

## Quality of Health Care After Adopting a Full-Replacement, High-Deductible Health Plan With a Health Savings Account: A Five-Year Study

*By Paul Fronstin, Ph.D., Employee Benefit Research Institute, and M. Christopher Roebuck, Ph.D., RxEconomics*

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### A T A G L A N C E

- This study reports use of health care services related to health care quality over five years among over 18,000 individuals from a single large employer in the Midwestern United States that adopted an HSA-eligible health plan for all employees. It represents one of the longest observation periods reported with a full-replacement CDHP, and it is one of the few studies with a matched control group.
- The introduction of the HSA-eligible health plan had a negative impact on office visits for annual physicals, well-child visits, and preventive visits in the year that the plan was adopted. In the second year, office visits increased for HSA-eligible health plan enrollees, but were mostly unchanged for the comparison group. By the fourth year in the HSA-eligible health plan, office visits for annual physicals, well-child visits, and preventive visits were down slightly relative to the comparison group.
- Rates of LDL testing for adults with cardiovascular disease were reduced only in the first year of the HSA-eligible health plan. However, the introduction of the HSA-eligible health plan had a negative effect on medication monitoring for adults on select maintenance drugs not only in the first year that the new health plan was introduced, but in the following three years as well.
- The HSA-eligible health plan reduced avoidance of both antibiotics for adults with acute bronchitis and imaging services for adults diagnosed with low back pain. Both services are often considered unnecessary.
- Adoption of the HSA-eligible health plan was associated with a reduction in breast cancer, cervical cancer, and colorectal cancer screening in year one, although screenings for breast cancer and cervical cancer rebounded in year two. By year four, breast cancer screening was higher among enrollees in the HSA-eligible health plan than in the comparison group. In contrast, cervical cancer screening was lower among HSA-eligible health plan enrollees than the comparison group in year four. Throughout all of the study years, colorectal cancer screening was lower among HSA-eligible health plan enrollees than in the comparison group.
- The HSA-eligible health plan was not associated with a change in the percentage of adults receiving HbA1c testing until the fourth year. LDL testing was lower as a result of the introduction of the HSA-eligible health plan in all years.

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## Introduction

A consumer-driven health plan (CDHP) is a combination of health insurance coverage with a deductible, generally in excess of \$1,000 for employee-only coverage, and a savings account option that can be used to pay out-of-pocket costs for health care services. Savings account options are typically of two varieties: health reimbursement arrangements (HRAs) or health savings accounts (HSAs). Employers have now been offering CDHPs to workers for over a decade. By 2013, 23 percent of employers with 10–499 workers and 39 percent of employers with 500 or more workers offered either an HRA-based or HSA-eligible health plan.<sup>1</sup> As a result, CDHPs covered about 26 million people in 2013, representing about 15 percent of the privately insured market, with most CDHP enrollees being in an HSA-eligible health plan (Fronstin, 2013).

Proponents of CDHPs contend that providing participants with a pre-funded account and subjecting claims to high deductibles before insurance benefits are triggered will induce enrollees to make more cost- and quality-conscious health care decisions (Herzlinger, 2002). Skeptics, on the other hand, caution that patients lack comprehensible, timely, and trustworthy information that is critical for them to make informed decisions (Davis, 2004). Skeptics are also concerned that higher cost sharing might lead to less use of preventive care, primary care, and other necessary health care services, especially among individuals of lower socioeconomic status (Haviland et al., 2011) (Newhouse, 1993). Another concern is that the reduced utilization might save costs in the short-term, but might well result in larger long-term costs.

This *Issue Brief* examines how adopting an HSA-eligible health plan impacts the use of health care services that are used to measure quality of health plans. Data come from a large employer that replaced all of its health insurance options with an HSA-eligible health plan. Use of health-care quality measures is examined over five years—of which four years follow the adoption of the HSA-eligible health plan. The analysis makes use of a matched comparison group of active workers and their dependents from a second large employer that continued to insure most of its workforce through traditional network plans without high deductibles or savings account options. This study represents one of the longest observation periods reported with a full-replacement, HSA-eligible health plan, and is one of the few studies with a control group.

## Background on CDHPs

There are two types of CDHPs: health plans that include an integrated HRA, and HSA-eligible health plans.

### HSA-Eligible Health Plans

In order to be an HSA-eligible health plan, the plan must have an annual deductible of at least \$1,250 for employee-only coverage and \$2,500 for family coverage in 2014. An out-of-pocket maximum may not exceed \$6,350 for self-only coverage or \$12,700 for family coverage with the deductible counting toward this limit. Minimum allowable deductibles and maximum out-of-pocket limits are indexed to inflation. Certain primary preventive services can be exempted from the deductible and covered in full, typically those deemed to prevent the onset of disease (Fendrick et al., 2014).

## **Health Savings Accounts (HSAs)**

Individuals enrolled in an HSA-eligible health plan are eligible to open and contribute to an HSA on a tax-free basis. Employers may offer HSA-eligible health plans and individuals may enroll in such plans without opening or contributing to an HSA.

