A Comparison of Relative Resource Use and Quality in Medicare Advantage Health Plans Versus Traditional Medicare

Bruce E. Landon, MD, MBA, MSc; Alan M. Zaslavsky, PhD; Robert Saunders, PhD; L. Gregory Pawlson, MD, MPH; Joseph P. Newhouse, PhD; and John Z. Ayanian, MD, MPP

Under managed competition, health plans are expected to compete to provide health services of high quality while also controlling the overall costs of care. A key element of a health plan's ability to contain cost is its ability to control utilization. Although some transparency initiatives are now publicizing the costs that health plans pay for specific services,[1] such approaches have not assessed differences in the full range of medical services used by patients with particular health conditions. Moreover, many have concerns that health plans that are more successful at controlling utilization might also deliver care of lower quality, though existing data from commercial health plans show no clear relationship between spending and quality.[2,3]

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Medicare's managed care program, Medicare Advantage (MA), currently provides care to 15.7 million Americans, representing 30% of beneficiaries.[4] Relative to traditional Medicare (TM), MA plans may be able to treat patients with particular diagnoses with greater efficiency while attaining equal or superior quality through their flexibility in enrollee benefits, network contracting, and coordination of care, but whether they do so is not known.[5] Since 1997, health plans participating in Medicare have been required to report annually on measures of the quality of preventive care and of the management of chronic diseases such as diabetes.[6-8] In 2006 and 2007, CMS also required MA plans to report a set of relative resource use (RRU) measures focused on the care of patients with diabetes (2006 and 2007) and cardiovascular disease (2007 only).[9] Such measures of price-adjusted utilization allow for direct comparisons of utilization among health plans as well as between MA and TM.

In this study, we evaluated both the utilization of services and the quality of ambulatory care provided by MA health plans by comparing annual standardized spending and quality of care for 2 specific medical conditions for MA health plan enrollees with corresponding measures among TM beneficiaries.

ABSTRACT

Objectives: Prior analyses of Medicare health plans have examined either utilization of services or quality of care, but not both jointly. Our objective was to compare utilization and quality for Medicare Advantage (MA) enrollees with diabetes or cardiovascular disease to that for similarly defined traditional Medicare (TM) beneficiaries.

Study Design: Cross-sectional matched observational study using data for 2007.

Methods: We obtained individual-level Healthcare Effectiveness Data and Information Set (HEDIS) relative resource use (RRU) and quality data for patients enrolled in MA, and then developed comparable claims-based measures for matched samples of TM beneficiaries. Main outcome measures: utilization levels for inpatient care, evaluation and management services, and surgery; number of emergency department (ED) and inpatient visits; and quality of ambulatory care measures.

Results: We studied approximately 680,000 MA health maintenance organization (HMO) enrollees with diabetes and 270,000 HMO enrollees with cardiovascular conditions. For both conditions and almost all major strata, the RRU was lower for those enrolled in MA than for those in TM. Spending for those with diabetes was $5223 for MA HMO enrollees compared with $6413 for those in TM (cost ratio, 0.81; P <.001). ED utilization rates were consistently lower in MA than TM (567 vs 719 visits/1000 enrollees; rate ratio, 0.79; P <.001). Health plans that are more established, nonprofit, and/or larger generally had lower resource use and better relative quality than did smaller, newer, for-profit HMOs or preferred provider organizations.

Conclusions: RRU for those with diabetes or cardiovascular disease is lower in MA, while quality of care is higher. Better MA plans may add value to the care of these major chronic medical conditions.

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Take-Away Points

We compared price-standardized utilization and quality of care for Medicare Advantage (MA) enrollees with diabetes or cardiovascular disease with matched beneficiaries from traditional Medicare in geographic areas. We found that:

- For both conditions, relative resource use was lower for those enrolled in MA than for those in traditional Medicare.
- Quality of care for diabetes and cardiovascular disease measures was higher in MA for the 4 measures examined, although plans varied greatly in their performance.
- Health plans that are more established, nonprofit, and/or larger generally had lower relative resource use and better relative quality than did HMOs or PPOs that were smaller, newer, and/or for-profit.

METHODS

Overview

From CMS and the National Committee for Quality Assurance (NCQA), we obtained health-plan-level Healthcare Effectiveness Data and Information Set (HEDIS) measures of RRU and individual-level HEDIS data on quality of ambulatory care for patients with diabetes and cardiovascular disease enrolled in MA health plans. We focused on care delivered in 2007, the most recent year in which MA plans were required to report these measures before reporting became voluntary and much less consistent.[2,3] We constructed similar measures within TM from Medicare claims data for a random 20% sample of beneficiaries. Given the well-known geographic variation in Medicare services, we created matched samples for each health plan based on its geographic region and enrollee demographic characteristics.[7,10]

Data Sources and Measures

Medicare Advantage. The RRU measures use standardized pricing applied uniformly to services delivered within MA and TM, thereby accounting for variation in prices due to geography and negotiated prices in MA.[9] Spending on all services for all patients with qualifying diagnoses is calculated over the entire year.

