SPECIAL ARTICLE

Health Care Spending and Quality in Year 1 of the Alternative Quality Contract

Zirui Song, B.A., Dana Gelb Safran, Sc.D., Bruce E. Landon, M.D., M.B.A., Yulei He, Ph.D., Randall P. Ellis, Ph.D., Robert E. Mechanic, M.B.A., Matthew P. Day, F.S.A., M.A.A.A., and Michael E. Chernew, Ph.D.

ABSTRACT

BACKGROUND

In 2009, Blue Cross Blue Shield of Massachusetts (BCBS) implemented a global payment system called the Alternative Quality Contract (AQC). Provider groups in the AQC system assume accountability for spending, similar to accountable care organizations that bear financial risk. Moreover, groups are eligible to receive bonuses for quality.

METHODS

Seven provider organizations began 5-year contracts as part of the AQC system in 2009. We analyzed 2006–2009 claims for 380,142 enrollees whose primary care physicians (PCPs) were in the AQC system (intervention group) and for 1,351,446 enrollees whose PCPs were not in the system (control group). We used a propensity-weighted difference-in-differences approach, adjusting for age, sex, health status, and secular trends to isolate the treatment effect of the AQC in comparisons of spending and quality between the intervention group and the control group.

RESULTS

Average spending increased for enrollees in both the intervention and control groups in 2009, but the increase was smaller for enrollees in the intervention group — $15.51 (1.9%) less per quarter (P=0.007). Savings derived largely from shifts in outpatient care toward facilities with lower fees; from lower expenditures for procedures, imaging, and testing; and from a reduction in spending for enrollees with the highest expected spending. The AQC system was associated with an improvement in performance on measures of the quality of the management of chronic conditions in adults (P<0.001) and of pediatric care (P=0.001), but not of adult preventive care. All AQC groups met 2009 budget targets and earned surpluses. Total BCBS payments to AQC groups, including bonuses for quality, are likely to have exceeded the estimated savings in year 1.

CONCLUSIONS

The AQC system was associated with a modest slowing of spending growth and improved quality of care in 2009. Savings were achieved through changes in referral patterns rather than through changes in utilization. The long-term effect of the AQC system on spending growth depends on future budget targets and providers' ability to further improve efficiencies in practice. (Funded by the Commonwealth Fund and others.)

From the Department of Health Care Policy, Harvard Medical School (Z.S., B.E.L., Y.H., M.E.C.), Blue Cross Blue Shield of Massachusetts (D.G.S., M.P.D.), and the Department of Economics, Boston University (R.P.E.) — all in Boston; the National Bureau of Economic Research, Cambridge (Z.S.); and the Heller School for Social Policy and Management, Brandeis University, Waltham (R.E.M.) — all in Massachusetts. Address reprint requests to Mr. Song at the Department of Health Care Policy, Harvard Medical School, 180 Longwood Ave., Boston, MA 02115, or at zirui_song@hms.harvard.edu.

This article (10.1056/NEJMsa1101416) was published on July 13, 2011, at NEJM.org.

N Engl J Med 2011.

The growth of health care spending is a major concern for households, businesses, and state and federal policymakers.[1-3] In response to the continued growth in spending in Massachusetts after health care reform, Blue Cross Blue Shield of Massachusetts (BCBS), the state's largest commercial payer, implemented the Alternative Quality Contract (AQC) in January 2009.[4] The AQC is a contracting model that is based on global payment and pay for performance. It is similar to the two-sided model for accountable care organizations specified by the Centers for Medicare and Medicaid Services (CMS) in its proposed regulations for those organizations.[5]

Global payment has received attention as an alternative financing mechanism to fee for service, because there is greater opportunity to control total spending with a global-payment approach than with a fee-for-service system.[6,7] In July 2009, the members of a Massachusetts state commission voted unanimously to move the state toward global payment within 5 years.[8] In contrast to a one-sided, "shared savings" accountable care organization model, in which providers do not bear risk, providers in a global-payment model share in savings if spending is below the prespecified budget but are also accountable for deficits if spending exceeds the budget.[9-11] This "downside" risk is a strong incentive for controlling spending.[12-14]

BCBS implemented the AQC in its health-maintenance-organization (HMO) and point-of-service enrollee population. These plans require enrollees to designate a primary care physician (PCP), a feature that is also found in many patient-centered medical home models.[15-19] Currently, the AQC does not extend to enrollees in a preferred-provider organization, since they are not required to designate a PCP. Therefore, when a provider organization enters the AQC, only patients enrolled in its HMO or point-of-service program are included in the contract.

