Medical Costs and Health Care Utilization Among Self-Insured Members with Carve-In Versus Carve-Out Pharmacy Benefits

Julia J. Smith, MS; Yang Qiu, MS; Steve V. Lam, PharmD; Chondra M. Lockwood, PhD; Cheryl Pegus, MD, MPH; and Patrick P. Gleason, PharmD, FAMCP, BCPS

ABSTRACT

BACKGROUND: Pharmacy benefit can be purchased as part of an integrated medical and pharmacy health package—a carve-in model—or purchased separately and administered by an external pharmacy benefit manager—a carve-out model. Limited peer-reviewed information is available assessing differences in use and medical costs among carve-in versus carve-out populations.

OBJECTIVE: To compare total medical costs per member per year (PMPY) and utilization between commercially self-insured members receiving carve-in to those receiving carve-out pharmacy benefits overall and by 7 chronic condition subgroups.

METHODS: This study used deidentified data of members continuously enrolled in Cambia Health Solutions self-insured Blue plans without benefit changes from 2017 through 2018. Cambia covers 1.6 million members in Oregon, Washington, Idaho, and Utah. The medical cost PMPY comparison was performed using multivariable general linear regression with gamma distribution adjusting for age, gender, state, insured group size, case or disease management enrollment, 7 chronic diseases, risk score (illness severity proxy), and plan paid to total paid ratio (benefit richness proxy). Medical event objectives were assessed using multivariable logistic regression comparing odds of hospitalization and emergency department (ED) visit adjusting for the same covariates. Sensitivity analyses repeated the medical cost PMPY comparison excluding high-cost members, greater than \$250,000 annually. Chronic condition subgroup analyses were performed using the same methods separately for members having asthma, coronary artery disease, chronic obstructive pulmonary disease, heart failure, diabetes mellitus, depression, and rheumatoid arthritis.

RESULTS: There were 205,835 carve-in and 125,555 carve-out members meeting study criteria. Average age (SD) was 34.2 years (18.6) and risk score (SD) 1.1 (2.3) for carve-in versus 35.2 years (19.3) and 1.1 (2.4), respectively, for carve-out. Members with carve-in benefits had lower medical costs after adjustment (4%, $P < 0.001$), translating into an average \$148 lower medical cost PMPY (\$3,749 carve-out vs. \$3,601 carve-in annualized). After adjustment, the carve-in group had an estimated 15% ($P < 0.001$) lower hospitalization odds and 7% ($P < 0.001$) lower ED visit odds. Of 7 chronic conditions, significantly lower costs (12%–17% lower), odds of hospitalization (22%–36% lower), and odds of ED visit (16%–20% lower) were found among members with carve-in benefits for 5 conditions (all $P < 0.05$).

CONCLUSIONS: These findings suggest that integrated, carve-in pharmacy and medical benefits are associated with lower medical costs, fewer hospitalizations, and fewer ED visits. This study focused on associations, and defining causation was not in scope. Possible reasons for these findings

include plan access to both medical and pharmacy data and data-informed care management and coordination. Future research should include investigation of integrated data use and its effect across the spectrum of integrated health plan offerings, provider partnerships, and analytic strategies, as well as inclusion of analyzing pharmacy costs to encompass total cost of care.

J Manag Care Spec Pharm. 2020;26(6):766-74

Copyright © 2020, Academy of Managed Care Pharmacy. All rights reserved.

What is already known about this subject

- Grey literature publications have found significantly lower associated medical costs, hospitalization rates, and emergency department (ED) rates among individuals receiving integrated medical and carve-in pharmacy benefits compared with those receiving carve-out pharmacy benefits.
- According to grey literature reports, medical costs were consistently in the single digit percentage point lower, ranging from \$77 to \$240 lower medical costs per member per year (PMPY) among the carve-in pharmacy benefit population.
- Some reports included chronic condition subanalyses with findings directionally similar to the lower overall medical cost and lower health care utilization for carve-in benefits.

What this study adds

- Study findings add to what has been reported in the grey literature regarding medical costs, odds of a hospitalization event, and odds of an ED event among members receiving carve-in pharmacy benefits concurrently compared with those with carve-out pharmacy benefits.
- This study found a small but statistically significant ($P < 0.001$) and financially important 4% lower medical cost at \$148 PMPY, 15% lower odds of a hospitalization event, and 7% lower odds of an ED visit over 2 years, among the pharmacy benefit carve-in members compared with temporally concurrent pharmacy benefit carve-out population within the same medical insurer.
- A priori planned subanalyses of 7 chronic conditions found significantly lower cost and medical event outcomes associated with carve-in benefits for 5 conditions, including asthma, coronary artery disease, chronic obstructive pulmonary disease, diabetes mellitus, and depression, while no significant differences were found for congestive heart failure and rheumatoid arthritis.

