

Association of Co-pay Elimination With Medication Adherence and Total Cost

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Nonadherence to medication prescriptions is a widespread problem and a major driver of health care spending and adverse health outcomes. Estimates from the World Health Organization suggest that adherence among patients with chronic conditions is only about 50% in developed countries.^{1,2}

A 2005 systematic review found that the financial costs of nonadherence are massive, potentially reaching \$100 billion annually from related hospitalizations.³ Recent estimates have placed the potential savings from improved adherence at \$13.7 billion in Medicare fee-for-service spending alone.⁴ Given these economic burdens, as well as preventable patient morbidity, extensive work has been devoted to studying the causes of nonadherence. Factors including patient forgetfulness, low levels of health literacy, and a lack of knowledge about medications and the diseases being treated have all been studied as potential contributors.⁵⁻⁹

The affordability of medications is also cited as a significant barrier^{10,11} and is a major impetus for the adoption of value-based insurance designs.¹² Pharmaceuticals have the highest demand elasticity among health care services.¹³ Moreover, research in behavioral economics has indicated that even small cost sharing may lead to large differences in consumption, and a price of zero may have discontinuous effects.^{14,15} Taken together, these facts suggest that interventions that eliminate patient cost sharing for prescription drugs may have significant impacts on medication adherence, especially for lower-income patients and households with financial stresses like food insecurity.¹⁶

Indeed, the evidence suggests that co-pay reductions do improve medication adherence,^{17,18} and measures to increase the affordability of medications are likely an important component of any comprehensive strategy to improve medication adherence.¹⁹ Considerably less evidence, however, shows that co-pay reductions reduce the total cost of care. Although increased adherence rates tend to increase spending on the prescription drugs themselves, some studies have found that these costs can be more than offset by reductions in hospitalizations and emergency department (ED) use.^{20,21} However, although the logical progression from interventions to increased adherence to reduced utilization may be clear,

ABSTRACT

OBJECTIVES: To determine whether elimination of co-pays for prescription drugs affects medication adherence and total health care spending.

STUDY DESIGN: Retrospective comparative study.

METHODS: We conducted a difference-in-differences comparison in the year before and after expansion of a Zero Dollar Co-pay (ZDC) prescription drug benefit in commercially insured Louisiana residents. Blue Cross and Blue Shield of Louisiana members with continuous disease management program enrollment were analyzed, of whom 6463 were enrolled in the ZDC program and 1821 were controls who were ineligible because their employers did not opt in.

RESULTS: After ZDC expansion, medication adherence fell in the control group and rose in the ZDC group, with a relative increase of 2.1 percentage points ($P = .002$). Medical spending fell by \$71 per member per month (PMPM) ($P = .027$) in the ZDC group relative to controls. Overall, there was no significant increase in the cost of drugs between treatment and controls. However, when drugs were further categorized, there was a significant increase of \$8 PMPM for generic drugs and no significant difference for brand name drugs. Comparisons of medication adherence rates by household income showed the largest relative increase post ZDC expansion among low-income members.

CONCLUSIONS: Elimination of co-pays for drugs indicated to treat chronic illnesses was associated with increases in medication adherence and reductions in overall spending of \$63. Benefit designs that eliminate co-pays for patients with chronic illnesses may improve adherence and reduce the total cost of care.

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TAKEAWAY POINTS

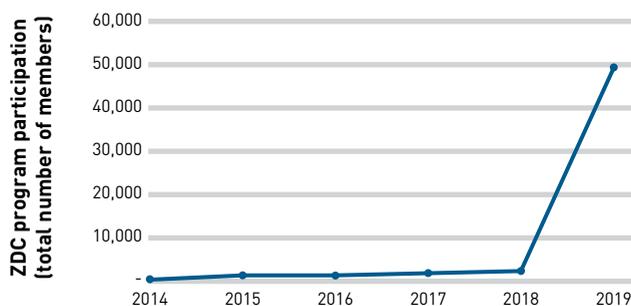
A follow-up evaluation of Blue Cross and Blue Shield of Louisiana's Zero Dollar Co-pay (ZDC) program found that there was a 10% decrease in medical spending after expanding the program.

