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Connecticut's Value-Based Insurance Plan Increased The Use Of Targeted Services And Medication Adherence

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ABSTRACT In 2011 Connecticut implemented the Health Enhancement Program for state employees. This voluntary program followed the principles of value-based insurance design (VBID) by lowering patient costs for high-value primary and chronic disease preventive services, coupled with requirements that enrollees receive certain primary and secondary preventive services. Nonparticipants in the program, including those removed for noncompliance with its requirements, were assessed a premium surcharge. The program was intended to curb cost growth and improve health through adherence to evidence-based preventive care. To evaluate its efficacy in doing so, we compared changes in service use and spending after implementation of the program to trends among employees of six other states. Compared to employees of other states, Connecticut employees were similar in age and sex but had a slightly higher percentage of enrollees with chronic conditions and substantially higher spending at baseline. During the program's first two years, the use of targeted services and adherence to medications for chronic conditions increased, while emergency department use decreased, relative to the situation in the comparison states. The program's impact on costs was inconclusive and requires a longer follow-up period. This novel combination of VBID principles and participation requirements may be a tool that can help plan sponsors increase the use of evidence-based preventive services.

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Faced with rising health care expenditures and evidence that service use often is not aligned with evidence-based metrics, employers are exploring ways to generate more value from their health spending. Many employers have opted to implement high-deductible health plans to transfer costs to employees and encourage consumer engagement.¹ Instead of increasing point-of-care financial obligations, the State of Connecticut opted in 2011 to remove financial barriers for services known to be clinically valuable and coupled that change with requirements that enrollees receive certain primary and sec-

ondary preventive care services. This plan, still in use, follows the principles of value-based insurance design (VBID), a concept that matches a patient's out-of-pocket spending with the clinical value of care that he or she is consuming.² VBID was designated as a federal policy priority in the Affordable Care Act (ACA), and many states are considering VBID policies for their own employees (for example, Oregon), their exchanges (for example, Maryland), or their Medicaid programs (for example, Michigan).

This article provides key data on the implementation and early results of a collectively bargained state-based application of VBID. It is one

of the first such programs in any context to use enrollee requirements in conjunction with reduced cost sharing to encourage patients to participate in their preventive and chronic disease care. The impact on utilization and spending of adding programs with VBID features can inform the optimal design of similar programs going forward.

Value-Based Insurance Design

VBID is an innovative approach to providing health benefits that aims to enhance patients' clinical outcomes. A consumer-focused intervention, it is one mechanism to encourage consumers to use high-value medical services. The key to a VBID plan is clinical nuance, which recognizes that medical services vary in the benefits provided. Therefore, such a plan seeks to align patients' out-of-pocket spending with clinical value using either the "carrot" of reduced cost sharing for high-value services or the "stick" of increased cost sharing for low-value services. In VBID plans, copayments are often reduced or eliminated for treatments that have a strong evidence base regarding their ability to improve clinical outcomes, increase health system efficiency, or both.

This clinical nuance stands in contrast to the blunt designs of traditional cost sharing, in which cost sharing is applied equally to all services or based solely on acquisition cost. Traditional plans have been shown to result in the underuse of high-value services and the overuse of low-value services.³⁻⁶

Early adopters of VBID primarily employed not "sticks" but "carrots": They reduced cost sharing for medications considered important for controlling chronic conditions. There have been a number of studies of these plans,^{7,8} and a recent literature review concluded that the plans improved medication adherence by an average of 3 percentage points over one year.⁹

Beyond medications, few studies have looked at the effect of decreased cost sharing on preventive services. Some have found no effect.¹⁰ Others have found that aligning cost sharing with a service's clinical value can shift utilization away from discouraged services, but it has limited effects when reductions in cost sharing are used to encourage the use of preventive services such as cervical cancer screening and mammography.¹¹

Additionally, there have been relatively few studies of VBID plans that bundle carrot-based approaches with other features such as sticks (higher cost sharing), disease management services, and enrollee engagement measures. Some work has shown that value-based cost reductions enhance disease management programs and

lead to increased medication adherence, compared with disease management alone.^{12,13} For services beyond pharmaceuticals, a benefit change for the Oregon public employees program that increased cost sharing for targeted overused or "preference sensitive" services such as diagnostic imaging led to reduced use of those services.¹⁴

Overall, the available evidence suggests that carrots often moderately increase the use of targeted high-value services. However, achieving greater clinical impact may require employing sticks or bundling VBID with complementary initiatives. Given the number of such initiatives (for example, wellness programs, patient education, disease management, provider pay-for-performance, enrollee accountability requirements, and price and quality transparency) and the different populations in which they could be employed, much more research is required to inform the optimal design of insurance plans that use VBID.

