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Consumer-Directed Health Plans: New Evidence on Spending and Utilization

This study examined 3-year spending and utilization trends associated with enrollment in a consumer-directed health plan (CDHP) offered by a large employer alongside a preferred provider organization (PPO) and a point-of-service (POS) plan. The CDHP cohort spent considerably more money on hospital care than the POS cohort. Results found evidence of pent-up demand in the CDHP, but not enough to explain the spending trend. Lower prescription drug spending – where the CDHP modestly controlled allowable costs – was associated with less hospital and emergency room use in following periods. Findings suggest the CDHP had too little out-of-pocket cost-sharing to control medical spending.

Consumer-directed health plans (CDHPs) have moved beyond the concept stage and are now available to employees of many large companies. Mainstream insurers such as Aetna, UnitedHealth Group, and Wellpoint have introduced CDHPs. This research project presents important information on the impact of CDHPs on medical care use and expenditures, issues that are likely to merit attention as CDHPs become more commonly available as an employee health benefit option. The study builds on our earlier work (Parente, Feldman, and Christianson 2004) that examined medical care use and expenditures associated with consumers who chose a CDHP in 2001 and 2002 from among the options offered by a large employer that previously offered a point-of-service (POS) plan and a preferred provider organization (PPO).

We extend the earlier study by including data from 2003 on the original cohort that selected the CDHP in 2001, thus providing three years of data on expenditures and use for these enrollees. We also examine two ''short cohorts'' of enrollees who worked for the employer in 2001 or 2002 and joined the CDHP in 2002 or 2003. The use of multiple cohorts lets us test whether the results observed in the original study were due to ''pent-up demand'' among the early CDHP enrollees.

Significance and Impact

Consumer-directed health plans differ from traditional insurance and managed care products in philosophy and design. Philosophically, they seek to involve the consumer more directly in health care decision making.

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Typically in these products, a portion of the employer's tax-deductible contribution to health benefits is put into a "personal care account" (PCA), from which the employee purchases services. Some form of major medical coverage is also a key part of the benefits design. If an employee spends all of the dollars in the personal care accounts in a given year, the employee would spend his or her own money until meeting the deductible requirement in the major medical coverage. Expenditures in excess of the deductible are covered by the major medical plan. The benefit design can be tailored to cover all or part of these "excess" expenditures. In addition, many CDHPs cover 100% of preventive care expenses. To facilitate informed decision making, employees are provided with information (usually available on the Internet) about health care providers in the area, including physicians' education and experience, average charge per service, and quality ratings.

Advocates of CDHPs and skeptics have offered different opinions based on their analyses of plan designs, past experiences, and philosophical beliefs (Moskowitz 2001). In theory, by combining a high-deductible health insurance plan with a personal care account, a CDHP creates incentives for enrollees to economize on their use of medical care. However, some experts have questioned the ability of deductibles to constrain medical spending (American Academy of Actuaries 2003). This criticism is based on the observation that the majority of medical expenses is incurred by enrollees who exceed the plan's out-of-pocket spending limit. All additional expenses are covered by insurance, and thus these enrollees have no incentive to control their medical care utilization. For example, only 7.7% of the U.S. population under age 65 with private health insurance (similar to the population in our study) spent more than $5,000 on medical care in 2000; yet, this group accounted for 56.8% of all medical spending among the reference population (AHRQ 2003). The average medical expenditure among this group was almost $13,000, well above the point in most insurance plans where all expenses are covered by the plan.

It is even possible that the CDHP personal care account could lead to an *increase* in medical care use, compared with a plan with only a deductible. For example, if an employer contributes 50% of the deductible each year to the PCA, employees who use only preventive services could bank two years of spending account dollars to reach first-dollar coverage by the third year. In this case, employees who never exceed their annual PCA allocations from year three forward will have first-dollar coverage indefinitely, and therefore will not have a financial incentive to restrain their use of medical care, even for trivial health issues. Whether consumers actually would increase their use of medical care under these circumstances is conjecture, as there is no empirical evidence that addresses the issue.

Previous Findings

In our earlier paper (Parente, Feldman, and Christianson 2004), we analyzed health insurance claims and personnel data from a large, self-insured employer that offered a CDHP to employees at its main corporate location in a large metropolitan area in 2001. The employer previously offered a POS plan and a PPO, and it kept these options when it offered the CDHP. Worldwide, the employer has 31,000 employees and almost $10 billion in annual revenues. The company is adding employees each year through internal growth and acquisitions of other firms.

In the 2004 study, we used a quasi-experimental pre/post design to assign employees to three cohorts: (1) those enrolled in the POS plan from 2000 to 2002; (2) those enrolled in the PPO from 2000 to 2002; and (3) those enrolled in the CDHP in 2001 and 2002, after previously enrolling in either the POS or PPO in 2000. Using this approach, we estimated a difference-in-differences regression model for expenditures and utilization to identify the impact of the CDHP. Several explanatory variables were used to control for differences in cohort demographics including, age, sex, illness burden, employee income, number of dependents, and flexible spending account contribution.

The measure of illness burden showed that the CDHP cohort initially had favorable selection, but expenditures increased until by

2002 they were greater than the POS cohort and only slightly less than the PPO cohort. CDHP hospital expenses increased at a particularly dramatic rate, from $1,370 in the prior year to $1,999 in 2001 and to $3,469 in 2002. Physician expenses also increased most rapidly in the CDHP. However, the CDHP appeared to be better able to control pharmacy expenses, which increased from $935 per contract in 2000 to $1,342 in 2002, compared with POS and PPO increases from $1,108 to $1,640 and from $1,008 to $1,789, respectively.

Only a handful of other studies is available for comparison to our previous research. In one, Mercer Human Resources Consulting (2005) found that CDHP plans are less expensive than PPOs. In a 2004 survey, Mercer found that the typical CDHP cost $5,233 per employee compared with $6,095 for the average PPO. However, this study did not control for differences in enrollee characteristics that might be related to health care costs, and it controlled for only one plan characteristic – the annual deductible. PPOs with deductibles of $1,000 or more cost less than the average CDHP.