The AQC contains three main features that distinguish it from traditional fee-for-service contracts and from capitation contracts locally and nationally.[4] First, physician groups, in some cases together with a hospital, enter into 5-year global budget contracts (rather than 1-year contracts). Baseline budgets and future increases in budgets are based on negotiations with BCBS, but no group was given a 2009 budget that was less than the amount the group spent in 2008. The budget covers the entire continuum of care, including inpatient, outpatient, rehabilitation, and long-term care and prescription drugs. The PCP's organization is accountable for all enrollee services, regardless of whether the enrollee receives care from the PCP, the PCP's organization, or any other provider. Since the model currently applies only to patients enrolled in an HMO or point-of-service program, enrollees must seek referrals for care by a specialist, consistent with the benefit designs of those plans. During the year, BCBS pays claims on a fee-for-service basis according to negotiated rates, with reconciliation of the budget at the end of the year.

Second, AQC groups are eligible for pay-for-performance bonuses up to 10% of their budget, with performance measures of ambulatory care and hospital care each contributing to half of the calculation of the bonus (Section 1 in the Supplementary Appendix, available with the full text of this article at NEJM.org). The potential bonus is substantially larger than typical bonuses in pay-for-performance programs in the United States. BCBS sets a range of performance thresholds, or "gates," for each measure at the beginning of the contract, and these gates remain fixed throughout the duration of the contract.[4] An annual score that is based on performance is given for each measure. Scores are weighted and aggregated to calculate the amount of the bonus paid to the AQC group.

Third, AQC groups receive technical support from BCBS, including reports on spending, utilization, and quality, to assist them in managing their budget and improving quality. In 2009, a total of 7 physician organizations, comprising 321 PCP practices and more than 4000 physicians in total, began assuming risk under the AQC system for more than 25% of the patients enrolled in a BCBS HMO or point-of-service program. Groups ranged from large physician–hospital organizations to small independent practices united by common leadership. Some AQC groups had prior risk contracts from BCBS, whereas others entered from fee-for-service contracts that did not involve financial risk. As of 2011, the AQC has grown to 12 groups, accounting for 44% of the patients enrolled in a BCBS HMO or point-of-service program. We evaluated the effect of the AQC system on health care spending and on measures of the quality of ambulatory care in 2009.

METHODS

STUDY POPULATION

Our population included enrollees in BCBS from January 2006 through December 2009. Of the 2,335,593 members in HMO or point-of-service programs, we excluded 701,079 who were not continuously enrolled for at least 1 calendar year. The remaining 1,634,514 members comprised the sample for our main analyses. All AQC and non-AQC providers with patients enrolled in BCBS were included. The Office for Research Subject Protection at Harvard Medical School approved the study and waived the requirement for individual informed consent.

STUDY DESIGN

We used an intervention–control, preintervention–postintervention, difference-in-differences approach to isolate the effect of the AQC. For our spending analyses, the preintervention period was 2006 through 2008, and the postintervention period was 2009. The intervention group consisted of all enrollees who designated PCPs in practices that began assuming risk under the AQC in 2009, and the control group consisted of the enrollees whose PCPs did not join the AQC system. Within the intervention group, we also prespecified two subgroups: one consisting of providers who had prior experience with risk-based contracts from BCBS (prior-risk subgroup), and the other of providers who entered the AQC without such prior experience (no-prior-risk subgroup). We hypothesized that the AQC would have a larger effect on spending in the no-prior-risk subgroup.

We compared spending between the intervention group and the control group, between the prior-risk subgroup and the control group, and between the no-prior-risk subgroup and the control group. For all three comparisons, we analyzed the AQC effect in four ways to understand the source of spending differences. First, we performed an analysis according to clinical category using the Berenson–Eggers Type of Service (BETOS) classification, version 2009, from the CMS.[20] Second, we performed an analysis according to site (inpatient vs. outpatient) and type of care (professional services vs. facility services). Third, we examined the results according to quartile of enrollees' health risk score.