Connecticut's Health Enhancement Program

In 2011 the State of Connecticut faced a projected budget gap of \$3.8 billion. State employees were asked to help address this deficit, in part through changes in employee health care costs. As a result, employees' unions and the Office of the State Comptroller jointly designed the Health Enhancement Program in the summer of 2011, with the twin goals of improving employees' health and generating savings.

This complex effort required ongoing collaboration by a number of partners. Given the new and central role of beneficiary participation requirements in the novel plan design, preliminary versions were carefully scrutinized. Shortly after union ratification of the Health Enhancement Program provisions, the program was launched on October 1, 2011, and open enrollment began. The program was voluntary: Employees could instead have coverage similar to what they had had in previous plan years, though to do so they would have to pay a surcharge of \$100 per month more than what program participants paid. Bargaining between the unions and the state had delayed the launch, so the program began three months into the plan year. However, services received during those three months were counted toward compliance with the new program requirements.

As of 2014, Connecticut was spending about \$3.9 million per year on the Health Enhancement Program, partly for chronic condition disease management. The program requires a staff of approximately twenty full-time-equivalent

workers, about half of whom are nurses engaged in disease management and patient education (Thomas Woodruff, Connecticut Office of the State Comptroller, personal communication, October 25, 2013). We did not assess the program's return on investment, which would have required us to use data that were not available to us—including measures such as absenteeism and productivity.

Key Features Of The Health Enhancement Program

Before the implementation of the Health Enhancement Program, Connecticut's state employee health plan did not distinguish between high- and low-value services in determining cost sharing. The Health Enhancement Program introduced incentives to align patient costs with the value of care, including the elimination of office visit copayments for chronic conditions (a savings of \$15 per visit) and the reduction or elimination of copays for medications associated with the management of the five following chronic conditions targeted by the program: asthma or chronic obstructive pulmonary disease (COPD), diabetes, heart disease, hypertension, and hyperlipidemia. Copays for drugs for diabetes were eliminated. Copays for drugs for the other chronic diseases were \$0 for generic drugs, \$5 for preferred brand-name drugs, and \$12.50 for other brand-name drugs, compared with \$5, \$10, and \$25, respectively, for employees not enrolled in the program.

Additionally, the program assessed a new \$35 copay for emergency department (ED) visits when there is a reasonable medical alternative and the member is not admitted to the hospital. This copay applies to all employees, both members and nonmembers of the program.

A novel feature of the program is its attempt to engage patients in preventive care by holding them accountable for receiving it. Members who desire to maintain Health Enhancement Program benefits must satisfy a number of requirements, including obtaining health risk assessments, screenings, and physical examinations that are appropriate for people of their age and sex. In some cases these are annual requirements, but in many cases they are not (for details, see online Appendix Exhibit 1).¹⁵ Enrollees with certain chronic conditions must also obtain guideline-based clinical services and participate in disease management.

While the program is voluntary, it provides significant incentives to participate. These include exemption from the monthly \$100 health insurance premium surcharge and the elimination of deductibles, which could amount to addi-

tional annual savings of \$350 per person and of \$1,400 per family. Members with chronic conditions who comply with all of the program's requirements receive annual \$100 incentive payments.

Members may be disenrolled from the Health Enhancement Program if they do not comply with its requirements. The program strives to avoid this outcome through regular reminders and other forms of outreach using multiple methods of communication, including e-mail, mail, telephone, and website posts. Compliance is evaluated annually, beginning with a claims evaluation by a third party. Enrollees are given opportunities to regain their compliance status before being disenrolled. A joint labor and management company makes final determinations of compliance status.

In this study we evaluated the impact of Connecticut's implementation of the Health Enhancement Program on the use of targeted services and, secondarily, on spending. The program's experience can inform initiatives to implement novel insurance packages by public and private employers.

Study Data And Methods

DATA AND SAMPLE We evaluated enrollment and claims data for Connecticut state employees and their dependents (collectively, 64,165 people) ages 18–64 who were continuously enrolled in the state's employer-sponsored insurance plan for the period July 1, 2010–June 30, 2013. This period encompasses the plan year before implementation of the Health Enhancement Program as a baseline and the first two plan years after the program began. The data included inpatient, outpatient, and prescription drug claims for the entire study period and demographic characteristics and comorbid conditions at baseline. Only active employees were included, since those who retired before the program was initiated were ineligible to participate in it. Claims include actual payment amounts and both insurer and patient obligations.

