, and Goldman are affiliated with the RAND Health Program, Santa Monica, CA, and Drs. Freed and Marcus are with the School of Dentistry, UCLA. Web site: http://www.dent.ucla.edu. Funded by the American Dental Association grant #96-0189. Manuscript received: 4/7/98; returned to authors for revision: 8/17/98; accepted for publication: 3/1/99.

than 3 percent of the population. The predictions are that by the end of the 1990s they will capture 20 percent of the market (1).

Little empirical research has evaluated the impact of managed care in dentistry. Because similar issues arise in medicine, where the impact of managed care has been well studied, it is natural to look to the experience of medicine when attempting to predict the evolution of dental managed care. To date the penetration of managed care in dentistry has been far more modest than in medicine; however, a key issue is whether the penetration of managed care that has been witnessed in medicine will be predictive of what will happen to dentistry (21,22). It is this issue that the present paper sets out to explore.

The remainder of this section evaluates existing theory and empirical research on the key factors shaping geographic managed care markets in medicine and assesses the likely relevance and implications for dentistry. In subsequent sections, we use our knowledge of the existing literature and available data to construct and evaluate empirical models of medical and dental managed care markets. We also discuss the limitations of relying on analogies from medicine to predict the future course of dental managed care in light of key differences between medicine and dentistry, and we suggest avenues for future research.

The Dental Market

Typically, researchers investigate the influence of managed care market forces by looking at the share of the population covered by managed care in particular geographic markets. They then try to explain variation in the "penetration rate" as a function of competing supply and demand forces in the market.

Supply-side Forces. Assuming there are no significant barriers to market entry, the number of managed care plans should be influenced by the perceived profitability of entering the market, which in turn depends on factors such as population size and density. Areas with large urban populations or high-density populations are likely to be attractive to managed care plans because it is easier to form provider networks that can efficiently serve large numbers of enrollees in these locations (23).

The potential supply of managed care is determined by the enrollment capacity of all plans in the market. In areas with an oversupply of dentists, managed care plans are predicted to be more successful at developing large provider networks because providers are likely to be eager to expand their patient base. This effect has been demonstrated to be true in medicine, where the number of total physicians per capita was positively associated with medical HMO growth (23). However, that same study found that the number of medical specialists per capita was negatively associated with medical HMO growth after controlling for the total number of physicians per capita. This finding may be attributable to a more specialty-oriented practice style having developed in some areas that is more resistant to managed care, or by successful mobilization against managed care by specialists in those areas where they are concentrated.

Demand-side Forces. It is widely accepted that the major demand-side force driving the growth of managed care in medicine has been the spiraling increase in the overall cost of medical care. National expenditures on medical care rose from approximately $20 billion in 1960 to over $1 trillion annually in the mid-1990s, far exceeding growth in the consumer price index during that time. National expenditures on dental care have grown far more slowly than the overall health care market during that time, reaching $47.6 billion in 1996 (6). Beazoglou et al. (24) reported that the annual US growth rate of real dental expenditures per person was 3.3 percent from 1950 to 1978, but that it leveled off to virtually zero (+0.2 percent) during the period from 1978 to 1990. The flat growth of national dental care expenditures, in stark contrast to medicine, provides limited but suggestive evidence that there may be less overall demand for cost control—and hence for managed care—in dentistry versus medicine.

The flattening of real per capita dental expenditures during this period is especially remarkable because it occurred during a period of rapid expansion in dental insurance coverage that would be expected to increase expenditure levels (5,25). Microeconomic theory predicts—and empirical evidence from the RAND Health Insurance Experiment has conclusively demonstrated—that providing dental insurance coverage to individuals results in increased dental care consumption and expenditures due to the reduced out-of-pocket expenses associated with insurance (6,26). Indeed, Beazoglou et al. (24) found that dental insurance expansion significantly increased expenditures for dental care over time. However, they also found that this inflationary effect was perfectly counterbalanced by dramatic improvements in oral health mainly stemming from increased use of fluoride dentrifices, fluoridated water, and improved oral hygiene. In light of the gross inflationary impact of dental insurance coverage on expenditures and the tremendous pressures for cost constraint throughout the health care system, it is unclear whether net stability of dental expenditures will successfully dampen the demand for dental managed care in the future.

