“A five-year study of health expenditures among full replacement CDHPs, optional CDHPs and traditional managed care plans”

AUTHORS	Song Chen Roger Feldman Stephen T. Parente

ARTICLE INFO	Song Chen, Roger Feldman and Stephen T. Parente (2014). A five-year study of health expenditures among full replacement CDHPs, optional CDHPs and traditional managed care plans. *Insurance Markets and Companies*, *5*(1)
RELEASED ON	Tuesday, 19 August 2014
JOURNAL	"Insurance Markets and Companies"
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES **0**

NUMBER OF FIGURES **0**

NUMBER OF TABLES **0**

Song Chen (USA), Roger Feldman (USA), Stephen T. Parente (USA)

A five-year study of health expenditures among full replacement CDHPs, optional CDHPs and traditional managed care plans

Abstract

Using claim data from multiple employers over a 5-year period, this study examines the impact of enrolling in consumer driven health plans (CDHPs) such as health savings accounts (HSAs) and health reimbursement arrangements (HRAs), when they were offered as a full replacement plan or as an option along side traditional managed care plans, on health care expenditures in a large and diverse population.

The study design is a five-year (2005-2009) pre-post cohort study on 142,325 members who were identified from 55 employers. All employers offered traditional plans such as PPO (preferred provider organization), POS (point of services), or EPO (exclusive provider organization) in baseline year 2005 and started offering a CDHP as full-replacement plan or as an option in January, 2006. All members enrolled in a traditional plan in the baseline. A cohort was assigned according to the member's plan enrollment in 2006. The traditional plan is used as the reference group.

Members were initially eligible for the study if they had 24 months continuous plan coverage from 2005 to 2006, were 64 years or younger by December 31, 2006, had both medical and pharmacy coverage, and had no multiple insurance carriers. Starting in 2007, eligibility was checked annually to determine whether a member stayed in the same plan as they did in 2006 and also had 12 months of enrollment that year. All employers had 100 or more employees.

Generalized linear models (GLMs) with a log link were estimated for total expenditure, plan-paid amount, and member-paid amount, respectively. Independent variables included cohort, dummy variables for years, and the interaction of cohort and years. Other controlling factors included sociodemographic variables such as age, gender, income, type of contract, and risk score in the baseline year; plan design variables in 2006, such as deductible, coinsurance, free preventive care coverage, and employer contribution to the account; and employer-level characteristics, such as industry and employer size.

While enrolling in HSAs was associated with comparable levels of spending to continuously enrolling in traditional plans, enrolling in HRAs was associated with higher levels of expenditure. Fully replacing the traditional plans with a HRA only saved costs in the first year of implementation and the costs escalated during the rest of the follow-up years (from 7% in 2007 to 28% in 2009). Optional HRAs resulted in higher levels of spending since the first year of offering, though the rise was relatively stable (14% in 2006 and 2007, 5% in 2008, and 12% in 2009). The elasticity of total expenditure as coinsurance changed from 10% to 20% was -0.01, suggesting a small response of demand with respect to the change in price. Members faced more out-of-pocket costs with higher cost-sharing.

HSAs are cost-neutral relative to traditional plans. Members tend to use more medical care in HRAs due to the relative rich plan generosity as well as the incentives of spending now rather than saving for later with employer-owned accounts.

Keywords: health insurance, health plan, health saving account, health expenditures, full health plan replacement.

Introduction

Consumer driven health plans (CDHPs) represent an increasing proportion of private health plan members in the United States. A recent study suggested that CDHPs were the only type of health insurance plan that grew in 2010 and the growth was strongest among large employers [1]. The two prevailing CDHP models are the health reimbursement arrangement (HRA) and the health savings account (HSA). The primary differences are: (1) both the employer and the member can contribute to an HSA, while only the employer can contribute to an HRA; and (2) employees own the HSA, while employers own the HRA, so after discontinuing employment or changing health plans, employees lose the money in the HRA. National CDHP enrollment was estimated to exceed 18 million in 2010 and HSAs are getting more popular among employers and employees than HRAs [1-3].

Although some studies have estimated the effect of enrolling in a CDHP on expenditures, [4-8] very few have studied how the effects might be different between full replacement CDHPs and optional CDHPs. Understanding such questions is important for employers and insurers. As more people switch to CDHPs than leave them and employers no longer offer choices of plans, if full replacement CDHPs do not really save costs, employers and insurers should take this into consideration before adopting full replacement plans or recommending such plans to employers. The current study used the longest cohorts in studies of CDHPs to date to answer two research questions: what are the long-term effects of HRAs and HSAs on health care expenditures rela-

tive to those of traditional managed care plans; and whether full replacement HRAs or HSAs have different effects than optional HRAs/HSAs. We examined the impact of choosing a HRA or HSA along with other insurance choices, as well as the impact of fully replacing non-CDHP plans with HRAs and HSAs. Doing so not only allowed us to examine whether CDHP members behave differently from traditional plan members when choices of plans are available; we could also compare the effectiveness of full replacement and optional plans. Observing full replacement CDHPs also allowed an additional control for self-selection beyond that of baseline health. We analyzed five years of claims data for a group of large employers that provide a variety of benefit designs. Having many employers with different characteristics is a unique aspect of our study.

