Medical Care Expenditures Under Gatekeeper and Point-of-Service Arrangements

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Objective. To compare expenditures for medical care in a closed-panel gatekeeper HMO and an open-panel point-of-service (POS) plan that share the same provider network.

Data Sources/Study Setting. The two study HMOs are distinct product lines of a single managed care organization; both plans are commercial products. We used administrative data files from the study plans for 1994–95 to assess differences in total medical care expenditures and spending for five categories of services: physician services, inpatient hospital services, outpatient hospital services, prescription drugs, and other services.

Study Design. Multivariate analyses were based on the two-part model of the demand for medical care. The dependent variables in these models were expenditures in each of the five categories of services, and the independent variables were indicator variables for plan type and visit copayments, prescription drug copayment, distance to the nearest primary care physician (PCP), demographic characteristics, chronic conditions, area characteristics, and entry/exit indicator variables.

Principal Findings. Total expenditures for medical care ranged from equal in both plans to 7 percent higher in the gatekeeper HMO ($p < .10$), depending on the copayments for physician visits. Expenditures were not higher in the POS plan for any of the five categories of services. These findings were robust to a wide range of sensitivity analyses.

Conclusions. Direct patient access to specialists in POS plans does not necessarily result in higher medical care expenditures. When POS enrollees are required to choose PCPs, patient cost sharing, physician financial incentives, and utilization review may control expenditures without constraining direct patient access to providers.

Key Words. Access, gatekeeper HMO, point-of-service HMO, medical care expenditures, managed care

Freedom of choice in selecting providers is a distinguishing characteristic of traditional indemnity insurance. Unrestricted access, coupled with a lack of incentives for limiting utilization, has historically resulted in high rates of spending for medical care. The growth of managed care in recent years is due in large part to a desire on the part of employers and other purchasers to reduce medical care expenditures.

Traditional health maintenance organizations (HMOs) use a variety of mechanisms for controlling utilization and expenditures, including selective contracting, sharing of financial risk with providers, and utilization review (Gold, Hurley, Lake, et al. 1995; Remler, Donelan, Blendon, et al. 1997). An additional prominent feature of many traditional HMOs is the use of closed provider panels and primary care physician (PCP) "gatekeepers" who must approve referrals to specialists as well as many surgical procedures and diagnostic tests. Original estimates, principally from demonstration projects in the 1980s, suggested that adding a primary care gatekeeper to a managed care plan could reduce costs by as much as 15 percent relative to indemnity insurance (e.g., Moore 1979; Richardson, Martin, Moore, et al. 1982; Bonham and Barber 1987; Martin et al. 1989; Hill et al. 1992). More recent evidence suggests that, compared with patients who have indemnity insurance, HMO enrollees have lower rates of hospitalization, inpatient diagnostic testing, elective surgery, and costly tests and procedures; shorter hospital stays; and lower medical care expenditures (Manning, Leibowitz, Goldberg, et al. 1984; Miller and Luft 1994, 1997; Chernew 1995).

However, much of the recent growth in managed care enrollment has been in plans such as preferred provider organizations (PPOs) and point-of-service (POS) HMOs, which have open physician panels and allow patients relatively free access to providers. In 1988, 18 percent of workers were enrolled in HMOs, and 11 percent were enrolled in PPOs and POS plans combined; by 1995, 28 percent of workers were enrolled in HMOs, 25 percent in PPOs, and 20 percent in POS plans (Gold 1999). Unlike traditional HMOs, POS plans provide generous coverage for patient self-referral to specialists

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and other providers both within and outside the network. Additional growth in plans that offer direct access to specialists may be fueled by patient bill of rights legislation.

Although the shift toward greater provider choice seems at odds with efforts to control health care costs, in fact little objective information exists on how alternative managed care models affect expenditures for medical care. This article assesses medical care expenditures in two different managed care models: a closed-panel gatekeeper HMO and an open-panel POS plan. We compared expenditures for several categories of services including physician services, inpatient and outpatient hospital services, and prescription drugs. To our knowledge, this is the first study to conduct a comprehensive analysis of spending in a POS plan compared with a more traditional HMO that uses primary care gatekeepers.

DATA AND METHODS

Setting

The study plans are distinct product lines of a single managed care organization located in an upper Midwestern metropolitan area, where their market penetration is 15 percent. Both plans are commercial products (i.e., they have no Medicaid or Medicare enrollees) and share the same provider network. Network physicians are independent contractors, not employees of the managed care organization. The majority of the network physicians are in solo practice or in small, single-specialty groups, whereas the remainder practice in multispecialty groups. The physician network includes 1,152 PCPs and 1,692 specialists. The plans also contract with 25 hospitals and 425 pharmacies.