Controlling rising health care costs continues to be a challenge in the United States, with employers, providers, health plans, and members seeking solutions to rein in costs. The Centers for Medicare and Medicaid Services project that nationwide expenditures will rise by 5.5% annually from 2018 to 2027.¹ Employers can expect the cost of covering their employees to rise by 6.5% in 2020 with prescription drug spending increasing by 3%-6% in part due to expensive specialty drug use and rising costs.^{2,3} Rising medical and pharmacy costs present challenges such as difficulty accessing needed treatments, as well as lower medication and treatment adherence, creating a challenging cycle for self-management of chronic conditions by individuals and for management of benefits by their employers.^{4,5}

When considering coverage for employees, employers are faced with the question of whether to include pharmacy benefit as part of the total integrated health package—a carve-in model—or to purchase as a separate benefit administered by an external pharmacy benefit manager (PBM)—a carve-out model. Both models promote savings through pharmacy network channel discounts; mail order pharmacy services; formulary management; pharmaceutical manufacturer rebates; and clinical offerings, such as specialty pharmacy services, utilization management, clinical programs, medication therapy management, drug utilization review, and care or disease management.

There may be differences in how carve-in PBMs and carve-out PBMs might achieve these aims. In theory, carve-out PBMs may benefit from singular focus, flexibility to allow employers to design drug benefit coverage specific to their employee population, and volume to negotiate drug costs and rebates with manufacturers. Some carve-out PBMs claim to be able to save employers large amounts in drug costs over time.⁶ However, rigorous statistical comparisons of carve-in and carve-out savings for pharmacy costs in the peer-review and grey literature are difficult to find, likely because carve-in and carve-out PBMs have access to pharmacy costs only for their members with no comparator data.

The perceived added value of integrated medical and pharmacy benefits via carve-in is that integrated data inform clinical offerings more efficiently and quickly. When leveraged effectively, integrated data can inform utilization management; authorization decisions; chronic condition care management including medication adherence, behavioral health conditions related to prescription drug abuse, and those conditions served by specialty drugs; and population health management.⁷ Holistic management of the patient and their medications may also lead to avoidance of unnecessary health care-related events. For example, a recent study showed that utilization management leveraging integrated claims for people with a substance use disorder can lower opioid prescription volume and emergency department (ED) visits.⁸

Although unable to compare drug claim data for carve-out members, integrated benefit plans have the advantage of access to medical claims data for both carve-in and carve-out members. Several health plans have performed pharmacy benefit carve-in versus carve-out assessments on medical costs and use, with results pointing to lower medical costs among members with integrated pharmacy benefits, as follows.⁹⁻¹⁶ From 2010 to 2012, 3 Blue Cross/Blue Shield (BCBS) nonpeer-reviewed studies were reported with a trend toward lower total medical cost savings per member per year (PMPY) in the carve-in populations ranging \$116 to \$217, or 6% to 7%; however, the associated lower medical cost was only statistically significant in the largest study.^{9,10,13} The national BCBS Association (2013) abstract and poster and BCBS Rhode Island (2018) self-report found significantly lower medical costs in the carve-in group (11%, or \$330 PMPY and 7%, or \$57 per employee per month [PEPM], respectively).^{11,12} Further, lower PEPM medical costs were found for members with cancer (3%), hypertension (HTN, 10%), diabetes mellitus (DM, 18%), and substance use disorder (19%).¹² In addition to Blue plan reports, self-reports by other insurers have been released with similar findings with chronic conditions HTN, DM, rheumatoid arthritis (RA), and coronary artery disease (CAD) subanalyses.¹⁴⁻¹⁶

A large portion of self-insured employers choose a carve-out pharmacy benefit design. This may be due to rapidly rising drug costs, consultant influence and business relationships, and marketing efforts that offer rebates or other discounts that are considered without comparative information, given the lack of peer-reviewed publication of utilization and cost analysis comparing carve-in versus carve-out benefits.¹⁷ Given that a large population of Blue plan members within Cambia Health Solutions have carve-in and carve-out pharmacy benefits, Cambia had the opportunity to investigate medical costs and health care utilization rates comparing members with carve-in to those with carve-out pharmacy benefits in the northwest United States, replicating the methods used in the BCBS Association study and added a priori subanalyses of 7 chronic conditions.

Methods

This study used 2 years of data and replicated methods used in the BCBS Association study.¹¹ The same study member attribution methods, study population characteristics, statistical testing, and statistical modeling were performed, by the same personnel, as for the BCBS Association study. A change from the BCBS Association study was to exchange CAD for hyperlipidemia and to add the rheumatoid arthritis chronic condition, a priori. All 7 chronic conditions were defined a priori, and no other chronic conditions were added or removed from the analyses. The BCBS Association study used the diagnostic cost grouper (DCG) risk score, and this study used the Cotiviti DxCG Intelligence risk score. An additional covariate in this

study was member enrollment in health plan care management or disease management.

Data

Cambia Health Solutions covers 1.6 million members in Oregon, Washington, Idaho, and Utah with approximately 65% of members with self-insured commercial coverage having carve-in and 35% having carve-out pharmacy benefits. Analyses included deidentified claims data from 2017 and 2018 calendar years with no protected health information. Thus, it does not constitute human subjects research and is not subject to Internal Review Board review. This 2-year period included the most recent complete calendar years when data collection began.