Humana, Inc., experimented with a consumer-centric solution that featured total replacement of existing health plans with a ''suite'' of options that included two PPOs and one health maintenance organization (HMO) in addition to a consumer-directed plan. Early analysis of 10,000 beneficiaries in 5,000 contracts showed that the new offerings reduced cost trends from the mid-teen percentages for HMOs and PPOs offered in the same markets to 5% (Bertko 2004). Hospital inpatient admissions actually decreased over a 3-year period. However, these results included utilization in all products in the total replacement package, while only 600 beneficiaries were enrolled in the CDHP. Also, the CDHP personal care account could not be rolled over and it could be used only for covered services obtained within the Human network – both significant differences from many other CDHPs.

The next section of the paper describes the study setting and data used for the new analyses. This is followed by an explanation of the four research questions and the method used to answer each question. The results section follows, with a concluding discussion section.

Study Setting and Data

As noted earlier, the employer in our study offered a POS plan and a PPO, and kept these options when it offered the CDHP. Information on the health plans at the study employer is shown in Table 1. The CDHP plan design was unchanged from 2001 to 2003 and the PPO and POS designs were unchanged from 2000 to 2003.

The POS plan was built around the network of a staff-model HMO that has operated in the metropolitan area of the study employer for many years.[1] It had a $15 copayment for office visits to network physicians and $100 copayment for network hospital admissions, followed by 100% coverage, throughout the study period. Out-of-network services required $30 and $300 copayments, respectively followed by 70% coverage. Certain services (routine physical and eye examinations, immunizations, chiropractic care, and mental/chemical care) had no out-of-network coverage. The PPO had in-network coverage identical to the POS plan and out-of-network coverage at 70% after a $300 per person deductible (maximum of $600 per family). The POS and PPO plans had identical coverage for prescription drugs: $10 copayment for generic medications in the plan formulary; $20 for brand-name formulary medications; and $30 for nonformulary medications. In contrast to the limited provider network in the POS plan, the PPO used a large network of medical care providers in the area.

The CDHP had generous benefits, with employer contributions to the personal care account of $1,000 for a single-coverage contract, $1,500 for two-person coverage, and $2,000 for a family. These were followed by gaps of $500, $750, and $1,000, respectively, before reaching the deductible, and 100% coverage above the deductible. Employees could accumulate balances in their PCAs that exceeded the deductible, but the accounts were not portable if employees left the firm or switched to another plan. The

Table 1. Health plan designs at the study employer

Plan characteristic	CDHP	PPO and POS/in-network
Employer PCA contribution	$1,000 single $1,500 two-person $2,000 family	Not applicable
Deductible	$1,500 single $2,250 two-person $3,000 family	None
Coinsurance/Copay	None	$15 office visit co-pay $100 inpatient co-pay
Rx coverage	Same as other covered services	$10 generic $20 formulary brand $30 non-formulary brand
Preventive Care	100% covered	$100% covered
Stop-loss limit	$500 single $750 two-person $1,000 family	$1,000 per person (PPO) $2,000 per family (PPO) $1,500 per person (POS) $3,000 per family (POS)

Notes: PCA = personal care account; CDHP = consumer-directed health plan; PPO = preferred provider organization; POS = point-of-service plan.

CDHP used a large network of local medical care providers and paid a higher ''rental'' fee for the network compared with the PPO.

Data on the employees' health plan elections from 2000 through 2003 were used to identify three population cohorts.[2] The CDHP cohort consisted of employees who worked for the employer all four years and chose the CDHP in 2001, 2002, and 2003. The CDHP cohort's experience in 2000 provides insights on the extent of favorable (or adverse) selection. The 2001 CDHP experience represents the first year after enrolling in the new plan, while 2002 and 2003 experience provide a glimpse of longer-term medical care demand. The POS and PPO cohorts consisted of employees who chose those plans in all four years. Additionally, we identified employees who worked for the firm in the prior year and joined the CDHP in 2002 or 2003. These ''short cohorts'' required only one year of prior data and one year of membership in the CDHP. Comparison enrollees for the short cohorts stayed in the other health plans for matching two-year periods.

The final sample size for our long-cohort analysis was 2,702 contracts, of which 429 were enrolled in the CDHP from 2001 to 2003 after being in another plan in 2000, 1,248 were in the POS plan all four years, and 1,025 were in the PPO all four years. This sample includes only 28% of the employees who worked for the employer in the metropolitan area at some point between 2000 and 2003, primarily because the firm was hiring new employees during the study period.[3] Some of these new employees were included in the short cohorts constructed on the basis of two years' employment.

The employer's personnel data provided a unique resource for this analysis. We were able to abstract annual information on the employee/subscriber's number of dependents, after-tax income from the firm, and flexible spending account (FSA) contribution (coded as one for using the FSA and zero for not using it). This information is important because an employee can use an FSA to finance the gap between the personal care account and the deductible,where 100% coverage begins. FSA election information was not available in 2003, so we substituted the 2002 FSA election for 2003.

The three health plans provided claims data which were sufficiently consistent to be pooled for this analysis. The key variables constructed from the claims data included utilization and total provider reimbursement as well as specific components for physician, hospital, emergency room, and pharmacy. In addition, total expenditures were partitioned into expenses borne by the employee/patient and the employer. Employer contributions to the PCA were not considered to be expenses

until the money was spent on medical care; then they were classified as employer expenses. Employee expenses for the CDHP were primarily reimbursements for services after the PCA was exhausted and before the deductible was met; employee expenses for the POS and PPO plans were deductibles and copayments. A major source of employees' costs – contributions toward their health benefit premiums – were not included in this analysis since our focus was on cost and utilization associated with different health plan designs.