Finally, we separated the AQC effect into price and utilization components by repricing claims for each service to its median price across all providers in the study period. Repriced spending differences reflect differences in utilization only. Moreover, we examined measures of utilization such as admissions or procedures directly. We further analyzed the spending differences due to price (fees) to consider two potential explanations: differential changes in fees (e.g., intervention groups may have received lower increases in fees than control groups) and differential changes in referral patterns (e.g., AQC enrollees may have received more care from providers who charge lower fees). This was accomplished by repricing claims to the median 2009 price for each service within each practice.

In our analysis of quality, we compared the performance on process measures of ambulatory care between AQC providers and non-AQC providers, using 2007–2009 data. These measures are primary care–oriented measures and are under the direct control of the AQC groups. The measures follow the specifications of the Healthcare Effectiveness Data and Information Set (HEDIS), which is used by most health plans. We analyzed individual measures and aggregate measures of the management of chronic conditions in adults, preventive care for adults, and care of children.

VARIABLES

For our spending analysis, the dependent variable was aggregate medical spending per member per quarter (combining BCBS spending and enrollee cost sharing). We excluded spending for prescription drugs from our primary analysis because not all enrollees had prescription-drug coverage through BCBS. Spending was computed from claims-level fee-for-service payments made within the global budget. This is an accurate measure of medical spending on the basis of utilization and negotiated fee-for-service prices, but it does not capture the quality bonuses or end-of-year budget reconciliation.

For each measure of the quality of ambulatory care, the dependent variable was a dichotomous variable indicating whether the criteria for performance of the measure were met for an eligible member in a given year. Eligibility was defined by member characteristics and diagnosis; for example, diabetes measures were restricted to members with diabetes.

We controlled for age categories, interactions between age and sex, risk score, and secular trends

to correct for differences in individual traits across intervention and control groups. Risk scores were calculated by BCBS from current-year diagnoses, claims, and demographic information with the use of the diagnostic-cost-group (DxCG) scoring system (Verisk Health),[21] which is similar to the method used by the CMS for risk adjustment of payments to Medicare Advantage plans. Higher scores indicate lower health status and higher expected spending. The DxCG score is calculated from statistical analyses in which a national claims database is used to relate current-year spending to current-year diagnoses and demographic information.

STATISTICAL ANALYSIS

All analyses were conducted at the enrollee level and quarter level. We used a one-part generalized linear model with propensity weights,[22] which mitigated differences in individual traits across intervention and control groups. Propensity weights were calculated with the use of data on age, sex, and risk scores. The dependent variable was spending (in dollars) per member per quarter. Our baseline model was not logarithmically transformed because the risk score is designed to predict dollar spending. Moreover, evidence shows that linear models perform better than more complex functional forms in predicting health spending.[23-26]

Additional independent variables included an indicator for the intervention, indicators for each quarter, and the interaction between quarter and intervention. We also included an indicator for the postintervention period, as well as the interaction of that indicator with the intervention group, which produced our estimate of the policy effect. Huber–White corrections were used to adjust standard errors for clustering of multiple observations for each person.[27-29]

To assess the effect of the AQC on quality, we estimated an analogous difference-in-differences model. For aggregate quality analysis, we pooled measures and adjusted for measure-level fixed effects. Independent variables were analogous to those in the spending model, with year indicators in place of quarter indicators.

We conducted a number of sensitivity analyses (Section 2 in the Supplementary Appendix). We also tested for changes in risk scores that would be consistent with the possibility that physicians may "upcode" to garner increased payments, which would make AQC patients seem sicker and thus would make spending adjusted for health status seem lower. This was an issue in the evaluation of Medicare's Physician Group Practice Demonstration.[30] For all analyses, we used STATA software, version 11. Results are reported with two-tailed P values.

RESULTS

STUDY POPULATION

There were 380,142 subjects in the intervention group and 1,351,446 subjects in the control group with at least 1 year of continuous enrollment from 2006 through 2009. The average age, the sex distribution, and the average health risk scores were similar between the groups (Table 1).

SPENDING

Health care spending increased for both AQC and non-AQC enrollees in 2009, but the increase was smaller for AQC enrollees (Table 2). Statistical estimates indicated that the intervention was associated with a $15.51 decrease (95% confidence interval [CI], –27.21 to –3.81) in average quarterly spending per enrollee in 2009, a 1.9% savings relative to the control group (P=0.007). In our models, the interaction of the secular trend with the AQC indicator showed that there were no significant differences in spending trends between the intervention group and the control group before the intervention (between-group difference of $0.89, P=0.28).