- ▶ Cost savings were identified in a previous study of the ZDC program; it was further confirmed that these results would generalize to a larger commercial population after the program expansion.
- ▶ Medication adherence improvements were greatest for low-income members, which means that members who financially benefit most from the program also show improved health behaviors.
- ▶ Medication adherence trends varied by medication type, which indicates that some chronic conditions benefit from a ZDC program more than others.

disease, chronic obstructive pulmonary disease, and asthma (Figure 1).

For each condition, BCBSLA identified a group of low-cost, high-prescription volume medications in each relevant drug class and eliminated co-pays for these drugs (eAppendix [available at ajmc.com]). Most drugs selected for the ZDC program were generic medications; however, if no generics were available within a drug class, a branded medication was selected instead. Details of the ZDC enrollment process for employers and members have been previously published.²⁵

FIGURE 1. Timeline of ZDC Program*



ZDC, Zero Dollar Co-pay.

*For years 2014, 2015, and 2016, fewer than 500 patients participated in the program.

When the ZDC program began in 2014, only members who were actively engaged with disease management nurses were eligible for ZDC participation. However, as of March 2018 members were no longer required to have active engagement with the disease management nurses for ZDC eligibility, substantially expanding the ZDC program's reach and eliminating a source of potential selection bias in our previous analysis of the program's effect on costs. The enrolled population grew dramatically, from 2273 in February 2018 to 49,252 in March 2019, one year following the expansion (Figure 1).

This study makes use of the ZDC program expansion to reevaluate the program's effects. We compared ZDC participants with a control group of BCBSLA members who would have been eligible for ZDC based on (1) disease management program enrollment and (2) receipt of at least 1 prescription for a ZDC-eligible medication, but whose employers did not elect to participate in the ZDC program. Both groups in the analysis were required to have continuous coverage and disease management program enrollment.

For a member to be eligible for inclusion in the study, they must have been enrolled in a disease management program for the full 25-month study period to ensure continuous enrollment and the availability of consistent data. Members must also have filled a prescription for a ZDC-eligible medication in April 2018, the first full month of the program. Additionally, members must have been Louisiana residents receiving primary coverage through BCBSLA. At least 10 months of medical and prescription drug coverage was required in order to compare adherence and utilization rates. State and federal employees, as well as members covered under Blue Saver high-deductible plans, were excluded because of differences in benefit design. Members younger than 18 years; those with end-stage renal disease, cancer, or rare illnesses; and cost outliers (defined as per-member per-month [PMPM] spending greater than \$6000) were also excluded.

This study used BCBSLA medical and pharmacy claims data from March 2017 through March 2019 and included records of physician, inpatient, outpatient, and prescription drug spending for all members. Prescription drug spending was further separated into brand and generic drug spending. Additionally, for a large subset (77%) of members, BCBSLA was able to link claims data to a database of

the evidence from randomized controlled trials²² and systematic reviews²³ does not consistently demonstrate such effects.

In 2014, Blue Cross and Blue Shield of Louisiana (BCBSLA) introduced a Zero Dollar Co-pay (ZDC) program that eliminated co-pays for a large subset of medications indicated for chronic illnesses.²⁴ The program proved successful in reducing members' total cost of care²⁵ and was expanded to a wider patient population in 2018. The current study aims to evaluate the impact of the ZDC program on adherence and total cost of care in the expanded population of commercially insured individuals. As a secondary objective, we explore whether the program had heterogeneous effects by income.

METHODS

ZDC Program, Study Participants, and Data

BCBSLA initially launched its ZDC program in 2014 along with a suite of new disease management efforts. The ZDC program's primary aims were to reduce financial barriers and improve prescription drug adherence, with secondary goals of improving health and reducing avoidable health care spending. To pursue these goals, BCBSLA automatically enrolled members in disease management programs following diagnosis of the following chronic conditions: diabetes, hypertension, coronary heart disease, chronic kidney

social determinants of health data. This resource includes members' predicted household income using the Wunderman AmeriLINK methodology²⁶ and allows for comparison across income groups.

