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By Joy L. Lee, Matthew Maciejewski, Shveta Raju, William H. Shrank, and Niteesh K. Choudhry

Value-Based Insurance Design: Quality Improvement But No Cost Savings

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ABSTRACT **Value-based insurance design (VBID) is an approach that attempts to improve the quality of care by selectively encouraging or discouraging the use of specific health care services, based on their potential benefit to patients' health, relative to their cost. Lowering beneficiary cost sharing or out-of-pocket spending to increase medication adherence is one common element of value-based insurance design. We conducted a systematic review of the peer-reviewed literature to evaluate the evidence of the effects of VBID policies on medication adherence and medical expenditures. We identified thirteen studies assessing the effects of VBID programs and found that the programs were consistently associated with improved adherence (average change of 3.0 percent over one year), as well as with lower out-of-pocket spending for drugs. In the studies we reviewed, providing more generous coverage did not lead to significant changes in overall medical spending for patients and insurers. Further research is needed to understand how best to structure VBID programs to both improve quality and reduce spending.**

Joy L. Lee is a doctoral student at the Johns Hopkins Bloomberg School of Public Health, in Baltimore, Maryland, and a research trainee in the Division of Pharmacoepidemiology and Pharmacoeconomics, Brigham and Women's Hospital, in Boston, Massachusetts.

Matthew Maciejewski is a professor at the Center for Health Services Research in Primary Care, Department of Internal Medicine, Duke University School of Medicine, in Durham, North Carolina.

Shveta Raju is an internal medicine physician at the Center for Health Services Research in Primary Care.

William H. Shrank is an assistant professor in the Division of Pharmacoepidemiology and Pharmacoeconomics, Brigham and Women's Hospital and Harvard Medical School.

Niteesh K. Choudhry (nchoudhry@partners.org) is an associate physician in the Division of Pharmacoepidemiology and Pharmacoeconomics at Brigham and Women's Hospital and an associate professor at Harvard Medical School.

The underuse of effective drug therapies is a major contributor to suboptimal disease control and poor outcomes for patients with chronic conditions. Although underprescribing by providers is common,[1] patients' long-term nonadherence to prescribed medications appears particularly problematic.[2] Value-based insurance design (VBID), or evidence-based plan design, attempts to promote adherence by lowering patients' out-of-pocket spending for treatments that are associated with large reductions in illness, death, or both. This tool is distinct from traditional insurance design, which prices medications based only on their cost, so that patients face low cost sharing for low-cost medications, regardless of their efficacy. In value-based insurance design, high value may be determined based upon both the treatment itself and the patients who are being targeted. So, for example, statin copayments may be lowered for patients with coronary artery disease but not for those receiving treatment for primary prevention.

Employers have been experimenting with VBID policies for a decade,[3,4] as a previous review by Niteesh Choudhry and colleagues described.[5] The literature to date has focused on VBID programs that introduce copayment reductions for pharmaceuticals (that is, "carrot" VBID), and no evaluation has yet been published on programs that raise cost sharing (that is, "stick" VBID).[5] Because of the growing interest in VBID and its codification in section 2713 of the Affordable Care Act, we updated our prior review and quantitatively synthesized data from the relatively large number of recently published observational studies; we conclude that VBID may improve quality of care without greatly increasing or decreasing health expenditures.[5]

Study Data And Methods

DATA SOURCES We performed a structured electronic search of peer-reviewed journals using PubMed, EconLit, Embase, Business Source Complete, and the National Bureau of Economic Research for studies published or in press before November 2012 that reported on the effects of VBID policies on medication use, medication expenditures, and health expenditures.

Our electronic search strategy included medical subject headings (MeSH) and keywords related to pharmaceuticals (for example, "economics, pharmaceutical," "drug utilization," "fees, pharmaceutical"), health care policy (for example, "health government policy regulation," "health policies"), and policy analysis (for example, "health economics," "cost and cost analysis"), in addition to those specifically related to value-based insurance design by name (for example, "value based insurance," "value based benefit design," "evidence based plan design"). Search terms were adjusted for each database, and a common overall architecture was maintained.