Procedures, imaging, and testing accounted for more than 80% of the savings. Further analysis showed that savings derived largely from less spending on facility services in the outpatient setting. There were no significant changes in spending for inpatient care or for physician services. Our analysis according to enrollee's health status showed that enrollees in the highest quartile of risk score accounted for most of the savings (savings of $14.75, P=0.01) (Fig. 1).

Models with standardized prices showed that there was no significant effect of the intervention on utilization. This finding was supported by quantity analyses of procedures, imaging, testing, admissions, and office visits. Thus, the observed savings reflect differences in price (Section 3 in the Supplementary Appendix).

This price effect could have resulted either from the providers in the intervention group receiving smaller increases in fees or from enrollees in the intervention group being shifted to

Table 1. Characteristics of the Study Population.*

Characteristic	All Intervention Groups (N=380,142)		Control Group (N=1,351,446)	
	Before Implementation of AQC (2006–2008)	After Implementation of AQC (2009)	Before Implementation of AQC (2006–2008)	After Implementation of AQC (2009)
Age (yr)	34.4±18.6	35.3±18.5	35.3±18.7	35.5±18.8
Female sex (%)	52.6	51.2	51.8	51.0
Health risk score†				
Mean	1.08	1.16	1.11	1.16
Interquartile range	0.12–1.29	0.13–1.39	0.11–1.33	0.12–1.39

* Plus–minus values are means ±SD. The total number of enrollees in the intervention and control groups exceeds 1,634,514 because there were enrollees who had one primary care physician in the intervention group and another in the control group for at least 1 year in each case. AQC denotes Alternative Quality Contract.

† The health risk score takes into account the health status of the enrollee and expected spending. It is calculated with the use of the diagnostic-cost-group (DxCG) scoring system (Verisk Health),[21] which uses statistical analyses based on a national claims database to relate current-year spending to current-year diagnoses and demographic information. The DxCG method is a commonly used, proprietary method similar to Medicare's Hierarchical Condition Category (HCC) system, which is used for risk adjustment of prospective payments to Medicare Advantage plans (and was developed by the same organization). DxCGs are designed for persons younger than 65 years of age and are more detailed than the HCC system. Among all the subjects, the scores ranged from 0 to 66 (mean [±SD], 1.13±1.86).

providers who charged lower fees. We found no significant differences in price trends (including hospital, non-hospital facility, and physician fees) between intervention and control providers. Our model with prices standardized according to physician practice showed that the price effect resulted from changes in referral patterns, whereby AQC patients were referred to providers who charged lower fees. Those providers could be in non-hospital settings (such as ambulatory surgery centers) or in hospitals that had lower negotiated fees for outpatient care than did other hospitals. This model showed that referral shifts accounted for a decrease of $14.21 in average quarterly spending per enrollee in 2009, representing more than 90% of the AQC-associated relative decrease in quarterly spending in 2009 (P<0.001) (Section 3 in the Supplementary Appendix).

As compared with the control group, the prior-risk subgroup incurred nonsignificant total savings of $9.29 (95% CI, –21.45 to 2.86), or 1.1%, per enrollee per quarter (P=0.13). In contrast, the no-prior-risk subgroup incurred larger and significant savings of $45.52 (95% CI, –78.13 to –12.90), or 6.3% (P=0.006), suggesting that this subgroup drove the main findings. Subgroup analyses mirrored the analyses of main findings (Section 4 in the Supplementary Appendix). An interaction test of the differential effect of the intervention between the two subgroups showed that there was a savings of $32.94 with the intervention (95% CI, –66.72 to 0.83; P=0.06). Sensitivity analyses supported our results (Section 2 in the Supplementary Appendix).

QUALITY

The intervention was associated with an increase of 2.6 percentage points in the proportion of eligible enrollees for whom quality thresholds for chronic care management were met (P<0.001) and an increase of 0.7 percentage points in the proportion of eligible enrollees for whom pediatric care thresholds were met (P=0.001) (Table 3). The AQC was not associated with significant improvement in adult preventive care. Comparisons between the prior-risk subgroup and the control group, as well as between the no-prior-risk subgroup and the control group, yielded similar results (not shown).

