Gatekeeping and Patterns of Outpatient Care Post Healthcare Reform

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ABSTRACT

OBJECTIVES: As US healthcare spending increases, insurers are focusing attention on decreasing potentially avoidable specialist care. Little recent research has assessed whether the design of modern health maintenance organization (HMO) insurance is associated with lower utilization of outpatient specialty care versus less restrictive preferred provider organization (PPO) plans.

STUDY DESIGN: Observational study of Massachusetts residents aged 21 to 64 years with any HMO or PPO insurance coverage from 2010 to 2013.

METHODS: We examined rates and patterns of primary care visits, new specialist visits, and specialist spending among HMO versus PPO enrollees. We estimated multivariable regression models for each outcome, adjusting for patient and insurance characteristics.

RESULTS: From 2010 to 2013, 546,397 and 295,427 individuals had continuous HMO or PPO coverage, respectively. HMO patients had fewer annual new specialist visits per member versus PPO patients (unadjusted, 0.37 vs 0.43), a difference after adjustment of 0.05 annual visits, or a 12% relative decrease among HMO members (P <.001). These visits were more likely to be with a specialist in the same health system as the patient's primary care physician (44.9% vs 40.7%; adjusted difference, 2.8 percentage points; P <.001). Mean annual spending on new specialist visits and subsequent follow-up per member was lower in HMO versus PPO patients (unadjusted, $104.10 vs $128.10), translating to 12% lower annual spending (adjusted difference, –$16.26; P <.001).

CONCLUSIONS: Having HMO insurance was associated with lower rates of new specialist visits and lower spending on specialist visits, and these visits were less likely to occur across multiple health systems. The impact of this change on overall spending and clinical outcomes remains unknown.

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The majority of private health insurance options in the United States fall into 1 of 2 broad categories: preferred provider organization (PPO) plans and health maintenance organization (HMO) plans. PPO plans generally have broadly inclusive physician networks with little barrier to self-referral, whereas lower-premium HMO plans generally have less inclusive networks and rely on provider-facing managed care strategies, such as requiring primary care physicians (PCPs) to approve referrals to access specialists (ie, "gatekeeping").[1,2] As of 2014, across the United States, HMO insurance products accounted for 24% of enrollment in the employer-sponsored insurance market, whereas PPO products accounted for nearly 50% of the market.[3] In Massachusetts, the setting for this analysis, HMO insurance was 39% of the commercial market, with an additional 19% with point-of-service (POS) coverage and 37% with PPO coverage in 2016.[4] One concept underpinning the provider-facing strategies used by HMOs is that PCPs can reduce the use of low-value specialty care and ensuing downstream utilization by either treating a condition in the primary care setting or directing specialty referrals to higher-value providers within their health system. This is in contrast to the consumer-facing cost-control strategies seen in PPO plans that may impose higher cost sharing but retain open provider choice and access at the discretion of the enrollee.[5,6]

In general, HMO plans require enrollees to identify a PCP to help direct their downstream utilization. Conceptually and empirically, a single PCP with overall responsibility for a patient's care could lead to better-coordinated care while reducing potentially avoidable outpatient specialist referrals.[7,8] Such gatekeeping arrangements, however, can also create problems for both patients and PCPs when disagreements arise over whether a specialist is needed.

The extent to which such gatekeeping affects specialist utilization or costs has mixed results in studies that are largely more than 15 years old.[9-15] Little recent research has assessed whether the design of modern HMO insurance is associated with lower utilization of outpatient specialty care compared with modern PPO plans. Moreover, broadly understanding the effect of insurance design on specialty utilization across a large heterogeneous payer

market is an important policy-relevant question recently made feasible through the availability of statewide all-payer claims databases (APCDs).

We used the Massachusetts APCD to examine the association between insurance design and outpatient care utilization patterns in multiple HMO and PPO arrangements. In Massachusetts, the primary distinction between HMO and PPO plans relates to gatekeeping requirements (ie, a referral requires PCP approval), in contrast to the existence of "closed-model" HMOs like Kaiser Permanente (ie, regardless of PCP approval, referrals outside the internal network are largely unavailable), which do not currently have market share in the state. We hypothesized that HMO enrollment would be associated with more PCP visits and fewer new specialist visits, with a larger share of specialty care received within the PCP's health system.

TAKEAWAY POINTS

Is specialist "gatekeeping" in modern health maintenance organization (HMO) insurance associated with differences in outpatient patterns of care?

- Compared with preferred provider organization insurance, HMO insurance was associated with lower rates of new specialist visits.
- These visits were less likely to occur across multiple health systems.
- HMO insurance was also associated with 12% lower specialist visit spending, which was largely driven by lower use, not lower price.

HMO gatekeeping may meaningfully reduce specialist utilization, although the impact of this change on overall spending and clinical outcomes remains unknown.