Employers are allowed to contribute to a person's HSA, but are not required to do so. In 2014, people with individual coverage were allowed to make annual contributions of \$3,300, while those with family coverage could contribute as much as \$6,550. Additionally, individuals who have reached age 55 and are not yet enrolled in Medicare may make an additional \$1,000 catch-up contribution. Any interest or other investment earnings build up tax free.

HSAs are individually owned and fully portable. While distributions from an HSA can be taken at any time, these withdrawals are excluded from taxable income if they are used to pay for qualified medical expenses as defined under Internal Revenue Code (IRC) Sec. 213(d). An individual need not be covered by an HSA-eligible health plan to withdraw money from the HSA.

## **Health Reimbursement Arrangements (HRAs)**

Prior to adopting HSA-eligible health plans, some employers offered HRA-based plans. In contrast to HSAs, HRAs are offered, owned, funded, designed, and controlled by employers, who have a tremendous amount of flexibility in designing health plans that incorporate this design. The amount of money available in the HRA, the level of the deductible, the comprehensiveness of the health insurance, and the account's portability upon job separation are all determined by the employer. There is no statutory requirement that an HRA be paired with a high-deductible health plan, although it is common practice.

HRAs are typically integrated with the health plan offered by the employer. Essentially, workers with an HRA have first-dollar coverage up to a limit (the employer contribution to the HRA), then face a deductible, after which insurance takes effect. This is in contrast to an HSA-eligible health plan, where employers could simply offer the health plan and let workers decide for themselves whether to open and fund an HSA.

## **Differing Incentives**

Research often combines enrollees in HRA and HSA-eligible health plans into one group for study purposes. However, enrollees and utilization patterns in these plans should be examined separately because HRAs and HSAs create different incentives related to use of health care services. HRAs are spending accounts, not savings accounts, and the lack of guaranteed portability creates the equivalent of a "use-it-or-lose it" incentive to use the money in the account on health care services. In addition, since HRAs are funded by employers, workers may view the account as "free" money and may not have a savings mentality attached to the account. In contrast, HSAs are savings accounts that are fully portable, owned, and frequently funded by the individual. Any time a worker chooses to not spend the money in the HSA, he or she is effectively saving it for future use.

Enrollees in HSA-eligible health plans should also be examined separately from HRA enrollees because the employer offering the HSA-eligible health plan may simply be offering a high-deductible health plan while not funding the HSA or facilitating worker contributions to an HSA. Workers are often offered only the health plan and left on their own to find an HSA provider and open an account.

Because employers have been offering HRA-based plans longer than they have been using HSA-eligible health plans, most prior research on CDHPs has focused on HRA-based plans. Unfortunately, however, published papers only note that they are examining "CDHPs", without specifying whether the CDHP is an HRA-based plan, an HSA-eligible health plan, or both. Also, studies that have examined CDHPs may have only been examining a health plan with a high deductible; in other words, a health plan that was not associated with a savings-account option. While the early studies on CDHPs that were not specific as to whether they examined an HRA-based plan or HSA-eligible health plan most likely used data on HRA-based plans, that is not necessarily the case. Not knowing what type of CDHP was examined makes it difficult to draw conclusions about prior work, for the reasons outlined earlier.

## Contribution to the Literature

There have been only a few studies on CDHPs and their impact on health care quality measures. Indeed, the authors of this *Issue Brief* found only seven studies on this topic. In general, the studies identified have examined HEDIS quality measures associated with preventive office visits, cancer screenings, diabetes care, childhood immunizations, and medication monitoring and management.

*Preventive Office Visits*—Wilson et al. (2008); Parente, Feldman, and Xu (2010); and Charlton et al. (2011) all examined the impact of a CDHP on the use of preventive office visits. The findings of these studies were mixed. Wilson et al. (2008) found that CDHPs resulted in higher use of preventive office visits, but the study examined data from employers that provided first-dollar coverage for such services. Parente, Feldman, and Xu (2010) found that CDHPs reduced preventive visits, but the study did not have a control group. Charlton et al. (2011) also found that the CDHP resulted in lower use of preventive visits, but the effect was barely statistically significant, was based on a small sample (n=696), and preventive visits were subject to the deductible in the plan examined.

*Cancer Screenings*—Buntin et al. (2011); Parente, Feldman, and Xu (2010); Haviland et al. (2011); Charlton et al. (2011); and Rowe et al. (2008) all examined the use of cancer screenings such as mammography, cervical cancer, colorectal cancer, and prostate cancer screenings. The studies consistently found that CDHPs led to lower use of preventive cancer screenings. Cancer screenings were lower both when they were subject to the deductible (Charlton et al., 2011) and when they were not (Haviland et al., 2011), (Rowe et al., 2008). Rowe et al. (2008) was the only study identified to look at the effect of the CDHP beyond the first year and found that while use of cancer screenings were lower in the first year, there were no longer term effects.