1. Conceptual model

Our models estimate how health expenditure changes with the enrollment in CDHPs, controlling for member's socioeconomic characteristics as well as for the plan design features. More specifically, our model of estimation with a log-link is:

$$\text{Log}(E(Y)) = \beta 0 + \beta 1\ \textit{Full Replacement HRAs} + + \beta 2\ \textit{Full Replacement HSAs} + \beta 3\ \textit{Optional HRAs} + + \beta 4\ \textit{Optional HSAs} + \beta 5\ \textit{Year}\ 2006 + \beta 6\ \textit{Year}\ 2007 + \beta 7\ \textit{Year}\ 2008 + \beta 8\ \textit{Year}\ 2009 + \beta 9\ \textit{Full Replacement HRAs} \times \textit{Year}\ 2006 + \beta 10\ \textit{Full Replacement HRAs} \times \textit{Year}\ 2007 + \beta 11\ \textit{Full Replacement HRAs} \times \textit{Year}\ 2008 + \beta 12\ \textit{Full Replacement HRAs} \times \textit{Year}\ 2009 + \beta 13\ \textit{Optional HRAs} \times \textit{Year}\ 2006 + + \beta 14\ \textit{Optional HRAs} \times \textit{Year}\ 2007 + \beta 15\ \textit{Optional HRAs} \times \textit{Year}\ 2008 + \beta 16\ \textit{Optional HRAs} \times \times \textit{Year}\ 2009 + \beta 17\ \textit{Full Replacement HSAs} \times \textit{Year}\ 2006 + \beta 18\ \textit{Full Replacement HSAs} \times \textit{Year}\ 2007 + + \beta 19\ \textit{Full Replacement HSAs} \times \textit{Year}\ 2008 + \beta 20\ \textit{Full Replacement HSAs} \times \textit{Year}\ 2009 + \beta 21\ \textit{Optional HSAs} \times \textit{Year}\ 2006 + \beta 22\ \textit{Optional HSAs} \times \textit{Year}\ 2007 + \beta 23\ \textit{Optional HSAs} \times \textit{Year} 2008 + \beta 24\ \textit{Optional HSAs} \times \textit{Year}\ 2009 + \beta 25\ \textit{Age} + \beta 26\ \textit{Risk Score} + \beta 27\ \textit{Gender} + \beta 28\ \textit{Region} + \beta 29\ \textit{Income} + + \beta 30\ \textit{Contract Type} + \beta 31\ \textit{Deductible} + \beta 32\ \textit{Employer Contribution} + \beta 33\ \textit{Coinsurance for Hospital Admissions} + \beta 34\ \textit{Employer Industry} + \beta 35\ \textit{Employer Size} + \varepsilon,$$

where Y is the per-member-per-year (PMPY) expenditure that was calculated from the claims data.

We modeled three types of Ys: total health care expenditure, member paid amount, and plan paid amount. Member paid amount generally includes the copayment, the deductible, and the coinsurance. Plan paid is the proportion of the total expenditure paid by the plan sponsor, which may be the employer (for administrative services only employers) or the insurer (for fully insured employers). Plan paid amount typically includes coinsurance on the plan side (100 percent minus coinsurance on the member side) and the amount that plan pays after the member's out-of-pocket maximum is met.

Member paid amount is processed differently in HRAs and HSAs. In HRAs, member paid is automatically charged from the employer-owned reimbursement account until it is exhausted. After that members pay out-of-pocket. In HSAs, members decide how to use their accounts since they are the owners. HSA members can pay with the account (e.g., for copay, coinsurance, or deductible) for the services at the time they occurred. HSA members can also pay out-of-pocket when the services occurred and keep the receipt and get reimbursed at a later time. Or if they want, HSA members can pay out-of-pocket and leave the fund in the account untouched. Nowadays it is not uncommon that banks where HSA members open their account offer options of investment. For instance, members can invest their money in mutual funds and save the money for future use of health care. In this sense the health savings account is similar to a retirement account.

The primary independent variables of interest are the interactions of cohort and year (β9 through β24), which measure the effect of plan enrollment on expenditures. With the log-link function on Y, β9 through β24 approximately represent the percent change in expenditures with respect to switching to CDHP cohorts relative to members who continuously enrolled in a traditional plan in a specific year. The main effects of cohort dummy variables (β1 through β4) capture permanent, unmeasured differences in expenditures among people who stay in the traditional plans versus those who switch to a CDHP. The year dummy variables (β5 through β8) measure the time effects on expenditures. Additional control factors (β25 through β35) include members' socioeconomic characteristics, such as age, gender, income, region, type of contract, and risk score in the baseline year; employer-level characteristics such as industry and size were used; as well as plan design features, which include level of employer contribution, deductible, coinsurance rate for hospital admissions, and whether preventive care is 100% covered.