Study Population

This retrospective concurrent comparison cohort study included data from claims files for Cambia members with continuous commercial coverage of a self-insured health plan and indication of pharmacy benefits as integrated (carve-in) versus separate (carve-out). Members were excluded if there was a major change in benefit design over the 2017-2018 study period. Major changes include a change to or from a consumer directed health plan, change in insured product type (e.g., preferred provider organization to health maintenance organization), change in pharmacy coverage, or any payment amount from a government program (e.g., Medicare). Some members had missing characteristics—specifically unknown gender or employer group size—and were excluded from analysis.

Outcomes

The primary outcome was total medical costs PMPY, annual average, over the 2-year study period. Secondary outcomes included 2 binary indicators: presence of at least 1 hospitalization and presence of at least 1 ED visit during the 2-year study period.

Covariates

Member characteristics include age in years, gender, state of residence, enrollment in health plan care or disease management (CM/DM), plan paid to total paid ratio, group size, member predicted risk score, and 7 chronic conditions.

Enrollment in health plan CM/DM includes members who are referred by providers, self-enrolled by calling for assistance, or engage with outreach by CM/DM clinicians after identification through proprietary algorithms based on patterns of risk identified in claims data (e.g., chronic conditions, serious medical events, multiple visits to the ED, or behavioral health diagnosis). The plan paid to total paid ratio is used as a proxy for the group benefit generosity, also known as the “actuarial value.” Under the Affordable Care Act, a health insurance plan’s actuarial value indicates the average share of medical spending that is paid by the plan, as opposed to being paid out of pocket

by the member. The plan paid to total paid ratio considers a plan’s various cost-sharing features, such as deductibles, coinsurance, copayments, and out-of-pocket limits.¹⁸

Group size refers to the size of the self-insured organization (e.g., employer) through which the member receives insurance. The predicted risk score and chronic condition identification came from industry standard software. DxCG Intelligence risk scores from Cotiviti were generated for each member.¹⁹ The DxCG Intelligence risk score is a proxy for illness severity with the primary purpose to predict future health care expenditure based on the individual’s age, gender, and diagnoses generated from patient encounters with the medical system, excluding pharmacy. The DxCG Intelligence risk is normalized to 1 and expressed on linear scale. A member with a risk score of 1 is expected to have the average future medical cost; a member with risk score of 2 is expected to have 2 times the future medical cost of the average member.¹⁹

The 7 chronic conditions in this analysis were identified as chronic conditions of interest a priori. Five of the 7 were identical to those used in a previous study the authors conducted and from which this study was intended to replicate as closely as possible.¹¹ A priori, CAD was exchanged for hyperlipidemia due to provision for a more severe condition, and RA was added to assess a specialty drug condition. The conditions were identified by Optum Impact Pro software and include asthma, CAD, COPD, congestive heart failure (CHF), depression, DM, and RA.²⁰

Statistical Methods

Descriptive statistics, distribution of covariates, and unadjusted outcomes were calculated with differences between the carve-in and carve-out groups tested using analysis of variance (ANOVA) for continuous and chi-square test for categorical variables. Unadjusted relative cost (RC) was calculated between the carve-in and carve-out groups. An RC of 1 indicates no difference in PMPY medical costs. An RC less than 1 indicates that the carve-in group had lower medical costs by a multiplier of the RC value. An RC of greater than 1 indicates the carve-in group had higher medical costs than the carve-out group.

The distribution of medical costs tends to skew to higher costs, with a small proportion of individuals having extremely high costs. Dodd et al. (2006) compared several multivariable regression analysis methods of costs displaying this skew: normal and bootstrapped multiple linear regression, median regression, gamma model with the log link, and normal linear regression of log costs.²¹ Based on their findings, the gamma log link model was the best fitting model because it had the smallest root mean square error and mean absolute error. To further assess the use of the gamma log link before fitting models, a modified Park test was performed to assess heteroscedasticity and distribution of total medical costs in this study.

FIGURE 1 Study Population

A generalized linear model with gamma distribution log link was fit with each covariate separately to assess independent effect on RC. To assess the primary outcome of total medical cost PMPY, a generalized linear model with gamma distribution log link was fit including all covariates to adjust for baseline differences between the carve-in and carve-out groups. A sensitivity analysis was performed excluding any member with \$250,000 or more in annual medical cost in 2017 or 2018 to remove the impact from extremely expensive members at a customary reinsurance threshold.

Multivariable logistic regression models estimated the odds of hospitalization and the odds of ED visit adjusting for the same covariates as the primary analysis to adjust for baseline differences. Seven subgroup analyses were performed separately for members with each of the chronic conditions using the same analytic methods described for the primary and secondary outcomes. Two-sided $P < 0.05$ were considered statistically significant. It is important to note that with large