Enrollees in the gatekeeper HMO must obtain health care through a PCP and are required to have PCP referrals to see specialists and obtain certain tests and procedures. Enrollees in the POS plan also select a PCP from whom they are encouraged to obtain all routine care and referrals, but they enjoy generous coverage for self-referrals to specialists and other providers within the network as well. Both study plans have required copayments for PCP visits and PCP-referred specialty visits that range from $0 to $15, depending on the employer contract. However, POS members pay only an incremental copayment averaging $5 to $10 for self-referred specialist visits.[1] In addition, POS members can use providers outside the network, although they face an average deductible of $200 and a 20 percent coinsurance. Copayments for prescription drugs range from $0 to $15. There is no cost

sharing for surgical procedures, diagnostic tests, hospitalizations, or physician services provided in inpatient settings.

Network physicians and nonphysician providers are paid on a discounted fee-for-service basis, and PCPs receive a year-end bonus based on performance. Both study plans include an evaluation of each PCP's referral patterns in the bonus criteria and provide feedback to PCPs on their referral patterns. Hospitals are paid on the basis of discounted charges. The study plans carve out and capitate mental health and substance abuse services (including services provided by psychiatrists), physical therapy and rehabilitation services, and optometric and chiropractic services.

Data and Study Sample

The main sources of data for this study were 1994–95 administrative files of the two study plans. The study sample included 16,819 working-age members (ages 18 to 64) of the gatekeeper HMO and 39,135 working-age members of the POS plan. Members in the sample were primary insureds who had continuous coverage for at least 365 days during the two-year period from January 1, 1994 through December 31, 1995.[2] Enrollment files from the study plans were used to obtain each person's dates of enrollment, age, sex, zip code of residence, and copayments for ambulatory visits and prescription drugs. Facility claims files were used to identify services provided by institutional providers, including hospitals, ambulatory surgery centers, skilled nursing facilities, hospices, laboratories, diagnostic imaging centers, home health care providers, and medical equipment providers; the type of provider who provided each service; and the charge for each service. Provider claims files were used to identify services provided by physicians and nonphysician providers (AMA 1995), the specialty of the physician or type of nonphysician provider who provided each service, and the charge for each service. Pharmacy claims files were used to identify each person's prescriptions and prescription drug charges. The claims files for the POS plan included claims for both PCP-referred and self-referred services. We had no information on other health insurance plans available to HMO members through their employers.

We used the claims data to determine each person's charges for the following five categories of services: (1) physician services, which includes charges for all services provided by physicians except psychiatrists (see below); (2) inpatient hospital services, which includes facility charges for inpatient hospital stays; (3) outpatient hospital services, which includes facility charges from hospital outpatient departments and ambulatory surgery centers; (4) prescription drugs, which includes charges for filled prescriptions;[3]

and (5) other services, which includes facility charges from skilled nursing facilities, laboratories, and diagnostic imaging centers; charges for home health care services, hospice services, medical equipment, and transportation; and charges for services provided by nonphysician providers including physician assistants, nurse practitioners, podiatrists, dieticians, nutritionists, speech therapists, occupational therapists, and audiologists. Charges for capitated services were excluded from the calculations because claims for these services were incomplete. Therefore, the charge totals excluded charges for mental health and substance abuse services (including psychiatrists' services), physical therapy and rehabilitation, and services provided by optometrists and chiropractors.

To construct the analytic file, we arranged the data for each person into "person-years" based on duration of enrollment. Thus, persons who were enrolled in a study plan for the entire two-year period of the data contributed two observations to the analytic file. Although most individuals in the sample were enrolled in a study plan for exactly one or exactly two years, some persons were enrolled for one year plus a fraction. We included one observation in the analytic file for each of these persons based on his or her first 365 days of enrollment and ignored the fractional year.[4] The final analytic file consisted of 83,115 observations corresponding to person-years of enrollment. Table 1 shows the visit copayments used by the study plans and the number of person-years subject to each copayment level. In preliminary analyses, we found no differences in expenditures between POS enrollees with copayments of $10 for PCP and PCP-referred specialist visits and $15 for self-referred visits and POS enrollees with copayments of $10 for PCP and PCP-referred specialist visits and $20 for self-referred visits. Therefore, we combined these two groups in all subsequent analyses. Zip code–level data from the 1990 census were used to assess the characteristics of the areas where plan enrollees resided.