All variables were measured by cohort and year at the employee contract level. Thus, the expense and utilization variables could represent service use by a single employee or an employee with a spouse and four children. Ideally, we would like to have person-level data for all people covered by an employee's contract. However, there was no consistent unique patient ID or denominator information to permit that level of analysis. As a result, we used a unique encrypted employee ID as our unit of analysis and identified the number of dependents in a family contract to estimate the number of covered lives associated with an employee. We assumed the number of lives per employee for single and two-person contracts to be one and two, respectively.

Another limitation of the data is our inability to separate hospital expenses into inpatient and outpatient components. Thus, although we can calculate the number of admissions per contract, we cannot put a price tag on the resources used during an admission and are forced to measure "intensity" of inpatient resource use by dividing admissions into total hospital expenses.

Diagnosis codes from the claims data were used to assign case-mix variables to the contract based on the Johns Hopkins adjusted clinical groups (ACG) software.[4] In particular, we used the ambulatory diagnostic groups (ADGs) and developed resource intensity estimates for each ADG (Weiner et al. 1991). These adjusted ADGs were used to develop a prospective case-mix measure to control for differences in illness burden in 2000. We also constructed a contemporaneous "health shock" variable to account for random events that degrade health, including major acute illnesses, injury, and malignancy. This categorical variable was based on the occurrence of any ADG in categories 3, 4, 21, 22, or 32 at the contract level. The employee's sex and age were used to complement the case-mix variables in the statistical models of expenditures and utilization.

Research Questions and Methods

This paper asks four research questions; the first two questions seek to replicate our earlier results:

1. Were the unfavorable expenditure and use trends observed in the original CDHP cohort in 2001 and 2002 a result of "pent-up" demand for services?
2. Would the results from the earlier study be replicated in cohorts that joined the CDHP in 2002 or 2003?

The third and fourth questions deal specifically with the causes of high hospital expenditures observed in the original CDHP cohort:

3. Did CDHP enrollees spend more money per hospital admission?
4. Was the additional hospital spending in the CDHP cohort a result of inappropriate substitution away from cost-effective drug therapy?

With respect to the first research question, the CDHP in our study had a generous benefit design, with only a limited "gap" between the personal care account and the deductible, and 100% coverage beyond the deductible. In contrast, the PPO and POS plans required enrollee cost-sharing up to much higher levels of total spending. For example, a single POS enrollee who used only network providers might never hit the $1,500 annual stop-loss limit.

Although it may seem counter-intuitive, the relatively generous design of the CDHP in our study may not be atypical. In a recent analysis of several plan and employer surveys, Remler and Glied (2006) found that most "conventional" health plans have cost-shar-

ing comparable to and sometimes greater than health savings accounts, a new form of consumer-directed health plan.

Because they could obtain 100% coverage on the margin for expensive services, CDHP cohort members may have deferred medical care use in 2000, but in subsequent years may have expressed "pent-up" demand caused by the opportunity to purchase services at a low out-of-pocket price.[5] To test for possible long-term pent-up demand by CDHP enrollees, we extended the observation period from two to three years.

As noted earlier, we also analyzed two "short cohorts" who joined the CDHP in 2002 or 2003. The strongest evidence of pent-up demand would be to observe stable or falling utilization for the original CDHP cohort in 2003, but high utilization for the two short cohorts. This would indicate that each CDHP cohort experienced a phase of pent-up demand, followed by stabilization of use and expenditures. On the other hand, if the short cohorts did not experience high use, we would suspect that there was something unusual about the "early adopters" of CDHPs; and if use or expenditures in the first cohort did not stabilize in 2003, we could not rule out permanent "moral hazard," that is, an increase in demand caused by removal of cost-sharing in the CDHP.

There are some fairly straightforward solutions for pent-up demand and moral hazard, such as a minimum coinsurance rate, a higher deductible, or a limit on how much money can be banked in the PCA. However, many early-adopting employers, including the one in our study, offered CDHPs with 100% coverage of services obtained from network providers after meeting the deductible.

Two-Part Models

To test for pent-up demand and/or moral hazard, we estimated two-part models of medical care utilization and expenses (Manning et al. 1981). This approach is based on the fact that the distribution of utilization or expenses in populations is characterized by some people who use no services at all and a skewed distribution among users. First, we estimated probit equations for the probability of contract i in cohort j using any service (or any expense) during year t, specified as:

$$Y_{ijt}^{*} = \beta_0 + \sum_{j=1}^{2} \beta_{1j} C_{ij} + \sum_{t=1}^{3} \beta_{1j} C_{ij} + \sum_{j=1}^{2} \sum_{t=1}^{2} \beta_{jt} C_{ij} t + \beta_4 X_{it} + e_{ijt} \quad (1)$$

Cohorts are defined by two indicator variables, C_{ij}, for CDHP and PPO contract holders compared with the omitted POS cohort. Coefficients of the cohort variables identify the effects of permanent, unmeasured enrollee characteristics on use or expenditures. Time is defined by three indicator variables, t, for 2001, 2002, and 2003 compared with 2000. Coefficients of the time variables represent the effects of common trends in use and expenditures. X_{it} is a vector of person-specific and possibly time-dependent variables influencing use such as health status, age, sex, income, and the number of covered lives per contract. The interaction of cohort and time identifies the effect of CDHP and PPO enrollment over time on the probability of using any service or having any expenditure. Finally, e_{ijt} is a random error term distributed N(0,1). The observed dependent variable $Y_{ijt} = 1$ if $Y_{ijt}^{*} > 0$ and 0 otherwise.

Second, we estimated log-linear regression models for utilization and medical care expenditures, conditional on these being positive. Using expenditures as an example, the second equation of the model is:

$$Ln\,(\$_{ijt} \mid \$_{ijt} > 0) = \beta_0 + \sum_{j=1}^{2} \beta_{1j} C_{ij} + \sum_{t=1}^{3} \beta_{2t} t + \sum_{j=1}^{2} \sum_{t=1}^{3} \beta_{jt} C_{ij} t + \beta_4 X_{it} + e_{ijt} \quad (2)$$

The same explanatory variables appear in equation 2 as in equation 1. This analytic approach permits an investigation of CDHP effects on service use. It has less bias than other alternatives and is statistically indistinguishable on the basis of mean square error.