METHODS

Data Source and Study Population

The Massachusetts APCD contains detailed data on healthcare utilization, insurance eligibility, and provider credentialing across all commercial payers and public health insurance programs in Massachusetts, representing approximately 90% of the nonelderly population in Massachusetts.[16,17]

Our study cohort included all Massachusetts residents aged 21 to 64 years who had 4 calendar years of continuous enrollment with any commercial HMO or PPO product from an APCD-participating commercial insurance provider from 2010 to 2013; public insurance was not included. We focused on members with this length of continuous enrollment because we were interested in the long-term association between HMO or PPO membership and specialist use among patients with stable benefit design. Enrollees may change from an HMO to a PPO plan or vice versa because of their plans for specialist use, which we wanted to reduce as a source of bias. We did not include children given the unique characteristics of the pediatric healthcare market in the state. The key exposure of interest was whether an individual was a continuous member of an HMO versus a PPO product, as defined by the insurer submitting data in the APCD member eligibility file. These designations are used by the insurers themselves to distinguish HMO from PPO plans for administering health plan benefits and requirements. We defined an HMO product as any product designated as HMO or POS (9.6% of all members, or 15.2% of HMO members in the final study sample), which have very similar benefit designs among the large insurers in Massachusetts.[18] PPO products were defined as those with a designation of PPO or exclusive provider organization (EPO; 1.5% of all members, or 4.3% of PPO members in the final study sample), which have similar flexibility to PPO plans.[19] We used diagnoses from all outpatient and inpatient claims in 2010 to measure baseline comorbidities for risk adjustment. We then performed cross-sectional analyses that focused on the period from 2011 to 2013. We defined continuous enrollment as 11 or more months of insurance coverage in a year, such that those with a short period of discontinuous enrollment, often due to an administrative error, were not excluded from the analyses. This project was approved by the Committee on Human Subjects at Harvard Medical School.

Patient and Physician Attribution

To attribute patients to PCPs, we assigned enrollees to the PCP with the plurality of office visits in a calendar year ("empirical" PCP assignment).[20,21] Nonphysician primary care providers, such as nurse practitioners or physician assistants, were not included because they were not consistently identified in provider classifications provided by insurers. We identified visits to primary care based on claim lines with evaluation and management (E&M) Current Procedural Terminology (CPT) codes to physicians classified as general internal medicine, general practice, or family medicine. If there were no primary care visits, we assigned enrollees to the non–primary care office-based specialist (eg, excluding radiology, pathology) with the plurality of visits. Any ties between physicians were broken randomly, and enrollees with no visits were not assigned to a PCP or another physician. We also examined patterns of PCP assignment as recorded by insurers, which we labeled "insurance" PCP assignment.

We also assigned physicians to larger physician organizations or health systems in Massachusetts using a publicly available database of Massachusetts hospital and physician group national provider identifiers,[22] grouped into physician organizations using the affiliations defined by the Massachusetts Health Care Delivery System Map, a manually curated listing of hospital and clinic affiliations within larger provider organizations (eg, which satellite clinics are part of Partners HealthCare) published by the Blue Cross Blue Shield of Massachusetts Foundation.[23] We assigned 76% of physicians to organizations using this approach, and the remainder were largely unaffiliated independent physicians.

Outpatient Utilization Outcomes

We assessed several dimensions of outpatient care delivery potentially influenced by type of insurance coverage. For primary care utilization, we calculated the average annual number of PCP visits of any kind per member from 2011 to 2013 and the proportion of

TABLE 1. Patient Characteristics by Insurance Type[a]

	Private HMO	Private PPO	*P*
n	546,397	295,427	
Age, years, mean (SD)	45.67 (11.15)	46.08 (10.97)	<.001
Male, %	46.7	46.2	.037
HCC score,[b] mean (SD)	0.34 (0.42)	0.36 (0.44)	.014
ADI,[c] mean (SD)	83.79 (19.16)	80.39 (21.10)	<.001
Insurance carrier, %			<.001
Blue Cross Blue Shield	58.5	57.5	
Fallon	6.7	0.3	
Harvard Pilgrim	15.4	12.0	
Tufts	8.9	17.6	
UnitedHealthcare	7.1	0.2	
WellPoint	0.3	8.1	
Other	3.1	4.3	
Employer size (no. of employees), %			<.001
Jumbo group (≥500)	51.7	81.1	
Large group (101-499)	15.6	8.6	
Midsize group (51-100)	5.1	2.3	
Small group (≤50)	17.5	6.0	
Individual	2.5	1.5	
Other	7.5	0.5	
Insurance plan risk type (%)			<.001
Fully insured	56.3	23.1	
Self-insured	43.7	76.9	

ADI indicates area deprivation index; HCC, Hierarchical Condition Category; HMO, health maintenance organization; PPO, preferred provider organization.

[a]All *P* values estimated using *t* test or χ^2 test as appropriate.

[b]HCC score calculated based on all diagnoses in claims for 2010, using the publicly available algorithm distributed by CMS.[25]

[c]ADI is a measure of socioeconomic disadvantage derived using a weighted combination of 17 Census-level indicators. Higher scores correspond to higher levels of deprivation.

patients with no PCP visits in a year. For primary care assignment, we assessed the proportion of patients ever assigned a PCP by their insurer and the percentage of all PCP visits occurring with those providers, as well as the consistency of empirically attributed and insurer-defined PCP assignment measured by the number of assigned PCPs per member over the 3-year study period.