METHODS We evaluated 198 abstracts to identify potentially relevant articles, including only observational studies and excluding those that (1) did not evaluate the effects of a value-based policy on medications, (2) did not present original data, or (3) did not assess changes in medication adherence or expenditures—our main outcomes of interest. We retrieved the published version of all twenty-six candidate articles and reviewed their reference lists to identify additional relevant studies. We contacted the primary authors of each article to obtain additional information, including, in one case, unpublished economic data.[6]

Two authors (Joy Lee, Shveta Raju) extracted data on study populations and characteristics, results, and study quality from each article, using a standardized protocol and reporting form, and resolved disagreements by consensus. Specific information collected included study and analysis design (that is, how confounding was controlled for), policy design (that is, changes in copayment), patient sample (that is, disease specific or general), drug classes, implementation date, and outcomes.

LIMITATIONS Our review had several limitations. Because of the nascent nature of the existing literature, the review included only thirteen published studies that met our evaluation criteria. This small sample size limited our ability to evaluate the effects of specific aspects of value-based insurance design, such as whether policies geared toward patients known to have a specific disease were more effective in improving health care quality and reducing expenditures than policies making the benefit available to all patients who used a particular medication.

Moreover, the review included only observational studies, which, by their nature, are somewhat limited in their internal validity. The quality of the studies and the extent to which the studies accounted for their observational designs also differed (for example, two studies did not have concurrent control groups). Six evaluations were limited to one year after implementation, and eleven lacked clinical outcomes beyond medication adherence. Finally, the evaluated policies affected many different disease classes and drugs, and the associations differed by drug class. This heterogeneity limited our ability to pool the data across studies to generate summary measures on the effect of value-based insurance design.

Study Results

Our search yielded thirteen published studies (see the online Appendix)[7] that evaluated the effects of VBID policies introduced by nine plan sponsors, of which one was a public entity (State of Colorado).[6,8–20] In each study, copayment reductions were applied to medications used to treat chronic diseases (Exhibit 1). Six studies examined the effects of VBID policies on multiple drug classes. Diabetes and hypertension medication were the most common classes subject to copayment reductions.[6,12,15,16,18,20] The decrease in copayment ranged from 25 percent to 100 percent per prescription (generally between $5 and $12.50).

METHODOLOGICAL QUALITY OF OBSERVATIONAL STUDIES The studies were generally of good or excellent methodological quality (see the online Appendix for more discussion).[7] All but two studies[17,20] included control groups and adjusted for covariate imbalance via covariate adjustment in regression analysis or propensity score adjustment. The covariates available for adjustment varied across studies to some degree, and some studies were more explicit than others about the variables that were adjusted for in the analysis. Age, sex, and medication use were the most common covariates. All studies included at least one year of pre-period outcomes, to enable difference-in-differences analysis and strengthen the internal validity of the quasi-experimental evaluations.

IMPACT ON MEDICATION USE AND ADHERENCE All thirteen studies reported an increase in medication adherence (an average change of 3.0 percent after one year). Copayment reductions at one year ranged from 0.5 percent to 9.9 percent (Exhibit 2). In two studies, however, these changes were not statistically significant.[15,18]

EXHIBIT 1

Descriptions Of Value-Based Insurance Design (VBID) Policies For Prescription Drugs

