

Forum for Health Economics & Policy

Volume 14, Issue 2

2011

Article 3

(HEALTH POLICY)

How Do Consumer-Directed Health Plans Affect Vulnerable Populations?

Amelia M. Haviland*

Neeraj Sood†

Roland McDevitt‡

M Susan Marquis**

*RAND Corporation, haviland@rand.org

†University of Southern California, nsood@sppd.usc.edu

‡Towers Watson, roland.mcdevitt@towerswatson.com

**RAND Corporation, susanm@rand.org

How Do Consumer-Directed Health Plans Affect Vulnerable Populations?*

Amelia M. Haviland, Neeraj Sood, Roland McDevitt, and M Susan Marquis

Abstract

We use health care claims data from 59 large employers to estimate how consumer-directed health plans (CDHPs)—plans that combine a high deductible with personal accounts—affect health care costs and the use of preventive services by vulnerable populations. The vulnerable populations studied are those that will have increased access to health insurance under health care reform: families with high health care needs and low income families. A difference-in-difference framework is used with costs and use available for a full year before and after enrolling in a CDHP and for controls.

Our key finding is that in almost all cases, CDHP benefit designs affect lower income populations and the chronically ill to the same extent as non-vulnerable populations. These effects include significant reductions in overall spending that increase with the level of the deductible and greater reductions for high deductible plans when paired with health savings accounts (HSAs) in comparison to health reimbursement arrangements (HRAs). However, enrollment in CDHPs also leads to reductions in care that is considered beneficial for all groups, and this may have greater health consequences for lower income and chronically ill people than for others.

KEYWORDS: consumer-directed health plans, vulnerable populations, health care costs, preventive care

*We would like to acknowledge grant support from the California HealthCare Foundation and the Robert Wood Johnson Foundation, helpful suggestions from the advisory group members for those grants, including Joe Newhouse, Linda Bilheimer, Paul Ginsburg, and Dennis Scanlon, and advice from Dr. Ateev Mehrotra, M.D. on the construction of our annualized preventive care measures. We would like to acknowledge essential technical support from Ryan Lore, M.P.P. and Laura Laudenberger, M.S. at Towers Watson; and from Scott Ashwood, M.A. and Al Crego, B.A. at RAND.

INTRODUCTION

Recently enacted health care reform legislation will expand access to health insurance coverage over the next decade, especially for low income people and those with serious health problems who currently experience the greatest barriers to coverage. Low-income people will find coverage more affordable due to penalties for large employers that do not offer affordable coverage, premium subsidies for those people without an offer of affordable employer coverage, and expansion of Medicaid eligibility to cover parents and childless adults with incomes below 133 percent of poverty. Those in poor health will benefit from market reforms that prohibit rating on the basis of health status and guarantee the issue and renewability of insurance.

On the other hand, many employees whose families are vulnerable due to low income or serious health problems may face new cost challenges as consumer-directed health plans (CDHPs) become more prevalent. CDHP plan designs include a high deductible paired with a tax favored personal account that may receive contributions from the employer. The high deductible creates cost consciousness because the member has “skin in the game.” The personal account and employer contribution provide resources to help the employee mitigate and manage the additional financial risk. Two kinds of personal accounts are associated with CDHPs: Health Reimbursement Arrangements (HRAs) and Health Savings Accounts (HSAs).

HRAs are funded by employers to reimburse employees for qualified medical expenses up to a stated level. These reimbursements are excluded from taxable income of the employee. Unused amounts at the end of the year may rollover for use as reimbursements in future years, but employees generally forfeit any account balance that remains if they leave the employer before retirement. Federal law does not require any minimum deductible or other cost sharing provisions to qualify for an HRA, and the deductibles for HRA plans are often lower than those of HSA plans.

HSAs create a stronger financial incentive for the employee to manage health care costs carefully, because the account balance is owned by the employee and is portable when the employee changes jobs. Created by the Medicare Modernization Act of 2003, HSA contributions are only permitted for those enrolled in high-deductible health plans as defined in the law; though prior contributions to the account may be used for qualified medical expenses at any time. The requirements for 2010 include minimum deductibles for single and family coverage of \$1,200 and \$2,400 respectively.¹ The law permits employer

¹ The qualifying deductible for an HSA ranged from \$1,000 to \$1,100 during our study period.

and employee contributions subject to limits in 2010 of \$3,050 for single coverage and \$6,150 for family coverage.²

More low income and chronically ill people are likely to enroll in CDHP plans over the next decade for several reasons. First, the Patient Protection and Affordable Care Act (PPACA) may accelerate the move to CDHPs among employers because of new requirements on offering coverage and the tax on generous plans (McDevitt and Savan, 2010). HSA-based plans will also be offered in health insurance exchanges that will be established by 2014 to manage the individual and small group markets (Pfeiffer, 2010), and these lower-premium plans may be attractive to people who have not previously purchased health insurance. Even in public insurance programs, deductibles and HSA-like accounts may arise as states look to greater use of cost-sharing in their Medicaid programs to control cost, especially as health reform is likely to increase cost pressures on state budgets. The Deficit Reduction Act of 2005 gives states greater leeway to use cost-sharing and also establishes a new, 5-year demonstration program to allow states to set up and fund Health Opportunity Accounts – accounts that can be used to pay for medical expenses-- in combination with high deductible health plans for certain Medicaid eligibles (Solomon, 2007).

Given the expected growth in enrollment in CDHPs by lower income and chronically ill people, we ask what effect CDHPs will have on access to health care for these vulnerable populations. The preponderance of evidence is that, in the general population, CDHPs reduce health care spending (Buntin et al., 2006, 2010, American Academy of Actuaries, 2009; Parente, S.T., R. Feldman and J.B. Christianson. 2004; Lo Sasso, A.T., T. Rice, J.R. Gabel and H. Whitmore, 2004). The evidence is less clear concerning the effects on persons with low income and those at risk of high health care spending. The RAND Health Insurance Experiment, a randomized controlled trial of the effects of cost sharing on health care, found that cost-sharing produced substantial reductions in use but the overall effects did not differ between the rich and poor or the healthy and sick. However, lower income people were somewhat more likely than higher income persons to cut back on care that is considered highly effective, especially for children (Newhouse et al, 1993). Moreover, in contrast to current high deductible plans, the stop loss provisions of the experiment plan were lower for low-income families than high-income families, which we expect to reduce any difference between low and high income people in the pure response to cost-sharing.