The RRUs are risk-stratified by age (categorized into 5-year intervals for patients aged 65-85 years), sex, type of diabetes (type 1 or type 2) or cardiovascular disease (acute myocardial infarction, congestive heart failure, angina, or coronary artery disease) and the presence or absence of 1 or more major comorbidities (ie, cardiovascular conditions, chronic obstructive pulmonary disease [COPD], depression, hypertension, or chronic kidney disease for diabetes, and asthma, COPD, diabetes, and hypertension for cardiovascular disease). We then aggregated these strata using nationally determined weights to create a standardized measure of overall resource use. Spending categories include inpatient care, surgery and other procedures, and evaluation and management services, and we also sum spending across these categories. Rates of emergency department (ED) visits and inpatient admissions are also reported. Beneficiaries with concomitant specified dominant medical conditions including active cancer, end-stage renal disease, human immunodeficiency virus/AIDS, and organ transplants are excluded.

HEDIS quality data are collected from administrative billing or encounter records, or by using a hybrid approach in which medical records are also reviewed for services that may not be recorded in administrative data.[7,11] CMS has audited HEDIS quality measures reported by Medicare health maintenance organizations (HMOs) and found them to be highly accurate.[12] In order to compare MA and TM, we focused on measures that can be constructed from Medicare claims for TM enrollees, including low-density lipoprotein (LDL) cholesterol testing in the current year for enrollees aged 65 to 75 years with cardiovascular disease, and 3 services for enrollees aged 65 to 75 years with diabetes: glycated hemoglobin (A1C) testing in the current year; LDL cholesterol testing in the current year; and a diabetic retinal exam in the current or prior year.

We defined health plans as CMS contracts, meaning a health plan unit operating in a single state, or in a few cases, up to 3 adjoining states, and we included both HMOs and preferred provider organizations (PPOs). We focused on beneficiaries 65 years or older who were enrolled for the entire calendar year. We excluded beneficiaries in legacy health plans that were reimbursed on a cost basis rather than by capitation. In addition, we excluded beneficiaries in private fee-for-service plans because these plans are not required to report HEDIS data to CMS, as well as those enrolled in special needs plans because such plans serve nonrepresentative beneficiaries. Finally, we excluded HMOs with fewer than 500 enrollees (accounting for <0.2% of enrollees).[7,10]

Traditional Medicare. To create a comparison sample for each health plan for both the RRU and the diabetes quality analyses, we used the TM enrollment file and Part A and Part B claims files for a random 20% of beneficiaries to identify all persons who were continuously enrolled in Medicare Part A and Part B for the entire reporting year and were 65 years or older as of January 1, 2007.[13,14] We excluded residents of long-stay nursing homes—identified using a validated algorithm—because these beneficiaries rarely enroll in MA; however, we had no similar method to exclude these beneficiaries from the MA data.[15,16] We applied NCQA specifications to identify the eligible populations for the measures, assigned a standardized price

Table 1. Health Plan Characteristics

Characteristics	HMO Health Plans		PPO Health Plans	
	Plans N = 190	Enrollment % N = 4,207,433	Plans N = 67	Enrollment % N = 318,293
Tax status				
Nonprofit	49	34.2%	11	36.4%
For-profit	141	65.8%	56	63.6%
Plan size				
Large (≥25,000)	49	75.3%	1	9.4%
Small (<25,000)	141	24.7%	66	90.6%
Entry year				
2006 or later	70	6.2%	56	73.0%
Before 2006	120	93.8%	11	27.0%

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

obtained from NCQA to each delivered service identified in the claims, and aggregated spending across groups using the exact specifications from NCQA.

Medicare Beneficiary Summary files provided demographic data (age, sex, race/ethnicity, zip code, county, and state of residence), vital status, and health plan and Medicare enrollment information for each beneficiary.

Health Plan Characteristics

We categorized health plans as large (>25,000 enrollees) versus small, and identified health plans new to MA since 2006. CMS provided the tax status.

Statistical Analyses

We compared RRUs and quality of care in each MA plan with a TM sample matched by geographic distribution (RRUs and quality measures) and demographic characteristics (quality measures only) and then aggregated these results to obtain national estimates. For the RRU measures, the control TM population was weighted to match the exact distribution of health plan enrollees across all zip codes in which it operated. Matching on geography controlled for variation in practice patterns within Medicare across regions.[17,18] By matching at the zip code level where possible, we also controlled for unmeasured socioeconomic characteristics associated with residence at this level of geography.

To provide nationally representative estimates of overall HMO and PPO performance relative to traditional Medicare, we averaged HEDIS RRUs and quality measures, respectively, over MA plans and matched cohorts of traditional Medicare enrollees, weighted by MA enrollment. To assess variation in performance of health plans based on particular characteristics relative to matched traditional Medicare in local areas, we used hierarchical regression models with correlated bivariate random effects for each health plan and its matched traditional Medicare sample and fixed effects for the health plan characteristics noted above, including an indicator variable for PPOs, with separate coefficients for the MA and traditional Medicare samples. Because more than 80% of PPOs were small, new, and for-profit, the PPO measure pertains to just this category of PPOs (the few other PPOs were not included in these models).

Finally, for each HMO plan, we created a composite of the 3 diabetes quality measures by taking the mean across the measures, and similarly created an aggregate measure of spending by summing over the 3 spending categories: inpatient care, surgery and other procedures, and evaluation and management services. We constructed similar summary measures of quality and spending for the matched TM cohort for each health plan. We then plotted mean quality relative to the local TM comparison group against mean spending relative to the same comparison group to provide a visual representation of the marginal contribution versus TM for each health plan. We also created a similar plot for the cardiovascular cohort using the single quality measure available for this group.