Statistical Analysis

Our statistical analyses followed the steps laid out in BCBSLA's goals for the ZDC program, first assessing changes in adherence and then examining whether those changes led to differences in health care spending. All analyses used a difference-in-differences approach, comparing outcomes before and after the expansion of the ZDC program, among those newly eligible (ZDC/treated) and ineligible (control) for the programs, as described in the preceding section. Members are not randomly assigned to the ZDC and control groups, but rather are drawn from employers choosing to opt into or out of the ZDC program. To account for this, our analyses of members' health care spending employed propensity score weighting to adjust for differences at baseline. The propensity score included member age, gender, region of residence, DxCG concurrent risk score, and indicators for chronic conditions. With respect to participation in BCBSLA programs, we included indicators for participation in the Quality Blue Primary Care program (similar to the patient-centered medical home [PCMH])²⁷ and level of disease management program engagement. Finally, the propensity score included baseline utilization and spending (ED visits and hospitalizations, medical and prescription spending PMPM).

First, we compared mean changes in medication adherence in the ZDC and control groups, before and after the ZDC expansion. We defined the mean percentage-point changes for each group using the proportion of days covered (PDC) metric. Second, we made use of BCBSLA's social determinants of health data to assess whether the association between ZDC and changes in medication adherence rates was driven by changes in behavior within income groups.

Finally, we compared PMPM spending between these 2 groups, examining total medical and prescription drug spending. Medical spending is then disaggregated into inpatient, facility outpatient, ED, and professional service spending, and prescription drug spending is separated by brand and generic spending to more closely inspect how adoption of the ZDC benefit design affected patterns of health care utilization. Propensity score-weighted means before and after ZDC program expansion are compared among the treated and control groups, as well as with a difference-in-differences estimate. Additionally, we present coefficient estimates from difference-in-differences regressions, which take log-transformed expenditures as the outcomes of interest. As a result, these coefficients can be interpreted as relative percent changes in spending. The regressions control for age, gender, an indicator for whether a member's provider participated in BCBSLA's PCMH initiative, member region of residence, insurance product type, and condition indicators for depression, chronic obstructive pulmonary disease, coronary artery disease, and congestive heart failure. The models also include time and member fixed effects, in addition to the indicators for treatment and pre- vs post expansion.

TABLE 1. Characteristics of ZDC and Control Groups

	Prewighting		Post weighting	
	Control	ZDC	Control	ZDC
Sample size	1821	6463	1821	6463
Female, %	48%	50%	47%	49%
Mean age in years	55	55	54	55
Member market region, %				
Alexandria	7	5	5	5
Baton Rouge	19	22	22	22
Lafayette	7	16	14	14
Lake Charles*	24	8	11	11
Monroe	9	6	6	6
New Orleans	11	33	28	28
Shreveport	22	11	13	13
Risk category, %				
Healthy	1	1	1	1
Stable	11	13	13	12
At risk*	42	45	43	44
Struggling	40	37	38	38
In crisis	6	4	5	5
Quality Blue Primary Care participants, %	69	69	68	69
Member active at recommended level, %*	10	3	4	4
Member with at least 1 of the chronic conditions, %*	95	93	94	93
Chronic conditions, %				
Diabetes*	52	44	46	46
Hypertension	85	83	83	83
CAD	18	16	17	16
CHF	3	2	3	3
Asthma	7	6	6	6
COPD	6	5	5	5
Depression	13	12	13	13
ED visits, %*				
≥ 1	22	18	19	19
Admissions, %*				
≥ 1	6	5	6	5
Spending PMPM (\$)				
Medical*	527	476	500	488
Rx*	514	401	424	421