More recent studies suggest that CDHPs may affect vulnerable population groups to a greater extent than the general population. CDHP enrollees with low incomes and those with chronic conditions are more likely to report cost-related access problems and delaying care than others in these plans based upon

² For additional information on the rules governing HRAs and HSAs see IRS, 2009.

telephone survey data (Davis, Doty and Ho, 2006; Reed et al 2009). In addition, evidence from one firm and one insurer respectively suggests that low-income persons who switched to CDHPs reduced their physician office visits and visits to emergency departments for high severity conditions more than others who switched (Hibbard et al., 2008; Wharam et al 2007). Similarly, in one firm, people in lower socio-economic status groups who enrolled in a CDHP reduced both low- and high-priority visits more than other enrollees (Hibbard et al, 2008). Additional evidence from a single firm suggests patients with chronic diseases enrolled in high deductible plans are more likely to discontinue taking their chronic illness medications than the chronically ill in other plans (Greene et al, 2008).

On the other hand, there is some evidence from relatively small samples that diabetics enrolled in CDHPs did not use fewer diabetic specific preventive services than those in traditional plans (Buntin et al, 2010; Rowe et al., 2008). In addition, another study of a single firm found that low-risk families in a CDHP spent less than those in traditional plans, but high-risk families in CDHPs did not spend less than comparable families in other plans (Feldman and Parente, 2010).

Understanding the effects of benefit design in general and CDHPs in particular on service use by the low income and chronically ill is critical to the implementation of health reform. It is important to policymakers as they evaluate the minimum health insurance policy standards and the subsidies for low income populations to ensure they have access to affordable health care coverage and adequate access to services. Policies to contain health care costs must curb spending by those with high health care costs, because a small minority of patients account for a large share of health care expenditures (Berk and Monheit, 2001; Stanton 2006). But how costs are reduced matters critically and high deductibles may only lead this vulnerable population to cut back or delay initiation of care for a problem (Newhouse et al., 1993) without curbing costs where it counts because most of the spending by high cost patients is above the deductible.

The effects of benefit design on the use of preventive services warrant special focus because health reform requires that cost-sharing for proven preventive care services be eliminated in Medicare by 2011 and for most private insurance plans with plan years that started after September 23, 2010. Most CDHPs currently waive the deductible for preventive services as permitted by the legislation authorizing HSAs. Several case studies suggest that eliminating the deductible does encourage CDHP patients to continue preventive service use even though overall service use is reduced. However, earlier analyses as part of this study found lower use of preventive care by CDHP patients (Buntin et al 2010). Moreover, a study of one insurer found most people were unaware of which services are exempt from a deductible after being enrolled for one year (Reed et

al., 2009), suggesting that exemptions may not achieve high utilization of preventive services.

The objective of this paper is to inform our understanding of how CDHPs affect the use of health care and preventive services by vulnerable populations. Based on previous studies, we expect CDHPs to lower use of services but whether the effects will be greater for vulnerable populations is uncertain. HSAs provide stronger incentives for patients to be cost conscious than other CDHP models, but here too it is uncertain whether the effects will differ for vulnerable populations. Our work adds to the current literature in two ways. First, it uses data from a large number of employers and many health insurers instead of case studies of a single employer or single insurer. Second, as a result of this diverse data and detailed information on insurance design, we are able to disentangle the separate effects of deductible level and the presence of HSAs and HRAs. These two extensions provide both more detailed and more generalizable results.

Our key finding is that in almost all cases, CDHP benefit designs affect non-vulnerable and lower income and chronically ill populations equally. These effects include significant reductions in overall spending that increase with the level of the deductible and greater reductions for high deductible plans when paired with HSAs in comparison to HRAs. However, for all populations, enrollment in CDHPs also leads to reductions in care that is considered beneficial, which could have greater health consequences for lower income and chronically ill people.

METHODS

Study Design and Sample. We constructed a unique data set including medical claims information from 2003 to 2007 for employees and dependents of 59 large US employers. The employers entered the study from two routes. Thirty-one employers were recruited because they were known to offer a plan with an individual deductible of \$500 or more during the period; we refer to these plans as high deductible health plans (HDHP). These employers were selected to yield a range of geographic regions, employee income levels, proportion of employees enrolling in higher deductible plans, and high deductible plan characteristics such as the size of the deductible, and the type of associated personal account. The other 28 employers are from the Thomson Reuters MarketScan™ database; some of these employers also offered HDHPs. These employers were selected to match the geographic, size, and industry distribution of the recruited employers to improve the balance in the distribution of employee characteristics across HDHP and other plans. Forty-three of our sample employers offered an HDHP as an option at some time during the study.

Our study sample for this analysis includes full time employees and dependents who were continuously enrolled in their employer's health benefit program for a period of two consecutive plan years. We use the term "family" to include families of 1 (employee only) as well as families of 2 or more (employee plus dependents). We have two types of families. "Treatment" families selected a traditional health plan in the first year and a high deductible plan in the second year. We limited the treatment sample to enrollees in firms with at least 3 percent enrollment in an HDHP. Thus, we have the first year experience in a high deductible plan and baseline data for 4 cohorts of families, those first enrolling in an HDHP in 2004, 2005, 2006, or 2007. Control families were enrolled in a traditional plan for both plan years and their employer did not offer a plan with an individual deductible of \$500 or more, during that time period. We selected a 50 percent sample of the resultant control group for analysis in order to speed processing time; the sample was stratified by plan year and employer.

High Deductible and CDHP Account Types. Our analysis classifies the treatment families into 5 types based on the size of the individual deductible and the presence of an HRA or HSA: (1) *Moderate* deductible with no account (individual deductible greater than \$500 but less than the qualifying deductible for an HSA³), (2) *Moderate* deductible with an HRA, (3) *High* deductible with no account (deductible equal to or greater than the qualifying deductible for HSA), (4) *High* deductible with an HRA (5) *High* deductible with an HSA. The latter two benefit designs are those that are typically thought of as CDHPs. We examine results for these five types of benefit designs in order to assess the effects of different levels of the deductible and the different types of personal accounts on patient behavior.