A possible explanation for our previous findings regarding hospital expenditures is that CDHP patients spent more money for each hospital admission than did patients from the other cohorts. Almost every CDHP enrollee with a hospital admission will reach 100% coverage where he or she is not sensitive to price differences among hospitals, or differences that result from use of more "intensive" hospital use. To investigate this possibility, which is addressed by our third research question, we selected the subsample of enrollees who used any inpatient hospital services over the four-year period from 2000 to 2003. We then posited equation 3:

$$\$ / ADM_{ijt} \mid ADM_{ijt} > 0 = \beta_0 + \sum_{j=1}^{2} \beta_{1j} C_{ij} + \sum_{t=1}^{3} \beta_{2t} t + \sum_{j=1}^{2} \sum_{t=1}^{3} \beta_{jt} C_{ij} t + \beta_4 X_{it} + \beta_5 IB_{ijt} + e_{ijt} \quad (3)$$

The dependent variable is average expense per admission. Explanatory variables include those used in the previous models, plus annual values (not just the baseline value) of illness burden, IB_{ijt}. Estimation of equation 3 answers this question: controlling for the illness burden associated with admissions in a given year, were those admissions more expensive in the CDHP?

To address the fourth question of possible substitution away from cost-effective drug therapy, we posited the following regression model:

$$Y_{ijt} = \beta_0 + \sum_{j=1}^{2} \beta_{1j} C_{ij} + \sum_{t=2}^{3} \beta_{2t} t + \sum_{j=1}^{2} \sum_{t=2}^{3} \beta_{jt} C_{ij} t + \beta_4 X_{it} + \beta_5 RX_{ijt-1} + \beta_6 Y_{ijt-1} + e_{ijt} \quad (4)$$

The dependent variable, Y_{ijt}, is hospital or emergency room use or expenditures (two-part models were used as appropriate), RX_{ijt-1} is lagged pharmaceutical use, Y_{ijt-1} is the lagged dependent variable, and the other explanatory variables are taken from equation 1. The idea behind equation 4 is that reduced prescription drug utilization may be associated, after a lag, with increased hospital or emergency room use or expenses. After controlling for baseline health status, current health shock, and the lagged dependent variable, we interpret the estimated effect of lagged pharmaceutical use as a causal effect. However, we discuss an alternative explanation after presenting the results of this analysis. The inclusion of lagged prescription drug data means that equation 4 is estimated with data for 2001, 2002, and 2003, with 2001 being the baseline (omitted) time indicator.

Results

Parente, Feldman, and Christianson (2004) presented baseline (calendar year 2000) demographic statistics for employees who worked for the firm from 2000 to 2002. The largest baseline difference was the contract holder's wage income, which was substantially higher for CDHP enrollees. This difference persists when the cohorts are extended to 2003. The average baseline income in the CDHP cohort is $93,409, compared with $52,162 in the POS and $69,555 in the PPO. Other demographic comparisons indicate that proportionately more CDHP contract holders are male (64% vs. 57% in the POS and 54% in the PPO), but average contract holder age in all cohorts is approximately equal (41 years old for the CDHP, 40 years old for the POS plan, and 42 years old for the PPO).

Another finding from Parente, Feldman, and Christianson (2004) was that CDHP enrollees had the lowest baseline illness burden. This finding also applies when the cohorts are extended to 2003, although the differences in illness burden are not as pronounced as those for income. Baseline illness burdens for the extended CDHP, POS, and PPO cohorts are 6.12, 6.51, and 6.98, respectively. The higher this number, the higher

Table 2. Impact of CDHP and PPO on spending compared with POS plan

Health plan cohorts	2000 mean	Model stage	2001 plan effects	2002 plan effects	2003 plan effects
CDHP cohort N=429					
Total expenditure	$4,037	Probit	−.00833	.0146	.0108
		GLM	4.1%	26.0%*	22.6%*
Employer expenditure	$3,627	Probit	−.000324	.000622	.000624
		GLM	11.2%	38.9%*	30.1%*
Employee expenditure	$410	Probit	−.434*	−0.459*	−.302*
		GLM	43.0%*	36.8%*	39.6%*
PPO cohort N=1,025					
Total expenditure	$4,661	Probit	−.00600	−.00636	−.0125
		GLM	8.3%	16.8%*	9.5%*
Employer expenditure	$4,172	Probit	−.000449	−.000563	−.000876
		GLM	11.2%	20.0%*	12.4%*
Employee expenditure	$490	Probit	−.00174	−.000113	−.00259
		GLM	−7.0%	−3.3%	−9.6%

* Significant at $p<.05$.
Note: Regressions control for annual trends, cohort, age, gender, illness burden, health shock, income, number of covered lives in contract, and use of healthcare flexible spending account

the extent of illness burden including both acute and chronic conditions. The differences between the CDHP versus PPO (t = 2.31) and POS versus PPO (t = 2.05) are statistically significant at p = .05, but the CDHP versus POS difference is not significant.

In this analysis, we also classified hospital admissions of each cohort into major diagnostic groups (MDGs). Childbirth (MDG 11), mental (MDG 05), and unspecified "other" admissions were the leading causes of hospital admissions in all cohorts, but the order differed among cohorts. Childbirth was first in the CDHP and PPO cohorts (24% and 18% of all admissions, respectively), while mental was first in the POS plan with 20% of all admissions. One significant difference was in admissions for circulatory problems (MDG 07: CDHP = 2%, POS = 6%, and PPO = 8%).