We now turn to other demand factors that are hypothesized to influence dental managed care penetration in particular geographic markets. Because approximately 80 percent of dental managed care contracts are offered through employment arrangements (27), it is useful to conceptualize managed care plans as being purchased by employers acting as agents for their employees. Employers that offer dental insurance are more likely to offer a dental managed care option, so increased access to any form of dental insurance generally should have a positive impact on dental HMO penetration. Further, we hypothesize that employers will be more receptive to marketing by dental HMOs if a mature local market for medical HMOs already exists. The stimulative effect of medical HMO penetration on dental HMO penetration is likely to operate independently from other factors that influence demand for dental HMOs.

Employer demand for managed care also should depend on the extent to which local dentists are believed to provide overly expensive care, which has been shown in the case of medicine (28-30). In the dental care market, one therefore might expect higher dental managed care penetration in areas with higher overall dental expenses, dental care prices, and dental care utilization per capita.

Aggregate employee preferences for managed care are likely to influ-

ence the success of dental HMO marketing efforts. We hypothesize that these preferences should be closely linked to geographic variations in population characteristics such as per capita income, average health status, and population mobility. The RAND Health Insurance Experiment and other studies have found that higher income persons demand substantially more dental care than low-income persons, with a 10 percent increase in income associated with a 7.5 percent increase in dental care expenditures (26,31). For that reason, dental HMOs may be less attractive in high-income populations that prefer to consume relatively high quantities of care and therefore may be less willing to accept restricted access to costly services or restricted choice of providers (32,33). Population health status may influence decisions between managed care and fee-for-service (32,34). Medical studies have shown that those who expect to be high utilizers of health care—or those with poor health status—place higher value on free choice of provider than others and therefore may be less likely to choose managed care (35). Finally, highly mobile populations (i.e., geographic areas in which residents move frequently) have been found to have higher managed care penetration rates than other areas (36). One reason that residents in highly mobile populations may prefer managed care is that they are less likely to have well-established relationships with providers, and therefore may be more willing to seek care from new providers who participate with managed care provider networks (37).

Methods

In this section, we report on our efforts to construct and evaluate empirical models of medical and dental HMO markets using available data. These models are intended to predict and explain HMO penetration in each market using factors that are hypothesized to be influential based on existing theory and prior empirical studies. We also explicitly test whether the level of medical HMO penetration in geographic markets is independently predictive of future dental HMO growth after other market factors have been taken into account.

To characterize markets for dental and medical HMOs, we linked geographic data from the National Association of Dental Plans (NADP) Dental Benefits Industry Census, the Interstudy Competitive Edge HMO Census, and the Area Resource File. The analytic database created for this study includes available data from 1987 to 1995 on: (1) the dental HMO market, (2) the medical HMO market, (3) dentist and physician supply, and (4) other market characteristics. The unit of analysis for this study is the state level. It would have been preferable to use metropolitan-statistical area (MSA) level data because MSAs most closely represent the actual geographic scope of many insurance markets. However, no substate data currently are available on the dental insurance industry.

The data on the dental HMO market are from a joint survey of the dental insurance industry sponsored by NADP and conducted by Interstudy (27). The 1996 NADP survey was conducted in the fall of that year and provides state enrollment data and provider network data from 144 dental insurance companies across the United States, including 112 dental HMOs. Each dental plan provided information to NADP regarding dental plan organization and state dental HMO enrollment. NADP classifies dental HMO patients as those enrolled in staff, group, and independent practice association (IPA) model HMOs in addition to enrollment in preferred provider organizations (PPOs). Although traditional Delta and Blue Cross dental plans involve contractual relationships with dental providers, the NADP survey defined these plans as indemnity insurers for the purpose of this survey because the payment systems more closely resemble indemnity reimbursement than discounted fee-for-service or capitation payments commonly used by dental HMOs and PPOs. The 20.7 million dental HMO enrollees directly identified by the NADP census are believed by NADP to represent virtually all enrollment in staff, group, and IPA model HMOs; however, reported enrollment in PPO plans may be somewhat underrepresented by NADP data. The dental HMO market is predominantly made up of the IPA model and for-profit plans.

Medical HMO data are from the Interstudy Competitive Edge Database (38). The database reports the results of HMO Census, which has been conducted annually by Interstudy since 1988. This database contains county-level data on managed care enrollment, model type, and location for each HMO in the United States during each year from 1990 to 1994. Interstudy's classification of HMO patients includes those enrolled in staff, group, and IPA model HMOs, but excludes enrollment in PPOs. Interstudy's medical HMO penetration data, while authoritative, thus constitute a narrower conception of managed care than is employed by NADP and in the popular literature, which accounts for the lower medical HMO penetration rates than are reported elsewhere for managed care. Data on the supply of dentists, physicians, and other market characteristics including population estimates, personal income, urban population, and Medicare Part B expenses are county-level data from the Area Resource File (39). In each case, the most recently available data are used.