The deductible that was used to assign families to treatment categories was identified from survey data and payment patterns in claims data. We included in our analysis only plans with at least 100 employees to ensure sufficient observations to make reliable estimates of the deductible. We validated our claims based cost-sharing provisions by comparing them with survey responses from 27 employers about 138 plans they offer with a total enrollment of 1.1 million members in 2005. Comparing the treatment classification based on the two sources, we found agreement for 93 percent of enrollees. In addition, all high deductible plans identified for this analysis were confirmed by survey data or other communication with the employer. Ninety-four percent of the CDHP plans and 98 percent of all the HDHP plans in our study required some cost-sharing above the deductible until an out-of-pocket spending limit.

³ The qualifying deductible for an HSA ranged from \$1,000 to \$1,100 during the study period.

We sampled treatment families from four firms that would have otherwise comprised more than 20 percent of one of these 5 treatment groups to limit the number of treatment families contributed by any single employer to 20 percent of the group. Our study sample sizes are shown in Table 1.

Vulnerable subpopulations. We identify the low income population using a geocoded variable. We classify a family as low income if the median income of families in the employee's five-digit zip code area is below 200 percent of poverty based on the 2000 Census. One recent study indicated that for some socio-demographic characteristics there is relatively little misclassification when using a geocoded versus an individual measure, although the study used finer geographic areas than are available to us (Fremont et al, 2005). In general, since geographic areas are not completely homogeneous, the use of geocoded data provides an imperfect measure of the family characteristic, which might be expected to lead to an attenuated estimate of the effect of family income. However, community factors, as well as individual characteristics, may influence outcomes. Other health researchers have demonstrated that in this case, the use of the aggregate measure as a proxy for the microvariable is likely to produce an overestimate of the effect of the individual characteristic that one would obtain from a model that includes only the microvariable, rather than an underestimate (Geronimus, Bound and Neidert. 1996).

Families at high health risk are those with a member who has one of the five most costly physical chronic illnesses: heart disease, cancer, diabetes, hypertension, or kidney disease (Cohen and Kruass, 2003). These five conditions also accounted for as much as 20 percent of total health care spending in 1997 and one-quarter of the total growth in health care spending from 1987-2000 (Thorpe et al, 2004, Cohen and Krauss, 2003, Stanton, 2006). Conditions were identified from medical claims in the baseline year using AHRQ's Clinical Classification Software, which aggregates ICD-9 codes, and groupings defined by Cohen and Krauss (2003).

Table 1. Study Sample Sizes

	Number of Families					
	Moderate Deduct.	Moderate Deduct.	High Deduct.	High Deduct.	High Deduct.	Control Sample
	No Account	HRA Account	No Account	HRA Account	HSA Account	
Cohort Year						
2004	28935	0	778	6309	0	70818
2005	14005	0	2405	9456	1275	76757
2006	6880	9837	1064	2113	9038	40446
2007	22569	8431	69	3254	9851	44348
Total	72389	18268	4316	21132	20164	232369
Family Income						
Below 200% poverty	21979	3712	1104	4619	3101	45246
Above 200% poverty	50410	14556	3212	16513	17063	187123
Health Risk						
Low	55482	13660	3570	17767	16152	183449
High	16907	4608	746	3365	4012	48920
Percent of Sample						
Cohort Year						
2004	7.8%	0.0%	0.2%	1.7%	0.0%	19.2%
2005	3.8%	0.0%	0.7%	2.6%	0.3%	20.8%
2006	1.9%	2.7%	0.3%	0.6%	2.5%	11.0%
2007	6.1%	2.3%	0.0%	0.9%	2.7%	12.0%
Total	19.6%	5.0%	1.2%	5.7%	5.5%	63.0%
Family Income						
Below 200% poverty	6.0%	1.0%	0.3%	1.3%	0.8%	12.3%
Above 200% poverty	13.7%	3.9%	0.9%	4.5%	4.6%	50.8%
Health Risk						
Low	15.1%	3.7%	1.0%	4.8%	4.4%	49.8%
High	4.6%	1.3%	0.2%	0.9%	1.1%	13.3%

The number of treatment and control families in the vulnerable populations is shown in Table 1.

Study Variables. Medical claims were processed by Thomson Reuters into a standardized format. From the claims data, we calculated annual family expenditures for medical care (insurance and patient payments for care received)

and divided these by 12 to obtain average monthly expenditures. Similarly, we measured average monthly expenditures for care in each of three health care settings: outpatient or emergency department, inpatient, and prescription drugs. Expenditures are measured in current dollars; our analysis includes indicators for year (cohort) and thus controls for medical care price inflation. Medical prices also vary regionally, but, as we discuss below, our model accounts for time-invariant factors that affect a family's health care spending, which will control for regional price variation. Medical claims data also provided the ICD-9 codes used to determine the presence of chronic conditions and to identify high risk-families as defined above.

We created six preventive measures from the claims data based upon HEDIS measure definitions (NCQA, 2008): three cancer screening measures (receipt of mammography, cervical and colorectal cancer screening) and three recommended tests for diabetic patients (HbA1c testing, lipid profile, and microalbumin test). For each preventive procedure, we construct a dichotomous measure indicating whether some or none of the eligible family members obtained the recommended care during the year. Those eligible for each of the outcome measures are: mammography--females age 40 and older; cervical cancer screening--females age 21 and older; colorectal cancer screening--persons age 51 and older; three recommended diabetes treatments—persons having a diagnosis code and/or a drug claim indicating diabetes.

Means on the outcome variables for our study sample at baseline are given in Table 2.

Statistical analysis. We use a difference-in-differences regression model to estimate treatment effects while controlling for selection. The selection concern is that factors that effect the decision to enroll in a CDHP also affect the outcomes we are trying to measure. But, as we have baseline and post period measures for each family, each family acts as its own control for unmeasured characteristics that have the same effect on the outcomes over time, such as differences in an inherent propensity to use health care or trust in doctors and modern health care. Further, our regression model controls for characteristics that may be related to the decision to select a CDHP that also affect growth in health care cost outcomes including age of the primary insured, family composition, and measures of education, unemployment, and race based on geocoded variables. The combination of these two features provides a strong control for selection. However, selection effects might still confound or bias our conclusions if there are unaccounted for differences between control and treatment families that affect the change in outcomes over time. To address this, we only included families as controls that were not offered an HDHP because we hypothesized that changes in

outcomes for those who were offered and declined a HDHP might differ from the change for families who chose to enroll in HDHPs.