Analyses were conducted with SAS version 9.2 (SAS Institute, Cary, North Carolina). Two-tailed *P* values are reported for statistical tests. Our study protocol was approved by the Human Studies Committee of Harvard Medical School and the CMS Privacy Board.

RESULTS

Characteristics of the Medicare HMOs and PPOs in our study appear in Table 1. We studied data from 190 HMOs

Table 2. RRU Health Plan and Matched FFS Results (2007)

		Total Spending			Hospital Inpatient			Evaluation and Management		
	n (%)[a]	MA ($)	TM ($)	Ratio	MA ($)	TM ($)	Ratio	MA ($)	TM ($)	Ratio
Diabetes						674,141			602,865	
Overall	100%	5223	6413	0.81	3127	3632	0.86	1085	1260	0.86
Type 1	14%	8419	10,775	0.78	5556	6818	0.81	1529	1877	0.81
Type 2	86%	4693	5687	0.83	2736	3120	0.88	1005	1149	0.88
With comorbidity	82%	5819	7311	0.80	3538	4245	0.83	1191	1410	0.84
Without comorbidity	18%	2638	2522	1.05	1309	925	1.42	642	631	1.02
Cardiovascular Disease						267,933			232,485	
Overall	100%	7642	9815	0.78	4964	6005	0.83	1354	1735	0.78
AMI	2%	12,269	20,028	0.61	8915	14,296	0.62	1658	2526	0.66
Angina	11%	6723	10,003	0.67	4008	5735	0.70	1344	1860	0.72
CAD	73%	6288	7561	0.83	3891	4212	0.92	1169	1445	0.81
CHF	14%	14,699	19,882	0.74	10,616	14,130	0.75	2323	3123	0.74
With comorbidity	87%	8133	10,508	0.77	5322	6475	0.82	1439	1862	0.77
Without comorbidity	13%	4425	5291	0.84	2593	2894	0.90	815	933	0.87

AMI indicates acute myocardial infarction; CAD, coronary artery disease; CHF, congestive heart failure; ED, emergency department; FFS, fee-for-service; MA, Medicare Advantage; RRU, relative resource use; TM, traditional Medicare.
[a]Slightly different numbers of patients were eligible for each of the measures, but we report the number and percentages based on the hospital inpatient data.
Visits are per 1000 member-years; costs are per member per year.
Unadjusted results are weighted to reflect total enrollment.

and 67 PPOs that included 4,207,433, and 318,293 enrollees, respectively, in 2007. About two-thirds of enrollees were in for-profit health plans. Although 75% of the health plans were small (<25,000 members), these HMOs represented only about 25% of enrollment. Most HMOs had participated in Medicare prior to 2006, but only 11 PPOs had done so.

The MA HMOs in our study enrolled approximately 680,000 beneficiaries with diabetes (and the PPOs approximately 50,000) and approximately 268,000 enrollees with 1 of the 4 cardiovascular conditions (and approximately 12,000 PPO enrollees; sample sizes vary slightly by measure). For the diabetes cohort, just under half were male (48.8%) and more than 80% were white. The largest proportion was from the south and more than 85% had at least 1 comorbid condition (eAppendix Table 1, available at **www.ajmc.com**). After weighting the TM sample to match the MA distribution, the 2 samples had identical demographic characteristics.

Utilization in MA and TM by Types of Diabetes and Cardiovascular Disease

With 1 exception, total standardized spending, as well as each of the 3 categories of spending, was markedly lower for MA HMO enrollees than for matched TM enrollees (Table 2). For instance, total spending was 19% less for diabetics enrolled in MA than for those enrolled in TM ($5223 vs $6413; P <.001). The single exception was for diabetics without comorbidity (eg, inpatient spending of $1309 for MA vs $925 for TM; P <.001). Visits to the ED were consistently lower in MA, as were rates of hospital inpatient discharges. Similar results were observed for those enrolled in PPOs (eAppendix Table 2).

Spending and Utilization by Type of Health Plan

Patterns of comparative price-standardized utilization by type of plan are presented in Figures 1 and 2 respectively (eAppendix Table 3 shows the detailed results). For large, established, nonprofit HMOs, all 3 categories of spending were lower than for the matched TM sample, with differences ranging from 16% (evaluation and management services for diabetics) to 70% (surgery rates for those with cardiovascular disease). In contrast, results were mixed for new, for-profit, small HMOs, where aggregate spending was higher in some categories in MA (eg, inpatient spending for cardiovascular disease, 16% higher), and lower for others (eg, surgery and procedures 43% lower for diabetics in MA). Results for PPO health plans were similar to those for new, for-profit, small HMOs.