*Diabetes Care*—Four studies examined the impact of CDHPs on diabetes care (Wilson et al., 2009) (Buntin et al., 2011) (Haviland et al., 2011) (Rowe et al., 2008). These studies examined whether the CDHP had an impact on glycated hemoglobin (HbA1c) testing, eye exams, low-density lipoprotein (LDL) screening, nephropathy screening, and microalbumin testing among patients with diabetes. Again the findings were mixed. Buntin et al. (2011) and Rowe et al. (2008) found no impact on diabetes care. Haviland et al. (2011) found a negative impact on diabetes care. And, Wilson et al. (2009) found no impact on HbA1c and LDL screening, but a positive impact on eye exams and nephropathy screening.

*Childhood Immunizations*—One study (Buntin et al., 2011) examined the impact of a CDHP on childhood immunization rates. It found lower rates as a result of the CDHP.

*Medication Monitoring and Management*—One study (Wilson et al., 2009) examined medication monitoring and management differences between CDHP and non-CDHP enrollees. The findings in this study were mixed. It found that CDHP and non-CDHP enrollees were equally likely to use appropriate medication among patients with asthma and equally likely to be managing antidepressant medications. However, annual monitoring of patients on persistent medications (angiotensin-converting-enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARBs), digoxin, diuretics, and anticonvulsants) was lower among CDHP enrollees, though the actual difference was only one percentage point.

*Other*—One study (Wilson et al., 2009) also examined LDL screening for patients with cardiovascular conditions and use of imaging for low back pain. It found that LDL screening and appropriate use of imaging for low-back pain were both higher among CDHP enrollees than among non-CDHP enrollees.

## Current Work

This *Issue Brief* builds on this earlier work on CDHPs and use of health care services related to quality measures. The prior studies examined early experience with CDHPs. One study (Haviland et al., 2011) used data from as recently as 2007, but most used data from 2003–2006. This *Issue Brief* examines data from 2006–2010.

The prior studies appeared to examine mostly HRA-based plans. Only two studies (Parente, Feldman and Xu, 2010) (Charlton et al., 2011) examined HSA-eligible health plans. With enrollment in HRA plans contracting and enrollment in HSA-eligible health plans growing and expected to continue to grow (Fronstin, 2013), studies using data from HSA-eligible health plans should fill this void in the literature. This study examines data from an HSA-eligible health plan.

Prior studies mostly examined only one year of data after the introduction of the CDHP. One study (Rowe et al., 2008) examined three years of data after the implementation of the CDHP, while another (Charlton et al., 2011) examined two years of data. This *Issue Brief* examines five years of data: one year of data prior to the adoption of an HSA-eligible health plan, and four years of data post-adoption.

## Data and Methods

This study utilized medical and prescription-drug claims data, as well as health insurance enrollment information from a large manufacturing employer located in the Midwest. On January 1, 2007, it adopted an HSA-eligible health plan for all active workers and their dependents. Both before and after that date, the employer offered a preferred provider organization (PPO) plan. Prior to the adoption of the HSA-eligible health plan, deductibles ranged from \$500–\$1,500 per person, and member co-insurance ranged from 10 to 20 percent for in-network services, and 10 to 40 percent for out-of-network services.

As noted previously, claims data were available for analysis for one year prior to the adoption of the HSA-eligible health plan (2006) and for four years post-adoption (2007-2010). Although the HSA-eligible health plan was the only plan option, workers were offered a choice of two deductibles:

- 1) \$1,250 per individual, \$2,150 per family; or
- 2) \$2,500 per individual, \$4,300 per family.

Almost 90 percent of enrollees selected the higher-deductible option, which required no worker contribution, in contrast to the required payroll deduction of nearly \$300 annually per worker for employee-only coverage in the lower-deductible plan. The employer contributed to the HSA, depositing \$700 for employee-only coverage and \$1,300 for family coverage, regardless of which deductible was selected.

The study group consisted of 18,965 active workers and their dependents who were continuously covered by the employer during the five-year analysis period.<sup>2</sup> Data from a second employer were used to create a comparison group. This second plan sponsor (with 82,154 continuously enrolled workers and dependents) maintained PPO coverage that was not HSA-eligible throughout the five-year study period. The comparison employer offered two PPO options: one with no deductible throughout the study period and one with a deductible that steadily increased during the study period. Both PPO option plans covered preventive services in full and had 20 percent member co-insurance for most other covered services. The comparison group was constructed by matching on pre-period (2006) values of a rich set of covariates to the study group. The analysis sample was reduced to 18,419 after matching. More information on this process is provided in the Appendix.

## Dependent Variables

The current study examined a total of 11 annual measures of use of health care services related to quality measures. In general, the algorithms used to construct these variables followed the methodology employed by the National Committee for Quality Assurance (NCQA) to derive Healthcare Effectiveness Data and Information Set (HEDIS) quality measures. In fact, these dependent variables were selected from the larger set of all HEDIS measures because they were calculable from administrative claims data only. Included were the following measures:

### Office Visits for Adults and Children

- Well-child/adult physical visit.

- Preventive visit.