Empirical Model

Our goal was to assess the effect of type of plan and visit copayments on annual expenditures for medical care, controlling for other factors that may affect the demand for care. Therefore, we estimated multivariate regression models for the following dependent variables: expenditures for physician services, expenditures for inpatient hospital services, expenditures for outpatient hospital services, expenditures for prescription drugs, and expenditures for other services. Expenditures were calculated as the sum of the charges reported on the relevant category of claims.[5]

Table 1: Number of Person-Years by Managed Care Model and Visit Copayment Level*

Copayments (PCP, Self-Referred Specialist Visit)	*Gatekeeper HMO*	*POS Plan*
$0	20,670	–
$10	5,213	–
$0, 20%	–	19,863
$10, $15	–	30,007
$10, $20	–	2,038
$15, $20	–	5,324
Total no. of person-years	25,883	57,232

*For a particular person the copayments for PCP and PCP-referred specialist visits are always the same. For the POS plan the second dollar amount (or percentage) is the copayment (or coinsurance) for self-referred visits.

The key independent variables in the models were binary indicator variables for the five combinations of plan type and visit copayments. Covariates included prescription drug copayment, distance to the nearest PCP, demographic characteristics, chronic conditions, area characteristics, and entry/exit indicator variables.

Demographic characteristics in the regression models included binary indicator variables for sex and age categories and their interactions. We assessed chronic conditions using an updated version of the Chronic Disease Score (CDS) (von Korff, Wagner, and Saunders 1992; Clark, von Korff, Saunders, et al. 1995; Johnson, Hornbrook, and Nichols 1994),[6] which identifies conditions based on the drug prescriptions that patients fill over a defined period. We used the CDS to construct a set of binary indicator variables for 17 chronic conditions that occurred with sufficient frequency to be included in the models. Zip code–level variables in the models included per capita income, percentage minority, and fraction of high school and college graduates. We included binary indicator variables for persons who entered or exited the study plan over the two-year period of the data to account for potential start-up or impending disenrollment effects on demand. Last, to improve the fit of the models we included selected interactions between plan type and prescription drug copayment, chronic conditions, or age based on tests of statistical significance.[7]

Estimation

Multivariate analyses were based on the two-part model of the demand for medical care (Manning, Morris, Newhouse, et al. 1981; Manning, Newhouse,

Duan, et al. 1987; Duan et al. 1982). The first part of the two-part model is an equation for whether an individual has nonzero expenditures in a particular category of physician services during the year and is estimated using probit regression. This equation, which separates users of services from nonusers, assesses the factors that influence the decision to spend on services.[8] From a statistical viewpoint it also deals with the fact that a large proportion of the population may not incur any expenditures during a year. The second part of the two-part model is an equation for the logarithm of expenditures conditional on nonzero expenditures and is estimated using ordinary least squares. This equation assesses the factors that affect the level of expenditures among those who use services. The logarithmic transformation of the dependent variable deals with the marked skewness of the distribution of expenditures and results in more robust estimates (Manning, Morris, Newhouse, et al. 1981; Manning, Newhouse, Duan, et al. 1987; Duan et al. 1982).

Many enrollees contributed two person-years to the analyses. Further, most of the PCPs who cared for the patients in the study sample cared for more than one enrollee. Therefore, standard errors of the regression coefficients in both equations were corrected for clustering within enrollee and within PCP.

Simulations

We used the coefficient estimates from the two-part models to obtain the predicted annual expenditures per person in each category of services under each of the five combinations of plan type and visit copayments, adjusted for other factors that may affect demand. First, we used the estimated coefficients from the first part of the model to predict the probability of nonzero expenditures for each person i, $E[p_i(\text{Exp}_i > 0)]$, under each plan type–copayment combination by substituting the person's covariate values and alternately switching each plan-copayment indicator variable on and off. Similarly, we used the estimated coefficients from the second part of the model and the heteroskedastic smearing retransformation (Duan 1983; Mullahy 1998) to predict conditional expenditures (i.e., conditional on nonzero spending) for person i, $E(\text{Exp}_i|\text{Exp}_i > 0)$, under each plan type–copayment combination. Second, we predicted unconditional expenditures for patient i, $E(\text{Exp}_i)$, under each plan type–copayment combination as:

$$E(\text{Exp}_i) = E[p_i(\text{Exp}_i > 0)] \times E(\text{Exp}_i|\text{Exp}_i > 0).$$

Third, for each plan type–copayment combination we averaged the individual predictions of unconditional expenditures across all persons in the study sample. Following Manning, Newhouse, Duan, et al. (1987) we used the

delta method (Bishop, Fineberg, and Holland 1975) to derive the standard errors of the predicted annual expenditures per person and the statistical tests of differences in expenditures across combinations of HMO type and visit copayments.