TABLE 1 Member Characteristics

Characteristic	Carve-In n = 205,835	Carve-Out n = 125,555	P Value ^a
Age, years, n (SD)	Mean 34.23 (18.63)	Mean 35.21 (19.28)	<0.001
≤ 18, % (n)	26.37 (54,276)	25.73 (32,300)	<0.001
19-35, % (n)	23.88 (49,159)	23.13 (29,042)	
36-50, % (n)	25.87 (53,251)	24.20 (30,385)	
51-64, % (n)	23.88 (49,149)	26.94 (33,828)	
Gender, % (n)			
Female	49.52 (101,930)	49.71 (62,408)	0.300
Male	50.48 (103,905)	50.29 (63,147)	
State, % (n)			
Washington	31.11 (64,036)	26.97 (33,861)	<0.001
Oregon	16.79 (34,560)	42.99 (53,977)	
Utah	23.29 (47,938)	20.29 (25,475)	
Idaho	10.32 (21,233)	3.73 (4,687)	
Other	18.49 (38,068)	6.02 (7,555)	
CM/DM (yes), % (n)	8.87 (18,249)	12.29 (15,435)	<0.001
Plan paid to total paid ratio, ^b (SD)	Mean 0.68 (0.31)	Mean 0.69 (0.30)	<0.001
<0.58, % (n)	26.88 (55,323)	23.45 (29,446)	<0.001
0.59-0.77, % (n)	22.68 (46,680)	24.51 (30,773)	
0.78-0.89, % (n)	24.05 (49,508)	27.19 (34,142)	
0.90+, % (n)	26.39 (54,324)	24.84 (31,194)	
Group size, n (SD)	Mean 8,352 (9,978)	Mean 13,399 (9,877)	<0.001
<2,000, % (n)	29.98 (61,714)	18.74 (23,530)	<0.001
2,000-6,499, % (n)	31.80 (65,451)	17.35 (21,783)	
6,500-14,999, % (n)	26.73 (55,013)	14.43 (18,116)	
15,000+, % (n)	11.49 (23,657)	49.48 (62,126)	
Chronic conditions, % (n)			
Asthma	7.49 (15,425)	8.19 (10,289)	<0.001
Coronary artery disease	1.43 (2,951)	1.59 (1,995)	<0.001
Chronic obstructive pulmonary disease	0.77 (1,575)	0.91 (1,145)	<0.001
Congestive heart failure	0.46 (957)	0.55 (685)	0.001
Diabetes mellitus	4.65 (9,562)	5.43 (6,814)	<0.001
Depression	7.06 (14,532)	7.81 (9,800)	<0.001
Rheumatoid arthritis	0.40 (832)	0.38 (482)	0.367
Risk score ^c	Mean 1.07 (2.30)	Mean 1.12 (2.36)	<0.001
<0.15, % (n)	27.02 (55,620)	26.32 (33,043)	<0.001
0.15-0.44, % (n)	24.09 (49,584)	22.91 (28,761)	
0.45-1.09, % (n)	24.55 (50,536)	25.02 (31,410)	
1.10+, % (n)	24.34 (50,095)	25.76 (32,341)	

^aP value from ANOVA test for continuous variables and chi-square test for categorical and ordinal variables.

^bPlan paid to total paid ratio is medical benefit actuarial value (i.e., benefit generosity proxy).

^cRisk score derived using the Cotiviti DxCG Intelligence software.¹⁹

ANOVA = analysis of variance; CM/DM = care management/disease management; SD = standard deviation.

samples, as found in this study, a *P* value of <0.001 may be more appropriate for the primary comparisons, which were considered in interpreting findings for primary outcomes in this study.²² For the subanalyses by chronic conditions, with 15,000 members or fewer in each group, then *P* < 0.05 is a reasonable threshold. For both primary and secondary outcomes, 95% confidence intervals (CI) are provided to inform variability in the comparisons.

Results

There were 858,458 distinct Cambia members with some self-insured commercial medical coverage in 2017 or 2018. After excluding members with noncontinuous coverage (*n* = 489,718; 57.0%), there were 368,740 members with continuous self-funded commercial insurance of which 18,866 (5.1%) had only partial pharmacy benefit coverage and 12,749 (3.5%) had some other major benefit change. Of the remaining members, 207,423 were identified to have continuous carve-in benefits

TABLE 2 Total Medical Cost PMPY: Adjusted Estimates, Confidence Intervals, and *P* Values^{a,b}

Primary Outcome	Adjusted ^a Mean PMPY Costs		Relative Costs (95% CI)	<i>P</i> Value ^c
	Carve-In USD (n)	Carve-Out USD (n)	Carve-In Versus Carve-Out	
Total medical cost PMPY ^b	3,601 (205,835)	3,749 (125,555)	0.96 (0.95, 0.98)	<0.001
Sensitivity analysis				
Total medical cost PMPY ^b excluding members with annual total costs in 2017 and 2018 ≥ \$250,000	3,371 (205,566)	3,498 (125,380)	0.97 (0.96, 0.98)	<0.001
Subanalysis chronic conditions				
Asthma	6,782 (15,425)	7,708 (10,289)	0.88 (0.86, 0.91)	<0.001
Coronary artery disease	21,546 (2,951)	25,896 (1,995)	0.83 (0.78, 0.88)	<0.001
Chronic obstructive pulmonary disease	20,248 (1,575)	23,425 (1,145)	0.86 (0.78, 0.96)	<0.001
Congestive heart failure	39,237 (957)	44,265 (685)	0.89 (0.77, 1.01)	0.078
Diabetes mellitus	9,721 (9,562)	11,084 (6,814)	0.88 (0.85, 0.91)	<0.001
Depression	8,543 (14,532)	10,250 (9,800)	0.83 (0.81, 0.86)	<0.001
Rheumatoid arthritis	16,753 (832)	17,596 (482)	0.95 (0.82, 1.11)	0.519

^aAdjusted for age, gender, state, care management/disease management enrollment, plan paid to total paid ratio, group size, risk score, and presence of 7 chronic diseases (asthma, coronary artery disease, chronic obstructive pulmonary disease, congestive heart failure, depression, diabetes, and rheumatoid arthritis).