### **Adult Chronic Disease Measures**

- LDL cholesterol testing for adults diagnosed with cardiovascular disease.
- Medication monitoring for adults on select maintenance drugs (ACE inhibitors, ARBs, digoxin, diuretics, and anticonvulsants) for at least 180 days.

### **Overuse Measures**

- Antibiotic prescription fill for adults with acute bronchitis within three days for diagnosis.
- Diagnostic imaging (x-ray, magnetic resonance imaging (MRI), or computerized tomography (CT) scan) for adults diagnosed with low back pain within 28 days of diagnosis.

### **Cancer Screenings**

- Mammogram for breast cancer screening for women ages 40 and older.
- Cervical cancer screening for women ages 21 and older.
- Colorectal cancer screening for individuals ages 50 and older.

### **Adults With Diabetes**

- Hemoglobin A1c (HbA1c) screening.
- LDL cholesterol screening.

## **Results**

### **Descriptive Findings**

Figure 1 contains the baseline (2006) sample characteristics of the individuals in the HSA-eligible health plan and the comparison group, both of which included 18,419 participants. Few statistically significant differences were detected between the population enrolled in the HSA-eligible health plan and the comparison group. This was the intended effect as a result of matching. Average age was 31 in both groups, and just over one-half of both groups were male. Policyholders made up about 40 percent of each group. Average household size was about 3.1. Tenure with the employers was about the same in both groups, 12 to 12.1 years, but statistically different. As noted previously, most of the HSA-eligible health plan group was located in the Midwest (79 percent), whereas comparison-group members were more evenly distributed across geographic regions.

Except for geographic region, which was not used in the matching process due to the study employer's extreme concentration in the Midwest, covariate balance was quite good. The percent bias was well below the commonly cited 10 percent threshold of tolerance (Austin, 2011). In other words, the comparison group closely resembled the study group prior to adoption of the HSA-eligible health plan.

Figure 2 shows mean baseline values for health-services utilization and cost measures for the HSA-eligible health plan group and the comparison group. In 2006, individuals included in the study had an average of 34–38 hospitalizations (per 1,000 individuals), 105–131 inpatient hospital days (per 1,000 individuals), 137–139 emergency department visits (per 1,000 individuals), about 3.5 outpatient physician's office and clinic visits per person, and just over 10 prescription drug fills per person (30-day adjusted).

Mean overall health spending, including both the employer and member shares, were \$213–\$228 for inpatient services, \$89–92 for emergency department, \$294–\$296 for outpatient physician's office and clinic visits, and \$576–602 for

**Figure 1**  
**Baseline Sample Characteristics (in 2006)**

Measure	HSA* Group (N=18,419) Mean	Comparison Group (N=18,419) Mean	% Bias	p-value
<b>Age:</b>				
Average (years)	30.6	30.5	0.90	0.38
<18	33%	33%	-0.10	0.93
18–24	3%	3%	0.80	0.45
25–34	16%	16%	0.90	0.37
35–44	19%	21%	-4.90	0.00
45–54	24%	22%	4.50	0.00
55–64	6%	6%	-1.60	0.14
Male	52%	53%	-0.80	0.43
Household size	3.1	3.1	1.70	0.10
Policyholder	43%	43%	0.20	0.84
Spouse	22%	22%	0.00	0.99
Child	34%	34%	-0.20	0.84
Years of tenure	12.1	12.0	1.80	0.08
<b>Region</b>				
Northeast^	0%	28%	-85.40	0.00
Midwest^	79%	16%	160.00	0.00
South^	18%	44%	-60.10	0.00
West^	3%	12%	-32.50	0.00
Charlson Comorbidity Index	0.13	0.13	-0.40	0.71

Source: Employee Benefit Research Institute estimates based on administrative claims data.

Notes:

\* Health savings account.  
 Values are proportions unless denoted otherwise.  
 Variables not used in propensity score matching model denoted by ^.  
 Reported p-values from t-test of differences in means across groups.

**Figure 2**  
**Mean Health Care Use and Spending Among HSA\*-Plan and Comparison-Group Members, by Type of Health Care Service, 2006**

Measure	HSA* Group (N=18,419) Mean	Comparison Group (N=18,419) Mean	% Bias	p-value
<b>Use of Services</b>				
Inpatient hospital admissions (per 1,000 individuals)	34	38	-1.80	0.09
Inpatient hospital days (per 1,000 individuals)	105	131	-1.90	0.07
Emergency department visits (per 1,000 individuals)	137	139	-0.40	0.67
Outpatient physician's office and clinic visits	3.5	3.5	-1.40	0.18
Prescription drug fills	10.2	10.3	-0.80	0.45
<b>Spending</b>				
Inpatient hospital costs	\$213	\$228	-0.50	0.63
Emergency department costs	\$89	\$92	-0.90	0.38
Outpatient physician's office and clinic costs	\$294	\$296	-0.80	0.45
Prescription drug costs	\$576	\$602	-1.50	0.16
Total healthcare costs	\$2,407	\$2,498	-1.40	0.17
Total healthcare costs paid by plan sponsor	\$1,948	\$2,001	-0.90	0.40

Source: Employee Benefit Research Institute estimates based on administrative claims data.