Policy (year)	Study authors	Drug class targeted	Pre-VBID plan design	Copay description	Study patients	Outcomes evaluated
CVS Caremark (2007)	Chang et al. (Note 8 in text)	Antidiabetics	3 tiers	Copay reductions for tier 1 and tier 2	20,173 beneficiaries from 3 plans	Adherence
Marriott (2005)	Chernew et al. (Notes 6 and 9 in text)	Antidiabetics, ACE inhibitors/ARBs, beta-blockers, statins, steroids	3 tiers	Eliminated for tier 1, tier 2 reduced to $12.50, tier 3 reduced to $22.50	37,867 employees and dependents	Adherence
Pitney Bowes (2007)	Choudhry et al. (Notes 10 and 11 in text)	Statins	3 tiers	Eliminated for all statins	2,051 beneficiaries with diabetes on statins	Adherence, cost
	Choudhry et al. (Notes 10 and 11 in text)	Clopidogrel	3 tiers	Reduced to tier 1	779 beneficiaries on clopidogrel	Adherence, cost
Novartis (2005)	Gibson et al. (Note 15 in text), Kelly et al. (Note 20 in text)	Antidiabetics, antihypertensives, bronchodilators	20% coinsurance for retail scripts, 10% coinsurance for mail-order scripts	10% coinsurance for retail scripts, 7.5% coinsurance for mail-order prescriptions	25,784 employee beneficiaries (Gibson et al.) 9,624 employee beneficiaries (Kelly et al.)	Adherence, payment, use Adherence, payment
Florida Health Care Coalition (2006)	Gibson et al. (Note 14 in text)	Antidiabetics	10–35% coinsurance	10% coinsurance	1,876 employee beneficiaries	Adherence, payment
		Antidiabetics	10–35% coinsurance	10% coinsurance with disease management	328 employee beneficiaries	Adherence, payment
Blue Cross Blue Shield of North Carolina (2008)	Maciejewski et al. (Note 16 in text), Farley et al. (Note 12 in text)	Antidiabetics, antihypertensives, cholesterol-lowering medications	3 tiers	Eliminated for tier 1 for program participants, reduced for tiers 2 and 3 for all beneficiaries	747,400 beneficiaries of participating employers	Adherence, cost
State of Colorado (2006)	Nair et al. (Note 17 in text)	Antidiabetics	3 tiers	All drugs and testing supplies reduced to tier 1	589 state workers	Adherence, utilization
Blue Cross Blue Shield of Minnesota (2006)	Rodin et al. (Note 18 in text)	Antidiabetics, cardiac medications	3 tiers	Eliminated for tier 1, increased to $35 for tier 2 and $50 for tier 3	4,654 beneficiaries of groups with 50 or fewer employees	Adherence, cost
Health Alliance (2007)	Zeng et al. (Note 19 in text)	Antidiabetics	3 tiers	Most items reduced to tier 1	71 beneficiaries of one employer[a]	Adherence
Health Alliance (2008)	Frank et al. (Note 13 in text)	Statins	3 tiers	Reduced copayments by 50% for 3 preferred drugs	14,976 beneficiaries from 24 employer-sponsored plans	Adherence

SOURCE Authors' analysis of cited studies. **NOTES** ACE is angiotensin-converting enzyme. ARB is angiotensin receptor blocker. [a]Carle Clinic, part of Health Alliance.

Five studies that examined multiple drug classes found variations in adherence response across drug classes within the same studies.[9,12,15,17,20] The largest adherence improvements were found for diabetes medications, followed by statins, angiotensin-converting enzyme (ACE) inhibitors, and angiotensin receptor blockers (ARBs).[14,19,21]

Four studies also reported adherence changes beyond one year (Exhibit 3). Teresa Gibson and colleagues found that for diabetes medications, adherence decreased slightly in the first year after program implementation (−0.2 percent) but improved by year 3.[15] Kavita Nair and colleagues found that compared to the year prior to copayment elimination, adherence improved by 9.4 percent in the first year after copayments were eliminated for insulin and by 11.3 percent a year later.[17] Gibson and colleagues' evaluation of the Florida Health Care Coalition's VBID program found that for patients in a disease man-

EXHIBIT 2

Impact Of Value-Based Insurance Design On Patients' Adherence With Prescribed Medications