^bPMPY averaged annually over the 2-year study period.

^c*P* value from general linear model with gamma distribution log link.

CI=confidence interval; PMPY=per member per year; USD=U.S. dollars.

and 129,702 to have continuous carve-out benefits. After removing 840 (0.4%) and 3,614 (2.9%) members with a government insurance payment, respectively, there were 206,583 members in the carve-in group and 126,088 members in the carve-out group. Of these, there were 748 (0.3%) carve-in and 533 (0.4%) carve-out members who were missing values for either gender or group size and were thus excluded from analysis. The final analytic cohorts consisted of 205,835 carve-in and 125,555 carve-out members, as seen in Figure 1. There were 269 (0.1%) carve-in and 175 (0.1%) carve-out members with \$250,000 or more in annual medical costs for 2017 or 2018, leaving 205,566 carve-in and 125,380 carve-out members included in sensitivity analysis (Figure 1).

Univariable comparisons of member characteristics for the carve-in and carve-out group are displayed in Table 1. In unadjusted comparison, the carve-out group was on average 1 year older and had significantly higher rates of asthma, CAD, COPD, CHF, DM, and depression:

$$\text{all } \hat{p}_{\text{carve-out}} - \hat{p}_{\text{carve-in}} < 0.8\%$$

wherein $\hat{p}$ denotes the sample percentage.

The difference in mean risk score between the groups was of small effect size (Cohen's $d=0.02$), but the carve-out group had marginally higher risk scores in the top 2 quartile risk score groups resulting in a significant risk score difference. Baseline differences highlight the importance of reducing bias through multivariable adjustment in regression analyses.

A modified Park test indicated the total medical costs were gamma distributed. Unadjusted total medical cost PMPY was lower for the carve-in group at \$4,166 (standard deviation

[SD] \$14,130) compared with the carve-out group \$4,575 (SD \$16,185), yielding an unadjusted RC estimate of 0.91, $P<0.001$. Thus, the carve-in group had 9% lower medical costs PMPY than the carve-out group before baseline characteristic adjustment. The independent effect of each covariate was assessed to determine if any was associated with higher medical cost in the carve-in group, indicated by an RC estimated greater than 1. None of the independent covariate RC medical cost estimates were greater than 1. All RC estimates were significantly below 1, all $P<0.001$, ranging from 0.90 for group size up to 0.98 for plan paid to total paid ratio.

As shown in Table 2, the adjusted primary outcome of total medical cost PMPY was an RC estimate of 0.96, indicating the carve-in group had an associated significantly 4% lower PMPY, $P<0.001$, compared with the carve-out group. Transformed to dollar amounts, this equates to an associated \$148 lower medical cost PMPY for the carve-in group. This finding of associated lower medical cost for the carve-in group remained when high-cost members were excluded with 3% lower medical cost on average after adjustment equating to \$127 PMPY, $P<0.001$. Medical costs were also significantly lower for the carve-in group on average for subgroups of members with 5 of the 7 chronic conditions, including asthma (12%; \$926 PMPY), CAD (17%; \$4,350 PMPY), COPD (14%; \$3,177 PMPY), DM (12%; \$1,363 PMPY), and depression (17%; \$1,707 PMPY). There was no significant difference in total medical cost PMPY for the subgroups of members with CHF ($P=0.078$) and RA ($P=0.519$).

The carve-in group had lower unadjusted hospitalization rates 4.4% versus carve-out 5.2%, $P<0.001$, and ED visit rates

TABLE 3 Hospitalizations and ED Visits: Adjusted Odds Ratio Estimates, Confidence Intervals, and *P* Values^a

Secondary Outcomes and Chronic Condition Subanalyses	Included Sample Size	2-Year Hospitalization Carve-In Versus Carve-Out		2-Year ED Visit Carve-In Versus Carve-Out	
	(n)	Odds Ratio (95% CI)	<i>P</i> Value ^b	Odds Ratio (95% CI)	<i>P</i> Value ^b
Secondary outcomes	Carve-in (205,835) Carve-out (125,555)	0.85 (0.82, 0.89)	<0.001	0.93 (0.91, 0.95)	<0.001
Subanalyses chronic conditions					
Asthma	Carve-in (15,425) Carve-out (10,289)	0.75 (0.67, 0.84)	<0.001	0.83 (0.78, 0.89)	<0.001
Coronary artery disease	Carve-in (2,951) Carve-out (1,145)	0.64 (0.53, 0.78)	<0.001	0.84 (0.73, 0.96)	0.012
Chronic obstructive pulmonary disease	Carve-in (1,575) Carve-out (1,145)	0.78 (0.63, 0.96)	0.021	0.80 (0.68, 0.95)	0.009
Congestive heart failure	Carve-in (957) Carve-out (685)	0.92 (0.74, 1.15)	0.486	0.90 (0.73, 1.13)	0.373
Diabetes mellitus	Carve-in (9,562) Carve-out (6,814)	0.74 (0.65, 0.85)	<0.001	0.84 (0.77, 0.91)	<0.001
Depression	Carve-in (14,532) Carve-out (9,800)	0.66 (0.60, 0.73)	<0.001	0.83 (0.78, 0.89)	<0.001
Rheumatoid arthritis	Carve-in (832) Carve-out (482)	0.99 (0.67, 1.46)	0.955	1.25 (0.94, 1.65)	0.121

