Evaluation of the Effect of a Consumer-Driven Health Plan on Medical Care Expenditures and Utilization

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Objective. To compare medical care costs and utilization in a consumer-driven health plan (CDHP) to other health insurance plans.

Study Design. We examine claims and employee demographic data from one large employer that adopted a CDHP in 2001. A quasi-experimental pre–post design is used to assign employees to three cohorts: (1) enrolled in a health maintenance organization (HMO) from 2000 to 2002, (2) enrolled in a preferred provider organization (PPO) from 2000 to 2002, or (3) enrolled in a CDHP in 2001 and 2002, after previously enrolling in either an HMO or PPO in 2000. Using this approach we estimate a difference-in-difference regression model for expenditure and utilization measures to identify the impact of CDHP.

Principal Findings. By 2002, the CDHP cohort experienced lower total expenditures than the PPO cohort but higher expenditures than the HMO cohort. Physician visits and pharmaceutical use and costs were lower in the CDHP cohort compared to the other groups. Hospital costs and admission rates, for CDHP enrollees, as well as total physician expenditures, were significantly higher than for enrollees in the HMO and PPO plans.

Conclusions. An early evaluation of CDHP expenditures and utilization reveals that the new health plan is a viable alternative to existing health plan designs. Enrollees in the CDHP have lower total expenditures than PPO enrollees, but higher utilization of resource-intensive hospital admissions after an initially favorable selection.

Key Words. ■ ■ ■

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Consumer-driven health plans (CDHPs) have moved beyond the concept stage and are now health benefit options available to employees in many large companies. Mainstream insurers, such as Aetna, United Health Group, and Wellpoint have introduced, or will soon introduce, their own CDHPs to compete with products offered by start-up companies such as Definity, Luminos, and others. Health policy analysts have expressed concerns that CDHPs could create adverse selection problems and have unintended impacts on service use. These concerns are motivated by analyses of plan

designs, and philosophical beliefs, but have been largely uninformed by empirical research. In this research project, we used a claims dataset to compare the medical service use and expenditures of employees who were enrolled in a CDHP in 2001 and 2002 to employees enrolled in a health maintenance organization (HMO) and a preferred provider organization (PPO). Our analysis addressed the following questions:

1. What was the impact of the CDHP on payments to providers (i.e., total expenses)?
2. What was the impact of the CDHP on employee out-of-pocket expenses for medical care?
3. Was service use different for CDHP enrollees compared with enrollees in the other health plans?
4. Was the illness burden different in the CDHP versus other plans, and how did it change over time?
5. Were the CDHP effects different in the first year of enrollment, compared with the second year?

BACKGROUND

Consumer-driven 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. Typically, in these products, a "health spending account" is created from which the employee purchases services. Some form of major medical or "wrap-around" coverage is also a key part of the benefits design. If an employee spends all of the dollars in the health spending account in a given year, she then spends her own money until the deductible requirement in the major medical coverage is met.

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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. To facilitate informed decision making, the employee is provided with information about health care providers, including physician education and experience, prices, and quality ratings. Usually, this information is available on the Internet to ensure easy access and promote its use (Christianson, Parente, and Taylor 2002).

Consumer-driven health plans are often compared to medical savings accounts (MSA). MSAs first became available in the mid-1980s; they were later regulated by the Health Insurance Portability and Accountability Act (HIPAA) (1996) as a tax-exempt health insurance product offered primarily to employers with 50 or fewer workers and individuals in Medicare (Bunce 2000). Consumer-driven health plans differ from MSAs in several important ways. Most CDHPs are Internet-enabled health plans that were originally financed by venture capitalists during the dot.com boom of the late 1990s (Christianson, Parente, and Taylor 2002). The use of information technology in an effort to create "informed consumers" is a distinguishing CDHP feature (Lutz and Henkind 2000; Wiggins and Emery 2001). In contrast, MSAs typically instruct subscribers to "shoe-box" their medical bills for later reimbursement from their accounts, as long as are under the deductible. For many CDHPs, the Internet has an interactive customer support system to allow a subscriber to track medical expenditures deducted from her account online. Consumer-driven health plans offer online linkages to prescription drug benefit programs as well as online benefit eligibility information to ensure prompt payment to medical providers. Because CDHPs are much more sophisticated in their product delivery to consumers and employers, they are attractive to many medium-to-large employers. In contrast, HIPAA-regulated MSAs contain a number of restrictive provisions that can make these plans difficult to describe to consumers and intimidating for health benefits managers and insurance brokers.