To establish a comparison group, we obtained a sample of state government employees and dependents from the Truven MarketScan Commercial Claims and Encounters Database for the same period. That sample included employees of six state employers and their dependents ages 18–64 (collectively, 215,314 people) who were continuously enrolled in employer-sponsored insurance in the study period.

Because of a confidentiality agreement with data contributors, Truven is unable to reveal which states were in the control group, but it confirmed that, like the State of Connecticut,

all six state employers are in the eastern half of the United States. Truven also screened state benefit plans to ensure that there were no major structural changes during the study period. Within each state, “contracts” (that is, employees and their covered dependents) were randomly selected to be representative of that state. However, the same number of enrollees was drawn from each state to ensure that the number of enrollees could not be used to identify states.

OUTCOME AND DISEASE COHORT DEFINITIONS

We examined the use of targeted services for the entire sample and for the five subpopulations with a targeted chronic disease retrospectively through the use of *Current Procedural Terminology* (CPT) and *International Classification of Diseases, Ninth Revision* (ICD-9), codes. The specific outcomes we analyzed for the entire sample were preventive office visits, colonoscopy or fecal occult blood test for enrollees ages fifty and older, mammograms for women ages thirty-five and older, Papanicolaou (Pap) tests for women ages eighteen and older, lipid screenings for all adults, and ED use. For the subpopulation of people with diabetes at baseline, the outcomes we analyzed were lipid screening, hemoglobin A1c tests, and eye exams. For the subpopulations of people with heart disease or with COPD or asthma at baseline, the outcomes were lipid screening and bone density tests for patients taking corticosteroids, respectively. In all five subpopulations, we examined adherence to relevant medications and ED use.

Disease subpopulations were defined through claims from the baseline year based on ICD-9 codes or through receipt of prescriptions specific to a given condition (for specific prescriptions, codes, and method of [please provide], see Appendix Exhibit 5).¹⁵ For medication classes specific to each subpopulation, medication possession ratios were calculated as the percentage of days in each year for which a filled prescription was available (that is, days of filled prescriptions divided by 360), top-coded at 100 percent.

STATISTICAL METHODS We used a difference-in-differences framework to assess changes before and after implementation of the Health Enhancement Program in the use of targeted services and in total and out-of-pocket spending, relative to the control group of state employees and dependents from other states. Our models included all beneficiaries eligible for the Health Enhancement Program, regardless of their enrollment status (that is, we used the intention-to-treat approach).

We used this approach for two reasons. First, the intervention is aimed at the entire population of employees and dependents. Thus, we allowed for the impact of nonparticipation on the

program outcomes. Second, it was not possible to identify and exclude beneficiaries from the comparison group who would not have participated had they been offered a program similar to the Health Enhancement Program.

We used linear probability models to estimate binary outcomes. The key variables of interest were interaction terms between the year indicators for the period after the Health Enhancement Program was implemented and the indicator for the intervention group (beneficiaries in Connecticut) versus the comparison group (beneficiaries in the other states). The linear probability model was chosen because of difficulties in interpreting the sign and significance of interaction terms in nonlinear models, such as logistic regression.¹⁶

Models for the continuous spending outcomes were ordinary least squares models of spending and log spending. We estimated a model with actual dollars spent and with standardized prices, to mitigate the potential effect of differential changes in price growth. Sensitivity analyses were estimated for total spending models by dropping outliers (people who spent \$50,000 or more annually) and by estimating using generalized linear models. (Appendix Exhibit 4 describes the full regression equation, and Appendix Exhibit 7 shows results.¹⁵)

LIMITATIONS This study had several limitations. First, our intervention group was state employees in a single state. Therefore, the study results may be limited in their generalizability to other states or other populations. We note that the intervention group was fairly similar to the comparison group in terms of baseline demographic characteristics. Given the functional similarities across state governments, the two groups probably also included a similar mix of occupational categories.

Second, despite the similar demographic characteristics, there were differences between the intervention and comparison groups in some clinical characteristics, which could reflect differences in unmeasured factors such as smoking, medical practice patterns, and coding patterns. Because we used a difference-in-differences approach, baseline differences in levels would not necessarily bias the analysis as long as those differences were consistent over time. However, the existence of such differences does raise concern about the possibility of baseline differences in trends.

