

Economic Outcomes of Insurer-Led Care Management for High-Cost Medicaid Patients

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High-need, high-cost patients account for 50% of US health care spending.¹ Fittingly, insurers and health care provider organizations across the country are seeking solutions to improve clinical outcomes while reducing costs for this population.^{2,3} High-need, high-cost patients often have multiple chronic conditions,⁴ resulting in medically complex management decisions and hampering the effectiveness of single disease-based programs designed to address their health needs and costs. In addition, they are often burdened by substantial economic and social barriers such as unstable housing, food insecurity, and poverty, which complicate the long-term management of their health.^{5,6}

Care management programs are commonly proposed as solutions for high-need, high-cost patients. Care management is typically delivered by a nurse or social worker who serves as a bridge between the patient and the clinical care team, the health system, and community resources, while assisting with administrative and care coordination tasks.^{7,8} The majority of care management programs are disease specific, focusing on medication adherence and monitoring, disease-specific management, health education, and self-care instructions.^{7,9}

Care management programs have had mixed results. Alone, disease-specific care management programs supporting existing health care delivery modalities have had minimal to no impact on reducing health care utilization or total costs of care across a variety of clinical settings for a variety of chronic conditions, including congestive heart failure, dementia, and cancer.^{7,9}

However, when care managers have been paired with community health workers (CHWs), better clinical outcomes and decreased utilization have been observed. The evidence is particularly strong for patients with diabetes.¹⁰⁻¹² CHWs are trusted laypeople, often from the local community, hired and trained to support patients. CHWs perform various roles, including informal social support, coaching to improve health behaviors, navigating complex health systems, coordinating care, and patient advocacy. CHW interventions are increasingly common and have, even independent of being paired with care managers, improved chronic disease outcomes.¹³⁻¹⁷ Many CHW programs are disease specific¹⁶ and face challenges scaling

ABSTRACT

OBJECTIVES: To evaluate the impact of the Community-Based Care Management (CBCM) program on total costs of care and utilization among adult high-need, high-cost patients enrolled in a Medicaid managed care organization (MCO). CBCM was a Medicaid insurer-led care coordination and disease management program staffed by nurse care managers paired with community health workers.

STUDY DESIGN: Retrospective cohort analysis.

METHODS: We obtained deidentified health plan claims data, enrollment information, and the MCO's monthly registry of the top 10% of costliest patients. The analysis included 896 patients enrolled in CBCM over the course of 2 years (January 2016 to December 2017) and a propensity score-matched cohort of high-cost patients (n = 2152) who received primary care at sites that did not participate in CBCM during the same time period. The primary outcomes were total costs of care and utilization in the 12-month period after enrollment. Secondary outcomes included utilization by care setting: outpatient, inpatient, emergency department, pharmacy, postacute care, and all other remaining sites. We used zero-inflated gamma and Poisson regression models to estimate average differences in postperiod costs and utilization between CBCM enrollees versus non-CBCM enrollees.

RESULTS: We did not observe meaningful differences in total costs or visit frequency among CBCM enrollees relative to non-CBCM enrollees.

CONCLUSIONS: Although our study found no association between the CBCM program and subsequent cost or utilization outcomes, understanding why these outcomes were not achieved will inform how future Medicaid programs are designed to achieve better patient outcomes and lower costs.

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across institutions.^{18,19} More recent evidence indicates that CHWs who manage patients with 2 or more chronic conditions and significant social needs can reduce hospital admission days by 65%.²⁰

Despite the promise, the impact of care managers teamed with CHWs to manage a broad set of clinical and social needs for high-need, high-cost patients is understudied.²¹ We sought to fill this knowledge gap by evaluating the impact of a Medicaid insurer-led care management and CHW program on economic measures—total costs of care and utilization—in Philadelphia, Pennsylvania, a racially diverse city with the fifth-largest population and the highest poverty rate among the 10 largest cities in the United States.²²

METHODS

This study is a retrospective, claims-based analysis of total costs of care and health care utilization among adult high-need, high-cost patients enrolled in Community-Based Care Management (CBCM), a care coordination and disease management program staffed by teams of nurse care managers paired with CHWs. CBCM was developed in partnership between a southeast Pennsylvania Medicaid managed care organization (MCO) and multiple health care provider organizations in North and West Philadelphia, some of the poorest neighborhoods in the city. In addition to intensive care management from the nurse and the CHW, CBCM enrollees received dedicated social work from some of the practices, and all CBCM care managers and CHWs received administrative support from dedicated project and medical directors.