Table 2. Baseline Spending and Use of Preventive Services

Measure	
Health Expenditures (\$ per family per month)	
Total spending	635
Inpatient spending	138
Outpatient spending	361
Prescription drug spending	135
Number of cases	368638
Cancer screening procedures (% receiving)	
Cervical cancer	50.4%
Number of cases	305168
Colorectal cancer	27.8%
Number of cases	105350
Mammography	46.6%
Number of cases	185145
Diabetes procedures (% receiving)	
HbA1c	68.7%
Lipid Profile	60.2%
Microalbumin	53.0%
Number of cases	19250

The basic model that we fit is:

$$Y_{it} = \alpha + \zeta \text{Post} + \beta_0 \text{HDHP}_i + \beta_1 \text{HDHP}_i * \text{Post} + \gamma_0 \text{Vulnerable}_i + \gamma_1 \text{Vulnerable}_i * \text{Post} + \gamma_2 \text{Vulnerable}_i * \text{HDHP}_i + \gamma_3 \text{Vulnerable}_i * \text{HDHP} * \text{Post} + \eta X_i + \mu_i + \varepsilon_{it}$$

In this model, Y_{it} is the outcome for family i in time period $t = 1, 2$; Post is an indicator for the 2nd year of observation for each cohort; HDHP_i is a vector of indicators denoting whether the family enrolls in one of the 5 treatment groups; Vulnerable_i is a vector of indicators for the vulnerable subpopulations; and X_i is a vector of personal and health plan characteristics that are time invariant but it also

includes cohort (year) indicators and cohort-post interactions to allow for differences in the starting level and change in outcomes among cohorts. Thus, the overall change in outcomes for the control population from the baseline to the post year is measured by coefficient ζ ; our measure of the treatment effect is the difference in change for the treated population and is measured by β_1 ; the difference in the treatment effect for those in vulnerable subpopulations is measured by γ_3 and the total effect of treatment for the vulnerable population is $\beta_1 + \gamma_3$. The term μ_i is the effect of all characteristics of the family not included in the regression and is constant through time, and ε_{it} is the remaining unexplained variation.

We estimate the parameters of the expenditure model using generalized least squares accounting for the correlation of errors for a family over time.⁴ The models are fit to expenditures in dollars.⁵ We present the expenditure treatment effects in both dollars and as semi-elasticities—the percent change in dollars. The semi-elasticities are evaluated at the predicted mean baseline spending for the relevant control populations: non-vulnerable, low income, and high risk. We fit a logistic model to estimate treatment effects for the preventive measures. In these models we focus on the role of the deductible only, rather than look at the five separate treatment categories, because these analyses are restricted to certain eligible populations and sample sizes in the separate treatment categories are too small to produce precise estimates. The treatment effects for the preventive procedures are shown in the tables as the difference between the treatment and control group in the change in probability of receiving the test, and are evaluated for a person with characteristics evaluated at the overall mean for the population eligible for the procedure. In the tables that follow, statistically significant treatment effects are indicated in bold. Statistically significant differences between the vulnerable and non-vulnerable populations are indicated with the symbols * or † indicating significance at $p < 0.05$ or $p < 0.10$ respectively. Statistically significant differences between CDHP plans with an HRA account and those with an HSA account are indicated with the symbol ‡ for significance at $p < 0.05$.

The complete set of parameter estimates is given in the Appendix.

⁴ Our sample is also clustered by employer, but there is large variation within employer in employee characteristics and in health care utilization and so we have not incorporated this clustering in our estimation.

⁵ In preliminary analysis, we tested a range of specifications using transformations of the raw dollar scale, including natural logs, and none of the other models outperformed the model we use.

RESULTS

Annual Health Care Spending. Total spending is reduced in high deductible health plans for both vulnerable and non-vulnerable families (Table 3). High deductible plans paired with HSAs have significantly lower levels of total spending than other high deductible plans for the general population—almost 30 percent lower spending for families with a high deductible and an HSA compared to about 13 percent lower spending for similar families in other high deductible plans. There is also a statistically significant reduction in total health care spending for those with a moderate deductible and no health account, but the

Table 3. Effect of Benefit Design on Total Health Care Expenditures: Difference In Change in Average Monthly Family Spending From Baseline For Treatment Groups in Comparison to Control Group

	Treatment Group Benefit Designs				
	Moderate Deductible	Moderate Deductible	High Deductible	High Deductible	High Deductible
	No Account	HRA Account	No Account	HRA Account	HSA Account
<i>Non vulnerable population</i>					
Treatment effect (\$ per family per month)	-24.60 (7.67)	0.21 (13.81)	-78.19 (27.65)	-73.43 (12.87)	-164.59 ‡ (19.46)
Semi-Elasticity (%)	-4.3%	0.0%	-13.7%	-12.9%	-28.8%
<i>Low income Population</i>					
Treatment effect	-25.26 (13.89)	-40.36 (31.86)	-77.47 (38.36)	-67.60 (23.62)	-131.13 (41.99)
Semi-elasticity	-4.4%	-7.0%	-13.5%	-11.8%	-22.8%
<i>High Risk Population</i>					
Treatment effect	-26.27 (25.31)	-27.00 (35.83)	-90.48 (79.97)	-156.28 (64.91)	-147.69 (59.15)
Semi-elasticity	-2.5%	-2.6%	-8.8%	-15.1%	-14.3%

* Significantly different from effect for non-vulnerable population p<.05.

† Significantly different from effect for non-vulnerable population p<.10.

‡ Significant difference between the high deductible with an HRA vs. HSA at p< .05.

Table Notes: Tests above compare non-vulnerable and vulnerable families. Standard errors in parentheses indicate significance of treatment effect within each population group and these estimates are in **bold** when significant at p < .05. Treatment effect is the difference between the treated population and the control population in the change in spending. The semi-elasticity is the ratio of this change to the baseline level of spending for the relevant control sample: \$571 per family per month for non-vulnerable families; \$575 for low income, and \$1032 for high risk.

reductions are small—about 4 percent. Thus, both the size of the deductible and the type of personal account affect use.