We defined a new specialist visit as any claim containing a new visit E&M CPT code with a non-PCP, which can only be billed if a patient has not been seen by any physician within that practice in the previous 3 years.[24] We then measured characteristics of new specialist visits that could be associated with higher likelihood of PCP-initiated referral, as opposed to patient self-referral. We did not attempt to identify specialist-to-specialist referrals because HMO referral policy focuses on PCPs as the key provider for approving referrals. We examined whether a new specialist visit's claim designated a referring physician and whether that referring physician was the patient's assigned PCP. We also measured the time in days between a new specialist visit and the most recent PCP visit for the patient in the past 365 days. When we had information on organizational affiliation for both the PCP and the specialist ("health system match" was available for 59% of new specialist visits), we assessed whether the PCP for the most recent visit or the assigned PCP was affiliated with the same provider organization as the specialist for the new visit.

We measured the percentage of patients with any new specialist visit from 2011 to 2013 and the average number of new specialist visits per patient in that period. Because HMO gatekeeping may have its most pronounced effect on the highest utilizers, we also examined the proportion of patients seeing 3 or more new specialists or seeing new specialists in 2 or more provider organizations, which we identified as approximately the top decile of utilization for the entire study population.

Lastly, we measured the average cost per new specialist visit and all subsequent visits with that specialist over the subsequent year by summing all costs (including insurer reimbursement and any out-of-pocket spending) from all E&M claims for new specialist visits for members, as well as E&M costs from any downstream established office visits with the same specialist seen in the following year. To test whether differences in spending by insurance type were driven by differences in price versus quantity of specialist visits, we standardized specialist visit prices using the average HMO cost per evaluation and management CPT code as a standard price for all encounters.

Control Variables

To measure comorbidities, we calculated Hierarchical Condition Category (HCC) scores from all diagnosis codes in the baseline year using software available from CMS. The HCC score represents the predicted risk of healthcare spending beyond average in the next year; a score of 1.0 corresponds to a risk profile for a Medicare enrollee with average expected annual spending.[25,26] To derive a proxy measure of socioeconomic status, we linked individuals' 5-digit zip code, the most granular geographic unit available, to the publicly available area deprivation index (ADI), a measure derived using a weighted combination of 17 Census-level indicators of socioeconomic disadvantage.[27,28] We also included the median co-pays for primary care and specialist physician visits for each separate insurance product in 2010 as a measure of plan generosity. Other variables included member age as of December 31, 2010; sex; fixed effects for insurance carrier (eg, Blue Cross Blue Shield vs UnitedHealthcare); insurance plan risk type (fully insured vs self-insured); and employer size (ranging from individual to ≥500 employees; see **Table 1**[25] for categories).

Statistical Analysis

We compared the characteristics of HMO and PPO patients and the unadjusted rates of the outcomes using χ^2 or *t* tests. To estimate adjusted comparisons between HMO and PPO patients, we fitted a series of multivariable regression models for each outcome, with the key explanatory variable being an indicator for whether a patient

TABLE 2. Characteristics of PCP Visits and Assignment, by Insurance Type, From 2011-2013[a]

	Private HMO (unadjusted)	Private PPO (unadjusted)	HMO vs PPO Adjusted Difference[b]	Adjusted 95% CI
Number of individuals	546,397	295,427		
Average annual PCP visits, 2011-2013, mean (SD)	2.31 (2.44)	2.45 (2.58)	−0.02	−0.03 to 0.00
No PCP visit, 2011-2013, %	11.0	5.0	5.0	4.9-5.1
Empirical PCP assignment[c]				
Number of different empirically assigned PCPs, mean (SD)	2.08 (1.25)	2.09 (1.30)	0.05	0.04-0.05
Insurance PCP assignment[c]				
Ever assigned PCP by insurance, %	90.4	39.7	46.2	45.9-46.5
Number of different insurance-assigned PCPs, mean (SD)	1.29 (0.81)	0.49 (0.69)	0.95	0.94-0.95
Proportion of primary care visits with insurance-assigned PCP, %	57.0	19.0	38.3	38.2-38.3

HMO indicates health maintenance organization; PCP, primary care physician; PPO, preferred provider organization.

[a]All *P* values for adjusted comparisons significant at <.001 except for "average annual PCP visits," which was .005.

[b]To estimate an adjusted difference and CI for each outcome, we drew 1000 simulations of the set of regression coefficients using the asymptotic multivariate normal approximation to the log-likelihood function, and we present the mean and 95% CI from these simulations. The following functional forms were used: Poisson (PCP visits, assigned PCP count), logistic (proportions).