The primary analysis compares total costs of care and utilization after CBCM enrollees enter the program with a propensity score-matched cohort of high-need, high-cost patients who were not offered CBCM because they received care at primary care practices without embedded teams. The 24-month study period is between January 2016 and December 2017. This study was approved by the institutional review board at the University of Pennsylvania.

CBCM Program Description

CBCM began enrolling patients in January 2016. Patients were eligible if they were in the top 10% of total costs for the MCO based on costs accrued in the prior 12 months and received primary care at 1 of 12 participating clinical practices. Clinical practice sites either were affiliated with 1 of 4 academic medical centers in Philadelphia or were federally qualified health centers. Nurse care managers were hired by the MCO, and CHWs were hired by the practice sites. CBCM was available to both pediatric and adult populations. This study reports economic outcomes for adults alone. CBCM enrollees were typically in the program for several months. The length of actual enrollment was at the discretion of the nurse care managers and CHWs.

TAKEAWAY POINTS

- ▶ We evaluated the impact of an insurer-led care management and community health worker program in Philadelphia, Pennsylvania, on total costs of care and utilization among high-cost, high-need patients enrolled in a Medicaid managed care organization.
- ▶ We did not observe clinically meaningful differences in total costs, visit frequency, or costs by site of care among patients enrolled in the care management program relative to a matched cohort of high-cost patients not enrolled in the program.
- ▶ Understanding the reasons that intended cost outcomes were not achieved will inform how Medicaid plans may design future programs intended to improve patient outcomes while controlling costs.

Care manager and CHW teams were advised to approach patients for enrollment in CBCM during scheduled primary care visits. These core teams worked together to provide administrative and clinical support to patients by coordinating care, managing medications for a variety of diseases, communicating with the care team, identifying social needs, and connecting patients to local community resources. In addition, CBCM partnered directly with Community Behavioral Health, a not-for-profit corporation contracted by the city of Philadelphia to provide mental health and substance abuse services for Philadelphia County Medicaid recipients, for coordination of behavioral health services.

Data Sources

The Medicaid MCO supplied deidentified health plan claims data, enrollment information, and a monthly registry of its top 10% costliest enrollees, based on costs accrued in the previous 12 months. We obtained complete medical claims for 52,665 individuals enrolled in the MCO's Medicaid plan who were in the top 10% of total cost for at least 1 month during the 24-month study period. Among these individuals, 1,658 received CBCM at some point during the study period across 12 clinical practices offering CBCM. We limited the study sample to 896 individuals 18 years and older who were continuously enrolled in the Medicaid plan for 12 months before and 12 months after the month of CBCM enrollment to avoid missing cost and utilization data. Enrollment files spanning January 2015 to December 2018 included patients' demographic information and complete data about health care use, including care settings (eg, inpatient, outpatient), dates of service, and visit diagnoses. The American Community Survey's Census 2017 data were used to approximate patients' income using the median household income of their zip code.

Study Sample and Controls

We matched the 896 CBCM enrollees in our analytic cohort with high-need, high-cost patients who were classified in the top 10% of costs among all plan members but were not enrolled in CBCM because they received primary care at sites without CBCM (non-CBCM enrollees). Therefore, the control group consisted of patients who could have been eligible had they received care at a targeted practice in the same month as a CBCM enrollee. Similar to our

approach to CBCM enrollees, we limited controls to individuals continuously enrolled in the Medicaid plan 12 months prior to and 12 months after the index month. We excluded control patients who never presented to their primary care clinics during the study period because a visit was the primary trigger for enrollment for the comparison CBCM cohort.

Study Variables

Our primary outcome of interest was the association between CBCM and changes in total costs of care (eg, the total dollar amount paid by the MCO) and utilization (eg, visit volume) for the 12-month period after enrollment. The amount paid by the MCO covered the costs of an episode of care, which consists of the services provided (eg, facility, professional fees, laboratory charges) at a rate agreed upon between the facility and the MCO. In a subgroup analysis, we evaluated utilization of specific care settings: outpatient, inpatient, emergency department (ED), pharmacy, postacute care, and all remaining care settings. In addition to patient demographics provided by the MCO, we used the claims data file to identify patients' comorbidities and calculated patients' disease severity at the time of CBCM enrollment using the Elixhauser Comorbidity Index,²³ and we used the enrollment files to calculate the number of months patients were enrolled in the Medicaid plan prior to entering CBCM.