Interviews with employees and CDHP managers suggest several reasons why larger employers are attracted to CDHPs (Christianson, Parente, and Taylor 2002). Philosophically, these employers want informed employee decisions to "drive the market." Under the CDHP spending account approach, employers believe their employees have an incentive to seek information on providers' prices and to carefully consider their need for services, because any unexpended funds "roll-over" into next year's account balance (Parrish 2001). This potentially reduces the annual "gap" between the spending account contribution and the deductible amount faced by the

employee. Also, employers see CDHPs as possibly reducing their administrative expenses. If the CDHP is popular with employees, it may mean that other plan options can be dropped. Finally, some employers may see the CDHP approach as a way to divorce the amount their contribution to health insurance increases each year from trends in premiums, linking it instead to overall employee compensation increases. In this respect, CDHPs would function as "transition vehicles" that could be used to redefine the role of employers in the purchase of health insurance, much as defined contribution retirement accounts did with respect to retirement benefits (Trude and Ginsburg 2000).

RESEARCH APPROACH

In theory, by combining a high-deductible health insurance plan with a health spending account, a CDHP creates incentives for enrollees to economize on their utilization of medical care. However, there is very little empirical evidence from the MSA experience to inform our research design. Simulation analyses indicate that an employer-funded MSA may have moderate effects on health care spending, depending on who joins (Keeler et al. 1996). A mandatory MSA might reduce spending by 6 percent to 13 percent. The RAND Health Insurance Experiment found that a high-deductible health insurance plan (about $5,000 per family in current dollars) would reduce spending by one-third compared with comprehensive fee-for-service insurance (Manning et al. 1987). But, the RAND study did not examine what would happen if the high-deductible plan were combined with a health spending account.

    Some experts have questioned the ability of deductibles in consumer-driven plans to constrain medical spending (American Academy of Actuaries 2003). This criticism is based on the observation that, because a majority of medical costs exceed the plan's out-of-pocket limit and thus are typically covered by the major medical plan, the insured person has no financial incentive to control his or her medical care utilization. For example, only 7.7 percent of the U.S. population under age 65 with private health insurance (similar to the population in our study) spent more than the RAND Health Insurance deductible of $5,000 in 2000; yet these people accounted for 56.8 percent of all medical spending among the reference population (Agency for Healthcare Research and Quality 2003). The average medical expenditure among this group was almost $13,000.

However, most Americans are not in high-deductible health plans, and therefore the data cited to "prove" that deductibles will not work are, in fact, suggestive that low-deductible health insurance may produce skewed medical expenditures. In order to test the effect of deductibles on medical expenditures it would be necessary, as in the RAND experiment, to *change* the level of deductibles and observe the resulting change in expenditures. Nevertheless, it is possible that the deductibles in CDHP plans will not have a significant impact on medical expenditures because, in most cases, the deductible is considerably less than $5,000.

It is even possible that the CDHP health spending account could lead to an *increase* in medical care use, compared with a plan that has only a deductible. For example, if the employer contributes 50 percent of the deductible each year to the account, employees who use only preventive services could bank two years of spending account dollars to reach first-dollar coverage by year three. In this case, employees who never exceed their annual PCA allocations from year three forward will have first dollar coverage up to two million dollars for a lifetime, indefinitely. Whether consumers actually act this way is a conjecture, as there is no empirical evidence that addresses the issue.

For this analysis, we used health insurance claims and benefits data from a large, self-insured employer that offered a CDHP for the first time in 2001. The employer previously offered an HMO and a PPO to employees at its main corporate location. (The employer retained these options when it offered the CDHP.) Worldwide, the employer has more than 20,000 employees and over $5 billion in annual revenue. With its products positioned in a rapidly growing sector of the economy, the company is adding employees each year through internal growth and acquisitions.

We conducted two types of analyses on the data: (1) an employee-level examination of inter-temporal variation in cost and use, employing up to three years of data, and (2) an employer-level analysis of the differences in cost and use among the plans, with and without case-mix adjustment. The presence of a large and significant case-mix effect in the aggregate would be evidence of differential selection among the health plans based on personal health care consumption preferences or health status. If the aggregate case-mix adjusted results are not statistically different from the unadjusted results, we can conclude that use differences are not likely due to differences in health status.

The distribution of health care utilization (or expenses) in populations typically is characterized by a large proportion of people who use no services at all, and a highly skewed distribution among users. As a result, we employed a two-part model in our analysis (Manning et al. 1981). First, we estimated

probit equations for the probability of using any service (or having any expense) during the year, specified as:

$$Prob\,(\text{visit} > 0) = B_x X_i + B_c C_i + e_i, \tag{1}$$

where e_i is a random person-level error term, X_i represents a vector of person i variables influencing use such as health status, age, gender, family status, location, and C_i represents a vector of health plan choices. Second, we estimated regression models for medical care expenditures and use. For expenditures, we used a log-linear regression model. Using expenditures as an example, part two of the model takes the form:

$$Ln\,(\text{covered expenditures})|\text{expenditures} > 0) = G_x X_i + G_c C_i + e_i, \tag{2}$$

where X_i and C_i are the same vector of variables used in equation one. Specifying C as a set of categorical dummy variables representing health plans will provide estimates of the marginal effect of the CDHP plan choice on an enrollee's cost and use.