Notes:

\* Health savings account.  
 Values are proportions unless denoted otherwise.  
 Reported p-values from t-test of differences in means across groups.

prescription drugs. In total, spending on health care services averaged \$2,407 for individuals on the HSA-eligible health plan and \$2,498 for the comparison group. Total employer spending was \$1,948 for the HSA-eligible health plan and \$2,001 for the comparison group, or about 80 percent in each group.

Figure 3 shows mean baseline values for the 11 health care quality measures examined in this study. Again, statistically significant differences were not detected between the population enrolled in the HSA-eligible health plan group and the comparison group, as this was the intended effect as a result of matching.

About one-half (46–47 percent) of individuals had a well-child office visit, adult physical, or a preventive visit.

Among adults with cardiovascular disease, 81–82 percent received LDL testing. About three-quarters (71–74 percent) of adults with selected chronic conditions received medication monitoring. About 34–35 percent of adults with acute bronchitis were not prescribed an antibiotic, and 84–85 percent of adults diagnosed with low back pain did not receive imaging.

When it came to preventive cancer screenings, 63–65 percent of women ages 40 and older received breast cancer screenings, 61–62 percent of women ages 21 and older received cervical cancer screenings, and 27–28 percent of adults age 50 and older received colorectal cancer screening.

Among adults with diabetes, 86–87 percent had their HbA1c levels tested, and 83–86 percent had their LDL tested.

### **Impact of the HSA-Eligible Health Plan on Use of Quality Measures**

Figures 4–7 present predicted mean quality measures examined in this paper. Predicted average quality measures are presented for each year. The figures also show the results for the difference-in-differences (DiD) regression model presented in equation (1) in the Appendix. The coefficient on the interaction term between the HSA and Year indicators are shown for each year relative to 2006.

*Office Visits for Adults and Children*—The introduction of the HSA-eligible health plan was found to have a negative impact on the number of office visits for annual physicals, well-child visits, and preventive visits in the year that the HSA-eligible health plan was adopted (Figure 4). Prior to the adoption of the HSA-eligible health plan, 48 percent of enrollees had office visits for annual physicals, well-child visits, and preventive visits. In 2007, the year the HSA-eligible health plan was adopted, 44 percent had office visits for annual physicals, well-child visits, and preventive visits. In contrast, the percentage of enrollees in the comparison group with such a visit was mostly unchanged.

In 2008, the second year of enrollment in the HSA-eligible health plan, the percentage of enrollees with office visits for annual physicals, well-child visits, and preventive visits increased to 46 percent, while it was mostly unchanged for the comparison group. Thus, the HSA-eligible health plan had no impact on office visits for annual physicals, well-child visits, and preventive visits in 2008 (relative to 2006), which was also true for 2009. By the fourth year in the HSA-eligible health plan, office visits for annual physicals, well-child visits, and preventive visits were down slightly relative to the comparison group.

*Mean Quality Measures for Adults*—Figure 5 contains the findings for various quality measures specific to adults with certain diseases or conditions. It was found that introduction of the HSA-eligible health plan had a negative impact on the amount of LDL testing for adults with cardiovascular disease in the first year after adoption of the HSA-eligible health plan, but no effect was found in the three years following the introduction of the plan. The introduction of the HSA-eligible health plan had a negative effect on medication monitoring for adults on select maintenance drugs (ACE inhibitors, ARBs, digoxin, diuretics, and anticonvulsants) not only in the first year that the new health plan was introduced, but the following three years as well.

Measures addressing avoidance of services that are often overused, such as the use of antibiotic prescriptions for adults with acute bronchitis, and imaging for adults with low back pain, were also examined. In both cases, the services are often unnecessary according to clinical practice guidelines, and thus are used as quality indicators by NCQA and

**Figure 3**  
**Quality Measures Among HSA\*-Plan and Comparison-Group Members,**  
**by Type of Health Care Service, 2006**

Measure	HSA* Group (N=18,419) Mean	Comparison Group (N=18,419) Mean	% Bias	p-value
<b>Adults and Children</b>				
Well-child or adult physical visit	47%	46%	1.70	0.10
Preventive visit	47%	46%	1.70	0.10
<b>Adults</b>				
LDL testing (cardiovascular disease)	82%	81%	1.60	0.87
Medication monitoring	74%	71%	5.60	0.16
Avoidance of antibiotic prescription fill (acute bronchitis)	35%	34%	0.90	0.88
Avoidance of imaging for low back pain	85%	84%	2.60	0.57
<b>Cancer Screenings</b>				
Breast cancer screening (females, age>=40)	65%	63%	3.60	0.14
Cervical cancer screening (females, age>=21)	62%	61%	1.30	0.50
Colorectal cancer screening (age>=50)	28%	27%	2.00	0.41
<b>Adults With Diabetes</b>				
HbA1c testing	87%	86%	2.90	0.66
LDL testing	86%	83%	6.50	0.33

Source: Employee Benefit Research Institute estimates based on administrative claims data.  
\* Health savings account.  
Notes:  
Values are proportions unless denoted otherwise.  
Reported p-values from t-test of differences in means across groups.