Propensity Score Matching

To control for nonrandom enrollment in CBCM, we used optimal matching based on the propensity score to match each of the 896 CBCM enrollees to controls. We estimated propensity scores using logistic regression with CBCM enrollment during a primary care appointment as the outcome. We included age, gender, race/ethnicity, neighborhood income category, Elixhauser Comorbidity Index score, and years of continuous enrollment in the Medicaid MCO plan as covariates. Controls were also matched based on having an outpatient claim filed at a non-CBCM site in the same month/year combination as their CBCM subject's month/year enrollment date. The month/year of this visit defined the beginning of the 12-month post period for controls (Table 1). The number of controls selected for each case was allowed to vary between 1 and 4 depending on the number of close matches. If controls were matched twice, duplicate matches were excluded from the analytic cohort (15%). Of the 18,606 Medicaid MCO plan members who met criteria for the control group, 2152 controls whose propensity scores matched CBCM enrollees most closely were selected for inclusion in the final sample. Propensity score matching was performed in R using the *optmatch* package.²⁴

Statistical Analysis

We compared total health care costs and utilization in the post periods between CBCM enrollees and non-CBCM enrollees. For costs, we employed a Bayesian hierarchical zero-inflated gamma regression to estimate posterior means and 95% credible intervals (CIs) for the average difference in postperiod costs between CBCM enrollees

versus non-CBCM enrollees, while adjusting for preperiod costs of the enrollees. Specifically, this is a 2-part model that accounts for both structural zeroes and skewness in the cost distribution via a logistic regression for zero cost values and a gamma regression for nonzero costs. Importantly, both components are allowed to depend on treatment and preperiod costs. It is hierarchical in that it allows for correlation between different types of costs for the same patient (eg, inpatient costs, outpatient costs). Moreover, it allows for the average difference in costs to be correlated across cost types. Similarly, a Bayesian hierarchical zero-inflated Poisson model was used to estimate posterior means and 95% CIs for the average difference in postperiod health care visit volume. Regression models were estimated in R using the *brms* package.²⁵

We conducted 3 secondary analyses for cost outcomes. First, we compared total costs and utilization in the post period between CBCM and non-CBCM enrollees by care settings (eg, inpatient, ED). Second, we stratified patients based on their spending pattern in the 12 months prior to CBCM enrollment into persistent and intermittent high-cost enrollees. Variation in spending was calculated as the SE of monthly cost. Members below the median SE (low variation) were categorized as persistent high cost, and members above the median SE (high variation) were categorized as intermittent high cost. Third, we evaluated changes in total spending among patients with certain clinical conditions: diabetes, chronic pulmonary conditions (chronic obstructive pulmonary disease and asthma), congestive heart failure, and mental health disorders (depression, psychosis, substance use disorder, and alcohol use disorder).

RESULTS

Our analysis included 896 patients enrolled in CBCM between January 2016 and December 2017. Among CBCM enrollees, the mean (SD) Elixhauser Comorbidity Index score was 7.0 (4.0) and the most common comorbidities were hypertension (72.7%), chronic pulmonary disease (58.4%), depression (55.8%), and diabetes (50.7%).

Before matching, CBCM enrollees and non-CBCM enrollees had several notable differences (Table 1). CBCM enrollees were more likely to be women, be Hispanic or Latino, and live in a neighborhood with average income of \$45,000 or below. After matching, CBCM enrollees and non-CBCM enrollees were similar on all matching criteria with standardized differences between -0.2 and 0.2.

Figure 1 shows the regression-based estimate of the average difference in postperiod costs between CBCM versus non-CBCM enrollees. Models are adjusted for preperiod spending. Postperiod costs did not differ significantly for CBCM patients relative to matched controls for either total spending or spending by care setting.

Figure 2 shows the regression-based estimate of the average difference in postperiod visit volume between CBCM versus non-CBCM enrollees. Total visit volume in the post period was slightly lower for CBCM enrollees relative to non-CBCM enrollees; on average, CBCM enrollees had 1.55 fewer visits (95% CI, -1.93 to -1.21). This difference was driven primarily by fewer primary care visits

TABLE 1. Characteristics of CBCM Enrollees, January 2016–December 2017, and of Matched Non-CBCM Enrollees in Top 10% of Spending for a Philadelphia, Pennsylvania–Based Medicaid Managed Care Organization*