Health plan choice can affect both equations (1) and (2). For example, in equation (1), a health plan may influence the use of any service. In equation (2), health plans may directly affect the reimbursement levels through fee schedules and denial of services. We examined the impact of health plan choice on both equations to determine the most appropriate modeling strategy. In addition, in some model specifications, we added interaction terms representing the combination of personal characteristics (e.g., family status) and health plan choice.

There are several benefit design features that are likely to influence service use and expenditures for CDHP enrollees. For example, if sufficient dollars in the health spending account are "rolled over," eventually the accumulated amount could exceed the "gap" between the annual contributions to the account and the deductible, care then costs the enrollee nothing out-of-pocket, creating a potential for "moral hazard." There are several benefit-design "fixes" for this moral hazard problem, such as implementing coinsurance above the deductible or limiting how much money can be banked. However, 100-percent-covered expenses after meeting the deductible is a current feature of CDHP products in many early-adopter employers, including the one in our study.

Other features include 100 percent coverage for preventive care, so that expenditures for preventive services do not affect the spending account balance or the deductible. Also, there are limitations on what pharmaceutical and provider expenses can be applied to the deductible if they are outside the

scope of what the CDHP and employer consider a normal range of payment. For example, a physician outside the CDHP's contracted panel would be reimbursed using spending account dollars, but only the usual, customary, reasonable equivalent in pricing the physician's services would be applied to the insured's deductible. With regard to the pharmacy benefit, prescription drug costs are paid directly from the account at the full allowed price negotiated by the CDHP and the pharmaceutical benefit management (PBM) firm. Thus, a CDHP participant would never face a copayment and would have the equivalent of first-dollar coverage for pharmaceuticals until the dollars in the PCA are exhausted, at which point he or she would pay out-of-pocket until the deductible for all health care expenses is reached. If the price of a drug is outside the allowed amount negotiated by the PBM, the prescription still would be paid in full by the PCA but, like the provider payment example, only the allowed amount for the drug would be applied to deductible. In both instances, the CDHP is designed to encourage enrollees to be price-conscious; if they deviate from what the employer and CDHP consider a fair provider payment structure, they will pay the difference. It is important to note that benefit design for CDHPs is a joint employer/CDHP decision. We have found in employer interviews that these designs can vary considerably by employer and over time.

DATA

This analysis required obtaining data from the employer as well as from three different health plans, including the CDHP, over three years. Person-level identification over time was necessary. In order to make the analysis compliant with new HIPAA regulations effective on April 14, 2003, we enlisted the services of a "trusted third party" whose roles in the analysis were: (1) to collect data from the employer and the health plans, identified by 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 an individual's actual identity. The trusted third party then prepared the resulting data sources, minus personal identifiers, for the investigators' analysis. In this capacity, the trusted third party served as an agent to the employer willing to participate in this study and signed a Business Associate Agreement with the employer as required by HIPAA.

Employer personnel data on the employees' health plan elections in 2000, 2001, and 2002 were used to identify three study population cohorts.

The CDHP was first offered in 2001. Our objective was to identify prior medical care utilization under employee contracts in 2000, as well as utilization in the first and second year in which the CDHP was offered. Thus, the CDHP cohort identified employees who chose this plan in 2001 and 2002. The CDHP cohort's experience in 2000 provides insight on the extent to which CDHP enrollees might have been relatively high, or low, users of services prior to enrollment. The 2001 CDHP experience represents the first year after enrolling in the new plan. The 2002 CDHP experience provides an opportunity to assess medical care use and expenditures after any remaining balance in the personal care account had been rolled over from 2001 to 2002. The HMO and PPO cohorts consisted of employees who chose these plans in 2000 and remained enrolled in them through 2001 and 2002.

      The final sample size for our analysis was 3,636 contracts. This sample reflects more than a 40 percent reduction in the number of contracts offered by all three health plans for the employer in the metropolitan area. The reduction occurred due to plan switching and the firm's addition of new employees in 2001 and 2002, for whom data were not available in 2000.

      To supplement the claims data, we abstracted annual information from the employer's database on the employee/subscriber's number of dependents, after-tax income from the firm, share of medical costs paid, and flexible spending account contribution. Flexible spending account information is important because dollars in these accounts can be used to finance the gap between the employer's PCA contribution and the deductible limit where 100 percent coverage begins.

      The key variables constructed from the claims data, after claims adjudications and denials were accounted for, included total provider reimbursement as well as reimbursement for physician, hospital, and pharmacy expenses. In addition, total expenditures were partitioned into those costs borne by the employee and the employer. Employee costs included deductibles and copayments in all of the three health plans. For the CDHP plan, in our analysis, expenditures paid by the personal care account and those paid after the deductible was met both were treated as employer expenses. Consumer-driven health plan employee expenses were primarily payments for services when the spending account was exhausted and before the deductible was met. Expenses also were incurred by some employees after the deductible was met; for example, if a prescription was purchased whose cost exceeded allowable reimbursement levels, or a specialty provider was seen whose cost was outside the scope of payment in the CDHP's panel of 500,000+ providers nationally. It is important to note that a significant source

of employee costs—contributions toward their health benefits—is not included in this analysis because our focus is on the cost and use associated with the different health plan designs and their operations.