The results are similar for the different components of annual spending: inpatient, outpatient (including emergency room), and prescription drug (Table 4). High deductibles have significant effects on all service categories for non-vulnerable families. High deductible HSA plans showed significantly greater reductions for outpatient services and prescription drugs than high deductible HRAs, but reductions in inpatient hospital spending for the HSA families were similar to those for the HRA families. Moderate deductibles with no account have significant, but small, effects on spending categories for outpatient care and prescription drugs. All of these tests remain statistically significant when we adjust the single comparison tests shown in the table by the Bonferroni correction to account for the multiple outcomes that we examine. Moderate deductibles with HRA accounts have significant but small effects only on outpatient spending although this result loses statistical significance after adjustment for multiple comparisons.

There are no statistically significant differences between non-vulnerable families and low-income or high-risk families in terms of dollar reductions in total spending that result from benefit designs (Table 3) and few differences in the components of spending (Table 4). However, since high-risk families have higher levels of spending, the proportional reductions in total annual spending are generally smaller for those at high risk. Spending reductions for outpatient care and prescription drugs by low-income families in high deductible plans with HSAs are smaller than reductions for non-vulnerable families; however, if we adjust these tests for multiple comparisons, these differences do not remain statistically significant. For families at high risk, the differences are all in prescription drug spending where there are larger effects in three of the five benefit designs as compared to effects for non-vulnerable families. Two of these contrasts remain statistically significant at $p = 0.10$ after adjusting for multiple comparisons.

High deductible plans with HRAs do not differ from high deductible plans with HSAs in their effects on total spending for high-risk families. However, for both outpatient and prescription drug components of spending, we do see significant differences for high risk families in the effects of high deductibles paired with HSAs as compared with other high deductible plans. It is also for these services that we find a difference in the effect of high deductibles paired

Table 4. Effect of Benefit Design on Difference in Change in Components of Average Monthly Family Health Care Spending From Baseline For Treatment Groups in Comparison to Control Group

	Treatment Group Benefit Designs				
	Moderate Deduct.	Moderate Deduct.	High Deduct.	High Deduct.	High Deduct.
	No Account	HRA Account	No Account	HRA Account	HSA Account
Inpatient spending					
<i>Non vulnerable population</i>					
Treatment effect (\$ per family per month)	-8.95 (5.74)	12.11 (10.32)	-43.11 (14.53)	-29.36 (9.85)	-34.26 (13.12)
Semi-Elasticity (%)	-9.0%	12.1%	-43.1%	-29.4%	-34.3%
<i>Low income Population</i>					
Treatment effect	-3.02 (10.45)	-7.80 (25.32)	-32.70 (27.60)	-12.67 (18.80)	-48.29 (34.36)
Semi-elasticity	-2.96%	-7.64%	-32.06%	-12.43%	-47.35%
<i>High Risk Population</i>					
Treatment effect	-6.58 (20.19)	-14.89 (26.28)	-47.57 (54.44)	-108.49 (60.58)	-33.21 (49.17)
Semi-elasticity	-2.36%	-5.34%	-17.05%	-38.89%	-11.90%
Outpatient spending					
<i>Non vulnerable population</i>					
Treatment effect (\$ per family per month)	-12.90 (4.08)	-15.63 (7.00)	-27.52 (21.76)	-31.51 (6.93)	-99.77 ‡ (12.97)
Semi-Elasticity (%)	-6.9%	-8.3%	-14.6%	-16.8%	-53.1%
<i>Low income Population</i>					
Treatment effect	-19.00 (7.20)	-31.85 (14.53)	-27.63 (21.54)	-39.69 (11.10)	-60.55 † (19.48)
Semi-elasticity	-9.9%	-16.7%	-14.5%	-20.8%	-31.7%
<i>High Risk Population</i>					
Treatment effect	-9.79 (11.79)	-9.98 (18.44)	-18.79 (45.31)	-25.41 (20.14)	-83.22 ‡ (24.23)
Semi-elasticity	-2.4%	-2.4%	-4.6%	-6.2%	-20.2%
Prescription drug spending					
<i>Non vulnerable population</i>					
Treatment effect (\$ per family per month)	-2.74 (1.09)	3.72 (2.09)	-7.56 (2.39)	-12.56 (1.51)	-30.55 ‡ (1.79)
Semi-Elasticity (%)	-2.0%	2.8%	-5.6%	-9.3%	-22.6%
<i>Low income Population</i>					
Treatment effect	-3.24 (2.21)	-0.72 (2.94)	-17.15* (3.86)	-15.23 (2.16)	-22.29 * (3.90)
Semi-elasticity	-2.4%	-4.1%	-18.6%	-16.2%	-21.4%
<i>High Risk Population</i>					
Treatment effect	-9.91* (3.04)	-2.12 (4.14)	-24.13† (9.01)	-22.38* (4.48)	-31.27 ‡ (5.14)
Semi-elasticity	-5.1%	-1.1%	-12.4%	-11.5%	-16.1%

* Significantly different from effect for non-vulnerable population p<.05.

† Significantly different from effect for non-vulnerable population p<.10.

‡ Significant difference between the high deductible with an HRA vs. HSA at p< .05.

Table Notes: Treatment effect is the difference between the treated population and the control population in the change in spending. Significant treatment effects within each population are in **bold** when significant at p <.05.

with HSAs and other high deductible plans for the non-vulnerable population. In general, the size of the deductible matters for all populations and HSAs are associated with greater reductions in spending for all populations.

Receipt of Recommended Care. Families in high deductible plans reduce their receipt of recommended cancer screening procedures relative to control families, even though the deductible is waived for preventive care in most of the high deductible plans (Table 5). For the non-vulnerable population, the probability of obtaining a recommended procedure in a year is about 3 to 5 percentage points lower among those in a high deductible plan relative to controls —reductions of about 7-10 percent in the rate of receipt depending on the procedure. In general, however, the moderate deductible does not appear to deter receipt of these procedures.