Policy	Drug class	Change in adherence (%) At 1 year	At 3 years
CVS/Caremark	Insulin	9.9[f]	—
	Oral antidiabetics	5.0[f]	—
	All antidiabetics	7.2[f]	—
Marriott	ACE inhibitors, ARBs	2.6[f]	—
	Beta-blockers	3.0[f]	—
	Antidiabetics	4.0[f]	—
	Statins	3.4[f]	—
	Inhaled steroids	1.9[a]	—
Pitney Bowes	Statins	3.1[d]	—
	Clopidogrel	4.2[d]	—
Novartis	Asthma	0.0[b]	0.3[b]
	Antidiabetics	−0.2[e]	2.0[d]
	Cardiovascular	0.7[e]	−0.1[e]
	Overall	0.5[e]	1.8[e]
	Asthma	—	9.0[c]
	Antihypertensives	—	9.0[c]
	Antidiabetics	—	4.0[c]
Florida Health Care Coalition	Insulin	2.5[b]	3.6[b]
	Oral antidiabetics	0.4[b]	0.8[b]
	All diabetes medications	8.3[b]	4.1[b]
	Insulin with disease management	3.7[b]	2.7[d]
	Oral antidiabetics with disease management	1.0[e]	5.8[f]
	All diabetes medications with disease management	3.7[e]	6.5[f]
Blue Cross Blue Shield of North Carolina	ACE inhibitors, ARBs	2.5[f]	4.8[a,f]
	ARBs	0.9[e]	−0.2[a,b]
	Beta-blockers	2.2[f]	4.3[a,f]
	Calcium channel blockers	0.9[e]	2.0[a,f]
	Cholesterol absorption inhibitors	0.3[b]	0.4[a,b]
	Diuretics	2.8[f]	4.5[a,f]
	Metformin	3.2[f]	5.0[a,f]
	Statins	1.4[f]	2.3[a,f]
State of Colorado	Insulin	9.4[e]	11.3[a,e]
	Oral antidiabetics	2.5[c]	−1.0[c]
	Overall	3.2[c]	1.3[c]
Blue Cross Blue Shield of Minnesota	Statins	4.9[d]	—
	Sulfonylurea	0.6[c]	—
	Metformin	2.3[c]	—
	Thiazolidinediones	−1.9[c]	—
	Insulin	−0.6[c]	—
Health Alliance 2007	Antidiabetics	7.3[f]	—
Health Alliance 2008	Statins	2.7[d]	—

SOURCE Authors' analysis of cited studies (see Exhibit 1). **NOTES** In empty cells, the study did not assess an outcome for that time frame. ACE is angiotensin-converting enzyme. ARB is angiotensin receptor blocker. [a]At two years. [b]Not significant. [c]p value not available. [d]$p < 0.05$ [e]$p < 0.01$ [f]$p < 0.001$

agement program, the effect increased from 3.7 percent in the first year to 6.5 percent by the third year.[14] In contrast, patients in the VBID program implemented without disease management saw nonsignificant changes in all three years. The study by Joel Farley and colleagues found that adherence increased 3–9.7 percent (depending on medication) for previously nonadherent patients between the first and second years of the VBID program.[12]

IMPACT ON PRESCRIPTION AND HEALTH SPENDING Several studies evaluated the effect of VBID policies on health plan spending. As expected, VBID policies were associated with significant increases in drug spending for insurers in the five studies that examined this outcome (Exhibit 3). This ranged from a 0.2 percent increase in expenditures for diabetes, hypertension, and asthma medications at Novartis[15] to a 61 percent increase in expenditures for diabetes medications for the State of Colorado.[17]

In the four studies that reported nonprescription medical spending for insurers, the VBID policies were not associated with significant changes in health spending.[9,11,14,15] Two studies that bundled VBID and disease management found that expenditures trended lower.[6,14] In one, Michael Chernew and colleagues reported medical savings of $51.03 per member per month, although the statistical significance of this change was not reported.[6] In the other, Gibson and colleagues also reported statistically insignificant savings.[14] In that study, only patients with diabetes who enrolled in disease management programs saw a significant drop in medical expenditures (26.4 percent reduction, $p < 0.10$). The trend held at three years (40.5 percent reduction, $p < 0.05$).[14]

Six studies evaluated the effect of the policies on medical and prescription spending collectively, and none observed significant increases past the first year.[6,11,14,15,17,20] Chernew and colleagues, Choudhry and colleagues, Gibson and colleagues, and Emily Kelly and colleagues did not observe statistically significant changes in overall insurer expenditures,[9,11,15,20] which suggests that the VBID policies may have increased prescription spending without increasing overall spending. Two studies observed significant changes in the first year, but not in the years after. Nair and colleagues observed an 18 percent increase in expenditures after one year ($p < 0.05$) compared to baseline. In the following year, the expenditures decreased by 18 percent compared to baseline ($p < 0.05$).[17] In contrast, Gibson and colleagues saw a 20.3 percent decrease in overall expenditures in a disease management setting after one year ($p < 0.01$). At three years the spending decrease shrank to 11.8 percent and was no longer statistically significant.[14]