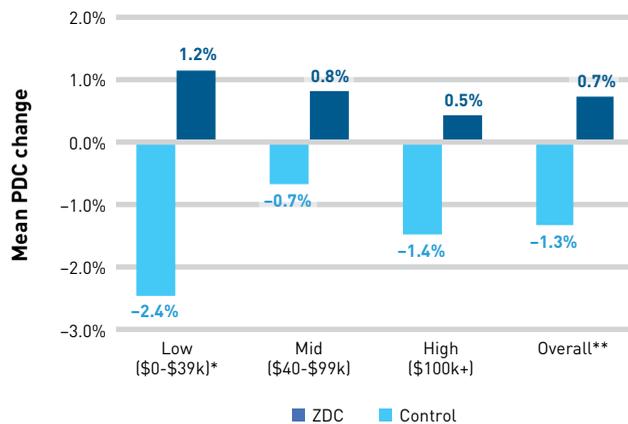
CAD, coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ED, emergency department; PMPM, per member per month; Rx, prescription drug; ZDC, Zero Dollar Co-pay.

* $P < .05$.

RESULTS

After applying the exclusion criteria described earlier, 1821 members in the control group and 6463 members in the ZDC group were identified as being eligible for the study. A comparison of these 2 groups in terms of age, sex, health status, residence, and spending/

FIGURE 2. Mean PDC Change Overall and by Household Income^a



PDC, proportion of days covered; ZDC, Zero Dollar Co-pay.
 * $P < .05$; ** $P < .01$; *** $P < .001$ for difference-in-differences comparison.
^aMedication adherence was measured by PDC and was calculated at the Generic Product Identifier-6 (drug subclass) level.

utilization appears in **Table 1**. Prior to matching, the 2 groups were similar in terms of demographics, but the ZDC members were significantly less likely to reside in Lake Charles, were more likely to have the “at-risk” health status flag, and were less likely to have a diagnosis of diabetes. ZDC members also had lower ED utilization rates and less medical and prescription drug spending at baseline. After propensity score weighting, however, none of these differences remained significant.

Medication Adherence Results and Changes by Household Income

Figure 2 presents the results for changes in mean medication adherence. For each result shown, the mean PDC was calculated at the drug subclass level. In each comparison, the first bar indicates the mean change in PDC for the controls, and the second bar indicates the change for the ZDC group. We find a statistically significant 1.3-percentage-point reduction ($P = .004$) in mean adherence for the control group during the study period, but a significant 0.7-percentage-point increase ($P = .004$) in mean adherence among the ZDC patients. The net change (2.1 percentage points) is also significant ($P = .002$).

The conceptual framework presented here—lower co-pays lead to greater adherence due to reduced financial barriers—suggests that the ZDC program may have heterogeneous effects by household income. That is, the effects will likely be larger for poorer households, where small changes in co-pays might materially affect decision-making. **Figure 1** also presents the change in mean PDC before and after the ZDC program expansion in each of 3 household income groups.

Among ZDC members, mean medication adherence increased in each income category. The largest increase was apparent among the lowest-income households (1.2 percentage points; $P = .043$), with smaller increases in the middle- and high-income groups (0.8 and

0.5 percentage points; $P = .028$ and $P = .19$, respectively). Among the control members, adherence decreased over time in all 3 income categories. The largest decline was in the low-income group, although the results do not show the same monotonic change moving from low- to high-income households. The difference-in-differences was significant at the 0.05 level only for the low-income households (3.6 percentage points; $P = .035$).

Difference-in-Differences Results

Previous studies have documented that co-pay reduction policies lead to increased adherence without reductions in total cost of care. To assess this question, we took 2 approaches, which are presented in **Table 2**. First, the propensity score–weighted mean spending before and after the ZDC program expansion is shown for both the ZDC and control groups, along with a difference-in-differences estimate reflecting these weighted means. Additionally, we present results from a difference-in-differences regression in the rightmost column.

The results point to large and significant reductions in total medical spending among ZDC members in the period following the program’s expansion: \$71 PMPM in the weighted mean results, or a 10.1% reduction ($P = .027$) in the regression estimate. Reviewing expenditure changes by component, the difference-in-differences estimate for spending for inpatient stays was not significant. However, the ZDC group experienced significant relative reductions in outpatient facility spending, ED visits, and spending on professional services.