Third, the ACA was signed into law just before our study period and eliminated cost sharing for the general population in nongrandfathered plans for the primary preventive services included in the Health Enhancement Program. This change may mean that the effects of the program

on the full sample (as opposed to the chronic disease subpopulations) reflect the impact of enrollee participation requirements instead of cost-sharing differences between the intervention and control groups, since cost-sharing changes could be similar in the two groups after passage of the ACA. Given that participation requirements were the most novel aspect of the Health Enhancement Program, the suggestion that accountability measures had an impact beyond that of reduced cost sharing is particularly notable.

Last, we used claims data to measure primary outcomes. While this has many advantages, one disadvantage is that multiple codes can be used for the same encounter. Thus, it is impossible, using codes alone, to distinguish changes in behavior from changes in coding. This issue is most problematic in areas such as office visits, and less so in the use of screening tests and prescription drugs.

Study Results

BASELINE CHARACTERISTICS OF CONNECTICUT AND COMPARISON STATE ENROLLEES The Connecticut and comparison groups at baseline (the plan year before implementation of the Health Enhancement Program) were quite similar in terms of age and sex, but the Connecticut group had a slightly higher percentage of enrollees with a positive Charlson comorbidity score

(Exhibit 1). Baseline spending was considerably higher in Connecticut than in the other states. An examination of the twenty services with the highest spending in the comparison group revealed that the difference in baseline spending was driven by both higher prices and greater utilization in Connecticut, but that prices accounted for most of the difference (data not shown). In addition, high-spending outlier cases were substantially more common in Connecticut than in the comparison states (Exhibit 1). As a result of these baseline differences, the spending analyses were not the primary focus of this evaluation and should be interpreted cautiously.

ENROLLMENT AND USE OF TARGETED SERVICES

► **FULL SAMPLE:** Connecticut's actuaries predicted that as many as 50 percent of people eligible for the Health Enhancement Program would not enroll in it, but first-year enrollment exceeded 98 percent. Compliance with accountability standards was equally high. About 98 percent of enrollees were deemed compliant at the end of each of the first two program years. Therefore, if we had excluded nonparticipants or people who did not comply with the program's requirements, our results would have been very similar to the results from our intention-to-treat analysis.

We found significant changes in the percentages of the eligible population receiving high-value medical services across a range of outcomes in Connecticut, relative to the comparison

EXHIBIT 1

Baseline demographic characteristics and spending among HEP enrollees and comparison-group enrollees

	HEP (n = 64,165)	Comparison group (n = 215,314)	Standardized differences
Mean age (years)	41.6 ****	42.2	4.74
Female	53.8% ****	57.8%	8.05
Dependent	41.0% ****	30.9%	21.16
Charlson comorbidity index			
1	14.8% ****	11.4%	9.94
2	6.0 ****	4.5	7.02
Chronic condition			
Has diabetes	6.5% ****	7.6%	4.31
Has heart disease	6.1 ****	7.5	5.61
Has COPD or asthma	14.5 ****	8.8	17.68
Has hypertension	20.4 ****	23.5	7.46
Has hyperlipidemia	24.2 ****	19.5	11.31
Has any chronic disease	42.3 ****	39.6	5.57
Average spending	\$7,913.69	\$4,375.27	18.07
Share of enrollees with spending ≥ \$50,000	2.15% ****	0.79%	11.31
Likelihood of preventive office visit	53.0% ****	36.9%	32.86

SOURCE Authors' analysis of claims data from the State of Connecticut and from the Truven MarketScan Commercial Claims and Encounters Database, July 2010–June 2013. **NOTES** Baseline is the plan year before the implementation of the Health Enhancement Program (HEP). Significance refers to the probability that the value for the HEP group is equal to that of the comparison group using a t-test. COPD is chronic obstructive pulmonary disease. ****p ≤ 0.001

states. Preventive office visits and nearly all of the targeted preventive screenings showed significant gains from baseline in both the first and second program years, relative to the comparison group (Exhibit 2). For example, the share of Health Enhancement Program enrollees versus the share of the comparison group receiving a preventive office visit increased by 13.5 percentage points in year 1 and 4.8 percentage points in year 2, relative to baseline. The largest jump was for lipid screenings for the population ages fifty and older, which increased by 20.1 percentage points in the program enrollees versus the comparison group in year 1 and by 7.8 percentage points in year 2, relative to baseline. The only screening that did not show a significant gain in both program years was Pap tests.