IMPACT ON HEALTH SERVICES USE Two of the studies examined the impact of value-based insurance design on health services use. Nair and colleagues found that the policy was associated

EXHIBIT 3

Impact Of Value-Based Insurance Design On Prescription And Medical Expenditures

Policy	Study author	Drug class	Change in expenditures: At 1 year	Change in expenditures: At 3 years
PRESCRIPTION EXPENDITURES				
Marriott[a]	Chernew et al.	Antidiabetics, ACE inhibitors/ARBs, beta-blockers, statins, and steroids	$20.87 PMPM[b]	—
Pitney Bowes	Choudhry et al.	Statins	0.0%[c]	—
		Clopidogrel	-6.0[c]	—
Novartis	Gibson et al.	Antidiabetics, asthma, and antihypertensives	0.2[c]	16.6%[c]
	Kelly et al.	Asthma	2.5[b]	—
		Antihypertensives	19.9[b]	—
		Antidiabetics	10.5[b]	—
Florida Health Care Coalition	Gibson et al.	Diabetes	-5.8[c]	-16.0[c]
		All causes	8.3[c]	23.0[c]
		Diabetes with disease management	15.7[e]	17.7[d]
		All causes with disease management	12.5[e]	21.6[e]
State of Colorado	Nair et al.	Not specified	61.0[d]	—
MEDICAL EXPENDITURES				
Marriott[a]	Chernew et al.	Antidiabetics, ACE inhibitors/ARBs, beta-blockers, statins, and steroids	-$51.03 PMPM[b]	—
Pitney Bowes	Choudhry et al.	Statins	16.0%[c]	—
		Clopidogrel	-26.0[b]	—
Novartis	Gibson et al.	Antidiabetics, asthma, and antihypertensives	34.0[c]	8.9%[c]
Florida Health Care Coalition	Gibson et al.	Diabetes	-4.3[c]	25.6[c]
		All causes	-30.6[f]	-23.5[c]
		Diabetes with disease management	-26.4[c]	-40.5[d]
		All causes with disease management	-1.9[c]	-0.2[c]
PRESCRIPTION AND MEDICAL EXPENDITURES				
Marriott[a]	Chernew et al.	Antidiabetics, ACE inhibitors/ARBs, beta-blockers, statins, and steroids	-$26.88 PMPM[b]	—
Pitney Bowes	Choudhry et al.	Statins	3.0%[c]	—
		Clopidogrel	-6.0[c]	—
Novartis	Gibson et al.	Antidiabetics, asthma, and antihypertensives	28.0[c]	8.4%[c]
	Kelly et al.	Asthma	—	-18.0[b]
		Antihypertensives	—	-5.0[b]
		Antidiabetics	—	-9.0[b]
Florida Health Care Coalition	Gibson et al.	Diabetes	-4.0[c]	3.4[c]
		All causes	-20.3[e]	-11.8[c]
		Diabetes with disease management	-6.6[c]	-15.3[c]
		All causes with disease management	3.3[c]	8.5[c]
State of Colorado	Nair et al.	Antidiabetics	18.0[d]	—

SOURCE Authors' analysis of cited studies (see Exhibit 1). **NOTES** In empty cells, the study did not assess an outcome for that time frame. ACE is angiotensin-converting enzyme. ARB is angiotensin receptor blocker. PMPM is per member per month. [a]Based on unpublished data. [b]p value not available. [c]Not statistically significant. [d]$p < 0.05$ [e]$p < 0.01$ [f]$p < 0.001$

with significant decreases in emergency department visits (−36 percent, $p < 0.01$), physician office visits (−5 percent), and hospitalizations (−13 percent) at two years.[17] Likewise, Choudhry and colleagues observed significant reductions in rates of physician visits for statin and clopidogrel users after copayment reduction (relative change: statin users: 0.80, 95% confidence interval: 0.57, 0.98; clopidogrel users: 0.87, 95% CI: 0.59, 0.96). Reductions in hospitalizations and emergency department admissions were also observed (relative change: statin users: 0.90, 95% CI: 0.80, 0.92; clopidogrel users: 0.89, 95% CI: 0.74, 0.90).[11]

