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Issue BRIEF

Health Care Spending 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

AT A GLANCE

- This study reports experience over five years from a single large employer in the Midwestern United States that adopted a high-deductible health plan with a health savings account (HSA) for all employees. This study 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.
- In the first year of the HSA, the employer's aggregate health care spending was reduced by $527 per person.
- Results show that spending was reduced significantly in the inaugural year of the HSA plan in medical, pharmacy, and total-claims categories. Further, the magnitude of the cost savings was greatest in this first year but the cost savings continued over the succeeding three years albeit at a slower pace.
- The introduction of the full-replacement HSA plan reduced total spending by 25 percent in the first year. Each category of health spending experienced statistically significant reductions in the first year of the HSA plan with the exception of spending on inpatient hospital stays. Spending on laboratory services and prescription drugs had the largest statistically significant declines (36 percent and 32 percent, respectively).
- When examining the spending components separately, only pharmacy and laboratory spending were statistically significantly lower throughout the entire four years after the HSA plan was adopted.
- Reductions in pharmacy spending were large and mostly sustained over the four years after the HSA was adopted. In the first year of the HSA, pharmacy-spending reductions were 40–47 percent for individuals in all but the highest quintile of spending.
- When spending by pre-HSA health spending quintile was examined, the largest spending effects in the first year of the HSA were seen in the third and fourth quintiles. The highest pre-HSA quintile group experienced spending reductions in the first year of the HSA that were not sustained. The second HSA-plan year showed total spending was reduced only in the second and fourth quintiles. By the fourth year, the HSA plan reduced pharmacy spending in the fourth quintile while only the third quintile continued to have reduced spending as compared with the year before the HSA plan was adopted.

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Table of Contents

Introduction 4
Background and Prior Literature 4
Current Study Data and Methods 6
Results 6
  Descriptive Findings 6
  Impact of HSA on Health Spending 9
Discussion 10
Study Limitations and Conclusion 12
Appendix – Sample Matching and Statistical Analysis 14
References 15
Endnotes 16

Figures

Figure 1, Baseline Sample Characteristics (in 2006) 6
Figure 2, Mean Health Care Spending Amounts among CDHP and Comparison-Group Members, by Year and Type of Health Care Service 6
Figure 3, Average Annual Increases in Health Spending, 2007–2010 7
Figure 4, Percentage Impact of CDHP on Health Care Costs, Relative to 2006, by Year and Type of Health Care Service 7
Figure 5, Annual Reduction in Health Care Costs Per Person Due to Adoption of HSA Plan, Relative to 2006, by Year 8
Figure 6, Percentage and Dollar Impact of CDHP on Medical Spending, Relative to 2006, by Year and Baseline Cost 10
Figure 7, Percentage and Dollar Impact of CDHP on Pharmacy Spending, Relative to 2006, by Year and Baseline Cost 10
Figure 8, Percentage and Dollar Impact of CDHP on Total Spending, Relative to 2006, by Year and Baseline Cost 10

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Introduction

Health insurance coverage with high deductibles (generally in excess of $1,000 for singles and twice that for families) is generally associated with savings-account options that can be used to cover out-of-pocket costs for health care services. These are often referred to as consumer-directed health plans (CDHPs). Accounts are typically one of two types: health reimbursement arrangements (HRAs), which are offered, owned, funded, designed and controlled by employers; or health savings accounts (HSAs), which are offered by employers, owned by employees, designed and effectively controlled by the U.S. government, and tax advantaged. Employers have now been using CDHPs for over a decade. In 2012, 22 percent of smaller employers, 36 percent of larger employers, and 59 percent of jumbo employers offered some form of a CDHP,[1] and nearly 1 in 5 workers were enrolled in one (Claxton et al., 2012).

Advocates of CDHPs contend that providing participants with an 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. 2011a; Newhouse and the Insurance Experiment Group 1993).

This *Issue Brief* examines the trajectory of spending on health care services over four years after an employer eliminated its traditional health insurance plans and replaced them with high-deductible health plans with health savings accounts (HSA plans). Prior analysis of the impact on health services utilization was recently published in Fronstin, Sepulveda and Roebuck (2013). Spending on inpatient and outpatient services, office visits, substance abuse and mental health, prescription drugs, laboratory services, and emergency services are examined separately over a five-year period that includes both pre- and post-HSA-plan experience for active workers and their dependents. The analysis makes use of a matched control group for 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 accounts (preferred provider organization (PPO) plans). This study 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.

Background and Prior Literature

The literature on CDHPs and their impact on health care spending is small, but growing. Much of the early research focused on CDHPs that used HRAs, and only a few studies have been published recently with data on HSAs. While HRAs and HSAs both fall under the CDHP umbrella from a design standpoint, they are at opposite extremes of what is considered a CDHP, with no additional types of CDHPs in between.