We obtained predicted annual total medical care expenditures per person under each of the five combinations of plan type and visit copayments by summing the predicted expenditures across the five categories of services. Standard errors of predicted total expenditures per person and statistical tests of differences in total expenditures across combinations of plan type and visit copayments were obtained using the variances of the predicted expenditures for the individual categories and correlation coefficients derived through a bootstrapping technique (Efron 1982).[9] This article presents the findings of the simulations. Full regression results are available from the authors on request.

RESULTS

Descriptive Data

About 83 percent of enrollees in the gatekeeper HMO used physician services annually, compared with 74 percent of enrollees in the POS plan ($p < .001$). Gatekeeper HMO members averaged 3.6 ambulatory visits to physicians per year, compared with 2.7 visits for POS plan members ($p < .001$). About 5.7 percent of gatekeeper HMO members and 4.5 percent of POS plan members had inpatient hospital stays each year ($p < .001$). In addition, 37 percent of gatekeeper HMO members and 32 percent of POS plan members were treated in hospital outpatient departments or ambulatory surgery centers each year ($p < .001$). About 65 percent of gatekeeper HMO members and 53 percent of POS plan members received prescription drugs each year ($p < .001$). Overall, 87 percent of enrollees in the gatekeeper HMO used some type of medical care annually, compared with 78 percent of enrollees in the POS plan ($p < .001$).

Mean annual expenditures for each category of services by type of plan and visit copayments are reported in Table 2. Unadjusted expenditures were substantially higher in the gatekeeper HMO. Specifically, gatekeeper HMO enrollees had 25 percent higher expenditures for physician services ($p < .001$), 23 percent higher inpatient hospital expenditures ($p < .01$), 30 percent higher outpatient hospital expenditures ($p < .001$), 43 percent higher prescription drug expenditures ($p < .001$), and 41 percent higher expenditures for other services ($p < .001$) than persons in the POS plan. Total medical care

expenditures were 29 percent higher in the gatekeeper HMO ($p < .001$). However, the distribution of spending across service categories was similar in the two plans. Approximately one-third of total medical care expenditures were for physician services, just over one-fourth were for inpatient hospital services, about one-fifth were for outpatient hospital services, and about one-tenth were for prescription drugs under both plan types. About 3.1 percent of total medical care expenditures in the POS plan were due to services obtained through patient self-referral. By category of services this proportion ranged from 1.2 percent for inpatient hospital expenditures to 5.4 percent for physician services expenditures.

Table 3 presents sample means for the covariates in the regression models by type of plan. Enrollees in the gatekeeper HMO were slightly older than POS enrollees (mean age 41.5 vs. 39.4 years). The gatekeeper HMO also had a higher proportion of women and higher rates of the chronic conditions. Over the two-year period of the data the POS plan exhibited higher rates of entry and lower rates of disenrollment compared with the gatekeeper HMO.

Regression Results

Table 4 reports predicted annual expenditures for each category of services by type of plan and visit copayments, adjusted for differences in the covariates that were included in the regression models. (Predicted annual expenditures

Table 2: Mean Annual Expenditures ($) by Managed Care Model and Visit Copayment Level*

	Physician Services	*Inpatient Hospital Services*	*Outpatient Hospital Services*	*Prescription Drugs*	*Other Services*	*Total Expenditures*
Gatekeeper HMO						
\$0 ($N = 20,670$)	893	694	544	290	241	2,661
\$10 ($N = 5,213$)	802	637	506	242	175	2,364
Total ($N = 25,883$)	874	682	536	281	228	2,602
POS plan						
\$0, 20% ($N = 19,863$)	730	522	438	213	157	2,060
\$10, \$15/\$20 ($N = 32,045$)	681	571	402	188	161	2,003
\$15, \$20 ($N = 5,324$)	668	587	402	182	180	2,019
Total ($N = 57,232$)	697	555	414	196	161	2,025

*For a particular person the copayments for PCP and PCP-referred specialist visits are always the same. For the POS plan the second dollar amount (or percentage) is the copayment (or coinsurance) for self-referred visits.