2. Methods

2.1. Study population and cohort assignment. The study population was selected from the large-group market (100 or more employees) of united health

care (UHC), one of the largest health insurers in the U.S. and also one of the largest in the CDHP market. HRAs and HSAs offered by UHC represent roughly equal market penetration (1.8 million HRA members and 2 million HSA members in 2011). Large employers were chosen for this study because small groups are often combined into bigger insurance pools to obtain better prices, which would make it hard to track small-group information at the employer-plan level. Using large employers also had the advantage of retaining a relatively large sample size for a longitudinal study.

We originally identified 55 employers and 142,325 members for a two-year (2005 and 2006) study [9]. In the baseline year, 2005, all employers offered traditional plans (PPOs, POSs, or EPOs)[1] to their employees. These traditional plans had relatively low in-network annual deductibles in 2005. Starting in 2006, all employers offered HRAs and/or HSAs either as a full replacement for the traditional plans or as an option in addition to a traditional plan. On average, employers that offered full replacement CDHPs had fewer members than employers that offered CDHPs as options. Although it is possible that an employer offered health plans from other insurers than UHC to its employees, such information was unavailable to us.

The unit of analysis is the individual member, including primary subscribers, who are normally employees, and dependents, who can be children. All members enrolled in a traditional plan in the baseline year. Members were assigned to five mutually exclusive study cohorts depending on the insurance plan they enrolled in for the first follow-up year, 2006: a full replacement HRA, a full replacement HSA, an optional HRA, an optional HSA, or an optional traditional plan cohort.

Members were excluded if they were older than 64 years on December 31, 2006, did not have both medical and pharmacy coverage, used health plans from other insurers than UHC[2], and had total allowed spending exceeding $200,000[3] in any calendar year. Members were required to continuously enroll for 24 months in 2005 and 2006.

We extended the study for three more years (2007-2009) and checked members' cohort assignment annually. For a specific year and a specific cohort, a member would be continuously eligible if s/he stayed in the same type of plan in that year as s/he did in 2006[4], had 12 months enrollment in medical and pharmacy coverage in that year, and also met the requirement for age and not using multiple insurers. The distribution of members between CDHPs and traditional plans was consistent in all years (Table 1).

Table 1. Sample size by cohort by year

Cohort	Full replacement HRAs	Full replacement HSAs	Optional HRAs	Optional HSAs	Optional traditional plans	Total
# of members (% of total members in that year)						(% of members in 2005 and 2006)
2005 and 2006	2,784 (2%)	10,021 (7%)	3,556 (3%)	11,501 (8%)	114,401 (80%)	142,263 (100%)
2007	2,296 (2%)	8,857 (8%)	3,053 (3%)	10,014 (9%)	86,362 (78%)	110,581 (78%)
2008	1,939 (3%)	4,646 (6%)	2,238 (3%)	8,371 (11%)	57,059 (77%)	74,253 (52%)
2009	631 (1%) †	4,169 (7%)	2,009 (3%)	6,814 (11%)	45,877 (77%)	59,500 (42%)

Note: † Two full replacement HRA employers terminated their contracts in 2009.

If a member became ineligible for that cohort, the outcome measures would not apply for that year for that member. Our sample size decreased over time (Table 1). Members became ineligible for a cohort for a variety of reasons, including changing jobs, switching health plans, or retiring[5]. In rare cases a member became eligible again after losing his or her eligibility[6].

2.2. Control factors and dependent variables. We controlled for members' age[7], gender, and ERG (episode risk groups) risk scores in the baseline

[1] Some employers offered more than one PPO, POS (Point of Service), or EPO (Exclusive Provider Organization) plan. One employer also offered an indemnity plan (a fee-for-service plan that does not use a network of preferred providers) with only a very small number of enrollees. We did not include this indemnity plan in our study.

[2] Claims from other insurers were not available.

[3] Such members accounted for only 0.01% to 0.04% in the five cohorts. Withdrawing these members did not have a disproportionate impact on any of the cohorts.

[4] Members who switched within the same type of plans (e.g., from one traditional plan to another traditional plan) were included in the original cohort.

[5] Examination of members who dropped out of this study suggested that they were not different from the eligible study subjects in term of age, gender, and baseline illness burden.

[6] Fewer than 2% of those who were ineligible in 2007 became eligible again in 2008 and fewer than 3% became eligible again 2009. One percent of those who were ineligible in 2008 became eligible again in 2009.

[7] Integer between a member's date of birth and December 31, 2006.

year[1]. ERG risk scores measure the relative resources that were expected to be required for health care. High risk scores imply greater illness burden. A score of 1.00 indicates risk comparable to that of the average person for the large managed care population that was used to develop ERG. The literature reports that ERG risk scores correlate highly with other risk-adjusted measures of practice efficiency [10]. We used the average per-capita income by zip code as a proxy for the member's income and assigned each member to a geographic region defined by the Census Bureau. We also controlled for contract type (individual vs. family) and employer fixed effects.

We controlled for a variety of plan benefit characteristics, including the account contribution, deductibles, copayment for office visits, coinsurance rates, and whether or not preventive care is 100% covered[2].