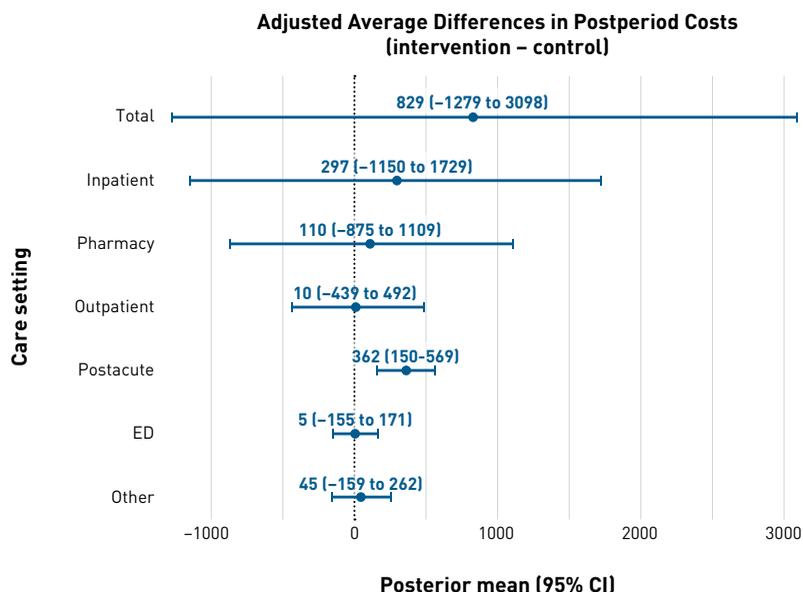
Characteristic	CBCM enrollees (n = 896)	Non-CBCM enrollees			Standardized difference ^b
		Before matching (n = 18,606)	Standardized difference ^b	After matching (n = 2152)	
Age range in years			0.22		0.05
18-39	27.3%	20.1%		27.5%	
40-59	59.0%	59.8%		60.7%	
≥ 60	13.6%	20.1%		11.8%	
Sex			0.20		<0.01
Female	75.1%	66.0%		74.7%	
Male	24.9%	34.0%		25.3%	
Race/ethnicity			0.63		0.10
Black	46.4%	48.3%		50.3%	
Hispanic or Latino	49.9%	29.9%		45.4%	
White	2.1%	16.5%		3.0%	
Other/unknown	1.6%	5.2%		1.3%	
Neighborhood income			0.35		0.11
< \$45,000	91.5%	80.3%		89.9%	
\$45,000-\$65,000	7.6%	18.0%		9.4%	
> \$65,000	0.4%	1.6%		0.7%	
Unknown	0.4%	0.1%		0	
Elixhauser Comorbidity Index score, mean (SD)	7.0 (4.0)	7.5 (4.0)	0.13	7.1 (3.9)	0.03
Continuous enrollment in Medicaid managed care			0.20		0
1-2 years	12.4%	19.9%		12.4%	
> 2 years	87.6%	80.1%		87.6%	
Month of enrollment/eligibility			0.73		0.18
2016, month 1	4.0%	3.5%		3.9%	
2016, month 2	7.1%	3.7%		7.2%	
2016, month 3	7.9%	4.0%		6.8%	
2016, month 4	10.6%	3.8%		9.9%	
2016, month 5	14.4%	3.6%		10.7%	
2016, month 6	5.9%	3.9%		5.6%	
2016, month 7	2.1%	3.8%		1.7%	
2016, month 8	4.1%	4.2%		4.5%	
2016, month 9	2.9%	4.2%		4.0%	
2016, month 10	3.7%	4.4%		3.9%	
2016, month 11	3.5%	4.0%		4.0%	
2016, month 12	2.7%	4.1%		2.2%	
2017, month 1	2.0%	4.4%		1.9%	
2017, month 2	0.7%	4.0%		0.7%	
2017, month 3	2.8%	4.5%		3.0%	
2017, month 4	2.1%	4.3%		2.9%	
2017, month 5	1.8%	4.6%		2.0%	
2017, month 6	2.2%	4.6%		2.8%	
2017, month 7	1.8%	4.1%		2.3%	
2017, month 8	4.6%	4.5%		4.5%	
2017, month 9	4.7%	4.4%		5.9%	
2017, month 10	4.5%	4.8%		5.3%	
2017, month 11	3.0%	4.4%		3.0%	
2017, month 12	0.9%	4.1%		1.3%	

CBCM, Community-Based Care Management.

*Pool of non-CBCM enrollees for matching includes eligible members at non-CBCM sites with at least 1 primary care visit during the month of eligibility. Some members in the pool of eligible matches are represented in multiple months.

^bVariables with standardized differences between -0.2 and 0.2 are considered balanced.