BCBS PAYMENTS

The savings associated with the intervention do not imply that total payments made by BCBS declined. Total BCBS payments must take into account quality bonuses and end-of-year budget surpluses paid to the AQC groups. In 2009, quality bonuses were generally between 3% and 6% of the budgets. Additional BCBS support for information technology, staffing, and other needs was between 0% and 2% of the budgets. Moreover, all AQC groups spent less than their 2009 budget targets, earning, on average, 3% in budget surpluses (consistent with our estimates). Taken to-

Table 2. Change in Average Health Care Spending per Member per Quarter in the Intervention and Control Groups.*

Spending	Intervention Group (N=380,142)			Control Group (N=1,351,446)			Between-Group Difference (Intervention – Control)	P Value
	Before Implementation of AQC	After Implementation of AQC	Change	Before Implementation of AQC	After Implementation of AQC	Change		
Total quarterly spending (U.S. $)	756	808	53	785	854	69	–15.51	0.009
Spending by BETOS category† (U.S. $)								
Evaluation and management	180	206	25	181	208	27	–2.22	0.002
Procedures	166	176	10	168	184	16	–5.96	0.001
Imaging	94	102	8	100	112	11	–3.47	<0.001
Test	67	75	7	74	85	11	–3.72	<0.001
Durable medical equipment	10	12	2	11	13	2	–0.14	0.68
Other	48	50	2	54	55	1	0.80	0.72
Exceptions or unclassified	190	189	–1	197	197	0	–0.80	0.84
Spending by site and type of care (U.S. $)								
Inpatient								
Professional services	35	36	2	34	37	2	–0.72	0.38
Facility services	152	154	3	156	158	3	0.23	0.95
Outpatient								
Professional services	316	350	34	300	334	34	–0.28	0.80
Facility services	214	230	16	255	285	30	–14.50	<0.001
Ancillary	39	39	–1	40	40	0	–0.24	0.86

* The intervention group comprised enrollees whose primary care physicians were in the Alternative Quality Contract (AQC) system of Blue Cross Blue Shield of Massachusetts, and the control group comprised enrollees whose primary care physicians were not part of the AQC system. Blue Cross Blue Shield of Massachusetts implemented the AQC system in 2009. All spending figures are in 2009 U.S. dollars.

† The clinical categories were designated according to the Berenson–Eggers Type of Service (BETOS) classification, version 2009,

gether, these first-year investments and payouts exceeded our average estimated savings of 1.9%, suggesting that total payments by BCBS to AQC groups rose for AQC groups in the first year.

DISCUSSION

The AQC was associated with modestly lower medical spending and improved quality in the first year after implementation. The savings derived largely from shifting outpatient care to providers who charged lower fees and were seen primarily among high-risk enrollees. Savings were larger among providers who were previously paid by BCBS in a fee-for-service system. These results were consistent with results from a series of sensitivity analyses and do not appear to be attributable to upcoding. In addition, spending trends before the intervention did not differ significantly between the intervention and control groups.

The improvements in quality are probably due to a combination of substantial financial incentives and BCBS data support. AQC quality bonuses are much higher than those in most pay-for-performance programs in the United States, since they apply to the entire global budget rather than to physician services alone or PCP services alone.[31]

Our study has several limitations. The study population was young and included only members enrolled in a BCBS HMO or point-of-service program. Therefore, the results may not be generalizable to the Medicare population, enrollees in a preferred-provider organization or indemnity plan, or persons who live in other states. However, the effects were greater for enrollees who had higher expected spending, so programs serving older populations may result in even larger savings. Furthermore, we did not examine the details of each AQC contract, which varied to some degree, or collect information on whether providers had risk contacts with other payers. Although our results suggest that quality improved, process measures do not completely capture quality. Formal evaluation of outcome measures could not be conducted owing to the lack of enrollee-level outcomes data before the implementation of the AQC. However, a weighted average of five outcome metrics at the provider-organization level suggests that the outcomes in AQC groups in 2009 were better than or similar to BCBS network averages for 2007, 2008, and 2009 (Section 5 in the Supplementary Appendix).

Our findings do not imply that overall spending fell for BCBS in the first year. This observation reflects the design of the AQC, which focuses on slowing the growth of spending and improving quality initially, rather than saving money in the first year. The AQC targets were set on the basis of actuarial projections to save money over the course of the 5-year contract, even after anticipated quality bonuses. Initial investments help to motivate participation and support the changes in the delivery system that are required for providers to succeed in managing spending and improving quality. Because the risk is borne primarily by the provider groups, fiscal success from the insurer's perspective depends on how well budgets and bonuses are set.