The outcome measure was per-member-per-year expenditure and its break-down by plan-paid and member-paid amounts. To estimate the impact of enrolling in CDHP on total expenditure in a specific year, we ran generalized linear models (GLM) that specified a Gamma distribution and a log link. A traditional way of modeling costs is using a log-transformed ordinary least squares (OLS) model $E(\ln y|x) = x\beta$, in which the dependent variable is first transformed to its natural logarithm format. In OLS, observations with zero expenditure are removed before fitting the model. GLM has been recently widely used in modeling health care expenditure. In GLM, two parameters are specified: a distribution that reflects mean-variance relationship and a link function between the linear part $x\beta$ and mean $\mu = E(y|x)$. GLM has advantages over OLS in that the coefficient estimates in OLS do not directly translate on the original scale $E(y|x)$. In contrast, with the log link in GLM, $\ln(E(y)) = \mu$, or $E(y|x) = \exp(x\beta)$, the effect on the cohort in a particular year can be interpreted directly as a multiplicative effect on costs without transforming the result from logarithm back to the original form. Also in GLM, the entire analytical data set can be used without removing observations with zero expenditure since zeroes in the data cause no problem for fitting such models.

We fitted several distributions, including Normal, Lognormal, and Gamma, to the error term of the expenditure equations. We found that the Gamma distribution curve fitted the best. We did not use a two-part model because during the 5-year study frame, over 89% of the observations had positive expenditures. Three models were estimated on total paid amount, plan paid, and member paid, respectively. All analyses were run with statistical software SAS 9.1™ (Cary, NC). Results of analysis were reported in the following section.

3. Results and descriptive analysis

3.1. Sociodemographic characteristics. CDHP members had similar age and gender distributions as traditional plan members (Table 2). The co-morbidity risk scores in the baseline year were measurably lower in the optional CDHP cohorts than their peers in optional traditional plans and members in firms that provided CDHPs as the only choice, suggesting that healthier people with less need of care chose CDHPs. Baseline total expenditure follows the same pattern as health status. Members in optional CDHP cohorts spent the least, followed by full replacement CDHP members, and then by optional traditional plan members.

Table 2. Descriptive analysis of study population in baseline year (2005)

Cohort	Full replacement HRA (N = 2,784)	Full replacement HSA (N = 10,021)	Optional HRA (N = 3,556)	Optional HSA (N = 11,501)	Optional traditional plans (N = 114,401)
Age (Mean)***	35	35	34	33	35
Female (%) ***	47%	52%	50%	46%	50%
Risk score (Mean)***	1.2	1.3	0.9	0.8	1.2
Expenditure (Mean)***	$2,683	$2,807	$1,945	$1,863	$2,974
Family contract (%)***	78%	79%	77%	83%	78%
Residence region (%)***					
Midwest	49%	81%	29%	8%	18%
Northeast	10%	2%	3%	9%	12%
South	32%	14%	51%	29%	40%
West	9%	3%	17%	54%	31%
Per-capita income by zip code (Mean) ***	$23,663	$28,188	$23,245	$28,462	$27,071

[1] Calculated with enrollment data and medical and pharmacy claims. ERG is a product of Ingenix, a subsidiary of United Health Group.

[2] Zero copayment and zero coinsurance for wellness visits, which often include physician office services such as routine physical examinations, cancer screening, well-baby and well-child care, vision and hearing screenings, and immunizations. The employer account contribution was set to $0 for the traditional plans that did not have health care accounts.

Table 2 (cont.). Descriptive analysis of study population in baseline year (2005)

Cohort	Full replacement HRA (*N* = 2,784)	Full replacement HSA (*N* = 10,021)	Optional HRA (*N* = 3,556)	Optional HSA (*N* = 11,501)	Optional traditional plans (*N* = 114,401)
When employers offered optional CDHPs					
Employers offered only optional HRAs but not HSAs	NA	NA	$23,904***	NA	$25,025
Employers offered only optional HSAs but not HRAs			NA	$28,411	$28,217
Employers offered both optional HRAs and HSAs			$21,413***	$31,240***	$24,913

Note: *** $p < .0001$. Chi-squared tests were used for discrete variables. Analysis of variance (ANOVA) was used for continuous variables.

Members who chose optional HRAs came from areas that had lower average incomes than those who chose traditional plans. In contrast, members who chose optional HSAs came from areas with comparable or higher average income than those who chose traditional plans, suggesting income selection into the HSAs when multiple plans were offered.

3.2. Expenditure over time. Figure 1 summarizes the raw expenditure by cohort and by payer. The total expenditure was the highest for traditional plans, followed by full replacement CDHPs, and then by optional CDHPs. Costs increased over time in all cohorts as suggested by the upward curves in Figure 1 (see Appendix). From 2005 to 2009, total expenditure increased relatively the fastest in HRAs (optional: 55%; full replacement: 43%), followed by traditional plans (33%), and relatively slower in HSAs (optional: 26%; full replacement: 22%).

The plan paid amount was the highest in traditional plans, followed by full replacement CDHPs, then by optional CDHPs. Over the five year study period, plan paid amount increased faster in HRAs (44%) as well as in traditional plans (32%) compared to that in HSAs (optional: 11%; full replacement: 3%).