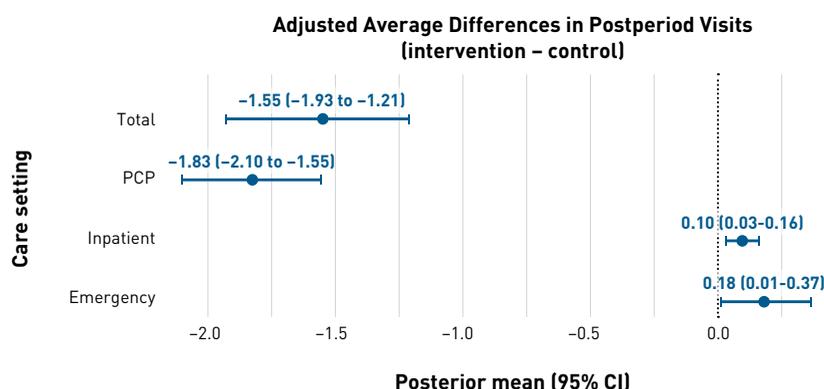
FIGURE 1. Adjusted Average Differences in Postperiod Costs Between CBCM and Non-CBCM Enrollees^a



CBCM, Community-Based Care Management; CI, credible interval; ED, emergency department.

^aFigure 1 shows the regression-based posterior mean estimate and 95% CI for the average difference in postperiod costs between CBCM versus non-CBCM enrollees. Results are from zero-inflated gamma regression of cost on a CBCM enrollment indicator, adjusting for subject's preperiod costs and subject's preperiod spending status (intermittent/persistent). Patient-level random effects were included to account for correlation between the multiple cost measures per patient (1 measurement per care setting). A random slope for CBCM enrollment indicator was included to account for correlation of the CBCM intervention effect across care settings.

FIGURE 2. Adjusted Average Differences in Postperiod Visit Volumes Between CBCM and Non-CBCM Enrollees^a



CBCM, Community-Based Care Management; CI, credible interval; PCP, primary care provider.

^aFigure 2 shows the regression-based posterior mean estimate and 95% CI for the average difference in postperiod visit volume between CBCM versus non-CBCM enrollees. Results are from zero-inflated Poisson regression of visit count on a CBCM enrollment indicator, adjusting for number of visits in the preperiod and subject's preperiod spending status (intermittent/persistent). Patient-level random effects were included to account for correlation between the multiple visit count measures per patient (1 measurement per visit type). A random slope for CBCM enrollment indicator was included to account for correlation of the CBCM intervention effect across visit types.

among CBCM enrollees (-1.83; 95% CI, -2.10 to -1.55). CBCM enrollees had slightly more ED visits (0.18; 95% CI, 0.01-0.37) and inpatient admissions (0.10; 95% CI, 0.03-0.16) in the post period relative to non-CBCM enrollees; however, these differences were very small.

Table 2 shows changes over time in total spending for CBCM enrollees and non-CBCM enrollees stratified by preperiod spending pattern (persistent high cost vs intermittent high cost). Among both CBCM enrollees and non-CBCM enrollees, total cost among persistent high spenders increased in the post period, whereas total cost among intermittent high spenders decreased. In a subgroup analysis stratified by clinical conditions, the treatment effect of CBCM did not vary appreciably by condition.

DISCUSSION

We did not observe clinically meaningful differences in total costs or visit volume among CBCM enrollees relative to non-CBCM enrollees. Because CBCM program enrollees had greater care coordination and disease management in the outpatient setting, we might have expected to observe a shift in total costs or visit frequency toward primary care and perhaps pharmacy costs due to greater medication adherence and reduced spending on emergency visits and inpatient admissions. However, we did not observe such a shift in spending patterns.

High-need, high-cost Medicaid beneficiaries vary considerably in their utilization patterns and the trajectory of their health care needs.²⁶⁻²⁸ Many high-need, high-cost beneficiaries with chronic conditions have persistently high spending, whereas others have episodic high costs often related to hospital admissions.²⁸ Regression to the mean was of particular concern for intermittent high spenders, whose costs we expected to fluctuate over time. However, we found that the treatment effect of CBCM was similar regardless of whether patients were persistently or intermittently high cost in the previous year.

There are several potential explanations for our null findings. First, high-need, high-cost patients in this health plan receive care management through programs offered by the health plan. A proportion of non-CBCM

enrollees (17.5%) were receiving some form of care management, albeit a less intensive one compared with CBCM. Our findings may indicate that the additional intensive attention provided by lower ratios of caseload to staff does not provide marginal benefit to cost and utilization outcomes. To isolate the effects of CBCM, the comparison group ideally would have received no case management.