Table 3: Sample Means for Covariates by Managed Care Model

	Gatekeeper HMO (N = 25,883)	*POS Plan (N = 57,232)*
Prescription drug copayment ($)	5.486	7.931
Miles to nearest PCP	.344	.402
Male	.562	.641
Age Distribution (years)		
18–24	.037	.085
25–34	0.242	.288
35–44	.352	.306
45–49	.141	.119
50–54	.095	.089
55–59	.073	.071
60–64	.060	.042
Plan Entry/Exit		
Entry	.179	.321
Exit	.167	.036
Area Characteristics (Zip Code)		
Per capita income (ln)	9.58	9.59
% minority	15.05	12.90
% high school graduate	80.37	80.29
% college graduate	20.78	20.54
Chronic Conditions		
Depression	.057	.041
Hyperlipidemia	.041	.026
Psychotic illness	.011	.008
Asthma/chronic lung disease	.051	.040
Cardiac disease*	.006	.003
Heart disease/hypertension*	.076	.054
Hypertension*	.086	.058
Crohn disease/ulcerative colitis	.004	.003
Diabetes	.025	.020
Epilepsy	.008	.007
Glaucoma	.005	.003
HIV/AIDS	.005	.004
Malignancies	.008	.006
Anxiety	.030	.021
Thyroid disorders	.017	.012
Acid peptic disease	.074	.056
Vascular disease	.009	.007

*Cardiac disease represents patients who take drugs that are used only for heart disease. Hypertension represents patients who take drugs that are used mainly for hypertension. Heart disease/hypertension represents patients who take drugs that are often used for either condition.

were derived from the simulations, as described earlier.) Total medical care expenditures were slightly higher in the gatekeeper HMO than in the POS plan, although covariate adjustment largely eliminated the substantial spending gap observed in the unadjusted data (see Table 2).

Effect of Managed Care Model. To understand better the independent effect of the managed care model on expenditures, we compared predicted annual expenditures in the two study plans at similar visit copayment levels (see Table 5). With $0 copayments for PCP and PCP-referred specialist visits, expenditures for prescription drugs were significantly higher in the gatekeeper HMO ($p < .01$). However, no other statistically significant differences were found in expenditures. In particular, total medical care expenditures were identical in the two plans. With $10 copayments for PCP and PCP-referred specialist visits, expenditures for physician services ($p < .05$), outpatient hospital services ($p < .05$), prescription drugs ($p < .01$), and other services ($p < .10$) all were significantly higher in the gatekeeper HMO. In addition, total medical care expenditures were 7 percent higher in the gatekeeper HMO ($p < .10$).

Table 4: Predicted Annual Expenditures ($) by Managed Care Model and Visit Copayment Level, Adjusted for Covariates*

	Predicted Expenditures					
	Physician Services	*Inpatient Hospital Services*	*Outpatient Hospital Services*	*Prescription Drugs*	*Other Services*	*Total Expenditures*
Gatekeeper HMO						
$0	842	571	462	233	188	2,296
	(19)	(31)	(23)	(4)	(11)	(56)
$10	800	570	502	220	191	2,282
	(24)	(46)	(32)	(5)	(12)	(74)
POS plan						
$0, 20%	824	594	467	215	187	2,288
	(16)	(36)	(22)	(4)	(9)	(59)
$10, $15/$20	749	574	444	196	179	2,142
	(18)	(36)	(20)	(4)	(8)	(52)
$15, $20	714	604	447	179	175	2,119
	(27)	(63)	(26)	(6)	(10)	(87)

*For a particular person the copayments for PCP and PCP-referred specialist visits are always the same. For the POS plan the second dollar amount (or percentage) is the copayment (or coinsurance) for self-referred visits. Covariates include prescription drug copayment, distance to the nearest PCP, demographic variables, chronic conditions, area characteristics, and indicator variables for plan entry and exit. Standard errors are in parentheses.

Table 5: Differences in Predicted Annual Expenditures ($) by Managed Care Model and Visit Copayment Level, Adjusted for Covariates †

		Predicted Expenditures					
Managed Care Model	*Copayment*	*Physician Services*	*Inpatient Hospital Services*	*Outpatient Hospital Services*	*Prescription Drugs*	*Other Services*	*Total Expenditures*
Gatekeeper (A)	$0	842	571	462	233	188	2,296
POS (B)	$0, 20%	824	594	467	215	187	2,288
Difference (A − B)‡		18	−24	−5	17***	2	8
		(21)	(41)	(17)	(6)	(6)	(60)
Gatekeeper (A)	$10	800	570	502	220	191	2,282
POS (B)	$10, $15/$20	749	574	444	196	179	2,142
Difference (A − B)‡		51**	−4	58**	24***	12*	140*
		(24)	(52)	(25)	(6)	(7)	(80)

*Significantly different from zero at 10% level.