The member paid amount was the highest in full replacement CDHPs followed by optional CDHPs, then by traditional plans. Member paid increased significantly in all CDHPs in 2006 as suggested by the upward "peak" in 2006 in Figure 1. After that, it kept increasing in full replacement HSAs and in optional HSAs and became relatively stable in optional HSAs. The member paid also slowly decreased in full replacement HRAs after 2006. Over the entire study frame, the increase of member paid was the highest in HSAs (full replacement: 187%; optional: 104%), followed by HRAs (optional: 96%; full replacement: 40%), and then by traditional plans (35%), suggesting a shift of cost to members in all CDHPs.

3.3. Benefit design characteristics. The benefit design in 2006 is summarized in Table 3. Deductibles in CDHPs were considerably higher than in traditional plans. Coinsurance for hospital admissions was primarily zero or 10%. The only exception is the optional HRAs, in which nearly half of the benefit designs have a 20% coinsurance. Copayments for office visits were relatively low in CDHPs and relatively high in traditional plans. Members in CDHPs were more likely to have free coverage of preventive care than their counterparts in traditional plans.

Table 3. Benefit design characteristics in 2006

Cohort	Full replacement HRA (*N* = 2,784)	Full replacement HSA (*N* = 10,021)	Optional HRA (*N* = 3,556)	Optional HSA (*N* = 11,501)	Optional traditional plans (*N* = 114,401)
Employer contribution*** Mean (Median)					
Individual	$613 ($500)	$772 ($500)	$674 ($700)	$644 ($523)	$0
Family	$1,230 ($1,000)	$1,613 ($1000)	$1,903 ($2,300)	$996 ($1,100)	$0
Total	$943 ($1,000)	$1,168 ($505)	$1,323 ($1,000)	$835 ($600)	$0
Deductible Mean*** (Median)					
Individual	$1,610 ($1,500)	$2,043 ($2,000)	$1,863 ($2,000)	$2,778 ($2,850)	$536 ($300)
Family	$3,041 ($3,000)	$4,079 ($4,000)	$3,910 ($4,000)	$3,548 ($3,600)	$1,374 ($900)
Member coinsurance for hospital admission (%)***					
0%	40%	96%	17%	16%	32%
10%	43%	3%	36%	77%	36%
20%	17%	1%	47%	6%	32%

Table 3 (cont.). Benefit design characteristics in 2006

Cohort	Full replacement HRA (*N* = 2,784)	Full replacement HSA (*N* = 10,021)	Optional HRA (*N* = 3,556)	Optional HSA (*N* = 11,501)	Optional traditional plans (*N* = 114,401)
Office visit copayment mean***(Median)	$2 ($0)	$5 ($0)	$7 ($0)	$2 ($0)	$16 ($20)
100% Preventive care coverage (%)*** $	92%	60%	87%	87%	25%

Notes: *** $p < .0001$. Employer contribution amount was set to $0 for the traditional plans that did not have health care accounts. $ Zero copayment and zero coinsurance.

4. GLM coefficient estimates

Table 4 and 5 summarize the coefficient estimates from the generalized linear models (GLMs). In Table 4, we focus on the impacts of enrolling in optional CDHPs on health care expenditures relative to optional traditional plans[1] as well as the impacts of other control factors. The comparison between optional CDHPs and full replacement CDHPs is reported in Table 5.

4.1. Effect of enrolling in optional HRAs and HSAs on expenditures. Relative to staying in traditional plans, enrolling in optional HRAs was associated with higher expenditures in all years (2006: 9%; 2007: 8%; 2008: 8%; 2009: 16%) and higher plan paid amount in one year only (2009: 14%). Enrolling in optional HSAs was relatively cost-comparable with staying in traditional plans, although fluctuations around zero were observed in the effects on total expenditure (2006: -6%; 2007: 9%; 2008: 8%) as well as in plan-paid amounts (2006: -11%; 2007: 7%; 2008: 7%). The impact turned insignificant in 2009.

Enrolling in both optional CDHP cohorts was associated with much higher member-paid amounts, suggesting that expenses were shifted to members in optional CDHPs. The effects were on average higher in HSAs than in HRAs, and slightly decreased over time in both cohorts.

The coefficients of the cohort dummy variables represent the permanent, unmeasured differences in health care expenditures among people who choose a CDHP versus those who stay in traditional plans. The coefficients of optional HRAs were negative on all expenditures and HSAs, suggesting that optional CDHP enrollees were lower spending individuals on average.