The utilization variables developed from the claims data were hospital admissions, physician office visits, and pharmacy prescriptions filled. In addition, diagnosis codes from the claims data were used to assign case-mix variables based on the Johns Hopkins ACG software. Specifically, we utilized the "ambulatory diagnostic groups" (ADGs) and developed resource intensity estimates for each ADG to approximate severity (Weiner et al. 1991). These severity-adjusted ADGs were used to develop a composite baseline case-mix measure. We also constructed a contemporaneous "health shock" categorical variable to account for random events that degrade health, including acute major illnesses, injury, and malignancies. This variable is constructed as the union of the occurrence of five ADGs (3, 4, 21, 22, 32) at the employee contract level. Gender and age variables for the employee also were used to complement the case-mix variables in the statistical models of expenditure and utilization.

All variables used in the analysis were measured by cohort and year at the employee contract level. Thus, for example, the utilization variables could reflect physician office visits by a single female employee, or an employee with a spouse and four children. Ideally, we would have liked to have person-level data for all people covered by an employee's contract. However, there was no consistent, unique patient ID to permit this level of analysis. As a result, we used a unique encrypted employee ID as our unit of analysis and controlled for the number of dependents in a family contract; for single and two-person contracts, we assumed the number of lives per employee ID to be one and two, respectively.

RESULTS

Descriptive statistics (for the 2000 calendar year) for the CDHP, HMO, and PPO study population cohorts are presented in Table 1. There was little difference with regard to age, with average employee age ranging between 39.5 and 41.6 years. Proportionately more male employees (61 percent) chose the CDHP than the HMO (57 percent) or the PPO (51 percent). The difference in the number of estimated covered lives per employee health benefit contract was relatively small, with a range of approximately 2.6 lives per contract in the CDHP and HMO cohorts to 2.5 lives per contract for the PPO.

Table 1:   Study Population Descriptive Statistics

Demographic Variable of Study Population Cohorts in 2000	(N = 531) CDHP Sample Mean	(N = 1,551) HMO Sample Mean	(N = 1,544) PPO Sample Mean
Employe age (in years)	40.9	39.5	41.6
Percent male	62%	57%	51%
Case-mix index of entire employee's contract	6.493	6.831	7.136
Case-mix index of each person covered under the employee's contract	2.691	2.961	3.221
Income Distribution			
<25th percentile or below of employer	12%	28%	27%
Between 25th and 75th pecentile of employer	52%	53%	47%
>75th percentile of employer	36%	20%	27%
Employee's health insurance premium contribution	$4,228.56	$3,524.84	$4,395.14
Employee's health care flexible spending account contribution	$407.84	$203.52	$236.42
Estimated number of covered lives including the employee	2.58	2.60	2.49
Reported number of dependents excluding employee	1.81	1.82	1.68

The two largest differences between the CDHP population and other cohorts at baseline were income and case-mix. The CDHP population had the highest share of employees with incomes above the 75th percentile for the entire firm. On the other end of the distribution, the CDHP had less than half the share of lower-income employees, with only 13 percent of CDHP enrollees with salaries below the 25th percentile. Clearly, the CDHP was relatively attractive to higher-paid employees. Regarding case-mix, the CDHP cohort began with the lowest average calculated illness burden, 6.5 per employee contract. This result contrasts with higher case-mix indices in the HMO and PPO populations with values of 6.8 and 7.1, respectively. The case-mix variable reflected the number of significant medical diagnoses that an employee contract might have in a year. The higher this number, the higher the extent of illness burden, including both acute and chronic conditions. This result suggests that the CDHP cohort had initial favorable selection, although the differences are not as substantial as the income differences.

The findings in Table 2 suggest that the CDHP cohort's initial favorable selection did not continue over time. The CDHP case-mix index per employee contract grew from 6.49 in 2000 to 7.45 in 2001 and to 7.94 in 2002. The HMO cohort index started at 6.83 in 2000, rose to 7.47 in 2001, and then fell slightly to 7.29 in 2002. The cohort with the highest case-mix index value

Table 2:   Case-Mix Comparisons over Time by Health Plan Cohort

Health Plan Cohorts	Year 2000 Sample Mean	Year 2001 Sample Mean	Year 2002 Sample Mean
CDHP Cohort $N = 531$			
Case-mix index of entire employee's contract	6.49	7.45	7.94
Case-mix index of each person covered under the employee's contract	2.69	3.14	3.38
HMO Cohort $N = 1,551$			
Case-mix index of entire employee's contract	6.83	7.47	7.29
Case-mix index of each person covered under the employee's contract	2.96	3.20	3.09
PPO Cohort $N = 1,554$			
Case-mix index of entire employee's contract	7.14	7.84	8.16
Case-mix index of each person covered under the employee's contract	3.22	3.48	3.64

in 2002 was the PPO, with case mix increasing from 7.14 in 2000 to 8.16 in 2002. It is important to note that the indices are entirely dependent on the diagnosis codes presented in the claims data, and that higher service utilization tends to be correlated with the presentation of more diagnosis codes.