In total, the magnitude of savings was modest. Sustainability of the AQC and the financial viability of the model for providers will ultimately depend on identifying and addressing clinically inefficient care and changing utilization patterns. Nevertheless, our findings on changes in referral patterns and improvements in quality

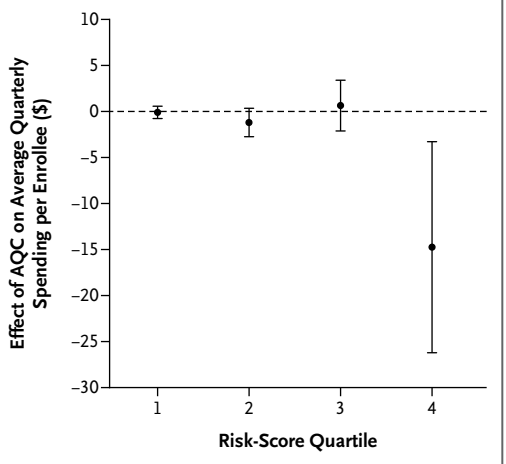

Figure 1. Difference-in-Differences Estimates of the Effect of the Alternative Quality Contract (AQC) on Average Health Care Spending.

The figure shows difference-in-differences estimates of the effect of the AQC on average health care spending per member per quarter, according to quartile of risk score. The intervention group (enrollees in Blue Cross Blue Shield of Massachusetts whose primary care physicians were in the AQC system) was compared with the control group (enrollees whose primary care physicians were not in the AQC system). Risk scores were calculated with the use of the diagnostic-cost-group (DxCG) scoring system (Verisk Health),[21] in which higher scores indicate lower health status and higher expected spending. I bars indicate 95% confidence intervals.

Table 3. Change in Performance on Measures of Quality of Ambulatory Care in the Intervention and Control Groups.*

Quality Metric	Intervention Group		
	Before Implementation of AQC	After Implementation of AQC	Change
	% of eligible enrollees for whom performance threshold was met		*percentage points*
Chronic care management (aggregate analysis)	79.1	82.4	3.3
Cardiovascular LDL cholesterol screening	88.6	90.4	1.8
Diabetes			
Glycated hemoglobin testing	89.3	92.0	2.7
Eye exam	58.5	63.6	5.1
LDL cholesterol screening	86.6	90.5	3.9
Nephrology screening	85.1	87.4	2.3
Depression			
Short-term prescription	67.2	66.4	–0.8
Maintenance prescription	51.2	52.0	0.8
Adult preventive care (aggregate analysis)	75.7	79.3	3.6
Breast-cancer screening	80.2	83.2	3.0
Cervical-cancer screening	87.3	87.6	0.3
Colorectal-cancer screening	64.2	70.7	6.5
Chlamydia screening for enrollees 21–24 yr of age	58.6	64.5	5.9
No antibiotics for acute bronchitis‡	18.7	25.9	7.2
Pediatric care (aggregate analysis)	79.5	81.8	2.3
Appropriate testing for pharyngitis	93.9	96.0	2.1
Chlamydia screening for enrollees 16–20 yr of age	54.8	63.7	8.9
No antibiotics for upper respiratory infection	94.9	95.8	0.9
Well care			
Babies <15 mo of age	93.0	93.1	0.1
Children 3–6 yr of age	92.3	94.1	1.8
Adolescents§	73.8	76.8	3.0

* The intervention group comprised enrollees whose primary care physicians were in the Alternative Quality Contract (AQC) system of Blue Cross Blue Shield of Massachusetts, and the control group, enrollees whose primary care physicians were not part of the AQC system. Blue Cross Blue Shield of Massachusetts implemented the AQC system in 2009. LDL denotes low-density lipoprotein.

† Adjusted results are from a propensity-weighted difference-in-differences model controlling for all covariates and secular trends. Pooled observations were used for the aggregate analyses of chronic care management, adult preventive care, and pediatric care, and the analyses were further adjusted for measure-level fixed effects.

‡ This measure was not a part of the calculation of quality bonuses in 2009 but was reported to AQC groups and was expected to become a part of the quality bonus in 2010. It was included in the aggregate analysis. Removing it from the aggregate analysis did not change our results.