Table 4. Coefficient estimates in generalized linear models (GLMs)

	Total expenditure			Plan paid			Member paid		
Parameter	Est	CL	Sig	Est	CL	Sig	Est	CL	Sig
Full replacement HRA*Year 2006	0	(-0.07,0.07)		-0.01	(-0.09,0.07)		0.54	(0.48,0.6)	***
Full replacement HSA*Year 2006	0	(-0.03,0.04)		-0.04	(-0.08,0)	*	1.08	(1.05,1.11)	***
Optional HRA*Year 2006	0.09	(0.02,0.15)	**	0.02	(-0.05,0.09)		0.59	(0.54,0.64)	***
Optional HSA*Year 2006	-0.06	(-0.09,-0.02)	**	-0.11	(-0.15,-0.06)	***	0.8	(0.77,0.83)	***
Full replacement HRA*Year 2007	0.14	(0.07,0.22)	***	0.18	(0.09,0.26)	***	0.48	(0.41,0.54)	***
Full replacement HSA*Year 2007	0.03	(-0.01,0.07)		-0.02	(-0.07,0.02)		1.05	(1.01,1.08)	***
Optional HRA*Year 2007	0.08	(0.02,0.15)	*	-0.01	(-0.08,0.06)		0.55	(0.5,0.61)	***
Optional HSA*Year 2007	0.09	(0.05,0.12)	***	0.07	(0.03,0.12)	***	0.75	(0.72,0.78)	***
Full replacement HRA*Year 2008	0.08	(0,0.16)	*	0.05	(-0.04,0.14)		0.39	(0.33,0.46)	***
Full replacement HSA*Year 2008	0.01	(-0.04,0.05)		-0.06	(-0.12,-0.01)	*	0.93	(0.89,0.97)	***
Optional HRA*Year 2008	0.08	(0.01,0.15)	*	0.03	(-0.05,0.11)		0.46	(0.4,0.52)	***
Optional HSA*Year 2008	0.08	(0.04,0.12)	***	0.07	(0.03,0.12)	**	0.67	(0.64,0.71)	***
Full replacement HRA*Year 2009	0.23	(0.11,0.35)	***	0.28	(0.14,0.42)	***	0.39	(0.29,0.49)	***
Full replacement HSA*Year 2009	0.02	(-0.03,0.06)		-0.06	(-0.11,0)		0.99	(0.95,1.03)	***
Optional HRA*Year 2009	0.16	(0.08,0.23)	***	0.14	(0.06,0.22)	***	0.41	(0.34,0.47)	***
Optional HSA*Year 2009	0.03	(-0.01,0.07)		-0.03	(-0.08,0.02)		0.64	(0.61,0.68)	***
Age (Scaled by 10 Years)	0.18	(0.18,0.18)	***	0.19	(0.18,0.19)	***	0.16	(0.16,0.16)	***
Male vs. Female	-0.09	(-0.1,-0.08)	***	-0.05	(-0.06,-0.05)	***	-0.11	(-0.12,-0.11)	***
Risk score	0.32	(0.32,0.33)	***	0.33	(0.32,0.33)	***	0.23	(0.23,0.24)	***
Income (scaled by $10,000)	0.02	(0.02,0.02)	***	0.01	(0.01,0.02)	***	0.03	(0.03,0.04)	***
Individual vs. Family contract	0.02	(0.01,0.03)	***	0.03	(0.02,0.04)	***	0.02	(0.01,0.03)	***
Contribution (scaled by $1,000)	0.02	(0,0.03)	*	0.03	(0.01,0.05)	**	-0.01	(-0.02,0.01)	

[1] These are coefficient estimates of the interaction between optional HRAs/HSAs and year dummy variables.

Table 4 (cont.). Coefficient estimates in generalized linear models (GLMs)

	Total expenditure			Plan paid			Member paid		
Parameter	Est	CL	Sig	Est	CL	Sig	Est	CL	Sig
Deductible (scaled by $1,000)	-0.03	(-0.04,-0.02)	***	-0.04	(-0.06,-0.03)	***	0.06	(0.05,0.06)	***
Coinsurance 10% (ref: 0%)	-0.01	(-0.02,0)		-0.04	(-0.06,-0.03)	***	0.18	(0.17,0.19)	***
Coinsurance 20% (ref: 0%)	-0.02	(-0.03,0)	*	-0.08	(-0.09,-0.06)	***	0.33	(0.32,0.34)	***
Office visit copay (scaled by $10)	-0.03	(-0.04,-0.03)	***	-0.03	(-0.04,-0.03)	***	-0.06	(-0.07,-0.06)	***
Preventive care coverage	-0.09	(-0.11,-0.06)	***	-0.1	(-0.12,-0.07)	***	0.03	(0.01,0.05)	**
Cohort (ref: Traditional)									
Full replacement HRA	-0.15	(-0.33,0.03)		-0.15	(-0.36,0.07)		0.16	(0,0.31)	*
Full replacement HSA	-0.37	(-0.51,-0.24)	***	-0.38	(-0.54,-0.23)	***	-0.33	(-0.45,-0.21)	***
Optional HRA	-0.22	(-0.27,-0.17)	***	-0.23	(-0.29,-0.18)	***	-0.3	(-0.35,-0.26)	***
Optional HSA	-0.2	(-0.23,-0.17)	***	-0.14	(-0.18,-0.1)	***	-0.55	(-0.58,-0.52)	***
Year (ref: 2005)									
2006	0.3	(0.28,0.31)	***	0.33	(0.32,0.34)	***	0.12	(0.11,0.13)	***
2007	0.42	(0.41,0.43)	***	0.47	(0.45,0.48)	***	0.24	(0.23,0.25)	***
2008	0.51	(0.49,0.52)	***	0.55	(0.53,0.56)	***	0.34	(0.33,0.35)	***
2009	0.59	(0.58,0.6)	***	0.63	(0.62,0.65)	***	0.42	(0.41,0.43)	***
Region (ref: Midwest)									
Northeast	-0.05	(-0.07,-0.04)	***	-0.07	(-0.09,-0.05)	***	0.01	(0,0.02)	
South	-0.02	(-0.03,-0.01)	***	-0.03	(-0.04,-0.02)	***	0.05	(0.04,0.06)	***
West	-0.05	(-0.06,-0.03)	***	-0.04	(-0.05,-0.02)	***	-0.03	(-0.04,-0.02)	***