Spending and Quality of Care by Health Plan Characteristics

The mean plan-weighted rates of A1C testing, LDL cholesterol testing, and diabetic retinal exams were

Surgery Procedures			ED Visits			Inpatient Visits		
MA ($)	TM ($)	Ratio	MA ($)	TM ($)	Ratio	MA ($)	TM ($)	Ratio
	547,844			679,822			677,528	
1011	1521	0.66	437	562	0.78	332	380	0.87
1333	2080	0.64	688	906	0.76	573	720	0.80
952	1418	0.67	396	507	0.78	293	325	0.90
1090	1656	0.66	478	625	0.76	376	441	0.85
686	966	0.71	256	286	0.89	140	109	1.29
	224,299			268,684			267,934	
1354	2074	0.64	567	719	0.79	579	600	0.96
1695	3206	0.53	841	1224	0.69	988	1328	0.74
1371	2408	0.57	548	756	0.72	459	615	0.75
1228	1904	0.65	460	564	0.82	465	434	1.07
1760	2629	0.67	1089	1403	0.78	1194	1326	0.90
1372	2170	0.63	607	774	0.78	621	647	0.96
1017	1464	0.69	301	349	0.86	297	288	1.03

89.7%, 87.6%, and 65.2%, respectively. Figure 3 presents scatter plots of HMO health plan spending and the composite measure of quality for the diabetes cohort by health plan age (established prior to 2006 or not), size (>25,000 members), and tax status. Several findings are apparent: first, while members of most health plans experienced higher quality than the matched TM population in their area and therefore are plotted above the solid horizontal axis, the MA-TM difference varied substantially and for some plans was negative (MA worse than TM). Similarly, MA spending was lower than that in TM for most health plans, but the magnitude of the difference varied and was sometimes reversed (plotted to right of solid vertical axis). Second, there was little association between the spending and quality effects (Pearson correlation coefficient, 0.16), as manifested by the nearly equal distribution of plans across the 4 quadrants formed by median splits (dashed lines) on the 2 variables. Finally, although HMO health plans of each type are present in all 4 quadrants of each plot, the upper left hand quadrant (higher quality/lower spending) contains the most established, large, nonprofit HMO plans and the lower right hand quadrant (lower quality/higher spending) contains a higher proportion of new, small, for-profit HMO plans. A similar pattern was seen for the cardiovascular measures (eAppendix Figure).

DISCUSSION

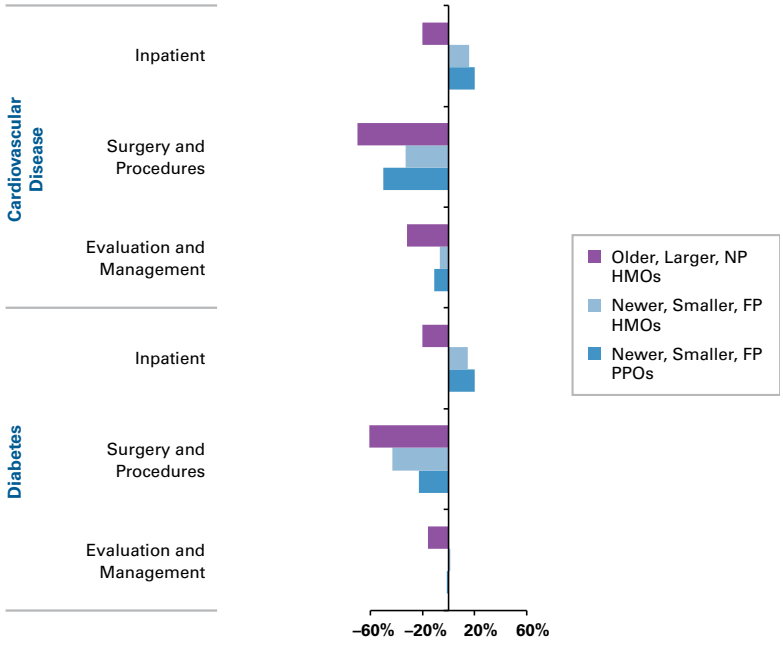
This study provides the first comprehensive comparison between MA and TM of price-standardized utilization and quality of care for those with diabetes and cardiovascular disease, 2 prevalent and costly chronic medical conditions. We found several notable results: first, for both cohorts, RRU—which is a measure of total utilization using a standardized set of prices—was lower in MA health plans than in TM in each of the main categories of spending examined. Moreover, MA plans achieved higher performance on measures of ambulatory quality.[19] Second, marked heterogeneity was evident among MA plans. Most older, larger, nonprofit health plans were able to achieve substantial reductions in service utilization while delivering care of high quality, whereas many newer, smaller, for-profit plans had similar or greater utilization when compared with TM. Finally, utilization among PPOs—an alternative arrangement to HMOs that is generally less managed and coordinated—showed patterns that were similar to new, smaller HMOs and to TM.

Policy Implications

Our findings have important implications for policy. With the 2010 passage of the Affordable Care Act (ACA), the attention of policy makers has now shifted to controlling the seemingly inexorable growth in healthcare costs.[20] Delivering high-value care requires decreasing utilization of services of low value while simultaneously maintaining or increasing the delivery of services of high value. We show that substantial numbers of larger, nonprofit HMO MA plans appear to be delivering care of high quality, while doing so with substantially fewer resources. Whether this is more due to their actions, as payers perhaps linked to their size and ability to influence provider behavior, or to use of more limited and selected networks of providers, or both, is unknown. Although there has been much focus on payment reform in TM—such as the launching of accountable care organizations (ACOs)—30% of Medicare enrollees are in MA health plans, a far larger proportion than are currently in ACOs.[21]