CDHP and PPO impacts on medical care utilization and expenditures are contrasted with the POS plan in Tables 2 through 7. Each table presents "plan times year" interactions for the CDHP and PPO relative to the POS plan, controlling for time-varying contract characteristics and cohort-specific fixed effects. The regressions also control for time trends (not reported here), which are positive, significant, and increasing in most regressions.[6] All tables are based on the two-part models, comprising a probit equation followed by a general linear model (GLM) for the natural logarithm of expense or use for contracts with positive expense or use. Probit results are reported as marginal effects, (i.e., the change in the probability of the dependent variable as the discrete cohort indicator changes from 0 to 1). GLM results are reported as percentage changes.

Table 2 analyzes total expenditure per contract, as well as the employer's and employee's expenditures. None of the plan effects was significant in the probit part of the models for total expenditure and employer expenditure, probably because 97% (10,440 of 10,808 contract-year observations) had some reimbursable medical expenditure and thus differences among plans likely were due to random unobserved events.[7] However, the CDHP cohort had a significantly lower probability of employee expenditure in all years. This indicates that some employees with positive total expenditures spent less than their personal care account balance since the personal care balance is considered to be an employer expenditure.

In the second part of the two-part model, the CDHP and PPO cohorts exhibited higher total expenditures over time compared with those individuals in the POS plan. Conditional on having some spending, the CDHP cohort was approximately 4.1% more expensive than the POS cohort in 2001, 26% more

Table 3. Impact of CDHP and PPO on physician, hospital and pharmacy spending compared with POS plan

Health plan cohorts	2000 mean	Model stage	2001 plan effects	2002 plan effects	2003 plan effects
CDHP cohort N=429					
Hospital expenditure	$1,332	Probit	−.0428	.0267	−.0196
		GLM	60.8%*	119.7%*	75.5%*
Physician expenditure	$1,891	Probit	−.00780	.0197	−.000575
		GLM	10.7%	20.2%*	25.1%*
Pharmacy expenditure	$814	Probit	−.00886	−.00617	.0201
		GLM	−14.7%	−5.1%	−3.9%
PPO cohort N=1,025					
Hospital expenditure	$1,669	Probit	.0421	.0411	−.0359
		GLM	23.8%	24.4%*	29.0%*
Physician expenditure	$1,958	Probit	−.00922	−.00463	−.0162
		GLM	5.9%	10.2%*	6.7%*
Pharmacy expenditure	$1,034	Probit	−.00283	−.00982	.00432
		GLM	8.3%	22.7%*	9.9%*

* Significant at $p<.05$.
Note: Regressions control for annual trends, cohort, age, gender, illness burden, health shock, income, number of covered lives in contract, and use of health care flexible spending account

expensive in 2002, and 22.6% more expensive in 2003. The PPO was 8.3% more expensive than the POS plan in 2001, 16.8% more expensive in 2002, and 9.5% more expensive in 2003. The 2002 and 2003 effects were statistically significant.

Also in the second part of the two-part model, CDHP employer and employee expenses were higher over time than those of people in the POS plan: the employer's expenses were 11.2% higher in 2001, 38.9% higher in 2002, and 30.1% higher in 2003; the employee's expenditures were higher by 43%, 36.8%, and 39.6% respectively. PPO employer expenses were 11.2% higher than the POS plan in 2001, 20% higher in 2002, and 12.4% higher in 2003, roughly matching the differences in total expenditures; the employee's expenditure in the PPO was not significantly different from the POS plan in any year.

A one-unit increase in the baseline ADG index was associated with a 12% increase in total conditional expenditure, while having a health shock was associated with an increase of 67%. The ADG effect, together with our descriptive finding that the average baseline illness burden of CDHP enrollees was .86 units lower than the PPO cohort, implies that the gain from favorable risk selection into the CDHP versus the PPO was about 10% of total expenditure ($.86 \times 12\% = 10.32\%$). However, the CDHP did not have significantly favorable risk selection versus the POS plan.

In Table 3, total expenditures faced by the employer and employee are decomposed into three categories: hospital (inpatient and outpatient combined), physician, and pharmacy expenditures. This breakdown provides a critical insight into expenditure differences among the three cohorts over time. We found no significant effect of plan enrollment on the probability of any physician expenditure. However, those who used doctors' care spent more money if they were enrolled in the CDHP, with statistically significant differences of 20.2% in 2002 and 25.1% in 2003 compared with the POS plan. In the second part of the two-part model, physician expenditures for PPO contracts also were higher by 10.2% in 2002 and 6.7% in 2003, compared with the POS plan.

Plan enrollment did not significantly affect the probability of hospital spending, compared with the POS plan. In contrast, all of the CDHP cohort effects on conditional hospital spending were positive and significant. Parente, Feldman, and Christianson (2004) found that hospital spending in the CDHP jumped between 2001 and 2002. With the addition of data from 2003, it appears

Table 4. Impact of CDHP and PPO on visits, hospital admissions, and Prescriptions compared with POS plan

Health plan cohorts	2000 mean	Model stage	2001 plan effects	2002 plan effects	2003 plan effects
CDHP cohort N=429					
Physician visits	5.84	Probit	−.134*	−.0846*	.0264
		GLM	−15.3%*	−17.9%*	17.3%*
Hospital admission rate	.11	Probit	.0364*	−.000152	.0320*
		GLM	8.8%	−.2%	6.2%
Prescriptions filled	17.19	Probit	−.0173	.00697	.0130
		GLM	.7%	−18.5%*	18.7%*
PPO cohort N=1,025					
Physician visits	5.95	Probit	−.0159	.00834	.00803
		GLM	.7%	4.1%	−6.2%
Hospital admission rate	.16	Probit	.00125	.00220	−.00270
		GLM	−8.5%	−4.3%	−8.2%
Prescriptions filled	21.98	Probit	−.0122	−.0137	−.0114
		GLM	−.9%	−24.9%*	−.7%

* Significant at $p<.05$.
Note: Regressions control for annual trends, cohort, age, gender, illness burden, health shock, income, number of covered lives in contract, and use of healthcare flexible spending account

that the CDHP effect has "leveled off" but is still much higher than the POS plan (75.5% higher in 2003 versus 119.7% in 2002). Hospital spending in the PPO was 24.4% higher than the POS plan in 2002 and 29% higher in 2003.