The Health Enhancement Program increased copays for some ED visits that did not result in hospitalization. Given that increased cost sharing as well as the possibility that increased preventive care may lead to offsets in emergency medicine use, we examined the use of the ED. We separately evaluated the likelihood that an enrollee would have any ED visits and the total number of visits (counting each visit separately).

Relative to the comparison group, we found no evidence of changes in the likelihood of having an ED visit without a resulting hospital admission between baseline and the first year of the program, but there was a significant 1.0-percent-

age-point decrease in the probability of an ED visit between baseline and the second year (Exhibit 2).¹⁷ In contrast, the total number of ED visits without a resulting hospital admission decreased significantly in both years. At baseline in the Health Enhancement Program, the average use of the ED without a resulting inpatient stay was 249 visits per 1,000 enrollees. Relative to the comparison group, the number of such visits decreased by 10 visits per 1,000 enrollees in year 1, and by 25 visits per 1,000 enrollees in year 2.

► **CHRONIC DISEASE SAMPLE:** The Health Enhancement Program reduced cost sharing and required the use of additional services for employees diagnosed with certain chronic diseases. Our difference-in-differences results examined changes in use of services for enrollees relative to the comparison group for the subpopulations of people diagnosed with these conditions at baseline. Thus, they reflect changes in use outcomes for each disease subpopulation, not changes in the prevalence of the chronic conditions.

Across all chronic conditions, there were significant increases in physician office visits, relative to the comparison group. The likelihood of having an office visit increased by 1.6 percentage points in year 1 and by 1.2 percentage points in year 2 (Exhibit 3). For people with diabetes, there was an increased likelihood of receiving all required services in year 1, compared to the

EXHIBIT 2

Changes in use of preventive services and emergency department by HEP and comparison-group enrollees

	Enrollees who used the service						Difference-in-differences between groups (percentage points)	
	Baseline		Year 1		Year 2		Year 1 vs. baseline	Year 2 vs. baseline
	HEP	Comparison group	HEP	Comparison group	HEP	Comparison group		
PREVENTIVE SERVICES								
Preventive office visit	53.0%	36.9%	68.4%	38.8%	60.0%	39.2%	13.5***	4.8***
Colonscopy ^a	13.3	11.0	18.2	10.2	15.1	10.0	5.6***	2.8***
Fecal occult blood test ^a	14.1	10.7	18.7	10.7	16.6	10.6	4.7***	2.6***
Mammogram ^b	47.0	40.4	56.7	41.8	51.5	42.1	8.1***	2.6***
Pap test ^c	50.3	43.9	55.5	43.9	47.4	41.4	5.2***	-0.4
Lipid screening	42.4	38.1	58.5	38.8	49.5	39.2	15.4***	6.1***
Lipid screening ^a	61.5	54.4	80.8	53.7	69.1	54.3	20.1***	7.8***
EMERGENCY DEPARTMENT VISITS WITHOUT HOSPITALIZATION								
Likelihood of visit	17.1%	11.6%	16.9%	11.8%	16.4%	12.0%	-0.28	-1.0***
No. of visits (per 1,000 enrollees)	249	159	244	164	233	168	-10***	-25***

SOURCE Authors' analysis of claims data from the State of Connecticut and from the Truven MarketScan Commercial Claims and Encounters Database, July 2010–June 2013. **NOTES** The exhibit shows the results of linear probability models estimated with robust standard errors. All models controlled for age, sex, dependent status, Charlson comorbidity index score, time period (plan year), and baseline differences in outcome measures. Baseline is the plan year before the implementation of the Health Enhancement Program (HEP). Significance refers to the probability that there is no difference in the actual, as opposed to estimated, population values of a variable. ^aFor enrollees ages fifty and older. ^bFor female enrollees ages thirty-five and older. ^cFor female enrollees ages eighteen and older. ^dChange in number of visits instead of percentage point change. **p < 0.05 ***p < 0.01

EXHIBIT 3
Changes in use of preventive services and emergency department by HEP and comparison-group enrollees with chronic conditions