**Figure 4**  
**Predicted Mean Quality Measures, by Year & Health Plan Type, 2006-2010**  
**Office Visits for Adults and Children**

Quality Measure (Dependent Variable)	2006	2007	2008	2009	2010
<b>Well-child/adult physical visit</b>					
HSA <sup>a</sup> Group	48%	44%	46%	47%	46%
Comparison Group	45%	44%	45%	45%	45%
Difference-in-Differences (relative to 2006)		-0.03***	-0.01	0.00	-0.02**
<b>Preventive visit</b>					
HSA <sup>a</sup> Group	48%	44%	47%	47%	46%
Comparison Group	45%	44%	45%	45%	45%
Difference-in-Differences (relative to 2006)		-0.03***	-0.01	0.00	-0.02**

Source: Employee Benefit Research Institute estimates based on administrative claims data.  
Notes:  
<sup>a</sup> Health savings account.  
Presented are marginal effects of the difference-in-differences estimators, calculated at the mean values of all other regressors, which included: indicators for male, spouse, child, five age groups, four years, HSA, and four HSA times year interaction terms (presented), as well as Charlson Comorbidity Index, years of tenure, and household size. All equations were specified using probit. Standard errors were clustered at the household level.  
Statistical significance denoted as follows: \*\*\* p<0.01; \*\* p<0.05; \* p<0.10

endorsed by the National Quality Forum.<sup>3</sup> The introduction of the HSA-eligible health plan resulted in slightly higher use of antibiotic prescriptions in the first (2007), third (2009), and fourth (2010) years. In contrast, there was no impact on imaging for low back pain in the first year (2007). However, use of imaging associated with low back pain was higher in the HSA-eligible health plan group relative to the comparison group in year two (2008), and use continued to increase thereafter.

Figure 5  
**Predicted Mean Quality Measures, by Year & Health Plan Type, 2006–2010**  
Adult Chronic Disease and Overuse Measures

Quality Measure (Dependent Variable)	2006	2007	2008	2009	2010
<b>LDL testing (cardiovascular disease)</b>					
HSA <sup>a</sup> Group	85%	74%	78%	78%	76%
Comparison Group	81%	82%	79%	77%	79%
Difference-in-Differences (relative to 2006)		-0.11**	-0.05	-0.03	-0.07
<b>Medication monitoring</b>					
HSA <sup>a</sup> Group	77%	66%	68%	68%	67%
Comparison Group	71%	68%	70%	70%	72%
Difference-in-Differences (relative to 2006)		-0.08***	-0.08***	-0.08***	-0.11***
<b>Avoidance of antibiotic prescriptions (acute bronchitis)</b>					
HSA <sup>a</sup> Group	36%	33%	37%	30%	27%
Comparison Group	34%	39%	39%	35%	32%
Difference-in-Differences (relative to 2006)		-0.07*	-0.04	-0.06*	-0.06*
<b>Avoidance of imaging for low back pain</b>					
HSA <sup>a</sup> Group	84%	76%	71%	73%	70%
Comparison Group	84%	79%	77%	81%	81%
Difference-in-Differences (relative to 2006)		-0.04	-0.06*	-0.08**	-0.11***

Source: Employee Benefit Research Institute estimates based on administrative claims data.

Notes:  
 \* Health savings account.  
 Presented are marginal effects of the difference-in-differences estimators, calculated at the mean values of all other regressors, which included: indicators for male, spouse, child, five age groups, four years, HSA, and four HSA times year interaction terms (presented), as well as Charlson Comorbidity Index, years of tenure, and household size. All equations were specified using probit. Standard errors were clustered at the household level.  
 Statistical significance denoted as follows: \*\*\* p<0.01; \*\* p<0.05; \* p<0.10

**Cancer Screenings**—Screenings for breast cancer, cervical cancer, and colorectal cancer fell between 2006 and 2007 for both enrollees in the HSA-eligible health plan and the comparison group (Figure 6). But because cancer screenings fell more for the HSA-eligible health plan than for the comparison group, the HSA-eligible health plan showed a negative impact on the predicted probability of getting a cancer screening relative to the comparison group. However, in 2008 (the second year in the HSA-eligible health plan) the number of breast cancer and cervical cancer screenings rebounded, narrowing the gap such that there was no difference in 2008 and 2009 in breast cancer and cervical cancer screenings between HSA-eligible health plan enrollees and the comparison group. In fact, by 2010 (the fourth year of the HSA-eligible health plan) breast cancer screening was higher among enrollees in the HSA-eligible health plan than in the comparison group. However, despite the rebound in 2008, cervical cancer screening was lower among HSA-eligible health plan enrollees and the comparison group in 2010. Throughout all of the study years (2007–2010), colorectal cancer screening was lower among HSA-eligible health plan enrollees than in the comparison group.