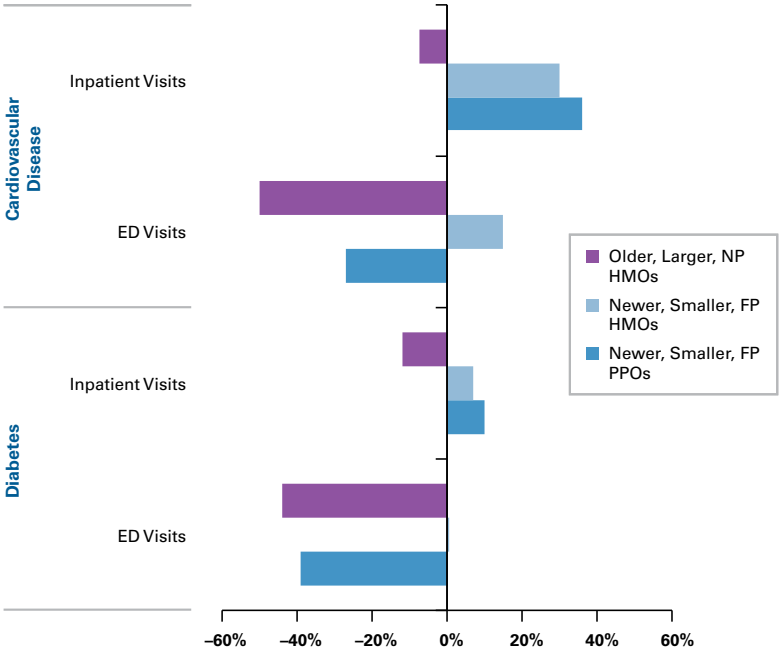
MA plans are currently paid more than TM on average.[22] Because of Medicare regulations and competition

Figure 1. Spending Relative to Traditional Medicare in Older, Larger, NP HMOs; Newer, Smaller, FP HMOs; and Newer, Smaller, FP PPOs



FP indicates for-profit; HMO, health maintenance organization; NP, nonprofit; PPO, preferred provider organization.

Figure 2. Emergency Department and Inpatient Utilization Rates Relative to Traditional Medicare in Older, Larger, NP HMOs; Newer, Smaller, FP HMOs; and Newer, Smaller, FP PPOs



ED indicates emergency department; FP, for-profit; HMO, health maintenance organization; NP, nonprofit; PPO, preferred provider organization.

among plans, many of the savings from these extra payments and the reduced utilization we documented in this study are passed through to beneficiaries in the form of lower premiums, less cost sharing, and benefits for noncovered services.[23] However, providers may also profit from these excess payments, as they may be able to negotiate higher prices from MA plans. To finance its expansion of health insurance, the ACA reduced reimbursement for MA plans; how these reductions will impact plan and beneficiary participation and the future growth of the MA program remains an open question.

Although MA plans as a whole were able to achieve substantially lower utilization rates, we found considerable heterogeneity among health plan types, consistent with earlier analyses.[5,24] In particular, larger, more established (mostly nonprofit) health plans were able to deliver care of high quality at substantially lower cost. Health plans may use a variety of approaches to influence the costs and quality of care,[25] ranging from contractually based incentives and pay-for-performance to care management programs directed to either patients or physicians, and utilization management programs such as prior authorization requirements. Future research will be needed to elucidate more fully how health plans have achieved these savings and what the most effective approaches might be.

Limitations

An important limitation of our research is that our quality measures were limited to basic ambulatory services, and we lacked measures of more complex services (eg, appropriate use of coronary revascularization procedures, such as coronary artery bypass graft surgery, for which rates are higher in MA health plans[10]) and outcomes of care. Ultimately, healthcare organizations must be evaluated on their success at controlling spending while improving both intermediate clinical outcomes (eg, control of blood pressure) and ultimate outcomes such as risk-adjusted mortality. Larger, more established

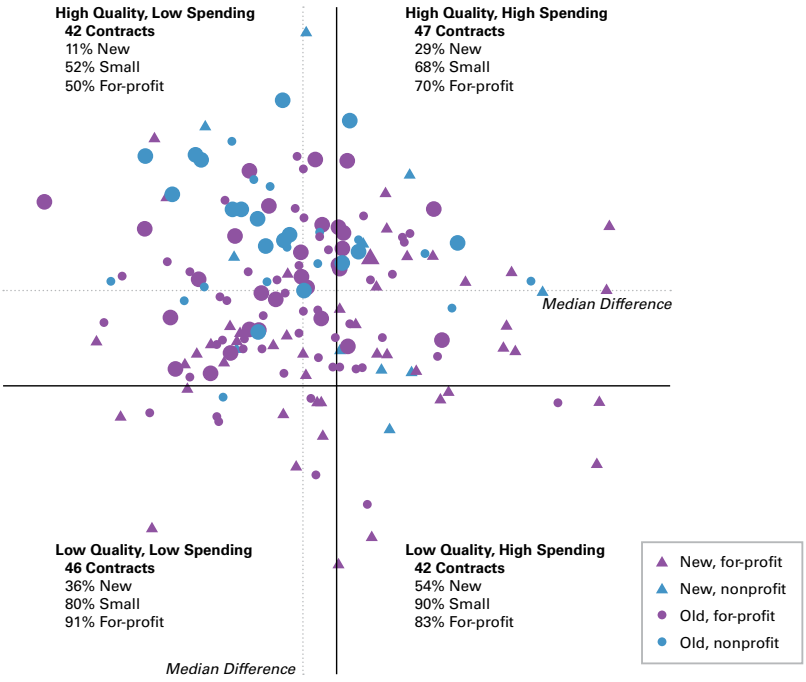
HMOs may have greater ability to achieve these goals.[25,26] Future extensions of this research should evaluate the extent to which health plans achieve savings while improving outcomes of care that are important to patients and delivery systems as a whole.