Enrollees with:	Number of enrollees and baseline percentage who used service or baseline possession ratio		Difference-in-differences between groups (percentage points)	
	HEP	Comparison group	Year 1 vs. baseline	Year 2 vs. baseline
Diabetes (n)	4,158	16,322		
Lipid screening	83.4%	76.5%	5.6***	0.11
Hemoglobin A1c test	87.1	82.7	4.0***	0.33
Eye exam	98.3	97.7	1.8***	1.4***
Metformin medication PR	0.38	0.37	2.1**	2.1**
Heart disease (n)	3,888	16,079		
Lipid screening	70.8%	64.6%	9.5***	1.3
Beta blocker medication PR	0.57	0.47	1.3	1.3
Loop diuretics medication PR	0.06	0.10	0.18	0.47
COPD or asthma (n)	9,306	19,053		
Bone density test ^a	0.28%	4.8%	0.4	0.2
Inhaled corticosteroid medication PR	0.12	0.09	1.7***	1.8***
Hypertension (n)	13,073	50,504		
Thiazide medication PR	0.11	0.10	0.5	0.6
ACE inhibitor medication PR	0.22	0.21	1.0*	1.0**
ARB medication PR	0.11	0.07	0.5	0.8**
Hyperlipidemia (n)	15,518	42,027		
Statin medication PR	0.42	0.43	3.3***	3.9***
Any chronic disease (n)	27,149	85,206		
Office visit	95.9%	96.4%	1.6***	1.2***
Emergency department visit ^b	19.7	14.4	-0.5	-1.3***

SOURCE Authors' analysis of claims data from the State of Connecticut and from the Truven MarketScan Commercial Claims and Encounters Database, July 2010–June 2013. **NOTES** The exhibit shows the results of linear probability models estimated with robust standard errors. All models controlled for age, sex, dependent status, Charlson comorbidity index score, time period (plan year), and baseline differences in outcome measures. Baseline is the plan year before the implementation of the Health Enhancement Program (HEP). Possession ratio (PR) is the percentage of days in each year for which a filled prescription was available (that is, days of filled prescriptions divided by 360), top-coded at 100 percent. COPD is chronic obstructive pulmonary disease. ACE is angiotensin-converting enzyme. ARB is angiotensin receptor blocker. ^aFor patients taking corticosteroids. ^bWithout hospitalization. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

baseline. However, in year 2 we did not find evidence of changes relative to baseline for any of the services except for eye exams. For people with heart disease, the pattern was similar: The likelihood of lipid testing was 9.5 percentage points higher in year 1, compared to the baseline, but in year 2 we were not able to rule out the possibility of no change from baseline. We found no significant changes in the use of bone screening for patients with asthma or COPD who were taking corticosteroids.

For asthma or COPD, hyperlipidemia, diabetes, and hypertension (in some drug classes), medication possession ratios for enrollees in the Health Enhancement Program increased significantly relative to the comparison group between baseline and subsequent years, with the effects often slightly larger in year 2. For example, for patients diagnosed with hyperlipidemia, the possession ratio of 0.42 is interpreted as the mean share of days a statin was available from a

filled prescription, or 42 percent of days at baseline for enrollees in the Health Enhancement Program (it was 43 percent for the comparison group) (Exhibit 3). The difference between the two groups increased by 3.3 percentage points between baseline and year 1 and by 3.9 percentage points between baseline and year 2. For people with heart disease, medication possession ratios did not change significantly.

As was the case in the full sample, in the subsample of enrollees with a chronic disease we were unable to discern any effect of the Health Enhancement Program on the likelihood of having an ED visit not resulting a hospitalization between baseline and year 1, but we found a significant decrease between baseline and year 2, relative to the comparison group (Exhibit 3). At baseline, 19.7 percent of the program enrollees with a chronic disease and 14.4 percent of their peers in the comparison group had at least one ED visit without hospitalization. The differ-

ence between the groups decreased by 1.3 percentage points in year 2, compared to baseline.

SPENDING Relative to the comparison group, spending in year 1 of the Health Enhancement Program increased by about \$730 per enrollee from baseline and in year 2 by about \$961 per enrollee from baseline, both significant changes (Exhibit 4). Generalized linear model regressions and regressions that trimmed outliers showed substantively the same result (Appendix Exhibit 7).¹⁵ The increase in spending was primarily driven by increases in nonpharmaceutical spending (data not shown). Enrollees' out-of-pocket spending dropped by about \$66 in year 1 and about \$76 in year 2, compared to baseline. Much of the spending appeared to be driven by outliers in the Health Enhancement Program group, which had more than twice the percentage of outliers than the comparison group did (Exhibit 1).