[c]Empirical PCP assignment refers to attribution from the PCP responsible for the plurality of office visits for a patient in a given calendar year. Insurance PCP assignment refers to insurer-documented PCP assignment from the member eligibility file.

was a member of an HMO versus a PPO insurance product. We fitted models with different link functions depending on the outcome: linear models for visit counts, costs, and visit intervals; Poisson models for counts of unique physicians or health systems; and logistic models for all other outcomes, which were binary or fractional in nature. All models adjusted for patient age, sex, HCC score, ADI, median primary care and specialist co-pays in that plan (with the exception of spending outcomes, which excluded co-pay covariates), and employer size. We also included a fixed effect for insurance carrier to control for unmeasured characteristics of carriers' networks or policies that might also influence the outcomes of interest. As a sensitivity analysis, we also estimated logistic regression models predicting the propensity to have HMO versus PPO insurance and then used propensity score weighting to more robustly address imbalance on observable variables between HMO and PPO patients and replicated all of our model results (see **eAppendix** [available at **ajmc.com**] for full description).[29]

Because of the mix of functional forms (eg, linear, Poisson, logistic), we used bootstrap methods within each model to present the effects of HMO membership as the adjusted difference in each individual outcome between the average HMO member and the average PPO member. For each effect, we drew 1000 simulations of the set of regression coefficients using the asymptotic multivariate normal approximation to the log-likelihood function, and we present the mean and 95% CI from these simulations.[30] Analyses were performed in R version 3.1.3 and SAS version 9.4 (SAS Institute; Cary, North Carolina). The 95% CI around reported estimates reflects 0.025 in each tail, or $P \leq .05$.

RESULTS

The study sample included 546,397 and 295,427 individuals with 4 years of continuous coverage in an HMO or PPO insurance product, respectively, from 2010 to 2013. HMO enrollees were younger than PPO patients (45.7 vs 46.1 years, respectively; $P < .001$), had slightly lower HCC scores (0.34 vs 0.36; $P = .01$), had higher ADI scores (ie, were more socioeconomically disadvantaged; 83.8 vs 80.4; $P < .001$), and were significantly less likely to be employed by an employer with 500 or more employees (51.7% vs 81.1%; $P < .001$; Table 1). Sample characteristics after propensity score weighting were identically balanced (**eAppendix Table 1**).

Primary Care Use

HMO patients had fewer PCP visits annually than PPO patients (2.31 vs 2.45, respectively), but there was only a marginal difference after adjustment (adjusted difference, −0.02; $P < .001$) (**Table 2**). As expected, HMO patients were significantly more likely to ever have a PCP assigned by their insurer (90.4% vs 39.7%; adjusted difference, 46.2 percentage points; $P < .001$) and had a higher proportion of visits with those PCPs than PPO patients did with their designated PCPs (57.0% vs 19.0%; adjusted difference, 38.3 percentage points; $P < .001$).

Specialty Care Use

Over the 3-year period, 56.2% of HMO patients had any new specialty visit versus 62.4% of PPO patients (adjusted difference, −5.3 percentage points; $P < .001$) (**Table 3**), with HMO patients having 14% fewer annual new specialist visits per member (0.37 vs 0.43; adjusted difference, −0.05; $P < .001$). Consistent with this lower utilization, fewer HMO patients were likely to have seen 3 or more specialists from 2011 to 2013 (13.3% vs 16.2%; adjusted difference, −2.5 percentage points; $P < .001$) or specialists in 2 or more health systems (21.8% vs 24.3%; adjusted difference, −2.2 percentage points; $P < .001$).

The interval between the most recent PCP visit and a new specialist visit was 7.7 fewer days for HMO versus PPO patients ($P < .001$) (**Table 4**). A lower proportion of PPO patients had no PCP visits in the 60 days preceding a new specialist visit (55.0% vs 49.4%;

TABLE 3. Characteristics of New Specialty Visits, by Insurance Type, From 2011-2013[a]

	Private HMO (unadjusted)	Private PPO (unadjusted)	HMO vs PPO Adjusted Difference[b]	Adjusted 95% CI
Members (n)	546,397	295,427		
Mean annual new specialist visits, 2011-2013, mean (SD)	0.37 (0.46)	0.43 (0.50)	−0.049	−0.051 to −0.046
Any new specialist visit, %	56.2	62.4	−5.3	−5.5 to −5.0
Saw ≥3 new specialists,[c] %	13.3	16.2	−2.5	−2.7 to −2.3
Saw new specialists in ≥2 health systems,[c] %	21.8	24.3	−2.2	−2.5 to −1.9

HMO indicates health maintenance organization; PPO, preferred provider organization.

[a]All *P* values for adjusted comparisons significant at <.001.

[b]To estimate an adjusted difference and CI for each outcome, we drew 1000 simulations of the set of regression coefficients using the asymptotic multivariate normal approximation to the log-likelihood function, and we present the mean and 95% CI from these simulations. The following functional forms were used: Poisson (new specialist visits), logistic (proportions).

[c]Cut-offs for number of new specialists and health systems based on the closest approximation possible to the top decile of patients.