**Diabetes Measures**—Two measures for quality of care among adults with diabetes are examined in Figure 7. The HSA-eligible health plan did not have any impact (positive or negative) on the percentage of adults receiving HbA1c testing until 2010, the fourth year in the HSA-eligible health plan. The volume of LDL testing was lower following the introduction of the HSA-eligible health plan in all four years.

## Study Limitations

Unlike prior research on health care quality measures after the introduction of a CDHP that has focused mostly on HRA plans, this study uses data on a full-replacement, HSA-eligible health plan. It is also able to follow over 18,000 enrollees over five years, uses a comparison group, and is the longest study of consumer-directed health plans compared to the previous studies discussed.

There are, however, several limitations to this study. First, it draws on the experience of a single, geographically concentrated, manufacturing employer with a large, captive workforce with regional, socio-demographic, and company cultural characteristics potentially influencing behavior under the HSA-eligible-health-plan change. Consequently, these findings are not necessarily generalizable to broader populations.

Second, although estimation of the impact of the HSA-eligible health plan four years post-adoption is a key strength of this analysis, it also requires plan participants to have maintained continuous eligibility throughout the study period. This eligibility criterion may also limit the generalizability of the results.

Third, deductible size matters in utilization (Newhouse, 1993), and in this study most plan participants chose the HSA plan with the higher deductible amounts, which were higher than national averages for HSA plans at the time (Claxton et al., 2007). [[not in refs]]

Fourth, although the HSA-eligible health plan cohort was matched to comparison members from a second employer as a control, the possibility remains that derived effects might still be biased if unobserved variables associated with the HSA-eligible health plan were also correlated with health-services utilization. There is also the possibility that HSA-eligible-health-plan enrollees may have altered the timing of consumption of health services at the end of 2006 (either delayed or accelerated) in anticipation of the impending change to the HSA-eligible health plan. First-year effects may be overstated if HSA-eligible-health-plan enrollees had altered the timing of use of health care services as a result of any announcement regarding health plan changes.

Finally, the difference-in-differences econometric method relies on the assumption that underlying trends in quality measures are comparable across the two groups. To the extent that this assumption is violated—perhaps due to geographic region that was not used in the propensity score matching process—the results may remain biased.

## Conclusions

This study adds to the literature on consumer-driven health plans (CDHPs) by examining use of health care services used to measure quality of health plans during the four years after a health savings account (HSA)-eligible health plan was adopted. As with prior research examined, the findings are mixed. Annual physicals, well-child visits, and preventive visits were lower in some, but not all years following the adoption of the HSA-eligible health plan. LDL testing for adults with cardiovascular disease was lower only in the first year following adoption of the HSA-eligible health plan, though medication monitoring fell in all years. Use of antibiotics for acute bronchitis, which is often unnecessary, was found to be slightly higher, while use of imaging for low back pain, also often unnecessary, also increased over time. Breast cancer screening was lower in the first year, but then rebounded. Cervical cancer screening was lower in the first year, rebounded, but then fell again. Colorectal cancer screening was lower in all years. While HbA1c testing for adults with diabetes was mostly unaffected, LDL testing was lower in all years.

**Figure 6**  
**Predicted Mean Quality Measures, by Year & Health Plan Type, 2006–2010**  
**Cancer Screenings**

Quality Measure (Dependent Variable)	2006	2007	2008	2009	2010
<b>Breast cancer screening (females, age&gt;=40)</b>					
HSA <sup>a</sup> Group	65%	57%	61%	61%	60%
Comparison Group	65%	62%	61%	60%	58%
Difference-in-Differences (relative to 2006)		-0.05***	0.00	0.01	0.03*
<b>Cervical cancer screening (females, age&gt;=21)</b>					
HSA <sup>a</sup> Group	60%	52%	54%	55%	49%
Comparison Group	61%	58%	56%	55%	53%
Difference-in-Differences (relative to 2006)		-0.05***	-0.01	0.00	-0.03**
<b>Colorectal cancer screening (age&gt;=50)</b>					
HSA <sup>a</sup> Group	29%	18%	21%	22%	21%
Comparison Group	26%	24%	24%	23%	21%
Difference-in-Differences (relative to 2006)		-0.09***	-0.06***	-0.04***	-0.03**

Source: Employee Benefit Research Institute estimates based on administrative claims data.

Notes:  
<sup>a</sup> Health savings account.  
 Presented are marginal effects of the difference-in-differences estimators, calculated at the mean values of all other regressors, which included: indicators for male, spouse, child, five age groups, four years, HSA, and four HSA times year interaction terms (presented), as well as Charlson Comorbidity Index, years of tenure, and household size. All equations were specified using probit. Standard errors were clustered at the household level.  
 Statistical significance denoted as follows: \*\*\* p<0.01; \*\* p<0.05; \* p<0.10

**Figure 7**  
**Predicted Mean Quality Measures, by Year & Health Plan Type, 2006–2010**  
**Adults With Diabetes**

Quality Measure (Dependent Variable)	2006	2007	2008	2009	2010
<b>HbA1c Testing</b>					
HSA* Group	87%	80%	79%	81%	79%
Comparison Group	88%	82%	80%	82%	84%
Difference-in-Differences (relative to 2006)		-0.01	-0.01	0.00	-0.05*
<b>LDL Testing</b>					
HSA <sup>a</sup> Group	87%	77%	76%	78%	75%
Comparison Group	84%	81%	78%	83%	80%
Difference-in-Differences (relative to 2006)		-0.07**	-0.06*	-0.08***	-0.08***

Source: Employee Benefit Research Institute estimates based on administrative claims data.