Table 2 also presents the case-mix indices on a calculated per-person basis for each person covered by the employee's contract. The same patterns apparent in the contract-level case-mix indices as are observed at the person level.

Medical care expenditures and utilization for the CDHP enrollees are contrasted with the experience of HMO and PPO enrollees in Tables 3 through 5. The results presented in each of the tables are regression-adjusted means for each cohort by calendar year experience. These means are adjusted by employee-level variables presented in Table 1 including age, gender, contract case-mix in 2000, taxable income (in dollars), number of covered lives in the contract, flexible spending account (FSA) election, health shock (represented as a categorical variable), plan choice, calendar year, and the interaction of plan choice and calendar year.

Table 3 shows that all three cohorts exhibited strong increases in medical expenditures over time in both the adjusted and the raw data. Total adjusted contract expenditures in the CDHP cohort were the lowest among the three groups in 2000 ($4,396.22) when the CDHP cohort was enrolled in either the PPO or HMO). In 2002, expenditures for the PPO cohort were the highest

Table 3:   Total Expenditure
Regression-Adjusted Means by Plan Cohort and by Year

Health Plan Cohorts	2000 Mean	2001 Mean	2002 Mean
CDHP Cohort N = 531			
Total expenditure	$4,396.22	$6,154.36	$8,149.26
Employer expenditure	$4,005.28	$5,903.61	$7,807.39
Employee expenditure	$416.51	$634.38	$792.01
HMO Cohort N = 1,551			
Total expenditure	$5,284.53	$6,773.62	$7,197.50
Employer expenditure	$4,895.75	$6,227.81	$6,428.83
Employee expenditure	$394.70	$549.32	$702.49
PPO Cohort N = 1,554			
Total expenditure	$5,228.42	$7,050.59	$8,377.78
Employer expenditure	$4,688.28	$6,349.99	$7,330.94
Employee expenditure	$511.84	$657.16	$881.47

Notes:

Regressions adjusted by annual trends, health plan choice, health plan choice interacted with annual trends, age gender, case-mix, income, number of covered lives in contract, use of an healthcare flexible spending account. Estimates are based on a two part model.

The unadjusted total expenditure amounts were: CDHP—$3,921 (2000), $5,155 (2001), $7,738 (2002); HMO—$4,745 (2000), $5,244 (2001), $5,654 (2002); PPO—$4,671 (2000), $5,701 (2001), $8,080 (2002).

($8,377.78), followed by the CDHP cohort ($8,149.26), and then the HMO ($7,197.50) group. An examination of the employer's cost for the health plans presents a different order of total expenditures: by 2002 the CDHP was highest at $7,807.39, followed by the PPO at $7,330.94, and the HMO at $6,428.83. This is reflected in the difference in employee expenditures; CDHP enrollees have lower out-of-pocket expenses than enrollees in the other two health plans. It is important to note that these employee expenditures are highly dependent on the plan design of the CDHP. In this firm, more than 80 percent of the CDHP cohort faced an out-of-pocket expenditure gap between their health spending account and complete coverage of only $1,000.

These results were generated from two-part models where the first stage estimated the probability of any expenditure and the second stage estimated expenditure controlling for employee demographics and the results of the first stage. Total expenditures were positively related to case-mix, as well as age, number of covered lives, and FSA election. There were strong time-trend effects indicated by calendar year dummy variables. The only significant

Table 4:   Hospital, Physician, and Pharmacy Expenditure by Employer and Employee

Regression-Adjusted Means by Plan Cohort and by Year

Health Plan Cohorts	Year 2000 Mean	Year 2001 Mean	Year 2002 Mean
CDHP Cohort $N = 531$			
Hospital expenditure	$1,369.97	$1,999.25	$3,468.53
Physician expenditure	$2,093.70	$2,935.84	$3,510.83
Pharmacy expenditure	$935.29	$1,103.72	$1,341.78
HMO Cohort $N = 1,551$			
Hospital expenditure	$1,842.80	$1,796.37	$1,956.83
Physician expenditure	$2,381.08	$2,959.90	$3,088.22
Pharmacy expenditure	$1,107.64	$1,498.54	$1,640.25
PPO Cohort $N = 1,554$			
Hospital expenditure	$1,779.06	$2,049.76	$2,367.17
Physician expenditure	$2,245.22	$2,834.32	$3,294.47
Pharmacy expenditure	$1,007.95	$1,484.91	$1,789.26

Notes:

Regressions adjusted by annual trends, health plan choice, health plan choice interacted with annual trends, age gender, case-mix, income, number of covered lives in contract, use of a health care flexible spending account. Estimates are based on a two-part model.

negative relationship aside from plan choice was whether the contract holder was male.