Prescription drug spending overall did not significantly increase (\$30 PMPM; 5.1% increase; $P = .277$). We did, however, observe a smaller but significant increase in spending of \$8 PMPM on generic prescriptions (9.5% increase; $P = .008$). **Figure 3** offers suggestive evidence for why this might be the case. The figure presents the pre-post difference in prescriptions per 1000 members for ZDC and control members. We observed a large increase in total prescriptions among both groups during the study period. However, the ZDC group experienced a relatively large increase in generic prescriptions and a smaller increase in branded medications.

DISCUSSION

The health services research literature provides considerable evidence that reduced co-pays are associated with increased medication adherence, and tiered co-pays are a common component of value-based insurance design approaches. However, the literature is substantially less clear on whether this relationship between co-pay amounts and adherence translates to reduced health care costs. This study aimed to answer that question using a difference-in-differences framework and to provide insight into whether health plan members of lower socioeconomic status were differentially affected.

Consistent with the prior literature, we find large relative increases in medication adherence among BCBSLA members who were eligible to have their co-pays eliminated for key medications in

TABLE 2. Health Care Cost Difference-in-Differences

Spending category	Control			ZDC			Weighted	Regression
	Preparticipation	Post participation	Change	Preparticipation	Post participation	Change	Means DID	DID (95% CI) ^a
Medical	\$499	\$749	\$250	\$488	\$667	\$179	-\$71*	-0.101* [-0.192 to -0.011]
Facility inpatient	\$100	\$160	\$60	\$87	\$171	\$84	\$24	0.154 [-0.067 to 0.374]
Facility outpatient surgery	\$98	\$168	\$70	\$98	\$128	\$30	-\$39**	-0.212** [-0.322 to -0.102]
Facility emergency department	\$289	\$319	\$30	\$288	\$269	\$19	-\$48***	-0.169*** [-0.160 to -0.848]
Facility outpatient other	\$82	\$135	\$53	\$81	\$103	\$22	-\$31***	-0.306*** [-0.498 to -0.115]
Professional	\$218	\$286	\$68	\$222	\$264	\$42	-\$26**	-0.107** [-0.178 to -0.036]
Rx	\$424	\$459	\$35	\$420	\$494	\$74	\$38	0.051 [-0.041 to 0.142]
Brand	\$322	\$363	\$41	\$333	\$405	\$72	\$30	0.028 [-0.094 to 0.151]
Generic	\$102	\$96	-\$6	\$87	\$89	\$2	\$8**	0.095** [0.025-0.166]

DID, difference-in-differences; Rx, prescription drug; ZDC, Zero Dollar Co-pay.

P* < .05; *P* < .01; ****P* < .001.

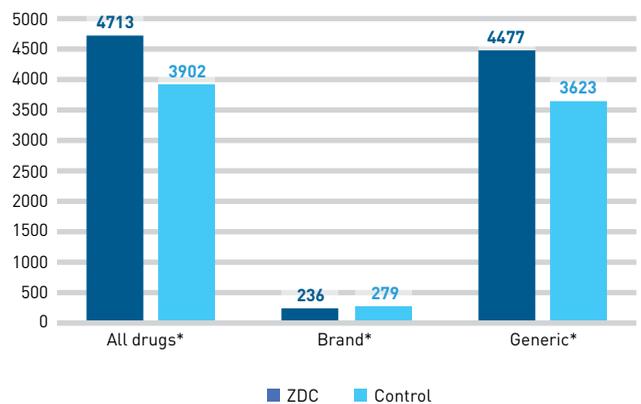
^aRegression estimates use log-transformed spending and reflect percentage changes. Numbers in parentheses reflect lower and upper 95% CI bounds.

drug classes linked to chronic conditions. Differences were largest for diuretics, antidiabetics, and calcium channel blockers and were relatively small for antihyperlipidemic and hematological agents. Results presented in Figure 2 suggest that ZDC members experienced relatively small increases in brand medication use and relatively large (more than offsetting) increases in use of generics. In other words, although the rate of prescribing increased relatively quickly for ZDC members, this increase came from a relatively low-cost mix of medications.