Creation of the analytic database for this project involved linking state-level data on the dental HMO market with county-level data on the medical HMO market, dentist supply, physician supply, and other population data. Statistical methods included calculating state-level and national statistics for key variables, producing simple, unadjusted Pearson correlation coefficients and constructing multivariate linear regression models using ordinary least-squares (OLS) techniques. All data analysis and statistical modeling were performed using the SAS statistical package.

First, all county-level data were summed within each state to yield state-level variables such as the number of medical HMO enrollees, plans, dentists, physicians, and urban population. Once all county-level data had been aggregated to the state level, they were linked with state data on dental HMO enrollment to form the project's analytic database. State-level per capita variables for dentists, physicians, and population income were derived by dividing the number of each by the state population. HMO penetration rate variables were derived by dividing the number of dental and medical HMO enrollees, respectively, by the state population. Data on Medicare expenditures per capita for Part B were derived by dividing all

Part B Medicare expenditures by the number of Part B enrollees. National level data on key variables were derived by aggregating and dividing state data in the same manner as described above for county data.

Multivariate linear regression models were developed to predict the level of medical HMO penetration and dental HMO penetration in each state. Because of the skewed distribution of medical and dental state HMO penetration rate variables, we developed and tested models using a square root transformation that improved the normality of distribution in addition to testing models that did not transform the dependent variable. To evaluate the robustness of our findings, we also evaluated the impact on parameter estimates of outliers, substituting variables that measured similar concepts (e.g., population density substituted for percent urban population), and excluding independent variables from the model. Given that the findings were relatively insensitive to different model specifications, we have chosen to present results of only the simplest models while noting those findings that varied based on the model specification.

The dental HMO penetration rate in Hawaii was found to be a large, positive outlier when compared to all other states in the United States. To ensure that data from this state did not exert an inappropriate influence on the empirical results, Hawaii was excluded for all correlation and regression analyses. Therefore, all correlation and regression analyses reported here are based on data from 49 states.

Results

National and State-level Summary Data. National level data on dental HMO penetration, medical HMO penetration, per capita dentists, per capita physicians, dentist participation in managed care networks, and other key insurance market variables are presented in Table 1. The national rate of dental HMO penetration grew from 6.8 percent to 7.6 percent from 1994 to 1995; however, penetration remained considerably below the medical HMO penetration rate of 17.8 percent in 1994. There is some evidence of excess capacity in dental HMOs. The average number of enrollees per dental HMO nationally of 26,000 was less than one-third of the average enrollment in medical HMOs of 86,000.

TABLE 1
National Data on US Dental and Medical HMO Markets*

Managed care market variable description	Variable value
Dental HMO penetration rate, 1995†	7.6%
Dental HMO penetration rate, 1994†	6.8%
Medical HMO penetration rate, 1994‡	17.8%
Practicing dentists per 100,000, 1990§	62
General practice dentists per 100,000, 1987§	35
Specialist dentists per 100,000, 1987§	34
Physicians per 100,000, 1990§	213
Primary care physicians per 100,000, 1994§	154
Specialist physicians per 100,000, 1994§	70
Population income per capita§	$20,800
Percent urban population, 1993§	75.1%
Per capita Medicare Part B expenses§	$1,273
Percent of dentists in HMO networks, 1994¶	17.6%
Percent of dentists in any managed care networks (HMOs, PPOs, risk pools), 1994¶	27.6%

*Hawaii and the District of Columbia excluded from the data set for this analysis.
†National Association of Dental Plans, 1996 Census and Directory, Dallas, TX: NADP, 1997.
‡Interstudy Competitive Edge, Competitive Edge Database, Minneapolis, MN: Interstudy Publications, 1997.
§US Bureau of Health Professions, ODAM Area Resource File (ARF), Rockville, MD: Public Health Service, Health Services and Resource Administration, Feb 1996.
¶American Dental Association, Survey Center, Quarterly Survey of Dental Practice, Chicago, IL: ADA, 1994.