In Table 4, average total expenditures faced by the employer and employee combined are decomposed into three categories: hospital, physician, and pharmacy expenditures. The most striking result was the substantial increase in hospital expenditures, including both institutional inpatient and outpatient services, for CDHP enrollees. For the CDHP cohort, costs increased from $1,369.97 to $1,999.25 between 2000 and 2001, but then dramatically increased an even larger amount (73 percent) to $3,468.53 in 2002. The HMO and PPO cohorts also saw substantial growth in hospital expenditures, but not to the degree of the CDHP cohort. For physician expenditures, including the costs for office visits, preventive services, specialist consults, and surgical procedures, there also was a substantial increase in all three cohorts, with the highest 2002 expenditure associated with the CDHP cohort ($3,510.83), followed by the PPO ($3,294.47), and then the HMO cohort ($3,088.22). With regard to pharmaceutical expenditures, the CDHP cohort consistently had lower drug costs over all three years compared with the HMO and PPO populations.

Table 5:   Utilization: Physician Visits, Hospital Admission Rate, and Prescriptions Filled Regression-Adjusted Means by Plan Cohort and by Year

Health Plan Cohorts	2000 Mean	2001 Mean	2002 Mean
CDHP Cohort N = 531			
Hospital admission rate	0.05	0.10	0.16
Physician visits	5.74	7.49	7.15
Prescriptions filled	18.89	22.23	25.25
HMO Cohort N = 1,551			
Hospital admission rate	0.07	0.06	0.09
Physician visits	6.75	7.56	7.29
Prescriptions filled	22.23	22.59	30.89
PPO Cohort N = 1,554			
Hospital admission rate	0.07	0.07	0.11
Physician visits	5.78	6.54	6.95
Prescriptions filled	20.63	23.79	24.50

Notes:

Regressions adjusted by annual trends, health plan choice, health plan choice interacted with annual trends, age gender, case-mix, income, number of covered lives in contract, use of a health care flexible spending account. Estimates are based on a two-part model.

Table 5 contains a comparison of utilization measures. Corresponding to the hospital expenditure results, the CDHP population experienced dramatic annual increases in hospitalization rates during the study period, while increases in admission rates for the other plans were smaller. All three cohorts experienced significant increases in office visits, particularly between 2000 and 2001. We also found that the nurse line utilization for the CDHP cohort increased dramatically over this same period and was much higher than use of similar services offered by the HMO and PPO. With regard to prescriptions filled, the results mirror the pharmaceutical expenditure results; the CDHP cohort had significantly lower increases in scripts compared to the HMO cohort. Interestingly, by 2002, the CDHP had more scripts filled than the PPO, but the PPO had a higher pharmaceutical expenditure annualized increase (39 percent) compared with the CDHP (22 percent).

DISCUSSION

This study presents early empirical data on expenditures and use of medical care for enrollees in a CDHP versus employees enrolled in other plan options.

There are five key results from this analysis. First, enrollees in CDHP contracts had lower total expenditures than enrollees in PPO contracts, but higher than HMO enrollees after a two-year period, controlling for a variety of enrollees characteristics. However, this result is not consistent across different types of medical expenditures, and there are differences by employer versus employee payment.

Second, we found that enrollees in CDHP contracts consistently had lower out-of-pocket expenditures than enrollees in PPO contracts. This result may be a function of this employer's design of the CDHP plan. The majority of the CDHP population chose an option with health spending account/ deductible threshold combinations of $1,000/$1,500, $1500/$2250, $2000/ $3000 for single, two-person, and family contracts, respectively. Thus, the out-of-pocket gaps for the three plans were $500, $750, and $1,000. These amounts are relatively low, based on interviews with other employers as part of a more general study of consumer-driven plans. In contrast to the HMO cohort, the CDHP cohort had higher employee expenditures, possibly reflecting lower cost-sharing requirements in the HMO, including low copayments for in-network provider access and prescription drugs.

A third finding relates to significant growth in hospital use by the CDHP cohort. Hospital admissions are not considered an area likely to be affected by the CDHP, other than through a possible reduction in use due to online access to disease management tools. One possible explanation for the increase is that CDHP employees were more price conscious as a consequence of the plan, and therefore were reluctant to seek care until they were very ill and in need of hospital services. However, there is insufficient evidence to determine the causal factors leading to increases in admission rates for the CDHP cohort. Given that preventive services, including physical exams, were covered 100 percent outside of the PCA and there were similar office visit trends in the HMO and PPO cohorts, it is difficult to characterize a lack of access to physician consults and evaluation as the driver for higher admission rates in the CDHP population.