^aAdjusted for age, gender, state, care management/disease management enrollment, plan paid to total paid ratio, group size, risk score, and presence of 7 chronic diseases (asthma, coronary artery disease, chronic obstructive pulmonary disease, congestive heart failure, depression, diabetes, and rheumatoid arthritis).

^b*P* value from logistic regression model.

CI=confidence interval; ED=emergency department.

19.3% versus 21.1%, $P<0.001$. As shown in Table 3, after adjustment, odds were 15% lower for hospitalization, $P<0.001$, and 7% lower for ED visits, $P<0.001$, among the carve-in members. Odds were lower for subgroups of the carve-in group for the same 5 of 7 chronic conditions found to have significantly lower medical costs as follows: asthma (25% and 17% lower odds of hospitalization and odds of ED visit, respectively), CAD (36% and 16%, respectively), COPD (22% and 20%, respectively), DM (26% and 16%, respectively), and depression (24% and 17%, respectively). There was no significant difference in odds of hospitalization or odds of ED visit for the subgroups of members with CHF ($P=0.486$ and $P=0.373$, respectively) or RA ($P=0.955$ and $P=0.121$, respectively).

Discussion

To our knowledge, this is the first peer-reviewed publication of a study assessing medical costs and health care utilization comparing individuals receiving carve-in pharmacy benefits to those receiving carve-out pharmacy benefits from self-insured employers. This large regional study found that carve-in pharmacy benefits were associated with a small, but statistically significant and financially important 4% lower PMPY medical costs at \$148 PMPY, 15% lower odds of a hospitalization event, and 7% lower odds of an ED visit from 2017 to 2018. These findings did not substantially change when high-cost members were removed from analyses. In addition, these findings are supported by the subanalyses finding lower associated medical costs, odds of hospitalization and odds of ED visit for 5 of 7

chronic conditions. Specifically, lower associated medical cost PMPY ranged from \$926 for carve-in members with asthma up to \$4,351 for those with CAD. Lower odds of hospitalization ranged from 22% for COPD up to 36% lower for CAD members with carve-in benefits, whereas odds of ED visit ranged from 16% for CAD and DM members to 20% lower for COPD members. The associated lower medical costs within the carve-in group are consistent with grey literature reported findings from other Blue plan studies.⁹⁻¹³

When compared with medical cost savings to those self-reported by non-Blue plans, whereas the amount varied across plan and location, these studies also reported similar lower medical costs PMPY.¹⁴⁻¹⁶ Among the chronic condition findings, the Cambia results are very similar with the exception of RA in 1 non-Blue study, which was found to be 9% lower while Cambia RA carve-in was not significantly lower.¹⁴ It is possible that the sample size of Cambia RA members was too low to detect a difference in medical cost between the carve-in and carve-out groups.

Lower medical costs may be due to the availability and use of integrated data and benefits for improved care management, chronic condition management, specialty and controlled medication management, improved artificial intelligence and machine learning algorithms to match members to targeted intervention, and improved collaboration in provider partnerships to deliver care.^{3,7,8} For example, with integrated data, Cambia care managers target members who could benefit from clinical programs and high-touch services to improve

their care, manage cost and their condition, prevent additional avoidable high-cost services, and enhance their experience. It also allows them to have important conversations regarding side effects, drug interactions, medication compliance, and any barriers to filling prescriptions such as cost or transportation when engaging members in CM/DM for any serious medical event or discussing conditions discovered through medical claim diagnoses. Interestingly, the rate of enrollment in CM/DM was lower for carve-in compared with carve-out members in this study. It is possible that this lower rate was due to lower rates of serious medical events for those with long standing carve-in benefits, lower rates or severity of chronic conditions in the carve-in group, or improved ability to target outreach to only those who would most benefit when integrated data is used in identification algorithms. However, investigating these factors was beyond the scope of this study and should be studied further.

From a personalized health management perspective, the integration of pharmacy data can enhance plan partnership with providers in value-based arrangements by providing more complete reporting on utilization and care gaps in medication adherence identified for members with specific medical diagnoses and absence of medication dispense. One such value-based arrangement program at Cambia, Common Care, includes a collaborative care management program between Cambia and providers that relies on a shared platform and proprietary technology solutions built with integrated data in order to provide a single, uniform picture of member health with insights to target intervention.²³ Additional programs include the use of integrated data to inform general messaging and outreach to inform members and providers of next steps in treatment for specific episodes of care based on previous medical and pharmacy history and the use of integrated data in machine learning algorithms to target treatment options to a member's predicted preferences and needs.