Discussion

This review of observational evaluations found that value-based insurance design was consistently associated with improved medication adherence. However, consistent with the limited randomized trial evidence evaluating value-based insurance design,[22] our review also found that the improvements in medication adherence associated with it were not accompanied by significant reductions in overall medical or total insurer spending.

The primary benefit of value-based insurance design may be in its ability to improve the quality of care for patients with chronic diseases.

However, much of the enthusiasm for this approach has been based on the hope that payer spending would decline after implementation.[23] This expectation comes from previous research based upon simulations from economic models that examined lifetime trends (not one-to-three-year trends as in these studies).[23] For example, using Medicare data, Choudhry and colleagues estimated the cost-effectiveness of eliminating all cost sharing for prescription drugs to treat Medicare beneficiaries following myocardial infarction. They found that this strategy would be cost saving within one year after the initial myocardial infarction and would lead to total savings of $2,500 per beneficiary over beneficiaries' remaining life span.[19] Two other studies reached similar conclusions regarding full coverage of ACE inhibitors for Medicare patients with diabetes.[23,24] Yet in our review we did not find that these cost savings were realized in real-world VBID implementations in the short term (one to three years).[6,11,14,15,17,20]

VBID programs can employ a variety of methods to reward the use of therapies of high clinical value, from reducing copayments and coinsurance rates to shifting medications to a lower tier (to lower beneficiary cost sharing) in the drug formulary. We found no published examples of VBID policies that discourage the use of low-value therapies. However, policies such as higher cost sharing for certain cancer medications that are administered outside of guideline recommendations have been proposed.[25] Determining what services or treatments are defined as *low value* may be a more difficult and controversial process than that required to define *high value* services. Yet both approaches aim to deter the use of treatments with uncertain or limited effectiveness and to encourage evidence-based practices.[25]

Many insurers recognize that VBID programs are a part of a larger strategy to promote the use of services of high clinical value. Consequently, some VBID programs link copayment reductions to clinical criteria or forms of patient engagement. For example, Gibson and colleagues found greater improvements in adherence from VBID programs only among patients who were enrolled in a disease management program.[14] Given the wide variety of choices and the paucity of existing data evaluating programs other than copayment reductions, the optimal design of VBID programs to obtain the greatest positive effects remains to be determined.[5]

Many unanswered questions remain regarding how to measure and maximize the potential benefits of VBID programs. The existing literature provides limited information about whether value-based insurance design improves health outcomes. The relatively short duration of many studies may have been insufficient to capture health effects that may take years to become apparent. The impact of value-based insurance design may also differ by the disease and risk levels of patients who are targeted. Moreover, the existing evaluation literature focuses solely on health spending, which provides an important but incomplete assessment of the business case for value-based insurance design. Employers considering VBID implementation may be interested in additional impacts, such as the impact on employee productivity (either missing work or suffering lower productivity while at work because of illness).

Conclusion

Implementation of value-based insurance design has been recommended as a possible contributor to efforts to improve health care quality without increasing cost and is of great political and research interest.[25] The Affordable Care Act included a provision that "the Secretary may develop guidelines to permit a group health plan and a health insurance issuer offering group or individual health insurance coverage to utilize value-based insurance designs."[26] Our review suggests that although value-based insurance design might not significantly reduce health spending in the short term—that is, within one to three years—some VBID plans improve medication adherence and reduce patients' out-of-pocket expenses. Clearly, studies that examine the longer-term, real-life effects of value-based insurance design are much needed to see if adherence remains improved and assess its impact on overall insurer expenditures. Efforts to identify the optimal VBID design should be the focus of ongoing research to realize the potential of this approach to quality improvement. ■

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