Fourth, we found the CDHP had initial favorable selection, but that it concluded the study period with a significantly higher illness burden. This may indicate a genuine decrease in health status, or simply reflect of the more complex diagnosis codes associated with the greater use of hospital and physician services experienced by this cohort. If the latter explanation is found in subsequent work to be valid, the initial favorable selection may actually be a proxy for "pent-up" medical care demand by the CDHP cohort that was not realized until enrollees had an expanded choice of providers. For example,

people who expected to have elective surgery in the future may have selected the CDHP to give them a wider selection of providers for that surgery.

Finally, we find some indication of different CDHP effects between the first year the plan was offered and the second year, with total expenditures accelerating dramatically during this period. Much of this increase is due to increases in admissions and their related expenditures. Given the quasi-experimental differences-in-differences study design employed, it is possible that this increase is a genuine CDHP effect. What remains speculative is whether this is an indication of a moral hazard problem. One scenario where moral hazard could occur is if the CDHP employees have enough money in their health spending account during the second year (2002) to make the deductible gap small enough to encourage utilization, particularly because, after the deductible was paid, there was no coinsurance under this employer's benefit design to act as a disincentive to service use. In the case of hospital services, we also may be seeing pricing differences among providers, because the change in admission rate year two to year three (60 percent) is less than the related hospital expenditure increase (73 percent). A contributing factor may be that the CDHP used a different firm to price provider services in 2002 versus 2001.

Although this study is too limited, with only a two-year data window, to fully ascertain if moral hazard may be influencing utilization, we know the proportion of the CDHP population that had money left over in a health spending account in 2001 (40 percent) and 2002 (28 percent). These data suggest that the benefit design did not discourage the majority of the population from consuming health care resources to the extent that expense accounts were exhausted. In 2002, 57 percent of the CDHP population—the majority—exceeded the deductible threshold and consumed medical care, at the margin, without any out-of-pocket cost above the deductible. The benefit design of the employer in this study suggests that a substantial incentive was provided for consumption. As suggested earlier, if moral hazard is present it can be tempered by changes in the spending account, the deductible gap, or the coinsurance level once the deductible has been met.

Our study has several limitations, some of which we have already noted. First, it examines the experience of only one employer. The effects of a CDHP may depend not only on the design of the CDHP itself, but also on the types of other plans that the employer offers. However, the non-CDHP health plans (an HMO and PPO) offered by this employer are relatively common in their design; therefore, we would expect the experience of these options, after introduction of a CDHP, to be representative. The advantage of focusing on

one employer is that it allows a quasi-experimental design that would be difficult to replicate in a multi-employer setting. The intention of this work is to provide early evidence, which can be expanded by analysis of other early-adopting employers. It is also important to reaffirm that the CDHP benefit design is strongly influenced by employer preferences and comparisons across employers would need to explicitly account for variation in benefit components. With regard to this study, the employer evaluated could be characterized as providing a more generous health benefit design than most.

A second limitation is that our results may be influenced by regression to the mean, where unusually low spending in the year prior to offering the CDHP (2000) was associated with joining the CDHP in 2001. If spending returned to more normal levels in 2001 and 2002, some of the differences attributable to the CDHP would be due to expenditure and utilization patterns returning to their mean. To address this possibility, we performed a sensitively analysis. The results suggest that regression to the mean is not a major problem that would adversely affect our 2002 results as much as it might affect our 2001 results. A summary of our sensitivity analysis is provided in the Appendix.

A third limitation is that the data systems of the three health plans were not completely consistent. This required certain assumptions to be made based on discussions with health plan data staff regarding data capture and record design. To mitigate this problem, we chose to construct relatively simple utilization and cost measures that could be verified easily with the experience of an employer or health plan. Future research will need to look for differences in disease-specific utilization patterns. We believe that the data from this employer are sufficiently detailed to complete these more specific analyses, but to enable benchmarking to future employers with uncertain data system structures we chose measures that would allow more valid comparisons.

As part of a larger research effort, we plan to extend our results through comparison with five other employers. As a study design, this project is entirely dependent upon the commitment and resources of the participating employers and their contracting third party administrators. In several cases, we have found HIPAA to emerge as a significant disincentive for employer collaboration. The employers participating in the larger study recognize the potential value of benchmarking their experience as early adopters of CDHPs.

In summary, this early empirical study of medical care expenditures and utilization in a CDHP suggests that the new health plan is a viable alternative to existing health plan designs. We found that CDHP enrollees had lower total expenditures than PPO enrollees, but higher expenditures than enrollees in an

HMO after two years. However, we found that hospital admissions and expenditures increased relatively dramatically for the CDHP study cohort. Relatively high utilization of resource-intensive hospital admissions after an initially favorable selection suggests that much more detailed analysis is needed to disentangle the experience of different types of enrollees in the CDHP. Also, more analysis clearly is needed to ascertain long-term trends and effects.