As shown in Table 2, considerable variation exists across states on key market variables. Five states have dental HMO penetration rates at or above 15 percent; these states can be classified as more mature markets for dental managed care. Hawaii's 41 percent penetration rate of dental HMOs leads the country by a considerable margin and is explained by the state's unique legislative mandate that employers offer insurance coverage that includes some coverage for dental services. The presence of a state insurance mandate renders Hawaii's managed care market incomparable to that of other states. Four other states have dental HMO penetration rates between 15 percent and 20 percent, including California, Maryland, Arizona, and Florida. These markets also are characterized by more mature and stable penetration of medical HMOs. States with high HMO penetration and a handful of those with medium penetration such as Pennsylvania, Texas, and Illinois typically achieved higher penetration through an increase in the number of enrollees per plan rather than an increase in the number of plans in the market.

Correlation Analysis. Simple, unadjusted Pearson correlation coefficients were calculated for all key variables (Table 3). As expected, a high correlation was found between the penetration rates of medical and dental HMOs and the number of medical and dental HMO plans in a state. The correlation of annual dental and medical HMO growth rates, however, was found to be essentially zero (–0.04, not shown). HMO penetration rates were highly correlated with measures of market size, such as the percent of the population in urban areas, and moderately correlated with per capita income. Location decisions of dentists and physicians are moderately correlated, and both are substantially more likely to locate in high-income areas and urban areas. Interestingly, these associations were less pronounced for dental specialists when compared to general dentists and both primary care and specialist physicians. The correlations between medical HMO penetration and physician supply variables were substantially higher than the correlation between dental HMO penetration and dentist supply. This find-

TABLE 2
Data from Selected States on the Market for Dental Managed Care

State	HMO Penetration Rate		Total # Dental HMOs 1995*	Total Dentists per 100,000, 1990†	Total Physicians per 100,000, 1994†	Enrollees per Dental HMO 1995*
	Dental 1995*†	Medical 1994†‡				
High penetration						
Hawaii	40.9	21.9	10	86	—	50,000
California	19.8	35.3	37	72	237	174,000
Maryland	16.6	33.9	19	78	334	44,000
Arizona	15.3	22.9	18	58	193	35,000
Florida	15.0	17.2	24	55	214	89,000
Medium penetration						
Pennsylvania	9.6	19.2	14	64	261	83,000
Illinois	9.4	16.6	30	64	233	37,000
Oregon	8.7	33.8	18	70	208	15,000
Texas	8.5	10.2	26	53	179	60,000
New Mexico	7.9	13.1	14	47	190	9,000
Oklahoma	7.8	6.9	16	59	152	16,000
Colorado	7.5	27.0	20	76	218	14,000
New Jersey	7.3	11.4	21	86	267	28,000
Connecticut	6.2	20.6	17	86	325	12,000
Minnesota	5.4	25.0	16	72	235	15,000
Wisconsin	5.9	22.8	24	62	204	13,000
Low penetration						
Georgia	4.9	6.6	20	50	181	17,000
Ohio	4.9	16.1	21	56	212	26,000
Michigan	4.6	19.0	22	64	199	20,000
New York	3.9	24.6	19	80	342	38,000
Utah	3.7	24.0	15	66	185	5,000
Tennessee	3.3	10.0	17	56	213	10,119
Virginia	3.1	5.8	21	55	212	9,924
Washington	3.0	17.1	22	71	219	7,528
Kansas	2.9	4.4	16	64	185	4,676
Massachusetts	2.7	35.6	19	75	371	8,608

Note: States with less than 2 percent dental HMO penetration are not shown.
*National Association of Dental Plans, 1996 Census and Directory, Dallas, TX: NADP, 1997.
†US Bureau of Health Professions, ODAM Area Resource File (ARF), Rockville, MD: Public Health Service, Health Services and Resource Administration, 1996
‡Interstudy Competitive Edge, Competitive Edge Database, Minneapolis, MN: Interstudy Publications, 1997.

ing suggests that excess supply of providers plays a stronger role in attracting managed care in the medical HMO market than in the dental HMO market.

Regression Results. OLS regression models were constructed to predict the level of medical HMO penetration in each state during 1994 and dental HMO penetration in each state during 1994 and 1995. The data in each regression model are weighted by state population to improve the efficiency of parameter estimation. The regression results for the medical and dental HMO markets are presented in Tables 4 and 5, respectively. In each case, we present alternative models using the square root transformation of the state HMO penetration rate and an untransformed version of the dependent variable. Model fit is good for all models, with the predictors explaining 70 percent of the variation in medical HMO penetration rates and 75 percent of the variation in dental HMO penetration rates.