Limitations

Limitations affect the interpretation of all studies using health insurance claims data. First, we were unable to compare pharmacy drug costs across the carve-in and the carve-out group, as we did not have access to drug costs for the carve-out group. We were limited to using medical claims data in this analysis, and there may be unmeasured confounders (e.g., social determinants) that have an effect on interpretation of these results. Another limitation is that claims data are subject to coding errors that could affect utilization and diagnoses, although it is assumed these errors would be equally distributed across medical claims and, thus, independent of carve-in or carve-out benefit design. Due to replication methods of previous work and sample size constraints,¹¹ we only included analysis of 7 a priori identified chronic conditions and did not include adjustment for other conditions.

These findings indicate associations with carve-in pharmacy benefits and do not establish causation. Even though multivariable modeling was used to adjust for baseline cohort differences, some selection bias may exist due to characteristics unavailable in claims data, and the bias in measured covariates is reduced by an unknown degree. For example, given that the carve-in group was younger on average by 1 year and had lower rates of chronic conditions, it is possible that the effect of carve-in benefits on costs and rates of hospitalization and ED visits would be different for older and less healthy populations. However, for member characteristics included, a study has shown that multivariable covariate adjustment in regression performs well, especially with large sample sizes, compared with other statistical methods.²⁴ Further, despite baseline differences between groups, the study is strengthened by nearly identical mean risk scores for the carve-in and carve-out groups, the large sample size, and indication that no independent covariate was associated with higher relative medical costs in the carve-in group.

These findings are limited to self-insured commercial groups, and findings may vary for members of government programs or members with other types of insurance. Finally, time with specified benefit design was not captured, so it is unknown when the lower cost and utilization associated with the carve-in models were first realized.

Conclusions

These findings suggest that integrated, carve-in pharmacy and medical benefits are associated with lower medical costs, fewer hospitalizations, and fewer ED visits. Although this study focused on associations and defining causation was not in scope, possible reasons for these findings include health plan access to both medical and pharmacy data and data-informed care management and coordination. For example, it is possible that care managers have a better picture of a member's health and are able to provide more personalized outreaches or coordinate with providers to improve outcomes. Additional benefits of integrated medical and pharmacy data may include cost stewardship efforts that can focus on both medical and drug costs; drug formulary benefits, utilization management, site of care optimization, and care gap management that can be based on member diagnoses and utilization in addition to medication use; and evaluation of medical and pharmacy services that can assess a more complete picture of cost and patient outcomes.

Future research should include evaluation of this type of integrated data use and its effect across the spectrum of integrated health plan offerings, care management, provider partnerships, and analytic strategies; investigation of time insured by specified benefits and differences in plan types; and inclusion of analysis of pharmacy costs to encompass total cost of care.

Authors

JULIA J. SMITH, MS; STEVE V. LAM, PharmD; CHONDRA M. LOCKWOOD, PhD; and CHERYL PEGUS, MD, MPH, Cambia Health Solutions, Portland, Oregon. YANG QIU, MS, Prime Therapeutics, Eagan, Minnesota, and PATRICK P. GLEASON, PharmD, FAMCP, BCPS, Prime Therapeutics, Eagan, Minnesota, and University of Minnesota, Minneapolis.

AUTHOR CORRESPONDENCE: Julia J. Smith, MS, Cambia Health Solutions, 100 S.W. Market St., M/S WW5-52, Portland, OR 97201. Tel.: 503.553.5041; E-mail: Julia.Smith@cambiahealth.com.

DISCLOSURES

This study received no external funding. The study was jointly conducted by employees of Cambia Health Solutions and Prime Therapeutics, a pharmacy benefit manager servicing Cambia Health Solutions. Smith, Lam, Lockwood, and Pegus are employees of Cambia Health Solutions. Qiu and Gleason are employees of Prime Therapeutics.

ACKNOWLEDGMENTS

The authors acknowledge the contributions of Casey Miller in cohort identification and data methodology.