The probit regressions indicate no significant differences among plans in the probability of any pharmacy expenditure. However, among those who had some pharmacy expenditure, PPO enrollees had 22.7% higher expenditures per contract in 2002 and 9.9% higher expenditures in 2003, compared with those in the POS plan. Conditional pharmacy expenditure for CDHP enrollees was negative, but not significantly different from the POS comparison group.

The differences in prescription expenditure differences among plans do not appear to be related to generic substitution. CDHP enrollees tended to use a higher proportion of brand name drugs than did those in other cohorts, but CDHP enrollees also purchased more brand name drugs by mail order, which is generally less expensive than retail pharmacy purchase. For example, in 2003, CDHP use of mail order drugs was about 1.8 prescriptions per contract, compared with 1.1 and .1 prescriptions per contract in the POS and PPO plans. At baseline, the CDHP cohort used only .3 prescriptions per contract, so this is evidence of a rising trend in mail order use in the CDHP cohort.

Table 4 presents the impact of CDHP enrollment on physician visits, hospital admissions, and the number of prescriptions written per contract year. CDHP enrollees used fewer physician services than the POS cohort in 2001 and 2002, but their conditional utilization was positive in 2003, with an effect of 17.3%. Their hospital admission rate was higher in all years, with statistically significant differences in 2001 and 2003 in the probit equation. Among those with any use of prescription medicines, the CDHP cohort had fewer prescriptions filled in 2002 but more in 2003, compared with the POS cohort. The only significant PPO effect was 24.9% fewer prescriptions than the POS cohort in 2002, among those who had any prescription.

Table 5 presents the results of the analyses of the two short cohorts. Among the first short cohort (2001–2002), there were 187 CDHP contracts, 994 PPO contracts, and 982 POS contracts. In total, 3,902 of 4,324 contract-year observations used some covered medical service. CDHP enrollment was associated with a significant increase in the probability of any expenditure in 2002 (marginal effect = .143) because of increased probability of employer expenditure (marginal effect = .148). In the conditional expendi-

Table 5. Short (1 year) impact of CDHP and PPO on total expenditure compared with POS plan

Health plan cohorts	Short cohort #1 2001 mean	Short cohort #2 2002 mean	Model stage	Cohort #1 plan effects	Cohort #2 plan effects
CDHP cohort	$N=187$	$N=336$			
Total expenditure	$3,063	$6,014	Probit	.143*	.0700
			GLM	2.7%	−1.2%
Employer expenditure	$2,740	$5,314	Probit	.148*	.0751
			GLM	6.7%	1.3%
Employee expenditure	$323	$700	Probit	−.0265	−.0597*
			GLM	67.6%	9.1%
PPO cohort	$N=994$	$N=700$			
Total expenditure	$5,131	$6,308	Probit	.0483	.00482
			GLM	16.3%*	12.1%
Employer expenditure	$4,593	$5,651	Probit	.0383	.00883
			GLM	18.7%*	12.6%
Employee expenditure	$538	$657	Probit	.0162	−.0153
			GLM	8.3%	12.0%

* Significant at $p<.05$.
Note: Regressions control for annual trends, cohort, age, gender, illness burden, health shock, income, number of covered lives in contract, and use of healthcare flexible spending account

ture equation, the PPO effect was 16.3% larger than the POS plan effect, also because of higher employer expenditure.

In the second short cohort (2002–2003), there were 336 CDHP contracts, 700 PPO contracts, and 899 POS contracts, with 3,256 of 3,870 contract-year observations using some covered medical service. In this cohort the only significant effect was a reduction in the probability of any employee expenditure for CDHP contracts in 2003 (marginal effect $= -.0597$).

Table 6 presents the results of the analysis of expenditure per hospital admission among contracts in the long cohort that had at least one admission. CDHP enrollees spent less money per hospital admission in 2001 and 2003, but the differences were not significant. In 2002, the CDHP effect was positive. PPO enrollees had higher expenditures per admission in all years, with significant differences in 2002 and 2003.

Table 7 presents the results for the effects of lagged drug utilization on current expenditure and use of other services. These effects were assumed to be equal across the three plan cohorts. If reduced drug use led to inappropriate substitution of other services, we would expect to see a negative effect of lagged drug use on hospital emergency room visits, which is a ''marker'' of inappropriate medical care use. Instead, we found that

Table 6. Impact of CDHP and PPO on all-cost hospital expenditure per admission compared with POS plan

Health plan cohorts	2000 mean	Model stage	2001 plan effects	2002 plan effects	2003 plan effects
CDHP cohort $N=429$					
Hospital expenditure (all) per admission	$6,828	GLM	−12.7	70.4*	−25.3
PPO cohort $N=1025$					
Hospital expenditure (all) per admission	$6,747	GLM	22.0	53.4*	70.8*

* Significant at $p<.05$.
Note: Regressions control for annual trends, cohort, age, gender, contemporaneous illness burden, health shock, income, number of covered lives in contract, and use of healthcare flexible spending account

Table 7. Impact of prior-year pharmacy spending on hospital and ER spending and use

Dependent variable	2001 mean	Model stage	Lagged Rx effect
Hospital expenditure	$1,686	Probit	.00216*
Effect / Lagged Rx		GLM	.593%*
Admission rate	.22	Probit	.000247*
Effect / Lagged Rx		GLM	.115%*
Emergency room visits	.16	Probit	.0000495*
Effect / Lagged Rx		GLM	.0301%

* Significant at $p<.05$.
Note: Regressions control for annual trends, cohort, age, gender, illness burden, health shock, income, number of covered lives in contract, use of health care flexible spending account, and lagged dependent variable

lagged drug use was positively associated with the probability of an ER visit. In addition, each additional lagged prescription increased the probability of current hospital spending by .00216, and increases conditional hospital spending in the current year by .593. At the mean value of hospital spending in 2001, this represents $10 of added hospital spending in the current year. We also found positive effects of lagged prescription use on current hospital admission rates.