Table 5. Effect of Benefit Design on Receipt of Recommended Procedures: Difference In Change in Probability of Receipt from Baseline for Treatment Groups in Comparison to Control Group

	Treatment Group Benefit Designs and Populations					
	Moderate Deductible			High Deductible		
	<i>Non-vulnerable</i>	<i>Low Income</i>	<i>High Risk</i>	<i>Non-vulnerable</i>	<i>Low Income</i>	<i>High Risk</i>
Cervical Cancer Screening						
Treatment Effect	-0.8% (0.35)	-1.5% (0.56)	0.7% (0.62) *	-4.8% (0.43)	-5.8% (0.82)	-3.2% (0.90) †
Colorectal Cancer Screening						
Treatment Effect	-0.9% (0.59)	-1.3% (0.84)	1.1% (0.74) *	-2.9% (0.80)	-4.2% (1.44)	-0.8% (1.09) †
Mammography						
Treatment Effect	0.5% (0.46)	-0.9% (0.72)	1.0% (0.64)	-3.2% (0.57)	-3.2% (1.09)	-0.3% (0.99) *

* Significantly different from effect for non-vulnerable population p<.05.

† Significantly different from effect for non-vulnerable population p<.10

Table Notes: Tests above compare non-vulnerable and vulnerable families. Standard errors in parentheses indicate significance of treatment effect within each population group and these estimates are in **bold** when significant at p < .05.

As with spending, there are few significant differences between low income and non-vulnerable families regarding the effect of plan design on receipt of the cancer screening. However, there are significant differences for those at high risk. For them, a high deductible is not associated with reductions in receipt of 2 of the 3 recommended procedures and the reduction for the 3rd is significantly less than for the non-vulnerable population, though this latter is not significant when we adjust for multiple comparisons. Those at high risk in the moderate deductible plans are in fact significantly more likely to receive 2 of the 3 treatments than the general population in these plans, though those at high risk do not significantly increase their use of these procedures relative to traditional plans.

Focusing on one high-risk group, those with diabetes, the difference in difference estimate suggests that diabetic patients have lower rates of receipt of recommended tests when enrolled in a high deductible plan than the controls in traditional plans; the differences are statistically significant for two of the three procedures (Table 6). For the diabetic population, we estimate that the probability of receiving the recommended tests is 2 to 5 percentage points lower when enrolled in a high deductible plan relative to a traditional plan; this translates into a reduction of 4-7 percent in the rate of receiving the procedures. Moderate

Table 6. Effect of Benefit Design on Receipt of Recommended Procedures for Diabetes Patients: Difference in Change in Probability of Receipt from Baseline for Treatment Groups in Comparison to Control Group

	Treatment Group Benefit Designs and Populations			
	Moderate Deductible		High Deductible	
	<i>Not low income</i>	<i>Low Income</i>	<i>Not low income</i>	<i>Low Income</i>
HbA1c				
Treatment Effect	0.4%	-1.3%	-3.9%	-2.9%
	(0.92)	(1.33)	(1.50)	(2.91)
Lipid Profile				
Treatment Effect	-0.5%	1.4%	-4.5%	-3.2%
	(1.06)	(1.52)	(1.66)	(3.09)
Microalbumin				
Treatment Effect	-0.3%	1.8%	-2.3%	-4.4%
	(1.22)	(1.75)	(1.81)	(3.41)

* Significantly different from effect for non-vulnerable population p<.05.

† Significantly different from effect for non-vulnerable population p<.10

Table Notes: Tests above compare non-vulnerable and vulnerable families. Standard errors in parentheses indicate significance of treatment effect within each population group and these estimates are in **bold** when significant at p < .05.

deductibles again do not deter use. There are no significant differences between low income persons with diabetes and other diabetics in the effect of high deductibles on the receipt of these tests. However, because of small samples we can not reject the hypothesis of no effect of high deductible on receipt of these tests for those with low income.

Sensitivity Analysis. If people who elect to enroll in HDHPs “crowd-in” health care services in the year prior to the change in their insurance in anticipation of the higher price of care in the next year, this would underestimate their service use in the first year of the HDHP and overestimate their service use in the baseline year. Although the literature suggests that people do not behave in this way (Newhouse, 1993; Kilbreith et al, 1998; Long et al, 1998), to test for the possibility, we estimated total expenditure models using only services received in the 2nd and 3rd quarter of the baseline and treatment year. Because the opportunity for a demand surge prior to the change in insurance is somewhat limited by timing of information on health plan offerings for the upcoming year, insurance restrictions on the frequency of many procedures, and uncertainty about future health needs, we assume that any crowding in of services would occur near the time of the insurance change and would include services that would otherwise be obtained early at the start of the new plan year. Our conclusions about the effects of benefit design overall and for vulnerable populations on total annual spending were unchanged when models were fit to the restricted dataset (results reported in Appendix).

DISCUSSION

If health reform leads to an expansion in CDHPs as seems likely, will this leave the low-income and chronically-ill populations with inadequate access to care? In general, our results suggest not. Although health care spending is lower for those in high deductible plans, the evidence suggests that non-vulnerable families, low-income families, and high-risk families are equally affected. However, equal effects with respect to health care spending may have different consequences for these populations. For example, high cost sharing places a greater economic burden on those with low income and high health care spending, and similar effects of cost sharing on utilization may produce greater health consequences for those with high health expenditures. These potential impacts are outside the scope of this research. Moreover, most of the employees in the CDHP plans that we studied had a choice of a CDHP or a traditional plan, only 4 employers in our study fully replaced their traditional offerings during the study period. If low-income and high-risk patients who currently opt for CDHPs behave differently

than those who opt for traditional plans, different conclusions might be reached if more and more firms offer only CDHPs.

Our conclusion that benefit design has a similar effect on low- and high-risk patients is consistent with results from the RAND Health Insurance Experiment, but at odds with a recent case study of enrollees in a CDHP at one employer (Feldman and Parente, 2010). They concluded that high risk CDHP enrollees increased their use of services relative to those in traditional plans because, in their case study, the former faced no cost-sharing at the margin. This was the result of a particular feature of the plan studied—there being no cost-sharing after the deductible was met—combined with enrollees being likely to exceed their deductible. In contrast to the benefit design structure in the employer they studied, almost all of those enrolled in the large employer CDHPs studied here had significant cost-sharing in the form of coinsurance above the deductible. This would help constrain use. Our results for low income populations vary from those found in some other studies and may be affected by our use of a geocoded income measure. Our findings are most properly interpreted as differences between residents of lower and higher income neighborhoods, rather than strictly differences between low and high income families. As noted earlier, others have concluded that geocoded income measures produce upwardly biased estimates of the pure micro-variable effect in health related studies where community effects are also likely to matter, so that our conclusion is not likely to be altered if we had access to measures of family income. In addition, unique characteristics of the CDHPs studied in case studies discussed above may explain differences in their results for low income families.