Notes:  
<sup>a</sup> Health savings account.  
 Presented are marginal effects of the difference-in-differences estimators, calculated at the mean values of all other regressors, which included: indicators for male, spouse, child, five age groups, four years, HSA, and four HSA times year interaction terms (presented), as well as Charlson Comorbidity Index, years of tenure, and household size. All equations were specified using probit. Standard errors were clustered at the household level.  
 Statistical significance denoted as follows: \*\*\* p<0.01; \*\* p<0.05; \* p<0.10

## Appendix

A Propensity Score Matching technique was used to create a comparison group. As recommended by Austin (2011), a 1:1 nearest-neighbor match was performed within one-fifth of a standard deviation of the propensity score. Specifically, a probit model of group membership (i.e., study vs. comparison) was estimated on a large set of pre-period (2006) variables. These regressors included: gender, age, age times gender, indicators for spouse and child, years of tenure, and number of members in the household. The Charlson Comorbidity Index was added to the model as a general measure of health status (Charlson et al., 1987) (Deyo, Cherkin and Ciol, 1992) (Quan et al., 2005).

To control for individuals' baseline health care consumption, the number and cost of each of the following were also included in the model: inpatient hospitalizations, hospital days, emergency department visits, physician's office visits, and prescription drug fills. Baseline (2006) values of the 11 health care quality measures listed below (i.e., the dependent variables used in the ensuing analysis) also entered the propensity score model. Finally, squared and cubed terms of all continuous variables listed above were also included. After estimating the probit model, the sample was reduced to the area of common support, which yielded the final study and control groups, comprised of 18,419 individuals each.

Except for geographic region, which was not used in the matching process due to the study employer's extreme concentration in the Midwest, covariate balance was quite good. The percent bias was well below the commonly cited 10 percent threshold of tolerance. In other words, the control group closely resembled the study group prior to adoption of the HSA-eligible health plan.

To estimate the impact of the HSA-eligible health plan on use of health care, a difference-in-differences (DiD) modeling framework was utilized. Using probit, the following model was estimated.

$$\text{Prob}(Y_{it}) = \alpha + \beta \text{Year}_{it} + \gamma \text{HSA}_{it} + \delta \text{Year}_{it} * \text{HSA}_{it} + \pi X_{it} + \varepsilon_{it} \quad (1)$$

Where  $Y$  is a measure of use health care for person  $i$  in year  $t$ ,  $Year$  is an indicator variable for each year from 2007–2010 (vs. 2006),  $HSA$  is an indicator for whether the person was a member of the employer implementing the full-replacement HSA-eligible health plan, and  $X$  is a vector of member characteristics for person  $i$  in year  $t$  including: the Charlson Comorbidity Index, demographic characteristics (age, gender, and geographic region), an indicator of whether or not the member was the policyholder (vs. spouse/dependent), household size (i.e., the number of individuals on the policy), and the number of years of tenure with the employer.  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ , and  $\pi$  are parameters to be estimated. The  $\varepsilon$  term is an idiosyncratic error.

The probit equation was estimated for each of the 11 health-use quality measures. Standard errors were clustered at the household level. Predicted probabilities were for all five years of data for the outcomes, using mean values for the other regressors. Marginal effects estimates (calculated at the means of all regressors) of the HSA-eligible health plan's impact on the likelihood of each of the dependent variables are also presented. All analyses were conducted using Stata/MP 12.0.

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## Endnotes

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<sup>1</sup> See <http://www.mercer.com/newsroom/united-states-health-benefit-cost-growth-slowed-again-in-2013.html>

<sup>2</sup> This sample includes almost 5,000 members who were not contained in earlier analyses (Fronstin and Roebuck 2014) (Fronstin and Roebuck 2013) (Fronstin, Sepulveda and Roebuck 2013) (Fronstin, Sepulveda and Roebuck 2013). After deep investigation, it was determined that some plan IDs were renumbered during one of the study years, which resulted in some individuals being misclassified as not continuously enrolled in the earlier studies. Subsequent to the earlier work, these records were rejoined and statistical power was bolstered accordingly. The impact of the HSA-eligible health plan on health services utilization and costs was re-estimated and qualitatively similar results as previously reported were found. These results are available upon request.

<sup>3</sup> See <http://www.qualitymeasures.ahrq.gov/content.aspx?id=47190> and <http://www.qualitymeasures.ahrq.gov/content.aspx?id=47167>

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