§ In accordance with the specifications of the Healthcare Effectiveness Data and Information Set, this measure covers persons 12 to 21 years of age.

suggest that provider groups changed their behavior in 2009. Changes in referral patterns can subsequently affect pricing in the health care market, as high-price facilities feel pressure from decreased volume. Future studies will need to assess whether changes in utilization and the broader market lead to larger savings.

This initial evaluation offers several lessons regarding payment reform.[32-34] First, quality need not be threatened by global payment, and pro-

Table 3. (Continued.)

Control Group			Between-Group Difference (Intervention – Control)		
Before Implementation of AQC	After Implementation of AQC	Change	Unadjusted	Adjusted†	P Value for Adjusted Difference
% of eligible enrollees for whom performance threshold was met		*percentage points*	*percentage points*		
79.6	80.1	0.5	2.8	2.6	<0.001
90.2	90.3	0.1	1.7	1.8	0.04
89.3	90.2	0.9	1.8	1.7	<0.001
61.3	60.8	-0.5	5.6	5.5	<0.001
86.3	87.3	1.0	2.9	2.8	<0.001
83.5	84.2	0.7	1.6	1.6	0.001
66.9	66.9	0.0	–0.8	–1.1	0.59
50.9	50.2	–0.7	1.5	1.1	0.59
72.8	76.2	3.4	0.2	0.1	0.67
79.5	81.9	2.4	0.6	0.6	0.006
84.4	85.2	0.8	–0.5	–0.5	0.002
60.0	66.5	6.5	0.0	0.0	0.97
53.4	60.1	6.7	–0.8	–0.8	0.41
19.5	21.1	1.6	5.6	5.5	<0.001
74.6	76.6	2.0	0.3	0.7	0.001
82.1	88.4	6.3	–4.2	–3.9	<0.001
51.1	54.7	3.6	5.3	5.4	<0.001
91.6	92.8	1.2	–0.3	–0.4	0.52
92.7	92.9	0.2	–0.1	–0.1	0.91
90.0	91.2	1.2	0.6	0.6	0.09
69.1	71.4	2.3	0.7	0.9	<0.001

viders can increasingly meet the criteria for performance of process measures if they are given clinically aligned incentives. Other aspects of quality remain to be evaluated. Second, global payment can introduce greater price competition into the market, as referrals move from high-price to low-price facilities. This is a bigger issue for private purchasers, since Medicare regulates prices. Finally, even with strong financial incentives, utilization will not change rapidly. Slowing the growth rate of health care spending will ultimately depend on budget updates and the ability of providers to practice in this new environment.

The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute on Aging or the National Institutes of Health.

Supported by a grant from the Commonwealth Fund (to Dr. Chernew). Mr. Song is supported by a predoctoral M.D./Ph.D. National Research Service Award (F30-AG039175) from the National Institute on Aging and a predoctoral Fellowship in Aging and Health Economics (T32-AG000186) from the National Bureau of Economic Research. The analysis of pediatric quality measures was funded by a grant from the Charles H. Hood Foundation (to Dr. Chernew).

No potential conflict of interest relevant to this article was reported.

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

We thank Megan Bell and Angela Li for data assistance and Yanmei Liu for programming assistance; John Ayanian and Ellen Meara for helpful comments on an earlier draft of the manuscript; and Thomas McGuire and Joseph Newhouse of Harvard Medical School for mentorship and support to Mr. Song.