TABLE 4. Patterns of Specialists Seen by Members, by Insurance Type, From 2011-2013[a]

	Private HMO (unadjusted)	Private PPO (unadjusted)	HMO vs PPO Adjusted Difference[b]	Adjusted 95% CI
New specialist visits, n	580,056	405,336		
Interval between PCP and new specialist visit if prior PCP visit, days, mean (SD)	58.9 (72.8)	66.9 (79.4)	−7.7	−8.1 to −7.3
Proportion of new specialist visits with PCP visit ≤60 days prior, %	55.0	49.4	5.3	5.1-5.5
Proportion with no prior PCP visit within 365 days, %	20.7	23.9	−2.9	−3.1 to −2.8
Any referring physician,[c] %	53.3	24.5	36.7	36.5-37.0
Referring physician is PCP,[c] %	30.9	13.0	17.0	16.8-17.1
PCP and specialist share health system, %	44.9	40.5	2.8	2.5-3.0

HMO indicates health maintenance organization; PCP, primary care physician; PPO, preferred provider organization.

[a]All *P* values for adjusted comparisons significant at <.001.

[b]To estimate an adjusted difference and CI for each outcome, we drew 1000 simulations of the set of regression coefficients using the asymptotic multivariate normal approximation to the log-likelihood function, and we present the mean and 95% CI from these simulations. The following functional forms were used: linear (time interval), logistic (proportions).

[c]Referring physician determined by presence of referring physician identifier in the insurance claim for a new specialist visit. For the "referring physician is PCP" outcome, the denominator is all new specialist visits with any referring physician listed.

adjusted difference, 5.3 percentage points; *P* <.001). HMO patients were more likely to have a referring physician for a new specialty visit (53.3% vs 24.5%; adjusted difference, 36.7 percentage points; *P* <.001) and had a modestly higher rate of health system match (44.9% vs 40.5%; adjusted difference, 2.8 percentage points; *P* <.001).

Costs and Spending on New Specialty Care

The average total cost per individual new specialty visit was $12.29 lower for HMO versus PPO patients, a relative difference of 6.1% (mean cost, $189.05 vs $201.34; *P* <.001) (Table 5). On average, office visit co-pays for both primary care and specialist visits were higher for HMO patients than PPO patients ($14.83 vs $13.48 for primary care; $20.78 vs $19.55 for specialists; *P* <.001 for both). Mean annual spending on new specialist visits plus subsequent downstream visits per member was also lower in HMO versus PPO patients ($104.06 vs $128.14; adjusted difference, −$16.26; *P* <.001) (Table 5), even after using a standardized price ($104.10 vs $122.98; adjusted difference, −$11.74; *P* <.001) (Table 5), suggesting that most of the difference in spending was related to quantity of new specialist visits and not to price.

Sensitivity Analyses

There were minimal differences in our estimates for these models using propensity score weighting to balance the observable characteristics of HMO- versus PPO-enrolled individuals (eAppendix Tables 2-5).

DISCUSSION

Using statewide data from Massachusetts, we found that HMO insurance was associated with modestly lower rates of new specialist visits and lower specialist visit costs compared with PPO insurance. New specialty visits within HMOs also were more likely to have closely followed a PCP visit, included a referral from a PCP in the claim, and been within the PCP's health system. Because this study was observational, we cannot interpret our conclusions as causal, and unobserved differences between the HMO and PPO populations may explain some of the effects we observed. However, these results are consistent with the concept that modest provider-facing requirements of HMO coverage may have the effect of PCPs for HMO patients taking a more active role in managing referrals.

Given the emphasis on gatekeeping within the HMO model design and policies, the relatively modest effect size on specialty utilization is notable. There may be few consequences for PCPs not actively coordinating referrals for HMO patients, such that they might simply have administratively approved all patient-initiated referrals without trying to influence them. Consistent with this fact, we found that the referring physician matched the assigned PCP only 30.8% of the time for HMO patients, despite the fact that 90% of HMO enrollees were assigned a PCP by their insurer. This suggests that current HMO policies may not be implemented consistently to maximize referral coordination. Supporting this observation, we find contrasting patterns of use

TABLE 5. Costs and Spending on Outpatient Care, by Insurance Type, From 2011-2013[a]

	Private HMO (unadjusted)	Private PPO (unadjusted)	Unadjusted Difference	HMO vs PPO Adjusted Difference[b]	Adjusted 95% CI
	US$, Mean (SD)		US$	US$	US$
Mean cost per new specialist visit	189.05 (92.7)	201.34 (88.7)	−12.29	−12.28	−12.65 to −11.90
Mean PCP visit co-pay	14.83 (10.0)	13.48 (10.2)	1.35	0.62	0.56-0.68
Mean new specialist visit co-pay	20.78 (13.2)	19.55 (13.7)	1.23	0.86	0.84-0.89
Mean annual new specialist visit spending per member[c]	104.06 (178.8)	128.14 (198.3)	−24.08	−16.26	−17.18 to −15.33
Mean annual new specialist visit spending per member, normalized price[c]	104.06 (181.1)	122.98 (195.6)	−17.76	−11.74	−12.64 to −10.80

E&M indicates evaluation and management; HMO, health maintenance organization; PCP, primary care physician; PPO, preferred provider organization.