**Significantly different from zero at 5% level.

***Significantly different from zero at 1% level.

†For a particular person the copayments for PCP and PCP-referred specialist visits are always the same. For the POS plan the second dollar amount (or percentage) is the copayment (or coinsurance) for self-referred visits. Covariates include prescription drug copayment, distance to the nearest PCP, demographic variables, chronic conditions, area characteristics, and indicator variables for plan entry and exit.

‡Standard error of the difference is in parentheses.

Effect of Cost Sharing. Although our main focus was differences in expenditures between the gatekeeper and POS plans, our analyses also enable an assessment of the independent effect of patient cost sharing on expenditures. To conduct this assessment we compared predicted annual expenditures within the same managed care model at different copayment levels (see Table 4). Raising the copayment for PCP and PCP-referred visits from \$0 to \$10 in the gatekeeper HMO was associated with 5 percent lower expenditures for physician services ($p < .05$) and 6 percent lower expenditures for prescription drugs ($p < .05$), but no significant differences were found in expenditures for other categories of services or in total medical care expenditures. Similar comparisons for the POS plan found that total medical care expenditures tended to fall as visit copayments increased, although the effects were modest. POS enrollees with \$15 copayments for PCP and PCP-referred specialist visits had 13 percent lower physician services expenditures ($p < .01$) and 7 percent lower total medical care expenditures ($p < .10$) than POS enrollees with a \$0 copayment for PCP and PCP-referred specialist visits.

Effect of Covariates. Several covariates in the regression models exhibited statistically significant associations with expenditures (data not shown). A higher prescription drug copayment was associated with lower expenditures for prescription drugs in both the gatekeeper and POS plans. In addition, a higher prescription drug copayment was associated with lower expenditures for physician services, outpatient hospital services, and other services in the gatekeeper plan, suggesting that prescription drugs and these services were economic complements. Women had higher expenditures than men, although the difference narrowed with age and eventually disappeared or even reversed at older ages. Persons with any of the chronic conditions identified by the CDS had higher expenditures for all categories of services than persons without such conditions. Last, the plan exit indicator variable was associated with higher expenditures for physician services, outpatient hospital services, prescription drugs, and other services.

Sensitivity Analyses. We conducted two types of sensitivity analyses to assess the robustness of our results. First, we were concerned that unobserved differences in practice patterns and referral styles across PCPs (e.g., Franks et al. 1999) might have influenced our results. However, our findings did not change when we reestimated the regression models including fixed effects for PCPs (data not shown).[10]

Second, we were concerned that our results might have been biased by self-selection of individuals into the gatekeeper plan versus the POS plan based on unobserved characteristics such as preferences for medical

care or unmeasured dimensions of health status. To address this concern we repeated the analyses using a three-equation discrete-factor model similar to that developed by Goldman, Leibowitz, and Buchanan (1998). The discrete-factor model retains the two equations in the two-part model of the demand for medical care, but it attempts to control for selection bias by adding a third (probit) equation to the model that describes the decision to enroll in the gatekeeper versus the POS plan. The error terms in the three equations are decomposed into uncorrelated and correlated components, and the correlated components, which capture the correlation in unobserved individual characteristics across equations, are approximated using a discrete factor with a finite number of points of support. The model is estimated by maximum likelihood.[11]

Table 6 reveals that the results of the discrete-factor model were similar to the findings of the main analyses.[12] Thus, using a statistical technique to correct for self-selection had minimal effects on predicted annual expenditures for both gatekeeper and POS enrollees (compare Tables 6 and 4).

We also repeated the analyses for a subsample of "healthy" patients, defined as enrollees without any chronic conditions. As anticipated, these enrollees had lower predicted annual expenditures than the full sample. How-

Table 6: Predicted Annual Expenditures ($) by Managed Care Model and Visit Copayment Level, Adjusted for Covariates and Selection*

	Predicted Expenditures					
	Physician Services	*Inpatient Hospital Services*	*Outpatient Hospital Services*	*Prescription Drugs*	*Other Services*	*Total Expenditures*
Gatekeeper HMO						
$0	842	565	466	218	171	2,262
$10	808	568	492	209	173	2,251
POS plan						
$0, 20%	778	593	452	222	173	2,218
$10, $15	717	579	440	211	165	2,113
$10, $20	744	504	469	215	174	2,106
$15, $20	702	596	456	200	162	2,116

*For a particular person the copayments for PCP and PCP-referred specialist visits are always the same. For the POS plan the second dollar amount (or percentage) is the copayment (or coinsurance) for self-referred visits. Covariates include prescription drug copayment, distance to the nearest PCP, demographic variables, chronic conditions, area characteristics, and indicator variables for plan entry and exit. The correction for selection was accomplished using the discrete-factor model described in the text. Standard errors were not calculated (see text).

ever, relative spending across the two study plans was unchanged. Predicted total medical care expenditures for healthy enrollees in the gatekeeper and POS plans with $0 copayments for PCP and PCP-referred specialist visits were $1,050 and $1,037 ($p > .10$), respectively. Predicted total medical care expenditures for healthy enrollees in the gatekeeper and POS plans with $10 copayments for PCP and PCP-referred specialist visits were $1,057 and $909 ($p < .01$), respectively.