REFERENCES

1. Orszag PR, Ellis P. The challenge of rising health care costs — a view from the Congressional Budget Office. N Engl J Med 2007;357:1793-5.
2. Chernew ME, Baicker K, Hsu J. The specter of financial armageddon — health care and federal debt in the United States. N Engl J Med 2010;362:1166-8.
3. Chernew ME, Hirth RA, Cutler DM. Increased spending on health care: long-term implications for the nation. Health Aff (Millwood) 2009;28:1253-5.
4. Chernew ME, Mechanic RE, Landon BE, Safran DG. Private-payer innovation in Massachusetts: the "alternative quality contract." Health Aff (Millwood) 2011;30:51-61.
5. Centers for Medicare and Medicaid Services. Medicare Shared Savings Program: accountable care organizations. Fed Regist 2011;76:19528-654.
6. Miller HD. From volume to value: better ways to pay for health care. Health Aff (Millwood) 2009;28:1418-28.
7. Engelberg Center for Health Care Reform. Bending the curve: effective steps to address long-term health care spending growth. Brookings Institution, September 2009. (http://www.brookings.edu/reports/2009/0901_btc.aspx.)
8. Bebinger M. Mission not yet accomplished? Massachusetts contemplates major moves on cost containment. Health Aff (Millwood) 2009;28:1373-81.
9. Health policy brief: accountable care organizations. Health Affairs, July 27, 2010. (http://www.healthaffairs.org/healthpolicybriefs/brief_pdfs/healthpolicybrief_20.pdf.)
10. Fisher ES, Staiger DO, Bynum JP, Gottlieb DJ. Creating accountable care organizations: the extended hospital medical staff. Health Aff (Millwood) 2007;26:w44-w57.
11. McClellan M, McKethan AN, Lewis JL, Roski J, Fisher ES. A national strategy to put accountable care into practice. Health Aff (Millwood) 2010;29:982-90.
12. Shortell SM, Casalino LP. Implementing qualifications criteria and technical assistance for accountable care organizations. JAMA 2010;303:1747-8.
13. Devers K, Berenson RA. Can accountable care organizations improve the value of health care by solving the cost and quality quandaries? Urban Institute, October 2009. (http://www.urban.org/url.cfm?ID=411975.)
14. Fisher ES, Shortell SM. Accountable care organizations: accountable for what, to whom, and how. JAMA 2010;304:1715-6.
15. Goroll AH, Berenson RA, Schoenbaum SC, Gardner LB. Fundamental reform of payment for adult primary care: comprehensive payment for comprehensive care. J Gen Intern Med 2007;22:410-5.
16. Bodenheimer T, Grumbach K, Berenson RA. A lifeline for primary care. N Engl J Med 2009;360:2693-6.
17. Rittenhouse DR, Shortell SM. The patient-centered medical home: will it stand the test of health reform? JAMA 2009;301:2038-40.
18. Merrell K, Berenson RA. Structuring payment for medical homes. Health Aff (Millwood) 2010;29:852-8.
19. Kilo CM, Wasson JH. Practice redesign and the patient-centered medical home: history, promises, and challenges. Health Aff (Millwood) 2010;29:773-8.
20. Centers for Medicare and Medicaid Services. Berenson-Eggers Type of Service. 2009. (https://www.cms.gov/HCPCSReleaseCodeSets/20_BETOS.asp.)
21. Pope GC, Kautter J, Ellis RP, et al. Risk adjustment of Medicare capitation payments using the CMS-HCC model. Health Care Financ Rev 2004;25:119-41.
22. Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. Biometrika 1983;70:41-55.
23. Buntin MB, Zaslavsky AM. Too much ado about two-part models and transformation? Comparing methods of modeling Medicare expenditures. J Health Econ 2004;23:525-42.
24. Manning WG, Basu A, Mullahy J. Generalized modeling approaches to risk adjustment of skewed outcomes data. J Health Econ 2005;24:465-88.
25. Ellis RP, McGuire TG. Predictability and predictiveness in health care spending. J Health Econ 2007;26:25-48.
26. Ai C, Norton EC. Interaction terms in logit and probit models. Econ Lett 2003;80:123-9.
27. Huber PJ. The behavior of maximum likelihood estimates under non-standard conditions. In: Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability. Berkeley: University of California Press, 1967:221-33.
28. White H. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. Econometrica 1980;48:817-30.
29. Casella G, Berger RL. Statistical inference. 2nd ed. North Scituate, MA: Duxbury Press, 2002.
30. Medicare Payment Advisory Commission. Report to the Congress: improving incentives in the Medicare program. June 2009. (http://www.medpac.gov/documents/Jun09_EntireReport.pdf.)
31. Rosenthal MB, Frank RG, Li Z, Epstein AM. Early experience with pay-for-performance: from concept to practice. JAMA 2005;294:1788-93.
32. Shortell SM, Casalino LP, Fisher ES. How the center for Medicare and Medicaid innovation should test accountable care organizations. Health Aff (Millwood) 2010;29:1293-8.
33. Mechanic R, Altman S. Medicare's opportunity to encourage innovation in health care delivery. N Engl J Med 2010;362:772-4.
34. Guterman S, Davis K, Stremikis K, Drake H. Innovation in Medicare and Medicaid will be central to health reform's success. Health Aff (Millwood) 2010;29:1188-93.