An HRA is an employer-funded health plan that reimburses employees for qualified medical expenses. An HRA is typically combined with a high-deductible health plan, though there is no statutory minimum-deductible requirement associated with an HRA. In fact, employers have a tremendous amount of flexibility in designing a health plan that incorporates an HRA. The amount of money placed in the account, level of the deductible, and comprehensiveness of coverage are all subject to variation. Employers often cover certain preventive services in full, not subjecting them to the deductible, and can carve out specific services from the deductible, such as prescription drugs, if they choose to do so. An HRA is typically set up as a notional arrangement: Leftover funds at the end of each year can be carried over to

the following year at the employer's discretion and restrictions can be placed on allowed rollover amounts. Employers are not required to make unused balances available to workers upon job disruption, but can allow such access for qualified medical expenses and for certain premiums. Given that most employers do not allow funds to be used after job disruption, workers only get value from the account if they use the funds for qualified medical services.

On the other hand, an HSA is a tax-exempt trust or custodial account that an individual can use to pay for health care expenses. In order to qualify for tax-free contributions to an HSA, the individual must be covered by a health plan that has a minimum, annual, statutory deductible ($1,250 for self-only coverage and $2,500 for family coverage in 2013), and all health care services except preventive services must be subject to the deductible. The HSA is owned by the individual and is completely portable. There is no use-it-or-lose-it rule associated with an HSA, as any money left in the account at the end of the year automatically stays with the HSA. Both the individual and the employer are allowed to contribute to an HSA, with annual contributions subject to statutory limits ($3,250 for self-only coverage and $6,450 for family coverage in 2013, plus catch-up contributions for individuals ages 55 and older).

The earliest series of studies examined a single employer that introduced an HRA in 2001 (see Parente, Feldman, and Christianson 2004; Feldman, Parente, and Christianson 2007; Parente, Feldman, and Chen 2008). Feldman, Parente, and Christianson (2007) examined three years of data after the HRA was adopted, and found that the HRA resulted in higher spending on hospital and physician services, and had no impact on prescription-drug spending, although the findings may have been influenced by its small sample of HRA enrollees (n=429).

Parente, Feldman, and Xu (2010) were able to examine four employers that fully replaced their health plans with CDHPs and found that two firms experienced savings (4.11 percent and 0.94 percent), but that the other two firms experienced increases in spending (3.57 percent and 1.28 percent). Unfortunately there was no control group to determine the effect of the plan-design change.

Lo Sasso, Helmchen, and Kaestner (2010) studied the impacts of CDHP features on health care spending, examining a sample of individuals that included multiple employers offering mostly HRA plans on a full replacement basis (about 2 percent offered an HSA). This study included data on beginning-of-year account balances and rollover amounts, and thus was able to examine the role of the account. Although the study did not include a control group or pre-CDHP data, the investigators executed an instrumental-variables analysis (and included firm-fixed effects), and concluded selection bias was of minimal concern. It is worth noting, however, that the study examined a non-traditional CDHP design. Hospital inpatient and outpatient surgeries were excluded from the deductible, and patient cost-sharing for prescription drugs could not be paid from the account. Overall, the study concluded that each $1 increase in the HRA led to a 92 cent increase in total spending on health care services.

Lo Sasso, Shah, and Frogner (2010) found that HSA enrollees spent 5–7 percent less compared with traditional-plan enrollees, with most of the relative reduction in spending occurring during the first year enrolled in the HSA, and that lower spending on prescription drugs drove most of the savings. This study examined over 76,000 individuals from 709 employers and used data one year prior to and two years after the HSA adoption, and used a difference-in-difference (DiD) model that took into account prior health care use as a way to control for adverse selection for individuals who had a choice of health plans. Nair et al., (2009) also found that lower pharmacy spending drove all of the savings in the first year of a full-replacement CDHP in 2005, and noted that lower pharmacy spending was not large enough to reduce overall spending.

More recently, a series of papers examined 28 employers that offered combinations of HRAs, HSAs, and health plans with high deductibles, but no associated accounts (see Buntin, Haviland, McDevitt, and Sood 2011; Haviland, et al. 2011a; Haviland, et al. 2011b). Researchers also had information on the amounts that employers contributed to these accounts. These studies had a number of findings: First, moving to higher deductibles and CDHPs was associated with a 14 percent savings in the first year, and the highest savings were associated with high-deductible health plans that had low or no employer contribution to the account. Second, higher deductibles resulted in fewer episodes of care as well as less spending per episode. Third, CDHPs affected lower-income populations and the chronically ill to the same extent as non-vulnerable populations, which for obvious reasons may have greater health consequences for the lower-

income and chronically ill. One of the strengths of the data is the large sample size and the mix of health plan types. One of the weaknesses is that only one year of data was examined after the CDHPs were adopted.

Current Study Data and Methods

Pharmacy- and medical-claims data and insurance-enrollment information were obtained from a large employer located in the Midwest, covering the five-year period from January 1, 2006, through December 31, 2010. On January 1, 2007, this employer adopted an HSA plan for all active workers and their dependents. Both before and after 2007, the employer offered PPOs as the network type. Prior to the adoption of the HSA plan, deductibles ranged from $500-$1,500 per person, and co-insurance ranged from 80 to 100 percent for in-network services, and from 60 to 90 percent for out-of-network services.

Claims data were available for analysis for one year prior to the adoption of the HSA plan and for four years post-adoption. All workers were given a choice of two deductibles: 1) $1,250 per individual, $2,150 per family; or 2) $2,150 per individual, $4,300 per family. Workers overwhelmingly (89 percent) selected the higher-deductible option, most likely the result of payroll deduction for premiums of nearly $300 annually for employee-only coverage in the lower deductible plan, compared with no worker contribution toward the premium for the higher deductible plan. The employer also contributed to the HSA and deposited $700 for employee-only coverage and $1,300 for family coverage, regardless of which deductible was chosen.