Discussion

This study investigates the effects associated with CDHP enrollment on the use of services and expenditures over a period of time that is long enough to disentangle temporary from permanent effects. There are five key results that relate to our study questions. First, and most important, the CDHP was not able to control medical expenditures over time in this large employer. Compared with the POS plan, the CDHP was 4.1% more expensive in 2001, 26% more expensive in 2002, and 22.6% more expensive in 2003. The PPO performed somewhat better, but still was more costly than the POS plan. This may seem rather surprising, given the small differences in both in- and out-of-network cost-sharing between the POS and PPO. However, the fact that the POS plan was built around the network of a staff-model HMO that still used rather strong management of care within the network is probably the reason for the POS plan having the lowest spending.

Second, there is some evidence of pent-up demand in the CDHP. Specifically, while total spending in the CDHP long cohort fell slightly from 2002 to 2003, the first CDHP short cohort displayed significantly higher probability of spending in 2002, compared with the POS plan. However, pent-up demand is not a sufficient explanation for higher medical care spending over time by the employer and CDHP enrollees. Therefore, our findings support the conclusion that there is a permanent problem of increased demand in the CDHP.

Third, this study, with an extended data window, begins to provide evidence that pinpointing the source of the increased demand – the CDHP population spent considerably more money on hospital care than the POS cohort. The difference was very large in 2002, and an additional year of data shows that it persisted in 2003, although at a lower level. This finding suggests that the deductible design did not discourage CDHP enrollees from consuming hospital resources. In this firm, the CDHP cohort faced an out-of-pocket expenditure gap between its personal care account and 100% insurance coverage of only $500 for single-coverage policies, $750 for two-person contracts, and $1,000 for family policies. Those with hospital admissions and many those using outpatient services exceeded the deductible threshold and could consume health care without any additional cost-sharing. Thus, the benefit design of the CDHP in this study provided a substantial incentive for medical care consumption. As we mentioned earlier, if moral hazard is found to be a problem by an employer, it can be tempered by changes in the personal care account, the deductible, or the coinsurance level once the deductible has been met.

Fourth, the analysis of expenditure per admission produces somewhat inconsistent results. CDHP enrollees spent more money per admission in 2002 compared with the POS plan, but the differences in 2001 and 2003 were not significant. A possible explanation is that the CDHP switched its network administrator in 2002 to one that had smaller discounts from hospital charges. The first administrator had become a competitor and was not willing to renew the contract in 2002. Further research is needed to explain the differences in hospital expenditures among the cohorts in our study. This requires disentangling inpatient and outpatient components of hospital expenses, which was not possible from the CDHP data at the time of the study.

Fifth, we did not find evidence that substitution away from prescription drug therapy results in higher hospital spending, admissions, or ER use. Instead, lagged prescription drug utilization was positively associated with hospital spending, inpatient admissions, and the probability of having at least one emergency room visit. These results – if causal – would have important implications for the debate concerning the effects of rising out-of-pocket drug prices on health outcomes. Rising drug prices will reduce drug use, but this may be associated with fewer costly hospitalizations in the next year, not more. However, an alternative explanation for our results is that the case-mix controls used in our study do not fully control for patient severity and that the positive association reflects this omitted variable bias.

This study has several limitations. It examines the experience of only one employer. The effects of a CDHP may depend not only on the design of the CDHP, but also on the other plans that the employer offers. While we ideally would like to have additional comparison firms with which to generalize our results, the designs of the non-CDHP health plans offered by this employer are relatively common; therefore, we expect their experience to be similar to other plans in similar metropolitan markets. The advantage of focusing on one employer was the construction of a quasi-experimental design that would not have worked easily with other employers and would have amounted to an employer-by-employer study unless the health plan and employer data were sufficiently comparable.

A second limitation is the relatively small sample size of this study. To control for prior health status while observing CDHP effects over time, we limited the main analyses to employees with four years of continuous employment with the firm. This reduced the CDHP cohort to 429 contracts. However, the total sample still comprised 2,702 contracts, representing 7,006 covered lives in 2000 and approximately 28,000 person-years of claims data over four years. Although some year-to-year variability in the results may have been due to the small sample size, when we examined total spending for all enrollees in each plan (the type of "streaming" data that a firm's human resources department would observe), we also saw increasing expenditures in the CDHP and the PPO compared with the POS plan.

Third, data limitations prevented us from analyzing use and expenditures at the person level, and from calculating a measure of hospital expense per admission that separates inpatient from outpatient spending.

From the employer's perspective, our findings indicate that the CDHP is not necessarily the least expensive plan design. It is important to note that the CDHP benefit design is strongly influenced by the employers themselves, and cross-employer comparisons would need to account for benefit components explicitly affecting health plan choice and subsequent utilization. The employer in this study could be characterized as providing more generous health benefits than most.

From a health policy perspective, it is important to note that health reimbursement accounts (HRAs) were, to some extent, created by Internal Revenue Service (IRS) tax guidance, which ruled that coverage and reimbursements of medical care expenses from the health reimbursement account were excludable from the employee's gross income (U.S. Treasury 2002). The IRS specified that: (1) the HRA must be funded solely by the employer, and (2) the plan may only provide benefits for substantiated medical expenses. However, it did not specify that the insurance plan which accompanied the HRA had to

have a high deductible. In contrast, the Medicare Prescription Drug, Improvement, and Modernization Act (MMA) of 2003, which provided tax-favored status for health savings accounts, required that they be paired with a high-deductible health plan (currently at least $1,050 per year for an individual or $2,100 for a family). While it might be argued that these minimum amounts are too low, they nevertheless imposed a quid pro quo on the tax break – it had to be accompanied by increased out-of-pocket cost sharing. Our findings suggest that it may have been a mistake not to place a similar restriction on tax-exempt HRAs.