Our study is subject to several additional limitations. One possible explanation for our findings is favorable selection into MA, as suggested by research using data prior to the time of our study.[27] To minimize the impact of such selection effects in our analysis, we matched MA and TM enrollees by age, sex, race/ethnicity, and geographic area, usually at the zip code level, which in the aggregate created cohorts with similar sociodemographic characteristics. Indeed, the health services research literature commonly uses US Census data at this level to impute these characteristics.[28-31] We then compared care for patient populations with specific diagnoses, further controlling for clinical characteristics that might be associated with higher spending. Furthermore, favorable selection into MA appears to have fallen considerably in recent years.[32-34] Also, our data are now several years old. These data, however, are from the most recent year of RRU data for which CMS required reporting by health plans. Nonetheless, the RRU data made possible analyses that would not otherwise be possible given the unavailability of health plan claims data, despite only covering a limited set of conditions. Finally, the RRU data that health plans submitted to CMS were not fully audited and may have been incompletely reported since they did not affect payment.

CONCLUSIONS

Proponents of managed care have long argued that integrated health plans can deliver care more efficiently than traditional fee-for-service care by using their ability to tailor their provider networks to the needs of their population and to implement disease and case management programs to improve chronic disease management.[19] In this large national study of enrollees with diabetes or cardiovascular disease, our findings suggest that many Medicare HMO health plans are able to deliver care of equal or better quality with lower RRU than TM.

Figure 3. Comparative Spending and Quality of Care for Enrollees With Diabetes in Medicare Advantage HMOs Compared With Matched Traditional Medicare



FFS indicates fee-for-service; HMO, health maintenance organization; RRU, relative resource use.
The dashed lines represent the median of the difference of each health plan and its matched FFS population across the entire population of HMOs. The quality of care composite is a simple mean of the 3 measures. The x and y axes represent the difference in mean quality and mean spending (calculated by summing the 3 RRU spending measures) for each health plan and its matched traditional Medicare comparison group. Quadrants are defined by the median values. Larger symbols represent large health plans (>25,000 enrollment).

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Author Affiliations: Department of Health Care Policy, Harvard Medical School (BEL, AMZ, JPN, JZA), Boston, MA; Division of Primary Care and General Internal Medicine, Department of Medicine, Beth Israel Deaconess Medical Center (BEL), Boston, MA; National Committee for Quality Assurance (RS), Washington, DC; Stevens and Lee (LGP), Lancaster, PA; Department of Health Policy and Management, Harvard School of Public Health (JPN), Boston, MA; John F. Kennedy School of Government, Harvard University (JPN), Boston, MA; National Bureau of Economic Research (JPN), Cambridge, MA; Institute for Healthcare Policy and Innovation, Gerald R. Ford School of Public Policy, University of Michigan (JZA), Ann Arbor, MI; Division of General Medicine, Medical School, University of Michigan (JZA), Ann Arbor, MI; Department of Health Management and Policy, School of Public Health, University of Michigan (JZA), Ann Arbor, MI.

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Authorship Information: Concept and design (BEL, JZA, AMZ, JPN); acquisition of data (LGP, JPN, RS); analysis and interpretation of data (BEL, JZA, AMZ, JPN, RS); drafting of the manuscript (BEL, LGP); critical revision of the manuscript for important intellectual content (JZA, LGP, AMZ, JPN, RS); statistical analysis (BEL, AMZ, JPN); obtaining funding (BEL, JPN).

Address correspondence to: Bruce E. Landon, MD, MBA, MSc, Department of Health Care Policy, Harvard Medical School, 180 Longwood Ave, Boston, MA 02215. E-mail: landon@hcp.med.harvard.edu.

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eAppendix. Statistical Appendix and Supplementary Tables

Matching

To implement matching, we tabulated the denominator population (the entire population qualifying for either the diabetes or cardiovascular relative resource use measures) by cells defined by age (5-year ranges), sex, race, and zip code and county of residence, as reported in the Medicare Beneficiary Summary File. We calculated summary means or rates from the traditional Medicare (TM) data for the corresponding claims-based measures for cells defined by the same tabulation variables (excluding the plan identifier variable), as well as for cells with coarsened geography at both the county and state levels. We then matched every cell of the Medicare Advantage (MA) tabulation to a corresponding cell of the TM summaries with identical demographic characteristics and the same 5-digit zip code if there were TM cases eligible for the measure. Otherwise, we matched to the county summary and to the overall state summary for the demographic cell if there were no matching data within the county. More than 95% of matches were at the zip code level.