[a]All *P* values for adjusted comparisons significant at <.001.

[b]To estimate an adjusted difference and CI for each outcome, we drew 1000 simulations of the set of regression coefficients using the asymptotic multivariate normal approximation to the log-likelihood function, and we present the mean and 95% CI from these simulations. We used linear regression models for spending outcomes.

[c]New specialist visit spending was defined as the sum of costs for all E&M claims associated with a new specialist visit as well as any subsequent office visits with the same physician in the next 12 months. For "normalized price," we set prices for all E&M services equal to the mean price across all HMO patients.

between patients' insurance-assigned versus empirically assigned PCPs, with 57% of HMO patients' PCP visits occurring with insurance-assigned PCPs. It is not clear whether this proportion is desirable from the insurer's perspective or too low. However, the match between patients' assigned PCP and the PCP actually seen could be an important determinant of the effectiveness of HMO design.

The modest effect size we find is consistent with the "norms hypothesis," which postulates that physicians have a relatively uniform approach to care consistent with overall financial incentives as opposed to the payment arrangement for an individual patient they are treating.[31,32] As accountable care organization (ACO) and other risk-based contracts become more prevalent, and as physician organizations take a more active role in managing new specialty use, we will likely see more pressure on PCPs to actively coordinate and approve specialty care (especially within ACO networks to which they belong) in the future.

We also found that reduced spending on new specialist visits was driven largely by differences in utilization, rather than price.[33] Although HMOs frequently negotiate lower prices in return for a more restricted network, our results show that the bulk of spending differences was driven by lower utilization of specialty care in HMOs. This strategy, likely influenced by PCP decision making, is a strong contrast to consumer-facing approaches, such as high deductibles, reference pricing, or price transparency, that aim to achieve reduced spending by increasing consumer sensitivity to prices, rather than reducing utilization overall. It is possible that a combination of consumer- and provider-facing approaches could be more effective at reducing medical spending than either alone.

Our findings are consistent with those of some prior research on the association of gatekeeping with specialist utilization. In 1979, a randomized controlled trial of a gatekeeping benefit design with more than 2000 participants found decreased rates of all specialist visits among patients with a gatekeeping arrangement versus those without.[13] In contrast, a 1998 natural experiment in a large multispecialty physician group where gatekeeping arrangements were eliminated found no change in total specialist visits, although rates of new specialist visits increased modestly after gatekeeping elimination.[14,15] In that study, however, the group also had constrained the availability of specialists within its system, which might have served to limit new specialist visits. Both of these studies are now decades old, making them less applicable to the current healthcare landscape.

Limitations

This study has several important limitations. First, this is a cross-sectional and observational analysis, so our results cannot be interpreted as causal. We addressed this limitation in part by using propensity score weighting to address the impact of observable patient characteristics on the outcomes of interest. Second, our sample is restricted to Massachusetts residents, which may not generalize to other states, although HMO and PPO insurance are the most commonly used types of plans throughout the country. In addition, we relied on insurers' designations of HMO versus PPO plan types to identify exposure to PCP gatekeeping patterns. We also combined similar plan types, like POS and EPOs, into these categorizations. This coarse categorization may misclassify the level of PCP control over referrals in a plan because we can only observe the HMO/PPO designation. Third, we are unable to capture potential mechanisms that providers or patients might use to mitigate the influence of gatekeeping tactics, such as automated approval processes or delegation of referral approvals to nonclinical administrative staff, which could bias our findings toward the null. Fourth, our ability to capture socioeconomic status, an important confounder, is limited by relatively coarse data on 5-digit zip code alone. Fifth, our cross-sectional analysis assumes that any changes in benefit design over time were similar between HMO and PPO plans. Due to missing data in the APCD, we were unable to confirm this assumption, which may bias our results. Sixth, we did not have access to accurate and

complete data on some aspects of cost sharing, such as deductibles, which could have influenced our findings. Lastly, we were limited in our ability to capture the appropriateness of a referral using claims data alone, which lack the detailed clinical information necessary to assess a referral's clinical necessity.

CONCLUSIONS

We found that HMO coverage was associated with similar PCP utilization but reduced specialist utilization compared with PPO coverage. To our knowledge, this analysis is among the first examinations of HMO benefit design in the current era across a large multipayer population. Not only was specialist utilization reduced, but the referrals that did happen among HMO patients appeared to be more physician-directed and coordinated within health systems. It is not clear whether this pattern is associated with improved outcomes, patient satisfaction, or population health, a set of questions that deserve further research. However, in light of the growing use of benefit designs such as high-deductible health plans that shift decision making to patients who might be poorly equipped to make treatment choices, modern implementation of HMO methods may present an alternative provider-facing strategy for cost control worth revisiting. However, care must be taken to avoid previous errors in overly onerous gatekeeping designs that were not sensitive to patient needs and appropriate clinical decision making. ■