In the longer run, plan designs such as the one observed in our study employer may not be viable, even with the tax subsidy for the HRA. In 2005, this employer introduced a 15% coinsurance rate in the major medical insurance policy once the deductible was met.

In summary, this study extends our previous analysis of a CDHP offered by a large employer in a common multiple-choice setting. Including three years of CDHP experience provided an opportunity to see whether the earlier findings suggestive of moral hazard had disappeared. They had not. Additionally, we did not find that inappropriate substitution away from prescription drugs is a cause of higher CDHP expenses. On the other hand, we did find that CDHP enrollment is associated with considerably higher hospital expenditure than the POS plan. A likely explanation for this finding is that the CDHP had too little cost-sharing.

Notes

1 Parente, Feldman, and Christianson (2004) referred to this plan as an HMO because it was built around the network of a staff-model HMO. However, because members have the option of obtaining reduced coverage of services from non-network providers, we decided that ''point-of-service'' (POS) would be a better description of this plan.

2 To make the analysis compliant with Health Insurance Portability and Accountability Act (HIPAA) regulations, we enlisted the services of a ''trusted third party'' whose roles were: 1) to collect data from the employer and the health plans with social security numbers of the employees in the study; 2) to merge all data by Social Security number; and 3) to replace all Social Security numbers with a unique study ID that had no relationship to the person's actual identity. The trusted third party then prepared the resulting data minus personal identifiers for the analysis. In this capacity, the trusted third party served as an agent for the employer and signed a Business Associate Agreement with the employer as required by HIPAA.

3 Because of attrition (employees switching plans or leaving the firm), the samples for the current study are smaller than in Parente, Feldman, and Christianson (2004): 429 compared with 531 for the CDHP; 1,248 compared with 1,551 for the POS plan; and the largest attrition of 1,025 compared with 1,544 for the PPO.

4 Although ADGs were developed for analyzing individual utilization data, they can be ascribed to each family member based on primary and secondary diagnoses for ambulatory encounters over a defined period of time. Because the number of ADGs is positively associated with family size, we include the number of lives covered by the contract as a control variable. Parente, Feldman, and Christianson (2004) used a similar approach to construct a measure of family illness burden.

5 Pent-up demand would be an unusual explanation for our previous findings. The RAND Health Insurance Experiment, which used three and five-year enrollment periods, found no evidence of pent-up demand except in the first year of enrollment for dental care (Newhouse et al. 1993).

6 Full estimation results are available upon request from the authors.

7 ''Health shock'' was dropped from several probit equations because it perfectly predicted the dependent variable.

References

Agency for Healthcare Research and Quality (AHRQ). 2003. Data from the Medical Expenditure Panel Survey (MEPS), Available at http://www.meps.ahcpr.gov. Accessed June 1, 2005.

American Academy of Actuaries, Defined Contribution Working Group. 2003. Financial and Other Implications of Consumer Directed Plans. Working paper. Washington, D.C.: American Academy of Actuaries.

Bertko, J. 2004. Commentary – Looking at the Effects of Consumer-Centric Health Plans on Expenditures and Utilization. *Health Services Research* 39(4) Part II:1211–1218.

Heisler, M., K. M. Langa, E. L. Eby, A. M. Fendrick, M. U. Kabeto, and J. D. Piette. 2004. The Health Effects of Restricting Prescription Medication Use Because of Cost. *Medical Care* 42(7):626–634.

Johnson, R. E., M. J. Goodman, M. C. Hornbrook, and M. B. Eldridge. 1997. The Impact of Increasing Patient Prescription Drug Cost Sharing on Therapeutic Classes of Drugs Received and on the Health Status of Elderly HMO Members. *Health Services Research* 32(1):103–122.

Manning, W. G., J. P. Newhouse, N. Duan, and C. E. Phelps, et al. 1981. A Two-Part Model of the Demand for Medical Care: Preliminary Results from the Health Insurance Study. In *Health, Economics, and Health Economics*, J. Van der Gaag and M. Perlman, eds. Amsterdam: North Holland.

Mercer Human Resources Consulting. 2005. Consumer-Directed Health Plans Were Least Costly Plan in 2004. Feb. 10. New York: Mercer Human Resources Consultary. Available at: http://www.mercerhr.com/pressrelease/details.jhtml/dynamic/idContent/1170045. Accessed June 1, 2005.

Moskowitz, D. 2001. What's Keeping Employers from Adopting Defined Contribution Health Benefit Plans? *Perspectives on the Marketplace Medicine and Health*. Washington, D.C.: Faulkner and Gray.

Newhouse, J. P., R. W. Archibald, and H. L. Bailit, et al. 1993. *Free for All? Lessons from the RAND Health Insurance Experiment*. Cambridge, Mass.: Harvard University Press.

Parente, S. T., R. Feldman, and J. B. Christianson. 2004. Evaluation of the Effect of a Defined Contribution Plan on Medical Care Expenditures and Utilization. *Health Services Research* 39(4) Part II:1189–1209.

Remler, D. K., and S. A. Glied. 2006. How Much More Cost-Sharing Will Health Savings Accounts Bring? *Health Affairs* 25(4):1070–1078.

Tamblyn, R., R. Laprise, and J. A. Haley, et al. 2001. Adverse Events Associated with Prescription Drug Cost-Sharing among Poor and Elderly Persons. *Journal of The American Medical Association* 285:421–429.

U. S. Department of the Treasury. 2002. Treasury and IRS Issue Guidance on Health Reimbursement Arrangements. June 26.

Weiner, J., B. H. Starfield, B. H. Starfield, and D. M. Steinwachs, et al. 1991. Development and Application of a Population-Oriented Measure of Ambulatory Care Case-Mix. *Medical Care* 29(5):452–472.