Second, implementation of the CBCM program may have varied by site. Challenges to implementing care management programs and CHWs can produce varying levels of impact on cost, utilization, and health outcomes.²⁹⁻³³ In our context, the CBCM sites were operated by different health care provider organizations, the practice sites employed the CHWs, and the Medicaid MCO employed the nurse care managers. This structure may have resulted in variable degrees of uptake, adoption, and fidelity across practice sites. More work is needed to identify potential implementation challenges and understand their effects on outcomes.

Third, selection bias may influence patient enrollment in CBCM. Selection bias may arise when nurse care managers and CHWs choose to enroll certain patients in CBCM before other patients or in a patient's decision regarding whether to enroll in the CBCM program. Because patients were primarily enrolled at their primary care clinics, individuals with frequent primary care visits were more likely to be selected into our analytic cohort. Had CBCM targeted enrollees who, when they were avoiding or delaying care, had high health care expenditures, and a comparable risk group could have been identified, our findings may have been different.

Our findings suggest that CBCM is not cost reducing; however, we are unable to evaluate whether the program is cost-effective because we did not have short-term or long-term measures of clinical outcomes or quality. We did not measure patient satisfaction or patient experience with the CBCM program. Previous studies of CHW interventions in chronically ill, low-income populations have demonstrated an increase in patient activation³⁴ and perceived quality of primary care.²⁰ Clinically, better patient experiences with care are strongly associated with better adherence to disease self-management plans and improved long-term health outcomes.³⁵⁻³⁸ Future evaluations of the CBCM program may identify noneconomic benefits of the CBCM program, and had patients been followed for a longer time period, economic benefits may have ultimately been observed.

Limitations

Our study's results are interpreted in the context of a few limitations. First, it included patients within a single Medicaid insurance plan in 1 urban area. Results may not be replicable in nonurban settings, for higher income earners, or in urban settings with different social contexts. Second, we identified the intervention and control groups using claims information dependent on coding from primary care practices, which may differ between CBCM and non-CBCM practices. Nonetheless, the claims data set is comprehensive, allowing us to account for health care utilization at any facility and accurately depicting costs as measured using charges paid by the health plan.

TABLE 2. Changes Over Time in Total Costs for CBCM Enrollees and Non-CBCM enrollees, by Spending Pattern (persistent high cost vs intermittent high cost), 12 Months Pre- and Post CBCM Enrollment or Eligibility^a

Spending pattern	Mean cost in \$ per member, preperiod	Mean cost in \$ per member, post period	Mean change in cost in \$ per member
Persistent			
CBCM	9887	15,356	5469
Non-CBCM	11,973	15,258	3285
Intermittent			
CBCM	33,723	25,213	-8510
Non-CBCM	33,545	24,458	-9087

CBCM, Community-Based Care Management; SE, standard error.

^aSpending pattern was identified based on variation in total monthly costs during the 12-month preperiod. Variation in spending was calculated as the SE of monthly cost. Members below the median SE (low variation) were categorized as persistent high cost, and members above the median SE (high variation) were categorized as intermittent high cost.

Third, our conclusions may be imprecise because of unmeasured confounders such as differential preferences in where the CBCM and non-CBCM patients choose to receive their care (practices that may have different negotiated prices with the MCO) and differences in the types or quality of clinical and social services provided to patients at CBCM and non-CBCM practices. However, we applied robust methods to create a comparable control group based on a number of measured confounders. Finally, because this program was not designed as a research study a priori, we do not know how many eligible patients refused to participate, and we did not conduct a power calculation to determine how many patients were needed to detect differences between groups. Estimations may have differed had we been appropriately powered. Similarly, because this program was not designed as a research study, patients at CBCM practices may have been preferentially enrolled in CBCM for unmeasured reasons that we cannot replicate among controls, and patients may have been contacted for enrollment outside of their primary care visit without our knowledge.

CONCLUSIONS

Payers and health systems have a strong incentive to implement programs that improve patient outcomes while controlling costs. Although our study found no association between an insurer-led care management program and cost and utilization outcomes, further work to understand the reason these outcomes were not achieved is important to inform how future programs for Medicaid enrollees are designed so that better patient outcomes and lower costs are achieved. Only by continuing to innovate around new care models and rigorous evaluations can we meet the Triple Aim objectives that we hope to achieve for high-need, high-cost populations. ■

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