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Supplemental eAppendix for "Gatekeeping and Patterns of Outpatient Care Post Healthcare Reform"

eAppendix Methods

A. Propensity score weighting

eAppendix Methods

A. Propensity score weighting

We balanced samples of individuals meeting the inclusion criteria described in the Methods section of the main manuscript using weights estimated from a propensity score model. Specifically, we used logistic regression to estimate the probability (*p)* that an individual (*i*) had health maintenance organization (HMO) coverage vs. preferred provider organization (PPO) coverage as a function of the observed person-level demographic and health characteristics shown in Table 1 of the main manuscript. We used the probabilities p_i estimated from this regression model to generate individual-level "balancing" weights, following the approach described by Li, Morgan and Zaslavsky 2017.[1] The weight assigned to individual *i* was equal to p_i if the individual has PPO coverage and (1- p_i) if the individual has HMO coverage. In other words, individuals were weighted proportional to the likelihood that their characteristics were similar to those in the opposite group. These weights balance the observable health and demographic characteristics of individuals in HMO and PPO plans (see Appendix Table). In contrast to traditional inverse probability of treatment weighting, this approach weights individuals to form comparable treated and control samples, so that our estimates represent differences between HMO and PPO individuals' health care utilization for comparable beneficiaries with HMO vs. PPO coverage. Propensity weighted models used only a single covariate representing HMO or PPO coverage without the use of additional covariates, as these are incorporated in the propensity weighting.

eAppendix Table 1. Patient Characteristics by Insurance Type with Propensity Weights*

	Private HMO	Private PPO
n	546,397	295,427
Age (mean)	46.0	46.0
Male (%)	45.8	45.8
HCC Score (mean)**	0.35	0.35
Area Deprivation Index (mean)***	80.8	80.8
Insurance Carrier (%)		
Blue Cross Blue Shield	65.6	65.6
Fallon	0.5	0.5
Harvard Pilgrim	15.8	15.8
Tufts	3.6	3.6
United	13.0	13.0
WellPoint	0.5	0.5
Other	1.0	1.0
Employer Size (%)		
Jumbo Group 500+	72.0	72.0
Large Group 101-499	11.9	11.9
Midsize Group 51-100	3.3	3.3
Small Group ≤50	9.7	9.7
Individual	2.2	2.2
Other	0.8	0.8
Insurance Plan Risk Type (%)		
Fully Insured	35.0	35.0
Self Insured	65.0	65.0

Abbreviations: health maintenance organization (HMO), preferred provider organization (PPO), hierarchical condition category (HCC), standard deviation (SD)

* By design, all means in both groups are equal with p-values for comparison equal to 1.0

** Hierarchical condition category (HCC) score calculated based on all diagnoses in claims for 2010, using the publicly available algorithm distributed by the Center for Medicare Services.[24]

*** Area deprivation score (ADI) is a measure of socioeconomic disadvantage derived using a weighted combination of 17 census-level indicators. Higher scores correspond to higher levels of deprivation.

eAppendix Table 2. Characteristics of PCP Visits and Assignment, by Insurance Type with Propensity Weights*

	Private HMO	**Private PPO**	**HMO vs. PPO Propensity Weighted Difference****	**95% Confidence Interval**	
Number of Individuals	546,397	295,427			
Average Annual PCP Visits, 2011-2013 (mean (SD))	2.31 (2.44)	2.45 (2.58)	-0.07	-0.08	-0.06
No PCP Visit, 2011-2013 (%)	11.0%	5.0%	7.1%	6.9%	7.3%
Empirical PCP Assignment***					
Number of Different Empirically Assigned PCPs (mean (SD))	2.08 (1.25)	2.09 (1.30)	0.02	0.01	0.03
Insurance PCP Assignment***					
Ever Assigned PCP by Insurance (%)	90.4%	39.7%	53.0%	52.8%	53.3%
Number of Different Insurance Assigned PCPs (mean (SD))	1.29 (0.81)	0.49 (0.69)	0.83	0.83	0.84
Proportion of Primary Care Visits with Insurance Assigned PCP (%)	57.0%	19.0%	36.5%	36.3%	36.6%

Abbreviations: maintenance organization (HMO), preferred provider organization (PPO), primary care physician (PCP), standard deviation (SD)

*Using propensity weights as described above in Appendix Methods. All p-values for adjusted comparisons significant at <0.001

** To estimate an adjusted difference and confidence intervals for each outcome, we drew 1,000 simulations of the set of regression coefficients using the asymptotic multivariate normal approximation to the log-likelihood function and present the mean and 95% confidence interval from these simulations. The following functional forms were used: Poisson (PCP visits, assigned PCP count), logistic (proportions). Propensity score weighting, as described in the Appendix, was used to account for imbalance in observable characteristics between HMO and PPO enrollees.