DISCUSSION

This study compared expenditures for medical care in a traditional gatekeeper HMO and a POS plan. Contrary to our expectations, we found no evidence that medical care expenditures were higher in the POS plan. Indeed, when we compared predicted expenditures in the two plans at similar copayment levels, one of the two comparisons found that expenditures were significantly higher in the gatekeeper plan, whereas the other comparison did not find statistically significant differences. These results did not change when we controlled for PCP referral styles or in sensitivity analyses to assess the potential for selection bias.

A possible explanation for our findings is that the administrative rules governing the gatekeeper HMO induced additional medical care expenditures. Enrollees in the gatekeeper HMO were obligated to see their PCPs before they could receive most services, and patients who see PCPs more often have more opportunities to receive referrals. In addition, the study plans, like many managed care plans, limited the number of services per referral. Limiting the number of services per referral forces patients who require additional specialty services or procedures during the same episode of care to return to their PCPs for additional referrals and possibly to the specialist for additional visits. In a recent study that used data from the same two plans, Joyce et al. (2000) found higher rates of ambulatory visits to PCPs in the gatekeeper HMO compared with the POS plan.

Our findings also may have been due to the requirement that POS enrollees select a PCP or to the breadth of the POS plan's provider network. POS enrollees who identify a PCP may be more likely to seek the PCP's advice before deciding to see specialists or other providers. In addition, a broad provider network reduces enrollees' incentives to seek care from providers outside the network. Because a considerable fraction of spending in POS plans may result from out-of-network use (Wong and Smithen 1999), reduced incentives to seek out-of-network providers may help to curb expenditures.

Finally, our findings may have been due to the fact that the gatekeeper HMO allowed all PCPs in the managed care organization's network to serve as gatekeepers. The effect of gatekeeping may in part be determined by the criteria used to select gatekeepers.

The study also examined the effect of patient cost sharing on medical care expenditures. Modest increases in copayments for physician visits led to significant reductions in physician services expenditures in both the gatekeeper HMO and the POS plan. However, the findings for total medical care expenditures were mixed.

Our results suggest that eliminating the requirement that patients access care through a PCP gatekeeper does not necessarily result in higher medical care expenditures in managed care plans. Recent trends toward expanding direct patient access to specialists and other non–primary care providers may be a response to widespread patient dissatisfaction with traditional gatekeeper HMOs and their restrictive referral policies. Patient surveys indicate that choice of physician is highly correlated with patient satisfaction (Grumbach, Selby, Damberg, et al. 1999). However, another possibility is that traditional gatekeeper HMOs do not reduce costs compared with other managed care models. Monitoring PCPs and maintaining authorization procedures is costly, and these costs may offset any cost savings from reductions in specialty care. Moreover, our findings suggest that when enrollees are required to choose PCPs, patient cost sharing, physician financial incentives, and utilization review may control expenditures without constraining direct patient access to providers.

Our analysis has several limitations. First, we examined the experience of working-age members from a single managed care organization in the Midwest. Thus, our findings may not be generalizable across health plans and areas of the country. In particular, our findings may not apply to managed care plans, such as many PPOs, that offer direct access to specialists but do little to manage utilization. Our findings also may not apply to gatekeeper HMOs that select gatekeepers using rigorous criteria regarding PCPs' practice styles. On the other hand, the focus on a single plan is a strength of the study because the results are less likely to be confounded by unobserved provider or plan effects. Second, our measures of patient case mix are constrained by the inherent limitations of claims data. However, the CDS based on pharmaceutical claims appears to be an important advance in measuring case mix in ambulatory patients. Third, we could not identify services obtained through patient self-referral in the gatekeeper plan because no claims were filed. But counting such services, if any, would strengthen our results. Fourth,

owing to incomplete claims for capitated services we excluded spending for mental health and several additional types of services from the expenditure totals.

This study provides an initial look at how POS plans affect expenditures for medical care. We found no evidence that eliminating PCP gatekeepers led to higher expenditures in a managed care plan with modest cost-sharing arrangements and provider incentives to control utilization. Future work is needed to determine whether these findings are consistent across a broader spectrum of plans and patient populations.