Our findings suggest that specific higher deductible plans designs are more effective than others in achieving the goal of cost control. We found that high deductible plans coupled with HSAs reduce spending by a greater amount than other high deductible plans with HRAs or no account at all, and by a greater amount than moderate deductible plans with or without an HRA. The greater spending reduction in HSA plans is consistent with the stronger incentive to save in HSAs. HSA account balances are owned by the employee, can accumulate from year to year, can be withdrawn for non-medical use (subject to penalty), and are portable when the employee leaves to accept a job with another employer. HRA account balances are owned by the employers and are not portable when the employee leaves for another job. Hence, employees not confident of staying for the long term are faced with a “use it or lose it” incentive, encouraging them to spend down the accounts for current health care.

One goal of health reform is to promote use of preventive services by eliminating out-of-pocket costs for this care. Our findings suggest that simply eliminating cost-sharing for preventive services may not increase use of these services, at least in the short-run. Although deductibles are waived for preventive

care in the CDHP plans we studied, high deductibles led to small reductions in receipt of recommended preventive services in low-income and high-risk families as well as non-vulnerable families. Even with the deductible waived, high deductibles may reduce preventive care if the deductible keeps people from seeking care for health problems that would have prompted a referral for some preventive or screening procedure. On the other hand, our analysis examined people in the first year of their enrollment in CDHPs, and they may not yet be familiar with the details of coverage. One encouraging finding on this front is that the deductible was less of a deterrent to receipt of preventive care for high-risk patients, who might be more engaged with medical providers and more familiar with the terms of their insurance. In general, our findings suggest that it will take more than first dollar coverage for preventive services to ensure that people actually obtain these services.

If benefit design is to help in controlling costs, it will need to target any unnecessary, low value spending by high-risk populations that account for most of spending and much of the growth in spending. We find that CDHPs reduce the spending by those with chronic conditions that account for a large share of health care costs and health care cost growth, although the proportional reduction in costs is not as large as for other populations. High deductible plans also led to reduced spending on high value care for those at high risk. Of particular concern are findings that those at high risk in CDHPs received significantly fewer recommended cancer screening procedure, and diabetic patients in high deductible plans received fewer recommended procedures for diabetics. Another potential concern is the finding that those with chronic conditions in CDHPs, most of whom require drug maintenance, reduced spending on prescription drugs by more than other populations in CDHPs. This highlights the need for additional research to explore whether more aggressive case management, educational approaches, or other programs would help ensure that patients eliminate unnecessary care and continue with appropriate treatment under CDHPs.

Study Limitations. There are several limitations of our study. First, we focus only on the first year experience in a CDHP. Responses may differ once families learn more about the benefits of their new plans. In addition, policy makers are concerned about whether the cost savings are a one-time savings or whether CDHPs will alter the trend in cost growth.

A second limitation is the amount of information we examined about what kind of care is reduced. The RAND HIE found that cost sharing reduced both necessary and unnecessary care. Our results suggest that some appropriate services, namely preventive services, are reduced in CDHPs. Further research is needed into how CDHPs produce cost savings and whether some of these savings may compromise access to appropriate care.

Selection remains the main threat to the validity of our conclusions, as it is with all observational studies of CDHPs. There are two sources of selection. First, employers choose to offer or not offer CDHPs. This decision regarding what types of health plans to offer might be correlated with unobserved trends in health care costs and thus bias our results. For example, our results would underestimate the effects of CDHPs on health care costs if employers offered CDHPs in response to a trend of rapidly rising health care costs. The second source of selection is the employee decision to take-up CDHPs once they are offered. For example, our results might overestimate the effects of CDHPs on health care costs if employees who expect lower health care cost growth choose to enroll in CDHP plans.

Existing studies attempt to control for these potential selection biases at the employer and employee levels. Some control for selection at the employee level by focusing on "full replacement" firms where all employees who want employer provided insurance coverage are forced to enroll in CDHP plans. The lack of plan choice for employees certainly mitigates bias due to employee selection but might increase bias due to selection at the employer level as full replacement employers might have very different cost growth trends compared to other employers. Other studies focus on the experience of a single employer where some but not all employees chose to enroll in CDHPs. These studies estimate the effects of CDHPs by comparing health care cost growth for employees who chose to enroll in CDHPs (treatment group) to growth in health care costs for employees who chose not to enroll in CDHPs (control group). This strategy mitigates concerns about selection at the employer level as they focus on a single employer but compound concerns about selection at the employee level as employees who chose to enroll in CDHPs might have different cost trajectories compared to employees who did not chose CDHPs. Finally, both of the above strategies typically focus on the experience of a single employer that may not generalize to other contexts.

Our study design attempts to account for these concerns in a variety of ways. First, we use data from a large number of employers, including those that offered CDHPs and others that only offered traditional plans. This allows us to compare cost growth for employees who enrolled in CDHPs to cost growth for employees in traditional plans who were not offered CDHPs by their employers. In other words, we do not use employees who were offered and did not enroll in CDHPs as a control group as this group is likely to have different cost growth trajectory. Second, we include a wide variety of covariates in our model. Third, we have baseline and post period observations on all families, so that each family serves as its own control for the effect of unmeasured factors that affect choice of health plan and health care use. Finally, we used geography, industry, and firm

size in selecting employers for our study in an effort to control for selection at the employer level. Nonetheless, selection bias remains a potential limitation of our study, and further research exploring the effects of CHDP benefit designs on low income and high risk populations is needed to confirm our findings.

In sum, our findings suggest that CDHPs reduce spending without unduly restricting access for lower income and chronically ill populations. However, in all groups, there is evidence of a small reduction in receipt of high value preventive procedures. Further research is needed to address whether these findings also apply after the first year of experience in a CDHP. This additional research should evaluate whether the reductions in health care spending for vulnerable populations have greater health or financial consequences for them than for others.