Notes: *** $p < .0001$. The omitted reference groups are the interactions of optional traditional group and year dummy variables. Employer fixed effects were included in the model but not reported in this table.

4.2. Difference between full replacement HRAs and optional HRAs. Do the effects of CDHP enrollment differ for optional and full replacement CDHP members? We looked into this question by comparing the coefficients of full replacement CDHPs with those of optional CDHPs[1] Table 5 provides the results in table form and Figure 2 (see Appendix) shows the marginal effect of each plan type on total, plan and member expenditures. We found that enrolling in full replacement HRAs had the same effect on expenditures as enrolling in optional HRAs. The only exception was in 2007 when full replacement HRAs were associated with 19% higher plan-paid amount compared with optional HRAs.

Table 5. Comparison of full replacement CDHPs and optional CDHPs †

Comparison	Total expenditure			Plan paid			Member paid		
	Est	CL	Sig	Est	CL	Sig	Est	CL	Sig
HRAs									
2006 ††	-0.09	(-0.18,0.01)		-0.03	(-0.13,0.08)		-0.05	(-0.13,0.03)	
2007	0.06	(-0.03,0.16)		0.19	(0.08,0.3)	***	-0.08	(-0.16,0)	
2008	0	(-0.1,0.1)		0.02	(-0.09,0.14)		-0.07	(-0.15,0.02)	
2009	0.07	(-0.06,0.21)		0.14	(-0.02,0.29)		-0.02	(-0.13,0.1)	
Cohort main effect †††	0.08	(-0.11,0.26)		0.09	(-0.13,0.3)		0.46	(0.3,0.62)	***
HSAs									
2006 $	0.06	(0.01,0.11)	*	0.06	(0.01,0.12)	*	0.28	(0.24,0.32)	***
2007	-0.06	(-0.11,-0.01)	*	-0.1	(-0.16,-0.04)	***	0.3	(0.26,0.34)	***
2008	-0.07	(-0.13,-0.02)	*	-0.14	(-0.21,-0.07)	***	0.26	(0.21,0.31)	***
2009	-0.01	(-0.08,0.05)		-0.02	(-0.09,0.05)		0.35	(0.3,0.4)	***
Cohort main effect $$	-0.17	(-0.31,-0.04)	*	-0.24	(-0.4,-0.09)	**	0.22	(0.1,0.34)	***

Notes: † * $p < .05$; ** $p < .01$; *** $p < .001$. †† The comparison is between interaction of full replacement HRAs with a specific year and interaction of optional HRAs with the same year. ††† The comparison is between the main effects of full replacement HRA cohort and optional HRA cohort. $ The comparison is between interaction of full replacement HSAs with a specific year and interaction of optional HSAs with the same year. $$ The comparison is between the main effects of full replacement HSA cohort and optional HSA cohort.

[1] The statistical test is whether the coefficient of the interaction between full replacement HRAs/HSAs and year dummy variable equals that of the interaction between optional HRAs/HSAs and year dummy variable.

Enrolling in full replacement HSAs was initially associated with higher costs relative to enrolling in optional HSAs (2006: 6% for total expenditure and plan-paid amount). Starting in 2007, enrollment in full replacement HSAs was associated with lower total expenditures (2007: -6%; 2008: -7%) and plan-paid amounts (2007: -10%; 2008: -14%). The difference was not significant in 2009. Enrolling in full replacement HSAs was associated with higher member-paid amounts in all years (2006: 28%; 2007: 30%; 2008: 26%; 2009: 35%) relative to enrolling in optional HSAs, suggesting that members in full replacement HSAs shared more costs than those in optional HSAs.

By comparing the coefficients of the cohort dummy variables between full replacement CDHPs and optional CDHPs (Table 5), we again found that full replacement HRA enrollees were on average the samelevel spending individuals as optional HRA enrollees, whereas full replacement HSAs were lower (-17% on cohort main effect comparison) spending individuals on average relative to optional HSA enrollees.

4.3. Effects of other control factors. The effects of other control factors on health care expenditures are also worthy of discussion (Table 4). We found that older, female, higher illness burden, higher income, lived in Midwest region, and covered by an individual contract were associated with higher expenditure.