In medicine, areas with large numbers of primary care physicians per capita have significantly higher medical HMO penetration rates after controlling for the impact of other factors. The supply of specialist physicians has a negative association with managed care penetration rates during 1994, as predicted, but it is not significant. As predicted, highly urbanized populations have significantly higher medical HMO penetration and high-income populations have significantly lower penetration. All of the previous relationships are in the hypothesized direction. However, the level of Medicare Part B expenditures, which serves as a combined proxy for medical utili-

TABLE 3
Unadjusted Pearson Correlation Coefficients for Key Market Variables

	HMOPenetration			Per Capita				Per Capita Income	% Urban Pop.
	Dental, 1995	Dental, 1994	Medical, 1994	General Dentists	Primary Care MDs	Dental Specialists	Specialist MDs		
Dental HMO penetration, 1995	1.00								
Dental HMO penetration, 1994	.98	1.00							
Medical HMO penetration, 1994	.65	.65	1.00						
General dentists per capita	.18	.19	.58	1.00					
Primary care MDs per capita	.40	.39	.72	.61	1.00				
Dental specialists per capita	.04	.06	.52	.92	.51	1.00			
Specialist MDs per capita	.33	.32	.67	.52	.90	.41	1.00		
Per capita income	.30	.29	.51	.66	.70	.47	.72	1.00	
% urban population	.63	.61	.65	.40	.41	.28	.48	.57	1.00
Medicare Part B expenses per capita	.50	.51	.28	.05	.36	–.23	.49	.42	.51

zation and physician prices, is insignificant and negatively associated with medical HMO penetration. This association is the opposite direction of what was hypothesized.

Models of the dental managed care market also were informative, and findings were largely consistent with those in medicine. Interestingly, the level of medical HMO penetration is the strongest independent predictor of state dental HMO penetration rates even after controlling for all of the variables known to predict HMO penetration in medicine. Areas with more general dentists per capita have significantly higher dental HMO penetration in two of four models. Urban populations also have significantly higher penetration rates. The number of specialty dentists per capita is highly significant and negatively associated with dental HMO penetration, as predicted, even though it is not significant in our models of medical HMO penetration. Although population income is negatively associated with dental HMO penetration in these models, there is a weaker relationship than in medicine and this variable is not statistically significant. When the medical HMO penetration rate is removed from the model of dental HMO penetration as a predictor variable, population income is marginally significant at the $P=.10$ level.

TABLE 4
Results of State Medical HMO Penetration Regressed on Predictor Variables

Variable	Dependent Variable Is Medical HMO Penetration Rate in 1994	
	Square Root Transformation	Untransformed
Primary care physicians per capita	388.38 (95.79)*	361.95 (80.85)*
Specialist physicians per capita	–15.96 (105.46)	–47.81 (79.73)
Population income per capita	–0.017 (0.008)†	–0.015 (0.006)‡
Percent urban population	0.625 (0.125)*	0.457 (0.095)*
Medicare Part B expenses per capita	–0.080 (0.066)	–0.071 (0.050)
Adjusted R^2	.69	.71

Significance level:
*$P=.001$.
†$P=.10$.
‡$P=.05$

We also evaluated additional models to test for the presence of interactions between predictor variables. In our models of dental HMO penetration, we found some evidence to indicate that there may be a significant, negative interaction between medical HMO penetration and per capita general dentists. This interaction term was significant using 1995, but not 1994, data on dental HMO penetration.

TABLE 5
Results of State Dental HMO Penetration Regressed on Predictor Variables

	Dependant Variable Is Dental HMO Penetration Rate			
	Square Root Transformation		Untransformed	
Variable	1995	1994	1995	1994
General dentists per capita	12.04 (6.85)*	14.96 (6.83)†	3.59 (3.60)	4.64 (3.50)
Specialty dentists per capita	–15.24 (4.92)‡	–17.10 (4.96)‡	–7.03 (2.58)‡	–7.49 (2.54)‡
Population income per capita	–0.008 (0.006)	–0.010 (0.006)	–0.003 (0.003)	–0.003 (0.003)
Percent urban population per capita	0.44 (0.11)§	0.45 (0.11)§	0.20 (0.06)§	0.19 (0.06)‡
Medical HMO penetration rate in previous year	0.61 (0.13)§	0.65 (0.14)§	0.41 (0.07)§	0.42 (0.07)§
Adjusted R^2	.75	.75	.76	.75

Significance level:
*P=.10.
†P=.05.
‡P=.01.
§P=.001.