*** Empirical PCP assignment refers to attribution from the PCP responsible for the plurality of office visits for a patient in a given calendar year. Insurance PCP assignment refers to insurer documented PCP assignment from the member eligibility file.

eAppendix Table 3. Characteristics of New Specialty Visits, by Insurance Type with Propensity Weights*

	Private HMO	**Private PPO**	**HMO vs. PPO Propensity Weighted Difference****	**95% Confidence Interval**	
Members (N)	546,397	295,427			
Mean Annual New Specialist Visits, 2011-2013 (mean (SD))	0.37 (0.46)	0.43 (0.50)	-0.057	-0.059	-0.055
Any New Specialist Visit (%)	56.2	62.4	-6.1%	-6.5%	-5.8%
Saw ≥3 New Specialists (%)***	13.3	16.2	-2.7%	-2.9%	-2.4%
Specialists in ≥2 Health Systems (%)***	21.8	24.3	-2.0%	-2.5%	-1.6%

Abbreviations: maintenance organization (HMO), preferred provider organization (PPO), standard deviation (SD)

*Using propensity weights as described above in Appendix Methods. All p-values for adjusted comparisons significant at <0.001

** To estimate an adjusted difference and confidence intervals for each outcome, we drew 1,000 simulations of the set of regression coefficients using the asymptotic multivariate normal approximation to the log-likelihood function and present the mean and 95% confidence interval from these simulations. The following functional forms were used: Poisson (new specialist visits), logistic (proportions). Propensity score weighting, as described in the Appendix, was used to account for imbalance in observable characteristics between HMO and PPO enrollees.

*** Cut-offs for number of new specialists and health systems based on the closest approximation possible to the top decile of patients.

eAppendix Table 4. Pattern of Specialists seen by Members, by Insurance Type with Propensity Weights*

	Private HMO	Private PPO	HMO vs. PPO Propensity Weighted Difference**	95% Confidence Interval	
New Specialist Visits (n)	580,056	405,336			
Interval between PCP and New Specialist Visit If Prior PCP Visit, Days (mean (SD))	58.9 (72.8)	66.9 (79.4)	-7.7	-8.0	-7.3
Proportion of New Specialist Visits with PCP Visit ≤60 Days Prior (%)	55.0	49.4	5.1%	4.8%	5.4%
Proportion with No Prior PCP Visit within 365 Days (%)	20.7	23.9	-2.9%	-3.2%	-2.7%
Any Referring MD (%)***	53.3	24.5	33.9%	33.6%	34.2%
Referral MD is PCP (%)***	30.9	13.0	20.6%	20.4%	20.9%
PCP and Specialist Share Health System (%)	44.9	40.5	3.2%	2.7%	3.6%

Abbreviations: maintenance organization (HMO), preferred provider organization (PPO), primary care physician (PCP), physician (MD), standard deviation (SD)

*Using propensity weights as described above in Appendix Methods. All p-values for adjusted comparisons significant at <0.001

** To estimate an adjusted difference and confidence intervals for each outcome, we drew 1,000 simulations of the set of regression coefficients using the asymptotic multivariate normal approximation to the log-likelihood function and present the mean and 95% confidence interval from these simulations. The following functional forms were used: linear (time interval), logistic (proportions). Propensity score weighting, as described in the Appendix, was used to account for imbalance in observable characteristics between HMO and PPO enrollees.

*** Referring MD determined by presence of referring MD identifier in the insurance claim for a new specialist visit. For the "referral MD is PCP" outcome, the denominator is all new specialist visits with any referring MD listed.

eAppendix Table 5. Costs and Spending on Outpatient Care, by Insurance Type with Propensity Weights*

	Private HMO	Private PPO	Unadjusted Difference	HMO vs. PPO Propensity Weighted Difference**	95% Confidence Interval	
	Dollars, Mean (SD)					
Mean Cost per New Specialist Visit	189.1 (92.7)	201.3 (88.7)	-12.3	-12.3	-12.7	-11.9
Mean PCP Visit Copay	14.8 (10.0)	13.5 (10.2)	1.4	0.5	0.4	0.6
Mean New Specialist Visit Copay	20.8 (13.2)	19.6 (13.7)	1.2	0.9	0.9	0.9
Mean Annual New Specialist Visit Spending per Member	104.1 (178.8)	128.1 (198.3)	-24.1	-17.6	-18.9	-16.3
Mean Annual New Specialist Visit Spending per Member, Normalized Price***	104.1 (181.1)	123.0 (195.6)	-17.8	-13.7	-15.2	-12.2

Abbreviations: maintenance organization (HMO), preferred provider organization (PPO), primary care physician (PCP), physician (MD), standard deviation (SD)

*Using propensity weights as described above in Appendix Methods. All p-values for adjusted comparisons significant at <0.001

** To estimate an adjusted difference and confidence intervals for each outcome, we drew 1,000 simulations of the set of regression coefficients using the asymptotic multivariate normal approximation to the log-likelihood function and present the mean and 95% confidence interval from these simulations. We used linear regression models for spending outcomes. Propensity score weighting, as described in the Appendix, was used to account for imbalance in observable characteristics between HMO and PPO enrollees.

*** Total specialist visit spending is defined as the sum of costs for all evaluation and management (E&M) claims associated with a new specialist visit as well as any subsequent office visits with the same physician in the next 12 months. For "normalized price," we set prices for all E&M services equal to the mean price across all HMO patients.

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