Contrary to much of the prior literature, however, we did find significant reductions in total medical spending: \$71 PMPM, on average. These reductions were only partially offset by increases in spending on brand medication (\$30 PMPM; nonsignificant) and generics (\$8; significant). The results indicate that for commercially insured individuals, a zero co-pay benefit structure may be not only cost-effective, but also cost-saving, with a total net savings of \$63 PMPM (-\$71 PMPM medical spending + \$8 PMPM generic drug spending). Finally, in assessing exposure to the ZDC program by household income, we looked at the changes in medication adherence among low-, middle-, and high-income households separately. We found that these relative increases in adherence were concentrated among low-income households.

Several factors could account for the sizable impacts on adherence and reduced medical spending observed here, in contrast to earlier studies. First, as noted in previous work on the BCBSLA ZDC program, a wider range of medications had associated co-pays eliminated in the ZDC than in many similar initiatives.²⁵ As a result,

FIGURE 3. Change in Prescriptions per 1000 Members



ZDC, Zero Dollar Co-pay.

**P* < .05.

the medications made more accessible may account for more of the polypharmacy needs of patients with complex chronic conditions. Additionally, a zero price may have special behavioral properties, such that small cost-sharing changes have disproportionate impacts on consumption.^{14,15} Finally, as our results by household income suggest, the effects on adherence were largest among low-income members. In 2019, the mean co-pay for a first-tier prescription drug was \$11.²⁴ Although these reduced (but nonzero) co-pays may create incentives to choose the targeted drug over alternatives, these

\$11 co-pays add up quickly, imposing costs of \$132 per member per year, per drug. For low-income households, these relatively low costs may still impose financial barriers that the ZDC program eliminated.

Taken together, these results suggest that insurers should consider the comprehensiveness of any effort to reduce the financial burden of prescription drug adherence, as well as absolute (as opposed to relative) pricing across drug tiers. Given the potential impacts on adherence, total cost of care, and health equity, ZDC benefits should be considered.

Limitations

These analyses have several limitations and therefore results should be interpreted with caution. Although the use of a difference-in-differences framework and propensity score weighting should mitigate baseline differences, there may be residual differences and unmeasured confounding variables between our treated and control populations that could bias our results. For example, employers may opt in to the ZDC program in tandem with other internal human resources changes that are not observable to BCBSLA. Additionally, our sample definitions limit the study to members already diagnosed with chronic conditions. As a result, its implications for medication uptake among newly diagnosed members are unclear, limiting the findings' generalizability. Relatedly, our study includes only members who were eligible for a wider suite of disease management services, and we cannot rule out that disease management services are a necessary condition for the ZDC program's success.

CONCLUSIONS

The purpose of the ZDC program was to remove financial barriers to medication adherence. Demonstrating that medication adherence improved more for members of low-income households compared with other income brackets would provide suggestive evidence that the ZDC program had the intended effect on the member population. Elimination of co-pays for high-prescription-volume drugs indicated for chronic conditions was associated with improved medication adherence and lower total cost of care. In particular, we found that the observed relative increase in adherence was most pronounced among households making less than \$40,000, suggesting that financial barriers to medication adherence may be adversely affecting health care costs overall. These findings suggest that eliminating co-pays for key medications used for treating chronic illnesses may help contain costs and potentially improve health equity. ■

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revision of the manuscript for important intellectual content (MCo, JC, BLM, MF, ML, LSK, YZ, SCN); statistical analysis (MCo, JC, BLM, ML, JO, HCW); provision of patients or study materials (JC); obtaining funding (DC); administrative, technical, or logistic support (JC, DC, BLM, MCa, MF, LSK, BVV, SCN); and supervision (JC, DC, MCa, JO, YZ, HCW, BVV, SCN).

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