Other coefficients were unaffected by the inclusion or exclusion of this interaction term. This finding suggests an avenue for future research.

Discussion

We have demonstrated that similar factors predict HMO penetration in medicine and dentistry. Our findings are largely consistent with existing theory and empirical data covering time periods during the early stages of managed care penetration in medicine. In addition, our results show that the level of medical HMO penetration is a strong, independent predictor of dental HMO penetration even after other supply and demand predictors have been taken into account. This finding provides evidence to support our hypothesis that there would be an independent stimulative effect of medical HMO penetration on dental HMO penetration due to the existence of proven employer demand for managed care and an established mature market infrastructure for managed care.

A few findings were unexpected. While the supply of generalists has a consistently positive association with HMO penetration and the supply of specialists has a negative association with HMO penetration in all models, the significance of these variables is inconsistent between medicine and dentistry. We find that association between the supply of generalists and HMO penetration is stronger in medicine than dentistry, and speculate that there may be less excess supply of generalists in dentistry to attract managed care plans or fewer incentives for generalists to participate in managed care.

Regarding the supply of specialists, we note that empirical evidence from a study conducted during an earlier stage of medical managed care evolution found that the supply of specialists was a significant negative predictor of HMO penetration (22). We speculate that medical specialists may have been effective in organizing resistance to prevent the penetration of managed care plans during the early stages of managed care, but that this influence has not persisted over time as the managed care market evolved. Recent reports of medical specialists relocating to areas where there is less managed care penetration provide evidence supporting this hypothesis. Given the relatively early stage of managed care development in dentistry to date, it is perhaps not surprising that the supply of dental specialists continues to be a significant negative predictor of dental managed care penetration. If the experience of medicine is predictive, this influence may be short-lived.

We found that per capita state Medicare Part B expenditures, our combined proxy for medical utilization and physician prices, was not a significant positive predictor of medical HMO penetration, in contrast to prior studies carried out during the 1970s and 1980s, when managed care was at an earlier stage in its evolution (28-30). Instead, our results showed a negative association between average expenditures and medical HMO penetration. More recent research has shown that managed care has reduced the growth of medical care expenditures across a wide range of services (40-42), rather than simply shifting costs to the fee-for-service sector. In light of these findings, we suspect geographic expenditures now largely reflect the impact of managed care on provider practice behavior, rather than the other way around, as previously hypothesized. If expenditure levels and managed care penetration are endogenously determined, then arguably medical expenditures should not be included in our medical HMO penetration model. We note that other variable coefficients are not sensitive to the inclusion or exclusion of expenditures in the model.

Although we hypothesized that higher dental expenditures—a proxy for dental prices and utilization—should predict higher penetration of dental HMOs after controlling for other factors, no geographic data are available on any of these variables. We therefore were unable to assess the influence of dental expenditures on dental HMO penetration, and our models of dental HMO penetration are underspecified. We explored using Medicare Part B expenditures in our models of dentistry as a rough proxy for local dental expenditures, but ultimately decided to drop this variable from our models because it was a very

indirect proxy for dental expenditures and because it performed poorly in our models of medical HMO penetration. If dental expenditures are positively correlated with population income, then omitting dental expenditures from the model should bias the population income variable toward zero (43). This possibility may or may not account for the significance of population income in our models of medical HMO penetration, but not dental HMO penetration. When we included Medicare Part B expenditures in our exploratory dental models as a rough proxy for dental expenditures, population income became marginally significant at the $P=.10$ level in two of four exploratory models (not shown). This expenditure proxy was positive but insignificant, and no other coefficients were sensitive to inclusion or exclusion of this variable.

The evidence examined in this paper suggests that low demand for dental managed care rather than supply-side constraints is primarily responsible for the small penetration of dental HMOs in most markets to date. The relatively large number of dental HMOs in each state and high overall dentist participation in managed care networks when compared with patient enrollment in HMOs imply a capacity for supply growth in managed care provider networks. Consistent with this evidence, a recent American Dental Association survey found that only 11 percent of dentists who refused to participate in managed care networks cited an adequate patient base as the reason (44).