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NOTES

1. For a given patient, the copayments for PCP and PCP-referred specialist visits are always the same. One cost-sharing option for self-referred specialist visits is 20 percent coinsurance rather than a fixed-dollar copayment.
2. We excluded dependents because of incomplete ascertainment of utilization as a result of other insurance coverage. We also excluded persons who switched plans during the observation period, had no coverage for prescription drugs, had unusual benefit provisions, or had incomplete data. These latter exclusions resulted in the loss of about 1,500 individuals.
3. We were concerned that claims for inexpensive prescriptions would be incomplete for persons with high prescription drug copayments because such persons might be unlikely to file claims when the price of the prescription was less than the copayment amount. Therefore, we included only claims greater than $10 (the highest drug copayment amount except for a small number of patients with a copayment of $15) when we calculated prescription drug charges. Only about 6 percent of prescription drug spending for persons with low prescription drug copayments was due to prescriptions costing less than $10, so any error should be small. In preliminary analyses we also found that the duration of prescription refills did not differ between the gatekeeper and POS HMOs and was uncorrelated with the prescription drug copayment.
4. The analytic file accounted for 88 percent of the cumulative enrollment duration for the individuals in the study sample. We ignored fractional years of enrollment because the two-part model of the demand for medical care that we used in

the multivariate analyses does not have an offset property and hence does not accommodate fractional years.

5. Charges are not the same as the fees actually paid to providers owing to discounts negotiated by the managed care organization. We used charges in our analyses because we had no information on the sizes of discounts.
6. An alternative measure of comorbidities is the Ambulatory Diagnostic Groups (ADGs) developed by Weiner et al. (1991). The major limitation of ADGs is endogeneity, as outpatient diagnoses are dependent on ambulatory visits and ADGs record visits for minor, self-limited symptoms where patient demand may be highly discretionary. Also, ADGs cannot identify comorbidities in persons without physician visits (or other ambulatory care encounters). In preliminary analyses we found that the CDS is much less susceptible to endogeneity bias and that the CDS identifies chronic conditions in many persons without physician visits.
7. Because the results of the statistical tests varied across models, different models used different covariates.
8. For certain chronic conditions and categories of services, nearly all persons with the condition used services. Therefore, we included a chronic condition among the covariates in the first part of the model for the particular category of services only if there were at least 15 persons who had the condition but did not use services.
9. The relationship we used was

$$\text{var}\left(\sum_k \text{Pred}_k\right) = \sum_k \text{var}\,(\text{Pred}_k) + \sum_{\substack{k,l \\ k \neq l}} r_{kl}\left[\text{var}\,(\text{Pred}_k)\,\text{var}\,(\text{Pred}_l)\right]^{1/2},$$

   where Pred_k is the predicted annual expenditure per person in service category k, and r_{kl} is the correlation of the predicted expenditures for categories k and l. These correlation coefficients were derived using a bootstrapping technique. In preliminary analyses we estimated a two-part model for total medical care expenditures. However, the fit of this model was considerably poorer than the fit of the models for the five categories of services. Therefore, we based our predictions of total medical care expenditures on the models for the five categories rather than on the model for total expenditures.
10. Additional analyses found that 84 percent of PCPs treated enrollees from both the gatekeeper and POS plans and that the PCPs who treated individuals from only one plan had very few patients. (On average each such PCP contributed fewer than three person-year observations to the analytic data file.) As a result 99 percent of patients had PCPs who treated enrollees from both the gatekeeper and POS HMOs. Therefore, variation in referral styles across PCPs would not likely bias the results in any event.
11. Mroz and Guilkey (1991) found that estimates from the discrete-factor model are more robust than estimates from alternative models when the true joint distribution of the correlated components of the error terms is unknown. Mroz and Guilkey (1991) and Goldman, Leibowitz, and Buchanan (1998) suggest that the model is best estimated with three points of support for the discrete factor.

Accordingly, we used three points of support in the model for physician services expenditures. In the models for the remaining service categories, however, we used two points of support because estimates from models with three points of support were virtually identical. Further, using the Akaike Information Criterion we rejected the models with three points of support in favor of the models with two points of support. For additional applications of discrete-factor models in health services research see Hamilton, Hamilton, and Mayo (1996) and Hamilton and Hamilton (1997). For an application in labor economics see Heckman and Singer (1984).

12. Standard errors are not reported in Table 6 because we were unable to correct the maximum likelihood estimates for clustering within enrollee and within PCP.

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