The study group consisted of 13,278 active workers and their dependents who were continuously covered by the employer during the five-year analysis period. Data from a second employer were used to create a comparison group. This larger plan sponsor, with 82,644 continuously enrolled employees and dependents, maintained PPO coverage that was not HSA-eligible throughout the five-year study period. Two PPO options were offered: one with no deductible throughout the study period, and one with a deductible that had increased nearly 50 percent throughout the study period. Both plans covered preventive services in full and used 20 percent coinsurance for most other covered services. This analysis constructed a comparison group by matching on pre-period values of a rich set of covariates to the study group. More information on this process is provided in the Appendix.

Results

Descriptive Findings

Figure 1 contains the baseline (2006) sample characteristics of the 10,509 individuals in both the full-replacement HSA plan and the comparison group. Few statistically significant differences were detected between the population enrolled in the full-replacement HSA plan and the comparison group. This was an intended effect as a result of matching. Average ages were about the same, although statistically different: 29.9 for the HSA plan group and 30.9 for the comparison group, though the percentages of individuals within each age group were not statistically different. Just over one-half (54 percent) of both groups were male. Policyholders made up about 40 percent of each group. Average household size was about 3.3 people. Tenure with the employers was about the same between the two groups, 13 to 14 years, but statistically different. As noted previously, nearly the entire sample was located in the Midwest.

Figure 2 shows mean spending amounts over time for the HSA-plan enrollees and the comparison group. The table shows total health spending, as well as its various components: inpatient, outpatient, emergency-room, office-visit, and pharmacy spending, etc. Overall average annual spending was $1,756 for the HSA plan group and $2,128 for the comparison group in 2006. Figure 3 shows the subsequent changes in spending. During the first year of the full-replacement HSA, spending increased 7 percent for the HSA plan group and 29 percent for the comparison group. In the next two years, spending increased 22 percent and 16 percent for the HSA plan group, while it increased less than 10 percent in each year for the comparison group.

Figure 1

Baseline Sample Characteristics (in 2006)

	HSA Group (N=10,509) Mean	Comparison Group (N=10,509) Mean	p-value
Age:			
Average (years)	29.94	30.91	0.00
<18^	0.38	0.38	0.96
18-24^	0.03	0.03	0.96
25-34^	0.09	0.09	0.96
35-44^	0.18	0.18	0.96
45-54^	0.26	0.26	0.96
55-64^	0.06	0.06	0.96
Male^	0.54	0.54	0.96
Policyholder	0.40	0.39	0.27
Household size	3.25	3.26	0.38
Years of tenure	14.02	13.33	0.01
Northeast^	0.00	0.00	0.96
Midwest^	0.97	0.97	0.96
South^	0.03	0.03	0.96
West^	0.00	0.00	0.96
Charlson Comorbidity Index^	0.09	0.08	0.70

Source: EBRI estimates based on administrative claims data.
Notes:
CDHP=Consumer-Directed Health Plan.
Values are proportions unless denoted otherwise.
Variables used in coarsened exact matching process are denoted by ^.
Reported p-values are from Kruskal-Wallis rank test of differences in means across groups.

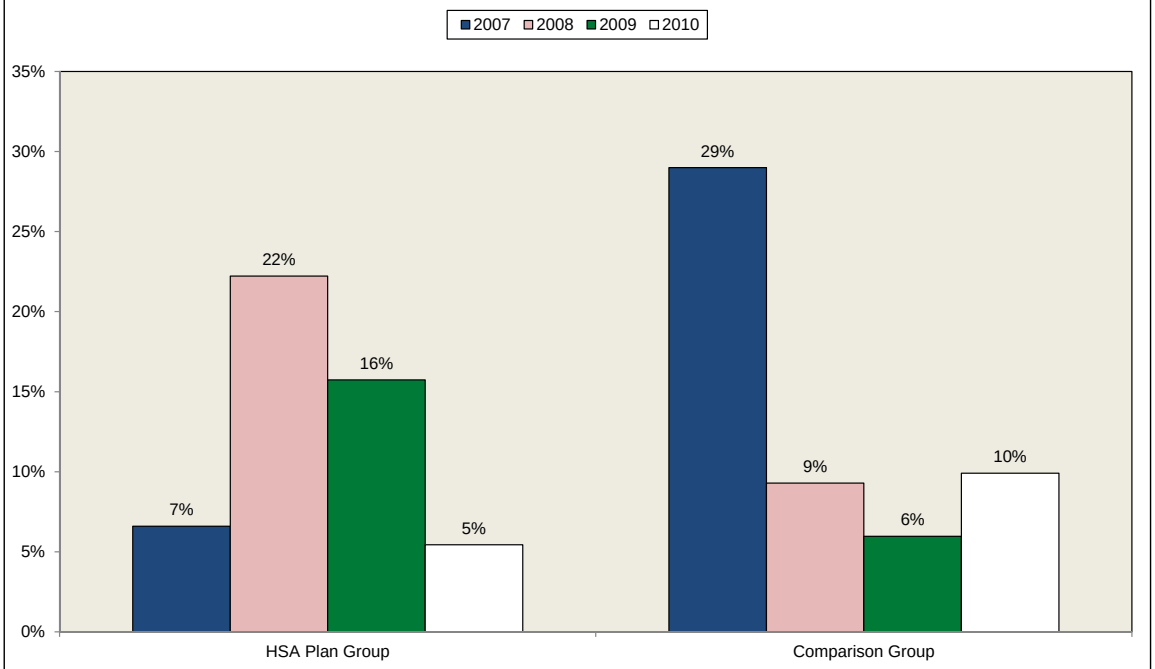
Figure 2

Mean Health Care Spending Amounts among CDHP and Comparison-Group Members, by Year and Type of Health Care Service