Finally, for each health plan we calculated a weighted mean of the TM summary means with weights defined by the MA frequency of the cell. Through this process, in effect, every denominator case in the MA data was matched to a case or cases in the TM data with the same demographic characteristics and the best possible geographic match.

eAppendix Table 1. Descriptive Statistics for Medicare Advantage (MA) and Matched Traditional Medicare (TM) to MA Diabetes Cohorts

		Diabetes		
		TM	**MA**	**MA matched to TM**
Sample Size (N)		529,839	697,627	
Sex	Male	48.4%	48.8%	48.8%
	Female	51.7%	51.2%	51.2%
Race	White	81.5%	80.7%	80.7%
	Black	12.2%	12.1%	12.1%
	Hispanic	1.8%	2.1%	2.1%
	Other	4.5%	5.2%	5.2%
Age (years)	65-69	43.3%	52.2%	52.2%
	70-74	36.9%	47.8%	47.8%
Region	Northeast	17.3%	22.8%	22.8%
	Midwest	24.7%	21.1%	21.1%
	South	42.7%	29.9%	29.9%
	West	15.3%	26.2%	26.2%
Comorbidities	Yes	86.6%	81.5%	81.5%
	No	13.4%	18.5%	18.5%
Type of diabetes	Type 1	10.2%	13.9%	13.9%
	Type 2	89.8%	86.1%	86.1%

eAppendix Table 2. 2007 PPO RRU Health Plan and Matched FFS Results (PPO only)

	Hospital Inpatient				Evaluation and Management				Surgery and Procedures				ED Visits				Inpatient Visits			
	n (%)	**MA ($)**	**TM ($)**	**ratio**	**n (%)**	**MA ($)**	**TM ($)**	**ratio**	**n (%)**	**MA ($)**	**TM ($)**	**ratio**	**n (%)**	**MA**	**TM**	**ratio**	**n (%)**	**MA**	**TM**	**ratio**
Diabetes	51,533				51,533				46,972				51,533				51533			
Overall	100	3084	3273	**0.94**	100	1108	1136	**0.97**	100	1171	1537	**0.76**	100	383	522	**0.73**	100	311	343	**0.91**
Type 1	18	4656	5528	**0.84**	18	1326	1639	**0.81**	18	1300	2093	**0.62**	18	509	852	**0.60**	18	456	592	**0.77**
Type 2	82	2748	2791	**0.98**	82	1061	1029	**1.03**	82	1142	1413	**0.81**	82	356	451	**0.79**	82	281	290	**0.97**
With comorb	75	3618	4051	**0.89**	75	1242	1302	**0.95**	75	1282	1708	**0.75**	75	422	602	**0.70**	75	366	421	**0.87**
Without comorb	25	1444	884	**1.63**	25	695	627	**1.11**	25	834	1018	**0.82**	25	264	276	**0.95**	25	143	105	**1.37**
CV	11,911				11,911				11,911				11,911				11,911			
Overall	100	4619	5460	**0.85**	100	1390	1581	**0.88**	100	1515	2015	**0.75**	100	457	634	**0.72**	100	521	529	**0.99**
AMI	2	8748	12060	**0.73**	2	1944	2174	**0.89**	2	2345	2802	**0.84**	2	656	1219	**0.54**	2	866	1219	**0.71**
Angina	7	4997	5362	**0.93**	7	1434	1678	**0.85**	7	1761	2435	**0.72**	7	436	620	**0.70**	7	466	567	**0.82**
CAD	78	3466	3916	**0.89**	78	1194	1324	**0.90**	78	1364	1857	**0.73**	78	376	520	**0.72**	78	421	392	**1.07**
CHF	12	11072	14250	**0.78**	12	2530	3071	**0.82**	12	2192	2634	**0.83**	12	953	1270	**0.75**	12	1137	1257	**0.90**
With comorb	84	5052	5853	**0.86**	84	1501	1708	**0.88**	84	1607	2098	**0.77**	84	495	692	**0.71**	84	573	575	**1.00**
Without comorb	16	2382	3426	**0.70**	16	817	924	**0.88**	16	1041	1583	**0.66**	16	261	333	**0.78**	16	252	292	**0.86**

AMI indicates acute myocardial infarction; CAD, coronary artery disease; CHF, congestive heart failure; comorb, comorbidity; CV, cardiovascular; ED, emergency department; FFS, fee-for-service; HMO, health maintenance organization; MA, Medicare Advantage; PPO, preferred provider organization; RRU, relative resource use; TM, traditional Medicare.

Visits are per 1000 member-years; costs are per member per year.