Will manage care come to dominate the market for dental benefits, much in the same manner that has occurred in the medical care sector? This paper has examined some of the assumptions and evidence that underlie the argument for managed care predominance in dentistry. Clearly, the penetration into dentistry by managed care, although currently at rates well below medicine, is following the same pattern. To the extent that dental managed care continues to follow in the footsteps of medicine, we can expect that the proliferation of managed care plans with excess network capacity will continue in early stage markets. In the short term, PPOs may have greater potential for growth because they utilize networks of existing dental offices. As markets mature, a process of market consolidation will take place that now is beginning to be seen in the dramatic increases in average plan size in most high penetration and some medium penetration states.

However, numerous potential barriers to the evolution of managed care that are specific to dentistry may lead to slower future penetration of HMOs in dentistry versus medicine. Key differences between medical and dental care include the lower proportion of the population covered by dental versus medical insurance, the relative stability of dental expenditures when compared to skyrocketing medical expenditures during the past three decades, and the relative infrequency of acute care service provision in dentistry versus medicine. The dental HMO market may be viewed as less attractive to potential HMO market entrants because there is a smaller established market for dental insurance both in terms of the number of insured enrollees and total potential premium dollars.

As discussed previously, the stability of net dental expenditures over time also may create less perceived need to contain costs, even though insurance coverage has had a gross positive impact on expenditures. Finally, a lower cost savings might be generated by managed care in dentistry versus medicine. The vast majority of savings achieved by medical HMOs to date have been for acute, inpatient services (e.g., reducing the length of hospital stays and the rates of expensive hospital procedures), rather than preventive and wellness-oriented services that characterize most dental services. This source of savings in medicine suggests that dental HMOs may find savings to be more elusive than medical HMOs.

Our models of state dental HMO penetration do a relatively good job explaining the state-level penetration growth. However, some degree of caution is warranted in extrapolating from these results. First, the ability to extend findings from our analysis to the PPO market is limited because our data from the medical care sector exclude PPO enrollment. More importantly, analyses need to be conducted at disaggregated levels (e.g., metropolitan areas) because health plan decisions often are made at the local level. That said, it also is common for managed care plans to make decisions to enter or leave markets at the state level based on such factors as state legislation or regulations that are designed to improve accountability and access to care and may render a state more or less hospitable to managed care (29). Obtaining adequate substate data on managed care enrollment has been a problem in medicine as well as dentistry. Due to problems with substate medical HMO enrollment data, prior studies to predict medical HMO penetration rates have conducted analysis at the state-level as we have done (e.g., 28). Research shows that aggregated state-level estimates based on Interstudy HMO data—the technique relied upon by this study—accurately measure market share (45). Valid geographic data are needed on additional factors that may influence managed care growth, and additional research should investigate the interrelationships between dental HMO competition and important societal outcomes including the quality of patient care, patient satisfaction, dental health outcomes, utilization, and expenditures.

References

1. Bailit HL, Bailit JL. Corporate control of health care: impact on medicine and dentistry. J Dent Educ 1988;52:108-13.
2. Tekavec MM. Metamorphosis of dentistry. Dent Clin N Am 1988;32:1-15.
3. Horin NS, Antopolsky E. A new concept in a dental plan. Dent Clin N Am 1987;31: 239-42.
4. Burakoff RP. Dentistry and health maintenance organizations. Spec Care Dent 1988;8:163-6.
5. Schoen M. Capitation in dentistry: original concepts and current reality. J Public Health Policy 1991;51:199-208.
6. Office of National Health Statistics, Baltimore, MD: Health Care Financing Administration, DHHS, 1996.
7. Pauly MV. The economics of moral hazard: comment. Am Econ Rev 1968;58:531-7.
8. Arrow K. Uncertainty and the welfare economics of medical care. Am Econ Rev 1963;53:941-73.
9. Davis MH, Schechter BL. The dentist and prepaid capitated systems. Dent Clin North Am 1987;31:225-37.
10. Calkins DH, Turner LT, Brady RJ. Network capitation plans: an operational perspective. Dent Clin N Am 1987;31: 209-23.
11. Holloway PJ, Lennon MA, Mellor AC, Coventry P, Worthingham HV. The capitation study 1. Does capitation encourage "neglect"? Br Dent J 1990;3:119-21.
12. Lennon MA, Worthington HV, Mellor AC, Holloway PJ. The capitation study. 2. Does capitation encourage more prevention? Br Dent J 1990;5:213-15.
13. Mellor AC, Coventry P, Holloway PJ,