Group/Cost Measure	Year				
	2006	2007	2008	2009	2010
HSA Group					
Total	$1,756	$1,872	$2,288	$2,648	$2,792
Inpatient hospital	118	291	307	410	399
Emergency department	62	63	82	98	101
Outpatient hospital, ambulatory, and surgical	532	589	741	840	884
Outpatient physician's office	486	486	611	663	695
Substance abuse and mental health	21	20	25	30	33
Laboratory	38	27	37	40	45
Pharmacy	449	368	434	507	556
Comparison Group					
Total	2,128	2,745	3,000	3,179	3,494
Inpatient hospital	172	474	505	438	489
Emergency department	35	41	51	51	55
Outpatient hospital, ambulatory, and surgical	588	698	823	935	1,059
Outpatient physician's office	714	798	856	893	966
Substance abuse and mental health	53	62	68	76	86
Laboratory	21	26	25	29	31
Pharmacy	507	573	611	681	733

Source: EBRI estimates based on administrative claims data.
Notes: CDHP=Consumer-Directed Health Plans; commenced in 2007.

Figure 3
Average Annual Increases in Health Spending, 2007–2010



Source: EBRI estimates based on administrative claims data.

Figure 4
Percentage Impact of CDHP on Health Care Costs, Relative to 2006, by Year and Type of Health Care Service

Cost Measure (Dependent Variable)	2007	2008	2009	2010
Total	-25%***	-8%*	-4%	-6%*
Inpatient hospital	-33%	6%	30%	11%
Emergency department	-17%*	-8%	8%	5%
Outpatient hospital, ambulatory, and surgical	-13%*	2%	-7%	-12%
Outpatient physician's office	-14%***	1%	4%	5%
Substance abuse and mental health	-22%**	-12%	2%	0%
Laboratory	-36%***	-21%**	-20%**	-19%*
Pharmacy	-32%***	-26%***	-26%***	-20%***

Source: EBRI estimates based on administrative claims data.
Notes: N=10,509. CDHP=Consumer-Directed Health Plan. Presented are coefficient estimates of the (difference-in-differences) effect of CDHP in each of four follow-up years from generalized linear models with gamma family and log link. Models included indicators for male, policyholder, five age groups, three geographic regions, four years, CDHP, and four CDHP times year interaction terms (presented), as well as Charlson Comorbidity Index, years of tenure, and household size. Statistical significance based upon robust standard errors (clustered by policyholder) denoted as follows: *** p<0.01; ** p<0.05; * p<0.10. More information about the econometric model can be found in the appendix and in Fronstin, Sepulveda and Roebuck (2013).