Because of large differences in baseline spending, we also measured differences in spending trends by standardizing all actual prices to the comparison group's median procedure or diagnosis price. (For a full description of this procedure, see Appendix Exhibit 6.)¹⁵ Essentially, this measure focused on changes in use by removing the effects of different prices at any point in time or of changes in prices over time. Using price-standardized spending as the outcome modified our results: There were insignificant differences in spending in year 1 compared to baseline and a

statistically significant decrease of \$190.46 in year 2 compared to baseline. This result suggests that the positive difference in spending relative to the comparison group in the primary regressions may be a result of growth of prices in Connecticut and not a result of changes in service utilization.

Discussion

This analysis demonstrates substantial increases in the use of medical services targeted by a value-based insurance design program that combined reductions in cost sharing with novel participation requirements for enrollees that aimed to enhance enrollees' engagement with health care decisions. Compared to earlier work,¹⁰ which showed little to no effect of reduced cost sharing on the use of preventive screening services, the Health Enhancement Program boosted the use of preventive services significantly across nearly all outcomes. For example, relative to the comparison group, lipid testing for program enrollees increased by 15.4 percentage points from baseline to the first year of the program, and colonoscopy increased by 5.6 percentage points.

There were differences in results between the first two years of the program compared to baseline (all relative to trends in the comparison group). Many utilization measures were higher in year 2 than at baseline but lower than in year 1. However, some measures reverted to baseline in

EXHIBIT 4

Changes in average annual spending by HEP and comparison-group enrollees

	Baseline		Difference-in-differences between groups	
	HEP	Comparison group	Year 1 vs. baseline	Year 2 vs. baseline
FULL SAMPLE				
Total spending	\$7,913.69	\$4,375.27	\$730.38***	\$961.12***
Ln(total spending) ^a	— ^b	— ^b	0.23***	0.11***
Out-of-pocket spending	\$176.51	\$656.93	-\$65.64***	-\$75.55***
Standardized prices				
Total spending	\$3,565.96	\$3,159.29	\$32.78	-\$190.46***
Out-of-pocket spending	\$78.90	\$81.80	-\$16.69***	-\$49.79***
CHRONIC DISEASE SAMPLE				
Total spending	\$11,430.68	\$6,867.46	\$816.92***	\$743.65**
Ln(total spending) ^a	— ^b	— ^b	0.14***	0.09***
Out-of-pocket spending	\$256.81	\$989.76	-\$71.60***	-\$90.00***

SOURCE Authors' analysis of claims data from the State of Connecticut and from the Truven MarketScan Commercial Claims and Encounters Database, July 2010–June 2013. **NOTES** The exhibit shows the results of linear probability models estimated with robust standard errors. All models controlled for age, sex, dependent status, Charlson comorbidity index score, time period (that is, plan year), and baseline differences in outcome measures. Baseline is the plan year before the implementation of the Health Enhancement Program (HEP). Significance refers to the probability that there is no difference in the actual, as opposed to estimated, population values of a variable. ^aThe natural log of total spending, constructed by taking the natural log of the total spending for each enrollee in each period plus \$1 (to avoid ln(0)). Multiplying the coefficients by 100 is roughly interpreted as the percent change in a period relative to comparison group and baseline spending. ^bNot applicable. ***p* < 0.05 ****p* < 0.01

year 2. This result was more frequent in the subpopulations with a chronic disease, whose baseline use of targeted services was high. Conversely, changes in medication possession ratios between year 1 and baseline were maintained or slightly increased in year 2, and decreases in ED use from baseline occurred primarily in year 2.

We explored several reasons for the dip in changes for some utilization measures between year 2 and year 1. Most important, for screenings that occur less often than once a year, such as colonoscopies or Pap tests, the smaller differences between groups in year 2 than in year 1 relative to baseline may reflect a natural decline in use: People who had the service in year 1 were exempt from the requirement in year 2.

For annual screenings, the reason is less clear. There were likely changes in the comparison group's cost sharing for preventive medical services relative to the Health Enhancement Program group because of ACA requirements that began taking effect for nongrandfathered plans in September 2010. Nonetheless, the comparison group showed relatively steady use of preventive services targeted by the program. In any case, the use of Health Enhancement Program accountability and cost sharing boosted the use of many targeted services beyond baseline levels in both years compared to use in other states, and differences between the two groups in medication adherence and ED use were as large or larger in year 2 than in year 1, relative to baseline.