Lennon MA. The capitation study 3. The views of participating dentists and the profession. Br Dent J 1990;383-5.
14. DePorter DJ, Marcus M, Jacobson JJ. A comparison of potential treatment costs for group capitation versus voluntary individual enrollment plans. J Dent Educ 1988;52:605-8.
15. Schoen MH, Atchison KA. Measurement of dollar value of services in a capitated dental plan. Quality Assurance Utilization Rev 1992;7:59-64.
16. Atchison KA, Schoen MH. A comparison of quality in a dual-choice plan: capitation versus fee-for-service. J Public Health Dent 1990;50:186-93.
17. Marcus M. Quality assurance and prepaid programs. Dent Clin N Am 1985; 29:487-506.
18. Hazelkorn HM. A comparison of dental treatment plans under different reimbursement systems. J Public Health Pol 1985;6:223-35.
19. Marcus M, Coulter I, Freed J, Atchison K, Gershen J, Spolsky V. Managed care in dentistry: promises and problems. J Am Dent Assoc 1995;126:439-46.
20. Public Health Service. Toward improving the oral health of Americans: an overview of oral health status, resources, and care delivery. Bethesda, MD: Oral Health Coordinating Committee, Public Health Service, 1993.
21. Capilouto E. Market forces driving health care reform. J Dent Educ 1995;59: 480-3.
22. Stein RM. Lessons from medicine: an economist's perspective. J Dent Educ 1996;60:368-72.
23. McLaughlin CG. The effect of HMOs on overall hospital expenses: is anything left after correcting for simultaneity and selectivity? Health Serv Res 1988;23:421-41.
24. Beazoglou T, Brown LJ, Heffley D. Dental care utilization over time. Soc Sci Med 1993;37:1461-72.
25. Office of National Health Statistics. Baltimore, MD: Health Care Financing Administration, DHHS, 1992.
26. Manning WG. The demand for dental care: evidence from a randomized trial in health insurance. J Am Dent Assoc 1985; 110:895-902.
27. National Association of Dental Plans, 1996 Census and Directory. Dallas, TX: NADP, 1997.
28. Goldberg LG, Greenberg W. The determinants of HMO enrollment and growth. Health Serv Res 1981;16:421-38.
29. Welch WP. HMO enrollment: a study of market forces and regulations. J Health Polit Policy Law 1984;8:743-58.
30. McNeil R Jr, Schlenker RE. HMOs, competition and government. Milbank Mem Fund Q/Health Soc 1975;53:195-221.
31. Hu T. The demand for dental care services, by income and insurance status. In: Advances in health economics and health services research. Vol 2. Greenwich, CT: JAI Press, 1981.
32. Juba DA, Lave JR, Shaddy J. An analysis of the choice of health benefits plans. Inquiry 1980;17:62-71.
33. Welch WP, Frank RG. The predictors of HMO enrollee populations: results from a national sample. Inquiry 1986;23:16-22.
34. Christianson J. The impact of HMOs: evidence and research issues. J Health Care Polit Policy Law 1980;5:354-67.
35. McLaughlin CG. HMO growth and hospital expenses and use: a simultaneous-equation approach. Health Serv Res 1987;22:183-205.
36. Goldberg LG, Greenberg W. The determinants of HMO enrollment and growth. Health Ser Res 1981;16:421-38.
37. Berki SE, Ashcraft ML. HMO enrollment: who joins what and why: a review of the literature. Milbank Mem Fund Q/Health Soc 1980;58:588-632.
38. Interstudy Competitive Edge. Competitive Edge Database. Minneapolis, MN: Interstudy Publications, 1997.
39. US Bureau of Health Professions. ODAM Area Resource File (ARF). Rockville, MD: Public Health Service, Health Services and Resource Administration, 1996.
40. Robinson JC, Luft HS. Competition, regulation, and hospital costs, 1982 to 1986. JAMA 1988;28:555-85.
41. Melnick GA, Zwanziger J. State health care expenditures under competition and regulation, 1980-1981. Am J Public Health 1995;85:1035-50.
42. Zwanziger J, Melnick GA, Bamazai A. Costs and price competition in California hospitals, 1980-1990. Health Aff 1994;13:118-26.
43. Weisberg S. Applied linear regression. 2nd ed. New York: Wiley and Sons, 1985.
44. American Dental Association, Survey Center. Quarterly survey of dental practice. Chicago, IL: ADA, 1994.
45. Baker LC. County-level measures of HMO enrollment and market share (mimeo). Stanford, CA: Stanford University, 1994.