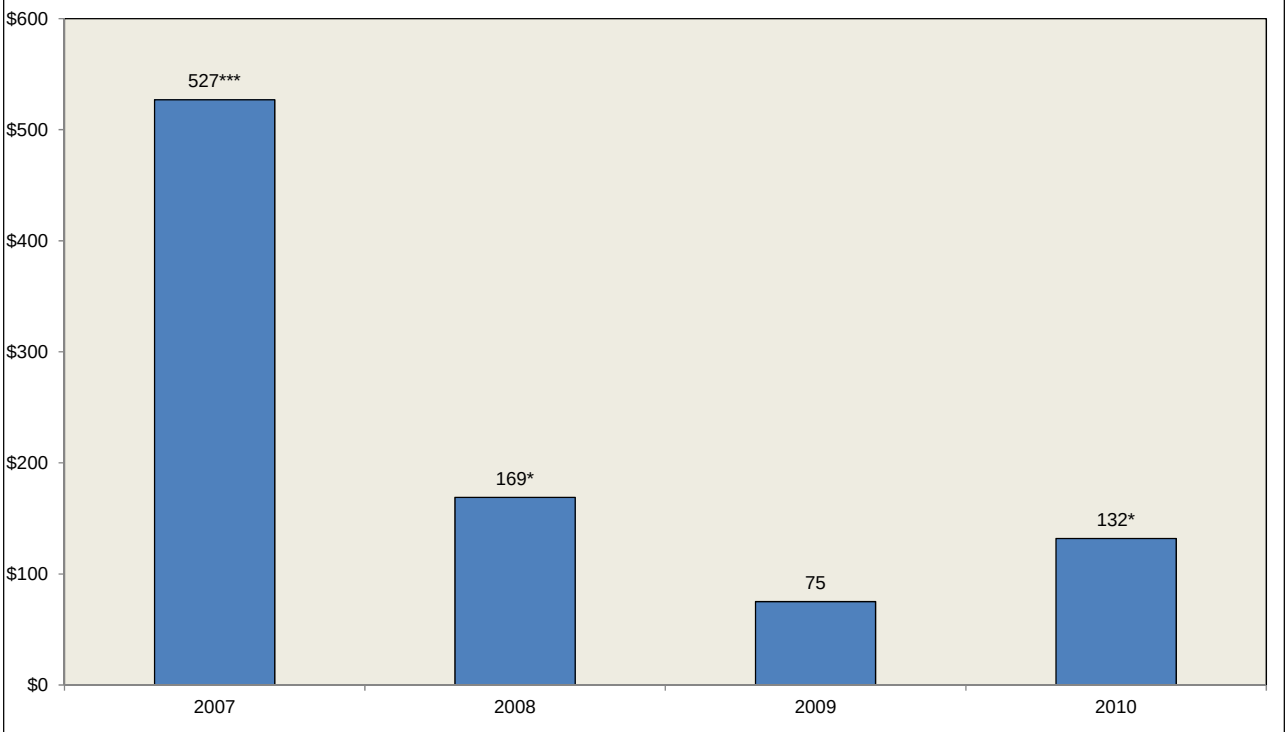
Impact of HSA on Health Spending

Figure 4 shows the results for the DiD regression model presented in equation (1) in the Appendix. Separate estimates are presented for the various components of health spending, as well as for total spending. Only the findings from the regression related to the impact of the HSA on health spending (the coefficient on the interaction term between the HSA and Year indicators) are shown. The introduction of the full-replacement HSA plan reduced total spending by 25 percent in the first year (2007). Each category of health spending experienced statistically significant reductions in the first year of the HSA plan with the exception of spending on inpatient hospital stays. Spending on laboratory services and prescription drugs had the largest statistically significant declines (36 percent and 32 percent, respectively).

In the second year of the HSA plan, total spending was 8 percent lower relative to the year before the HSA was adopted. However, when examining the spending components separately, only pharmacy and laboratory spending were statistically significantly lower, and those were the only components of health spending that remained lower throughout the entire four years after the HSA plan was adopted. Furthermore, the reduction in spending on laboratory services appeared to decline as the significance levels dropped (though they remain statistically significant). By 2010 (the fourth year of the HSA plan), total spending was still 6 percent lower relative to the year before the HSA was adopted.

Figure 5 shows the total amounts saved as a result of introducing the HSA. In the first year of the HSA, spending was reduced by $527 annually per person. Because second-year spending increased faster in the HSA group than in the comparison group, spending was only $169 lower annually per person relative to the year before the HSA was adopted. In the third year of the HSA, spending was $75 lower due to the HSA, but this amount was not statistically different from total spending prior to the adoption of the HSA. In the fourth year of the HSA (2010), spending was $132 lower per person as a result of the HSA relative to the year before the HSA was adopted.

Figure 5
Annual Reduction in Health Care Costs Per Person Due to Adoption of HSA Plan, Relative to 2006, by Year



Source: EBRI estimates based on administrative claims data.
*** p<0.01; ** p<0.05; * p<0.10.

Figures 6–8 show the summary results from separate equations based on 2006 health care spending. The results are shown by 2006 spending quintiles: Figure 6 shows medical spending (such as inpatient, outpatient, emergency-department, and lab spending), Figure 7 shows pharmacy spending by quintiles, Figure 8 shows total spending by quintiles. The more detailed spending estimates shown in Figure 3 are not used in these figures because individuals in the lower-spending quintiles did not often incur expenses in each of the more detailed categories. Additionally, only the findings from the regression related to the impact of the HSA on health spending (the coefficient on the interaction terms between HSA and Year) are shown.

Figure 6 shows the impact of adopting a full-replacement HSA on spending on all health care services other than pharmacy spending, by 2006 pre-HSA health-spending quintile. The biggest effects of the HSA were found in its first year: The HSA reduced spending by 29 percent among individuals in the third and fourth quintiles, and by 13 percent among those in the highest spending quintile. By the fourth year of the HSA, only the middle quintile was experiencing spending reductions relative to the year before the HSA was adopted: Spending reductions for this group were 14 percent. In dollar terms, by the fourth year of the HSA, the middle quintile was spending $183 less per year than they were in the year before the HSA was adopted.

Figure 7 shows the impact of the HSA on pharmacy spending. Reductions in pharmacy spending were large and mostly sustained over the four years after the HSA was adopted. In the first year of the HSA, pharmacy-spending reductions were 40-47 percent for individuals in all but the highest quintile of spending, and the highest-spending quintile experienced a 24 percent decline in pharmacy spending. By the fourth year of the HSA, individuals in the four lowest spending quintiles experienced a 21-41 percent reduction in pharmacy spending, ranging from $21 to $170. The highest-spending quintile experienced a 5 percent reduction in pharmacy spending in the fourth year of the HSA relative to the year before the HSA was adopted, which amounted to $62, although the impact of the HSA plan was not statistically significant for individuals in this spending quintile.