Our spending results were sensitive to the model specification we used. Models of total spending that standardized and thus mitigated the effect of differential rates of price increases between Connecticut and the comparison states showed decreases in costs between the groups in the second year of the program, relative to baseline. Because it is implausible the Health Enhancement Program changed prices, this model makes most sense to us as a representation of the effect of the program on utilization. However, models that used actual dollars spent, including models that took into account the fact that the data were skewed by a small number of high spenders, showed increases in both program years. Because of this discrepancy, we are hesitant to draw firm conclusions about the magnitude or direction of costs following implementation of the program.

We do note that there was a significant decrease in Connecticut, compared to the other states, between baseline and year 2 in (often costly) ED visits. It's unclear whether this decrease is a result of the effect of the increased cost sharing for ED visits or an offset to increases in preventive care. Other states or private payers

considering this type of a program will want to balance the potential for improved health and productivity that comes from increasing the use of high-value services with the potential for higher costs resulting from that increased use.

Conclusion

Overall, we believe that our results show that adding enrollee participation requirements to value-based insurance design cost-sharing changes can have a meaningful impact on the use of targeted services. Other states or payers considering VBID plans should strongly consider these types of schemes to boost the use of specific services.

The intervention in Connecticut was also one of the first to go beyond prescription drugs and reduce cost sharing across the spectrum of care, including medical services for chronic disease. The positive results in this case should encourage other payers to incorporate reduced cost sharing for high-value services across entire episodes of care in their benefit plans.

Also, the inclusion of higher ED cost sharing for nonemergency visits and premium surcharges for nonparticipation is just a small step toward implementing higher cost sharing (or sticks, as opposed to carrots) for low-value services. The impact on spending from raising cost sharing for low-value services can be more immediate than that of lowering cost sharing for high-value services. However, raising cost sharing is more challenging than lowering it from an implementation standpoint, and the expansion of increased cost sharing relies on improving knowledge of its clinical and economic effects. Such expansion could be built upon platforms already being created, such as the Choosing Wisely initiative, which aims to identify and avoid unnecessary medical services.

The Health Enhancement Program's focus on chronic conditions could also be replicated by other payers. A substantial majority of overall health care spending is devoted to chronic disease. Most common chronic diseases have evidence-based quality metrics, with ample evidence of suboptimal performance on these metrics. Patient out-of-pocket spending contributes to this underuse.

The expansion of VBID is likely to continue, as public payers focus on services that are of the highest clinical value to them. Notably, Connecticut was one of the seven states selected to participate in the Medicare Advantage Value-Based Insurance Design Model, which allows Medicare Advantage plans to offer supplemental benefits or reduced cost sharing to enrollees with certain chronic conditions specified by the Centers for

Medicare and Medicaid Services.¹⁸ Within a larger context, VBID is one type of consumer-focused initiative that, along with provider-focused initiatives, is transforming health care from a volume-based to value-based system. Notably, as the Health Enhancement Program continues to be refined, Connecticut is working toward integrating its VBID features into other statewide initiatives, such as its State Innovation Model and an accountable care organization structure.

The findings presented from the first two years of the Health Enhancement Program have important implications for other states. Because of

their size, states as employers can potentially affect the benefits structure of enough consumers to catalyze changes that affect the functioning of health care markets. Moreover, as public and private payers increasingly adopt alternative payment models, it is critical that they align consumer incentives with these provider-focused programs. As momentum grows for a transition from a volume-driven to a value-based health care delivery system, the addition of clinically nuanced payment reform and consumer initiatives can improve the quality of care and enhance the consumer experience. ■

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NOTES

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- 16 Ai C, Norton EC. Interaction terms in logit and probit models. *Econ Lett*. 2003;80(1):123–29.
- 17 Percentages in Exhibit 2 do not correspond exactly to the estimates in the text because the authors' models include controls for age, sex, comorbidities, and dependent status.
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Queries

1. Abstract, please verify that the edited version of the text you added at the last stage is correct, or revise as needed.
2. Paragraph just above “Statistical Methods,” two points: (1) At the last stage you added “method” but did not explain what method you meant. Please now add wording to clarify—method of what? (2) Please verify that you divided the days of filled prescriptions by 360 instead of 365, or revise the text as needed.
3. Paragraph beginning “Relative to,” we added note 17 containing an edited version of the explanatory note you provided in response to a copy editor query.
4. Paragraph beginning “For asthma,” please verify that the edited version of the wording you added at the last stage is correct, or revise as needed.
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