REFERENCES

- American Academy of Actuaries Consumer-Driven Health Plans Work Group: American Academy of Actuaries Emerging Data on Consumer Driven Health Plans, May, 2009.
- Ash, A. S., Ellis, R. P., Pope, G. C., et al. (2000). Using diagnoses to describe populations and predict costs, *Health Care Financing Review*, 21(3); 7-27.
- Berk, M. and Monheit, A. (2001). The Concentration Of Health Care Expenditures, Revisited. Managed care has had little impact on how resources are spent in treating high-cost illnesses. *Health Affairs*, 20(2): 9-18.
- Buntin, M. B., Damberg, C., Haviland, A., Kapur, K., et al. (2006). Consumer-directed health care: early evidence about effects on cost and quality. *Health Affairs*, 25(6): w516-530 (web exclusive).
- Buntin, M. B., Haviland, A., McDevitt, R. and Sood, N. (2010). Cost Savings in the New Generation of High-Deductible Health Plans: A Multi-Employer Multi-Insurer Study. Working paper.
- Cohen, J. and Krauss, N. (1997). Spending and Service Use Among People With the Fifteen Most Costly Medical Conditions. *Health Affairs*, 22(2): 129-138.

- Cohen, R., Martinez, M. and Ward, B. (2009). Centers for Disease Control and Prevention, Health Insurance Coverage: Early Release of Estimates from the National Health Interview Survey 2009.
<http://www.cdc.gov/nchs/data/nhis/earlyrelease/insur201006.htm>.
- Craver, M.L. (Dec. 27, 2009). New Cachet for Health Reimbursement Accounts: Both employers and retirees like the flexibility that HRAs provide. *The Kiplinger Letter*.
- Davis, K., Doty, M. and Ho, A. (2005). How High Is Too High? Implications of High-Deductible Health Plans. *The Commonwealth Fund*, No.816.
- Ellis, R. P. and Ash, A. S. (1995). Refinements to Diagnostic Cost Group (DCG) Model. *Inquiry*, 32(4): 418-29.
- Feldman, R. and Parente, S. (2010). Enrollee Incentives in Consumer Directed Health Plans: Spend Now or Save for Later, *Forum for Health Economics and Policy*, 13(2).
- Fremont, A. M., Bierman, A, Wickstrom, S. L., Bird, C., et al. (2005). Use of Geocoding in Managed Care Settings to Identify Quality Disparities. *Health Affairs*, 24(2): 516-526.
- Geronimus, A. T., Bound, J. and Neidert, L. J. (1996). On the Validity of Using Census Geocode Characteristics to Proxy Individual Socioeconomic Characteristics. *Journal of the American Statistical Association*, 91(434): 529-537.
- Greene, J., Hibbard, J. and Murray, J. (2008). The Impact of Consumer-Directed Health Plans on Prescription Drug Use. *Health Affairs*, 27(4): 111-1119.
- Hibbard, J., Greene, J. and Tusler, M. (2008). Does Enrollment in a CDHP Stimulate Cost-Effective Utilization. *Medical Care Research and Review*, 65(4): 437-449.
- IRS (2009). Publication 969, Health Savings Accounts and Other Tax-Favored Health Plans. Publication 969. November 25, 2009.
<http://www.irs.gov/pub/irs-pdf/p969.pdf>.

- Kilbreith, E. H., Coburn, A. F., McGuire, C., et al. (1998). State-Sponsored Programs for the Uninsured: Is There Adverse Selection? *Inquiry*, 35(3): 250-265.
- Krieger, N., Williams, D. and Moss, N. (1997). Measuring Social Class in Us Public Health Research: Concepts, Methodologies, and Guidelines. *Annual Review of Public Health*, 18: 341-378.
- Lee, T. and Zapert, K. (2005). Do High Deductible Health Plans Threaten Quality of Care? *New England Journal of Medicine*, 353(12): 1202-1204, Perspective.
- Lo Sasso, A., Rice, T., Gabel, J. and Whitmore, H. (2004). Tales from the New Frontier: Pioneers' Experiences with Consumer-Driven Health Care. *Health Services Research*, 39(4p2): 1071-1090.
- Long, SH., Marquis, M. S., and Rodgers, J. (1998). Do people shift their use of health services over time to take advantage of insurance? *Journal of Health Economics*, 17(1): 105-115.
- McDevitt, RD and Savan, J. (2011 in press), Prospects for Account-Based Health Plans under the Patient Protection and Affordable Care Act. *Benefits Quarterly*. 2011 First Quarter. 27(1):21-25.
- NCQA: HEDIS 2008. Technical Specifications.
<http://www.ncqa.org/tabid/536/Default.aspx> (Accessed October 21, 2009).
- Newhouse, J. and the Insurance Experiment Group. (1993). Free For All? Lessons from the RAND Health Insurance Experiment. *Harvard University Press*, Cambridge.
- Parente, S., Feldman, R. and Christianson, J. (2004). Evaluation of the Effect of a Consumer-Driven Health Plan on Medical Care Expenditures and Utilization. *Health Services Research*, 39(4-2): 1189-1210.
- Pfeiffer, D. (2010). Incorporating the Best Ideas from Both Parties. The White House Blog, March 3, 2010.
<http://www.whitehouse.gov/blog/2010/03/03/incorporating-best-ideas-both-parties>

- Reed, M., Fung, V., Price, M., Brand, R., et al. (2009). High-Deductible Health Insurance Plans: Efforts To Sharpen A Blunt Instrument. *Health Affairs*, 28(4): 1145-1154.
- Rowe, J., Stevenson, T. B., Downey, R. and Newhouse, J. (2008). Effect of Consumer-Directed Health Plans on the Use of Preventive and Chronic Illness Services. *Health Affairs*, 27(1): 113-120.
- Solomon, J. (2007). Cost-Sharing and Premiums in Medicaid: What Rules Apply? Center on Budget and Policy Priorities.
<http://www.cbpp.org/cms/index.cfm?fa=view&id=1125> .
- Stanton, M. (2006). The High Concentration of U.S. Health Care Expenditures. *Research in Action*, 19: 06-0060.
- Thorpe, K, Florence, C. and Joski, P. (2004). Which Medical Conditions Account for the Rise in Health Care Spending? *Health Affairs*, w4: 437-445 (web exclusive).
- Wharam, J., Landon, B., Galbraith, A., Kleinman, K., et al. (2007). Emergency Department Use and Subsequent Hospitalizations Among Members of a High-Deductible Health Plan. *Journal of the American Medical Association*, 297(10): 1093-1102.