Figure 8 shows the total impact of the HSA on health spending by pre-HSA spending quintile. Similar to the results shown in Figure 6, the HSA had stronger effects on spending in its first year. The largest spending effects in the first year of the HSA were seen in the third and fourth quintiles, which exhibited moderate levels of spending. Spending was 31 percent lower in the fourth quintile and 29 percent lower in the third quintile. In comparison, spending was 15 percent lower in the fifth quintile, 14 percent lower in the second quintile, and 12 percent lower in the lowest quintile (though not statistically significant).

The second HSA-plan year showed total spending was reduced only in the second and fourth quintiles. By the fourth year, the HSA plan had no effect on spending among the highest- spending 2006 quintile. The HSA plan reduced pharmacy spending in the fourth quintile, but not enough to reduce total spending. Total spending also was not lower in the first and second quintiles. Only the third quintile continued to have reduced spending in the fourth year of the HSA plan as compared with the year before the HSA plan was adopted. In the third quintile, spending was 15 percent lower, amounting to a reduction of $232 as compared with the year before the HSA was adopted.

Discussion

This study reports experience over five years from a single large employer in the Midwestern United States that adopted a high-deductible health plan with an HSA for all employees in 2007. The analysis examines health care spending in the plan over a period of four years after this change. Results show that spending was reduced significantly in the inaugural year of the HSA plan in medical, pharmacy, and total-claims categories. Further, the magnitude of the spending decline was greatest in this first year and eroded over the succeeding three years. It is observed that spending declines affected medical claims transiently, whereas prescription-drug claims were affected over a sustained period of years. These results are consistent with the findings of Lo Sasso, Shah, and Frogner (2010), who reported reduced health care spending after the introduction of an HSA-based, high-deductible plan and attributed spending reductions to reduced prescription-drug claims.

Figure 6

Percentage and Dollar Impact of CDHP on Medical Spending, Relative to 2006, by Year and Baseline Cost

2006 Spending Quintile (Range, Mean)	**2007**	**2008**	**2009**	**2010**
1 (0-$161, Mean=$52)	-7%	14%	-6%	18%
2 ($162-$473, Mean=$303)	-11%	-25%**	-5%	2%
3 ($474-$1,064, Mean=$727)	-29%***	8%	-10%	-14%*
4 ($1,065-$2,569, Mean=$1,691)	-29%***	-10%	7%	-4%
5 ($2,570+, Mean=$6,157)	-13%*	-2%	5%	-1%
1 (0-$161, Mean=$52)	-$38	$74	-$32	$90
2 ($162-$473, Mean=$303)	-$94	-$205**	-$44	$18
3 ($474-$1,064, Mean=$727)	-$365***	$98	-$125	-$183*
4 ($1,065-$2,569, Mean=$1,691)	-$576***	-$207	$132	-$71
5 ($2,570+, Mean=$6,157)	-$515*	-$99	$201	-$21

Source: EBRI estimates based on administrative claims data.

Notes: Medical spending includes: inpatient hospital, emergency department, outpatient hospital, outpatient physician, substance abuse and mental health, and laboratory. CDHP=Consumer-Directed Health Plan. Presented are coefficient estimates of the (difference-in-differences) effect of CDHP in each of four follow-up years from generalized linear models with gamma family and log link. Models included indicators for male, policyholder, five age groups, three geographic regions, four years, CDHP, and four CDHP times year interaction terms (presented), as well as Charlson Comorbidity Index, years of tenure, and household size. Statistical significance based upon robust standard errors (clustered by policyholder) denoted as follows: *** p<0.01; ** p<0.05; * p<0.10. More information about the econometric model can be found in the appendix and in Fronstin, Sepulveda and Roebuck (2013).

Figure 7

Percentage and Dollar Impact of CDHP on Pharmacy Spending, Relative to 2006, by Year and Baseline Cost

2006 Spending Quintile (Range, Mean)	2007	2008	2009	2010
1 (0-$161, Mean=$52)	-47%***	-20%	-41%***	-41%***
2 ($162-$473, Mean=$303)	-44%***	-36%***	-21%	-25%*
3 ($474-$1,064, Mean=$727)	-40%***	-17%**	-31%**	-21%*
4 ($1,065-$2,569, Mean=$1,691)	-42%***	-36%***	-40%***	-30%***
5 ($2,570+, Mean=$6,157)	-24%***	-19%***	-9%*	-5%
1 (0-$161, Mean=$52)	-$24***	-$10	-$21***	-$21***
2 ($162-$473, Mean=$303)[a]	n/a	n/a	n/a	n/a
3 ($474-$1,064, Mean=$727)	-$109***	-$46**	-$185**	-$58*
4 ($1,065-$2,569, Mean=$1,691)	-$240***	-$206***	-$231***	-$170***
5 ($2,570+, Mean=$6,157)	-$331***	-$271***	-$129*	-$62

Source: EBRI estimates based on administrative claims data.

Notes: CDHP=Consumer-Directed Health Plan. Presented are coefficient estimates of the (difference-in-differences) effect of CDHP in each of four follow-up years from generalized linear models with gamma family and log link. Models included indicators for male, policyholder, five age groups, three geographic regions, four years, CDHP, and four CDHP times year interaction terms (presented), as well as Charlson Comorbidity Index, years of tenure, and household size. Statistical significance based upon robust standard errors (clustered by policyholder) denoted as follows: *** p<0.01; ** p<0.05; * p<0.10. More information about the econometric model can be found in the appendix and in Fronstin, Sepulveda and Roebuck (2013).