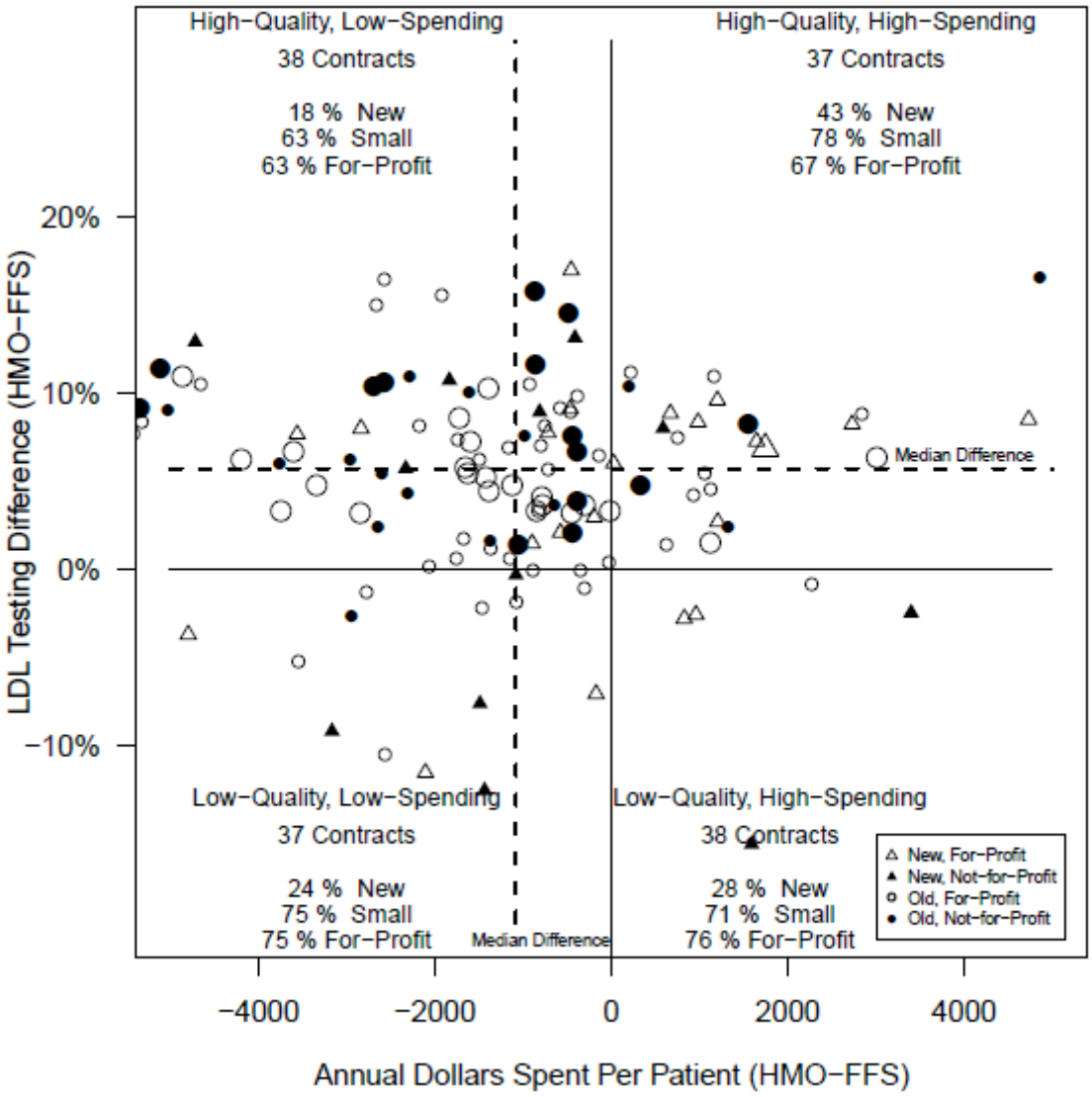
Unadjusted results are weighted to reflect total enrollment.

eAppendix Table 3. Performance Measures for Medicare HMOs and Matched Traditional Medicare Enrollees by HMO Characteristics in 2007

Measure	Nonprofit, large, established HMOs				For-profit, small, new HMOs				For-profit, Small, New PPOs			
	HMO	Matched TM	MA-TM	MA-TM %	HMO	Matched TM	MA-TM	MA-TM %	HMO	Matched TM	MA-TM	MA-TM %
Diabetes Care												
Evaluation and management	$1036	$1204	($169)	(16%)	$1194	$1177	$16	1%	$1108	$1120	($12)	(1%)
Inpatient	$2920	$3500	($580)	(20%)	$4014	$3403	$611	15%	$4230	$3396	$834	20%
Surgery	$917	$1475	($558)	(61%)	$1043	$1491	($448)	(43%)	$1249	$1540	($291)	(23%)
ED visits/100	39	56	(17)	(44%)	56	57	0.014	0.025%	41	57	(16)	(39%)
Inpatient visits/100	33	37	(4)	(12%)	41	38	3	7%	41	37	4	10%
Cardiovascular												
Evaluation and management	$1258	$1660	($402)	(32%)	$1715	$1828	($113)	(7%)	$1394	$1551	($156)	(11%)
Inpatient	$4636	$5582	($946)	(20%)	$8033	$6751	$1282	16%	$7182	$5720	$1,461	20%
Surgery	$1160	$1974	($814)	(70%)	$1606	$2142	($536)	(33%)	$1399	$2094	($695)	(50%)
ED visits/100	47	70	(23)	(50%)	99	83	15	15%	56	71	(15)	(27%)
Inpatient visits/100	53	57	(4)	(7.5%)	82	57	24	30%	73	47	26	36%

ED indicates emergency department; HMO, health maintenance organization; MA, Medicare Advantage; PPO, preferred provider organization; TM, traditional Medicare.
Estimates derived from hierarchical linear regression models. Smaller HMOs had <25,000 enrollees, and newer HMOs joined Medicare in 2006 or later.

eAppendix Figure. Comparative Spending and Quality of Care for Enrollees With Cardiovascular Conditions in MA HMOs Compared to Matched Traditional Medicare



FFS indicates fee-for-service; HMO, health maintenance organization; LDL, low-density lipoprotein cholesterol; MA, Medicare Advantage; RRU, relative resource use; TM, traditional Medicare.

The dashed lines represent the median of the difference of each health plan and its matched FFS population across the entire population of HMOs. The x and y axes represent the difference in mean quality and mean spending (calculated by summing the 3 RRU spending measures) for each health plan and its matched TM comparison group. Quadrants are defined by the median values. Larger symbols represent large health plans (>25,000 enrollment).