REFERENCES

1. Sisko AM, Keehan SP, Poisal JA, et al. National health expenditure projections, 2018-27: economic and demographic trends drive spending and enrollment growth. *Health Aff (Millwood)*. 2019;38(3):491-501.
2. Health Research Institute. Medical cost trend: behind the numbers 2020. June 2019. Available at: <https://www.pwc.com/us/en/industries/health-industries/assets/pwc-hri-behind-the-numbers-2020.pdf>. Accessed February 12, 2020.
3. Anthem. Pharmacy and ancillary benefits outlook report. 2020. Available at: https://specialtybenefits.info/media/pdf/integratedhealthcare/report082019/ANS-Pharmacy_and_Ancillary_Benefits_Outlook_Report.pdf. Accessed February 12, 2020.
4. Goldberg SE, Fragala MS, Wohlgenuth JG. Self-insured employer health benefits strategy established a negative cost trend while improving performance. *Popul Health Manag*. 2019;22(6):547-54.
5. Anbil P, Bajpai S. Formulary decisions without comparative effectiveness research. *Manag Care*. 2014;23(10):38-41.
6. Molis J. Pharmacy plan 'carve-outs' help employers control prescription costs. Minneapolis/St. Paul Business Journal. November 7, 2019. Available at: <https://www.bizjournals.com/twincities/news/2019/11/07/pharmacy-plan-carve-outs-help-employers-control.html>. Accessed February 12, 2020.
7. AMCP Partnership Forum: Managing total cost of care through medical and pharmacy data integration. *J Manag Care Spec Pharm*. 2019;25(3):292-99. Available at: <https://www.jmcp.org/doi/full/10.18553/jmcp.2019.19004>.
8. Chen X, Ma Q, Barron J, DeVries A, Horn J, Agiro A. Effect of controlled substance use management on prescribing patterns and health outcomes among high-risk users. *J Manag Care Spec Pharm*. 2019;25(3):392-401. Available at: <https://www.jmcp.org/doi/10.18553/jmcp.2019.25.3.392>.
9. Wells P, Ness D. Pharmacy carve-in: the value of integrated benefits. Available at: <https://www.healthcarenewssite.com/newsletters/wa-premera-0412.pdf>. Accessed February 12, 2020.
10. Culley E, Williams LC, Thomas L. Pharmacy benefit carve-in: the right prescription for cost savings. *Benefits Compensation Digest*. 2010;47(11):22-26.
11. Gleason P, Qui Y, Bowen K, Johnson SV, Yoder D. Economic and event outcomes of members with carve-in versus carve-out pharmacy benefits: a 2-year cohort study. Poster presented at: AMCP 2014 Nexus meeting; October 8, 2014; Boston, MA. Available at: http://cdn2.content.compendiumblog.com/uploads/user/220a4eb2-dd7f-4520-ab96-7cfb9e87326b/8e648f20-2a6c-4610-9b15-849b37ce4f51/File/86ade63edbf946ddbaf7222d0c5e9ea/4085_b_amcp_2014_fall_poster___carve_in_vs_carve_out_v4.pdf. Accessed February 12, 2020.
12. Blue Cross Blue Shield Rhode Island. The importance of integration. May 2018. Available at: https://www.bcbsri.com/sites/default/files/organfiles/Rx-Integration-Story-7272018.pdf?mkt_tok=eyJpLjoiTkRzZD09UjB1OEpqTmptneClslNQiOjBOTR2YWd1YVVBqStlStnU4eGFjc2wrVDJlUHVSXblwvU3h4TU1tb1JPVUVWZG9aYmRjWE1wK1heGjGR2orVGZsamYycHpwZlFDSHlxU3Ncl3JEbkhFREl0TmJHUWZmUVlaZEFXaXlTSmpMjd2QXNARlwrR2tReDRuWU83dFRMY1NaNCJ9. Accessed February 12, 2020.
13. Smith-McLallen A. Effects of pharmacy benefit carve-in on utilization and medical costs: a three-year study. Available at: <https://www.ifebp.org/inforequest/0161568.pdf>. Accessed February 12, 2020.
14. Aetna. Integration is the answer. November 2018. Available at: http://www.aetna.com/pdf/Integrated_pharmacy.pdf. Accessed February 12, 2020.
15. Cigna. A proven formula for better outcomes: the value of pharmacy integration. October 2016. Available at: <https://www.cigna.com/assets/docs/business/pharmacy-value-of-integration-white-paper.pdf>. Accessed February 12, 2020.
16. Optum. OptumRx study shows an average savings of \$16 PMPM medical savings. May 2019. Available at: https://www.optum.com/content/dam/optum3/optum/en/resources/PDFs/M54610-W4-Optum-2019-Macro-Study_3.1.pdf. Accessed February 12, 2020.
17. Brown S, Whaley S; Accenture. Pharmacy benefits: Are carve-outs on the way out? 2019. Available at: https://www.accenture.com/_acnmedia/pdf-103/accenture-health-pharmacy-benefits-carve-outs-way-out.pdf. Accessed February 12, 2020.
18. American Academy of Actuaries. Actuarial value for health insurance consumers [letter]. April 1, 2013. Available at: https://www.actuary.org/sites/default/files/files/Actuarial_value_basics_for_NAIC_040113.pdf. Accessed February 12, 2020.
19. Cotiviti. DxCG intelligence: clearly identify, stratify, and manage individual and population risk. 2020. Available at: <https://www.cotiviti.com/solutions/quality-and-performance/dxcg-intelligence>. Accessed February 12, 2020.
20. Optum. Impact Pro: better understand individual and population risk. 2019. Available at: <https://www.optum.com/content/dam/optum3/optum/en/resources/sell-sheet/impact-pro-sell-sheet.pdf>. Accessed February 12, 2020.
21. Dodd S, Bassi A, Bodger K, Williamson P. A comparison of multivariable regression models to analyse cost data. *J Eval Clin Pract*. 2006;12(1):76-86.
22. Lin M, Lucas HC, Shmueli G. Too big to fail: large samples and the P value problem. *Info Sys Research*. 2013;24(4):906-17.
23. Regence Blue Cross Blue Shield. Common Care approach helps behavioral patient get back on track. May 14, 2019. Available at: <https://www.regence.com/producer/knowledge-center/producer-news/common-care-approach-helps-behavioral-patient?ecid=>. Accessed February 29, 2019.
24. Markus CE, Gregson J, Baber U, et al. Comparison of propensity score methods and covariate adjustment: evaluation in 4 cardiovascular studies. *J Am Coll Cardiol*. 2017;69(3):345-57.