[a] Marginal effects could not be estimated because of the non-linear function being non-differentiable at the mean of the regressors.

Figure 8

Percentage and Dollar Impact of CDHP on Total Spending, Relative to 2006, by Year and Baseline Cost

2006 Spending Quintile (Range, Mean)	**2007**	**2008**	**2009**	**2010**
1 (0-$161, Mean=$52)	-12%	10%	-11%	9%
2 ($162-$473, Mean=$303)	-14%*	-25%**	-7%	-1%
3 ($474-$1,064, Mean=$727)	-29%***	6%	-12%	-15%**
4 ($1,065-$2,569, Mean=$1,691)	-31%***	-15%**	-2%	-9%
5 ($2,570+, Mean=$6,157)	-15%***	-7%	2%	-1%
1 (0-$161, Mean=$52)	-$69	$57	-$64	$53
2 ($162-$473, Mean=$303)	-$136*	-$239**	-$66	-$13
3 ($474-$1,064, Mean=$727)	-$453***	$89	-$180	-$232**
4 ($1,065-$2,569, Mean=$1,691)	-$805***	-$382**	-$43	-$224
5 ($2,570+, Mean=$6,157)	-$831***	-$366	$92	-$62

Source: EBRI estimates based on administrative claims data.

Notes: CDHP=Consumer-Directed Health Plan. Presented are coefficient estimates of the (difference-in-differences) effect of CDHP in each of four follow-up years from generalized linear models with gamma family and log link. Models included indicators for male, policyholder, five age groups, three geographic regions, four years, CDHP, and four CDHP times year interaction terms (presented), as well as Charlson Comorbidity Index, years of tenure, and household size. Statistical significance based upon robust standard errors (clustered by policyholder) denoted as follows: *** p<0.01; ** p<0.05; * p<0.10. More information about the econometric model can be found in the appendix and in Fronstin, Sepulveda and Roebuck (2013).

Reductions in health-services utilization after introduction of the high-deductible HSA plan is likely a result of the large deductible in this plan design elected by most employees, namely $2,150 for single enrollees and $4,300 for families. Wage and income data are not available for this analysis, but prior studies have shown that far smaller increases in cost shifting have caused significant reductions in health-services utilization (Newhouse and the Insurance Experiment Group 1993). The data also suggest that there was an "inexperience factor" in the conversion to account-based plans, as evidenced by erosion of first-year spending reductions over the succeeding years.

Health insurance coverage is complex for non-health maintenance organization (non-HMO) plans because their premiums do not account for nearly all of the spending by plan participants, as they do in HMOs. In plans with choices of providers, health insurance coverage is laden with multiple cost-sharing mechanisms within the same plan; differential cost for high-performance vs. standard networks of providers; in-network vs. out-of-network cost sharing; reference pricing (fixed payments for services with beneficiaries paying the difference for any higher charges); and tiered pharmacy payments where the placement of a medication in a tier is associated with a different beneficiary cost. The addition of a large deductible and an account with employer-provided funds to this mix certainly increases the cognitive demands for new users of account-based, high-deductible health plans. However, it is reasonable to expect that behaviors will change as users become more familiar with how to use the plan for meeting health-care-services needs over time.

The data also show that health-services spending appeared to vary by baseline level of health spending before the HSA plan design was introduced. High utilizers (the fifth pre-HSA quintile) had the lowest reduction in use of medical services in the first year after the HSA plan was introduced, and the shortest duration of reductions in pharmacy spending. This is not surprising given this group's need for medical services reflected in their poorer health status by the Charlson Comorbidity Index score. Also, while prescription-drug spending reductions were prominent over the four-year observation period, these were most consistent in groups with pre-HSA spending patterns representing moderate users of health services (the third and fourth spending quintiles). Moderate health-services consumers may represent a locus where high-deductible plans and an HSA account will have a greater impact. The data do not permit any assessment of the necessary vs. discretionary need for prescription-drug spending.

Prior work has found that CDHPs reduce spending primarily among low- and medium-risk people (see Bundorf 2012 for a summary). This suggests that individuals who exceed their deductibles will not change their services consumption as a result of changes to health insurance designs that add large deductibles in combination with spending or savings accounts. The observations in this analysis are not inconsistent with that point of view. For example, high utilizers, defined as pre-HSA high spenders (fifth quintile), had the lowest reductions in medical-services spending and the shortest duration of pharmacy benefits reductions than other utilizer groups.

Study Limitations and Conclusion

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

Second, although estimation of the impact of HSA plans 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, 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).

Fourth, although the HSA-plan cohort was matched to comparison members from a second employer, the possibility remains that derived effects might still be biased if unobserved variables associated with the HSA plan were also correlated with health-services utilization. There is also the possibility that HSA enrollees may have altered the timing of

consumption of health services at the end of the 2006 (either delayed or accelerated) in anticipation of the impending change to the HSA plan.

Finally, this analysis is unable to determine the cause of the large increase in health spending in the comparison group in 2007. As a result of this increase, first-year savings as a result of the adoption of the HSA plan may be overstated.