APPENDIX

AN ANALYSIS OF REGRESSION TO THE MEAN

Regression to the mean was considered as a possible concern affecting our expenditure results. To ascertain the extent of the problem we completed a two-step process. First, we wanted to test for the *potential* of regression to the mean to be a problem. This would be the case if unusually low spending in the year prior to offering the CDHP—2000—was associated with joining the CDHP in 2001. To examine this possibility, we estimated an equation for total expenditures in 2000 and calculated the residuals from that regression. Next, we estimated a multinomial logistic regression for the probability of joining the CDHP in 2001 (as well as in 2002, given the way our cohort was structured) or staying in the HMO or PPO from 2000 through 2002. This model included the following predictors: case-mix in 2000, age, gender, income, and number of dependents, as well as the predicted and residual estimates of 2000 expenditures.

The results of this analysis, presented in Table A1, provide a conservative test of the influence of prior expenditure on joining the CDHP because some of the factors that we put into the residual expenditure may be known to the employee and thus not "unusual" to him or her. Examining the impact of the residuals on plan choice, we find a significant negative relationship for CDHP and PPO choice relative to the HMO, indicating that regression to the mean may affect our results.

In the second step, we developed a set of total expenditure regressions to estimate the extent of regression to the mean, using the following specification:
Let

$$E_t = y + u_t \tag{A1}$$

and

$$u_t = \rho u_{t-1} + v_t \tag{A2}$$

Table A1:   Regression to the Mean Identification Multinormial Choice Regression to Identify if Prior Expenditure Experience in 2000 Influenced Subsequent 2001 Plan Choice

	Coefficient	*T-statistic*
Plan Intercepts (HMO is reference)		
PPO	− 1.0457	− 3.832*
CDHP	− 1.4460	− 3.774*
Plan–Employee Age Interactions (HMO is reference)		
PPO	0.0188	4.817*
CHHP	0.0107	1.888
Plan–Gender Interactions (HMO and male is reference)		
PPO	− 0.3534	− 4.63*
CDHP	0.0163	0.151
Plan–Income Interactions (HMO is reference)		
PPO	0.0000	4.996*
CDHP	0.0000	6.873*
Plan–Dependents on Contract Interactions		
(HMO and single person contracts are reference)		
PPO	− 0.1539	− 1.753
CDHP	0.0391	0.307
Plan–Predicted Estimated Interactions		
PPO	0.0392	1.11
CDHP	− 0.0784	− 1.575
Plan–Residual Estimated Interactions		
PPO	− 0.0904	− 2.154*
CDHP	− 0.1925	− 3.306*

Notes:

Coefficients significant at the $p < .05$ level.

Predicted and residual estimated generated from a expenditure regression where total expenditures in 2000 were regressed on 2000 case-mix, gender, age and contract size.

Where E = expenditure, y = mean, and u and v = errors. Time is denoted by subscript t. Lagged values of E are multiplied by the constant ρ to create:

$$\rho E_{t-1} = \rho y + \rho u_{t-1} \tag{A3}$$

Substitute (2) and (3) into (1) to get

$$Et = (1 - \rho)y + \rho E_{t-1} + v_t \tag{A4}$$

Therefore, expenditure at time t is a weighted average of mean and lagged expenditure, where the weight ρ depends on the autocorrelation of the errors in the expenditure model over time:

If $E_{t-1} < y$, expenditures regress up to the mean

If $E_{t-1} > y$, expenditures regress down to the mean.

If y is not a constant then:

$$Et = y_t - \rho y_{t-1} + \rho E_{t-1} + v_t \tag{A5}$$

Using equation (A5), we can directly estimate the autocorrelation parameter ρ by regressing current expenditure on lagged expenditure and variables that influence mean expenditure. This procedure generates the following estimates:

	2000–2001	*2001–2002*
No plan choice	0.192	0.129
Plan choice	0.184	0.132

"No plan choice refers" to an expenditure model that excludes plan choice as a determinant of mean expenditures, because plan choice is clearly endogenous. These estimates can be viewed as a reduced-form model, where expenditure depends only on exogenous or predetermined variables (e.g., employee age). However, for comparison we also estimated ρ using an expenditure model that includes plan choice. In both approaches, we found estimates of ρ less than 0.2, and in 2001–2002 the estimates were closer to 0.1.

The correlation between u_t and u_{t-s} is ρ^s (Welch 1985). Using the estimates above, the correlation over two years ranges from 0.0166 to 0.0369, assuming that the autoregressive process follows a simple first-order pattern. These results lead us to believe that regression to the mean could be an issue if we had only one year of data after the CDHP was offered. However, the effect of unusually high or low prior-year expenditures disappears fairly quickly from our data, and most of the effect is gone by 2002. Consequently, estimates of the "CDHP effect" based on comparing expenditures in the CDHP and other plans in 2001 versus 2002 will be more reliable than the 2000–2001 comparison.

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