This study adds to the consumer-directed-health-plan literature by reporting changes in spending during the four years after an HSA plan was adopted and showing that, in one employer, spending reductions eroded over time and that reductions varied by pre-replacement levels of health spending. The data suggest that the highest users were least affected and that moderate users were most vulnerable. The data did not allow for distinguishing discretionary from necessary services utilization. This is essential for understanding the value of account-based, high-deductible plans.

Appendix – Sample Matching and Statistical Analysis

The Coarsened Exact Matching technique was used to create a comparison group (Iacus, King, and Porro 2011). One-to-one pairing between study group subjects and comparison group individuals was conducted based upon calendar year 2006 (i.e., pre-period) values of the following variables with pre-specified cut points (in parentheses): gender; age (18, 25, 35, 45, 55); geographic region; and Charlson Comorbidity Index (0, 1, 2, 3)—a proxy measure of health status (See Charlson Pompei, and MacKenzie 1987; Deyo, Cherkin, and Ciol 1992; and Quan et al., 2005).[2] Additionally, pre-period values of the eight variables on use of health care services (described below) were also balanced across the study and comparison groups.[3] Using this process, 10,509 members (79 percent) of the study cohort were successfully matched (1:1) and employed in the ensuing analysis. Given the potential for dual coverage (e.g., Medicare), and consequently unobserved health-services utilization in the available claims data, all members were required to be less than 65 years of age as of the last day of the five-year study period.

In order to measure the overall effect of the switch to an HSA plan on health care spending, this analysis built on the generalized linear model (GLM) with a gamma distribution and log-link presented in Lo Sasso, Shah, and Frogner (2010). As they note, this model is frequently applied to health care data because of its tractability and ease of estimation as a result of advances in personal computing (Manning 1998; Mullahy 1998; Manning and Mullahy 2001).

The basic model with a log-link is

$$Log\ (E(Y_{it})) = \alpha + \beta_1 Year_{it} + \beta_2 HSA_{it} + \beta_3 Year_{it}\ x\ HSA_{it} + \delta X_{it} + \varepsilon_{it} \quad (1)$$

where Y is annual spending 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 is in the full-replacement HSA plan cohort, and the coefficients on the interaction terms between HSA and Year reveals the difference-in-differences (DiD) estimate of the effect of HSA enrollment on health care spending. The coefficients of interest (β_3) can be interpreted directly as a multiplicative effect of the HSA-plan design on total costs, as full replacement eliminates individual-level selection as a potential source of bias.

The model also controls for a number of enrollee characteristics. The Charlson Comorbidity Index and demographic characteristics (age, gender, and geographic region) were included, and three other variables were constructed for use as covariates in the multivariate models: 1) an indicator of whether or not the member was the policyholder (or dependent), 2) household size (i.e., the number of individuals on the policy), and 3) the number of years of tenure with the employer. The ε term is an idiosyncratic error.

A number of health-spending measures were derived annually for each individual. They included spending on 1) inpatient hospital admissions, 2) outpatient surgery, 3) emergency-department visits, 4) outpatient physician's office/clinic visits, 5) substance-abuse and mental-health treatments, 6) outpatient pharmacy, and 7) laboratory services. This analysis examined spending in total and for each type of service separately.

Another specification check involved estimating separate regressions based on total spending on health care in 2006. The sample was divided into 2006 spending quintiles. Spending in 2006 was used as a proxy for health status. This permitted testing on whether the effects of the HSA plan design were symmetric across different health statuses of enrollees. In these specifications, three equations were estimated: total spending, outpatient pharmacy spending, and all other medical spending. Separate equations were not estimated for the various types of medical spending because individuals in the lower spending quintiles did not often incur certain types of health care services, such as inpatient admissions and outpatient surgery.

Standard errors were clustered at the policyholder level. All analyses were conducted using Stata/MP 12.0.

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Endnotes

[1] See Figure 6 in www.mercer.com/pressrelease/details.htm?idContent=1491670

[2] Because this analysis impose continuous eligibility in the HSA plan cohort and comparison group, the sample is one year older each year, and increases in use of health care services will naturally increase over time. As a result, the Charlson Comorbidity Index will increase over time as well. Annual average Charlson Comorbidity Index scores for both the HSA plan cohort and control groups are available from the corresponding author upon request.

[3] Five health-services utilization measures and three preventive screening indicators were derived annually for each individual: 1) number of inpatient hospital admissions, 2) number of inpatient hospital days, 3) number of emergency-department visits, 4) number of outpatient physician's office/clinic visits, and 5) number of prescriptions filled, on a 30-day adjusted basis. The preventive screening indicators included three yearly cancer screenings recommended by the National Committee for Quality Assurance (NCQA) as Healthcare Effectiveness Data and Information Set (HEDIS) quality measures. These included: 1) a mammogram (for females, ages 40 and older); 2) cervical cancer screening (for females, ages 21 and older); and 3) a colorectal exam (for males and females, ages 50 and older). Inpatient hospital admissions, and the three cancer screening indicators were exactly matched on all of their values. The remaining four health-services utilization measures were coarsened and employed in the matching process using Sturge's rule, the default binning algorithm of the user-written Stata command "–cem-" that was implemented. This automation resulted in 18 cut points for each of these four count "measures. See http://gking.harvard.edu/cem/ for a complete description of this methodology.

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