All benefit design characteristics examined in this study, except the employer contribution, were associated with lower total expenditures and lower plan-paid amounts, suggesting that cost-sharing and generous preventive care coverage might lower health care costs. All characteristics except copayment for office visits and employer contribution were associated with higher member-paid amounts. The price elasticity of demand as coinsurance increased from 10% to 20% was -0.01, suggesting a very small response to a price increase.

5. Discussion

Using five years of claims data for a population from multiple employers, we observed per-member-per-year expenditures among five cohorts: members switching voluntarily (optional plan) or involuntarily (full replacement plan) to HRAs or HSAs, and members staying voluntarily in a traditional managed care plan. We compared the effects of optional HRA/HSA cohorts with those of the optional traditional plan cohort, and the effects of full replacement HRAs/HSAs with those of optional HRAs/HSAs.

Our findings suggest that enrolling in optional HRAs was associated with a higher level of spending compared with staying in traditional plans. Enrolling in optional HSAs was associated with a level of spending comparable with continuous enrollment in traditional plans, though higher spending was observed in some years. We found that full replacement HRAs are cost neutral to optional HRAs, while full replacement HSAs saved costs over optional HSAs.

Our results were not surprising given the relatively generous plan benefits in HRAs compared with HSAs. The different account ownership arrangements in CDHPs could also explain the different spending behaviors associated with them. Because the employer-owned HRA accounts are not portable across employers or health plans, even though the funds can be rolled over from year to year, members may prefer spending now rather than saving for later. In contrast, HSAs are portable with members, who can decide to use the funds at any time. For instance, members can leave the funds untouched and save for future health care use[1], or even take the funds with them if they change employers or health plans. The benefit rush that might occur in HRAs is less likely to be observed in HSAs. Benefit rush refers to situations in which one wants to spend all the money in the account when s/he starts looking for a new job or worries about losing a job, faces retirement, or changes plans at the same employer.

Though enrolling in all CDHP cohorts appeared to be associated with much higher member-paid amounts, it should be noted that the increased member-paid amounts would be absorbed on a pre-tax basis by the spending account. In 2006, the average employer contribution exceeded the average member-paid amounts in all CDHPs, suggesting that members' out-of-pocket expenses were on average fully covered by the employer contribution.

We found that benefit design characteristics such as free preventive care and cost sharing were associated with decreased plan paid amounts as well as total expenditures. Higher employer contributions, on the other hand, were associated with higher plan-paid and total expense. The price elasticity of demand was only -0.01 when coinsurance increased from 10% to 20%. Although this elasticity is smaller than the one reported by Manning et al. (1987) using RAND HIE data (-0.2), the absolute value for both was much less than one, implying very inelastic demand with respect to the price change [12].

[1] In a separate study of HSA account balances, we observed some members keeping their HSA accounts open even if they were no longer enrolled in HSAs at UHC.

6. Sensitivity tests for selection effects

We completed a series of sensitivity analyses to test for selection effects. Specifically we sought to examine the permanent, unmeasured differences in service use among people who stay in the traditional plans versus those who switch to a CDHP. For example, are optional CDHP members different from full replacement CDHP members? We explored this question by looking into the coefficients of cohort dummy variables. The coefficients of all CDHP cohorts on all expenditures were negative, suggesting that CDHP enrollees were lower spending individuals on average.

By comparing the coefficients within CDHP type[1], we found that full replacement HSAs had the same degree of selection effects as that of optional HSAs (total expenditure: -15% vs. -15%, $p = 0.6381$; plan paid: -9% vs. -10%, $p = 0.7829$). The only exception was member paid, on which full replacement HSA enrollees spent less (-61% vs. -44%, $p < .0001$).

The story was different for HRAs. Enrollees in full replacement plans were higher spending people than those who chose HRAs over traditional plans (total expenditure: -18% vs. -29%, $p = 0.0011$; plan paid: -22% vs. -32%, $p = 0.009$; member paid: -16% vs. -31%, $p < .0001$), suggesting larger selection effects in optional HRAs.

7. Limitations

Caution should be taken in generalizing our results to large employers offering only traditional plans or using other insurance carriers and to small groups. Employers included in this study offered CDHPs either as a choice or as a full replacement plan in 2006, after offering only traditional plans in 2005. We did not include a cohort of employers that offered only traditional plans from 2005 through 2009. Although our employers were from different regions and different industries, all firms offered UHC products, which could be different from the products of other health insurers. Another limitation of this study is that we did not have information on whether firms offered plans from other carriers. That being said, our study still provides generalizeable results in the sense that more than 20% of CDHP members nationally are covered by UHC, large groups account for nearly 90% of the UHC CDHP population, and employers commonly offer insurance product(s) from a single insurer.

Conclusion

Our findings have implications for employers. As more employers consider offering CDHPs to their employees, HSAs seem to provide better control of costs than HRAs. Meanwhile, as many employers are looking at full replacement CDHPs, our results suggest that full replacement may not be worthwhile because there may be no saving (in HRAs), or the saving is relatively small (in HSAs). In fact, a trend in favor of HSAs has been observed in UHC's member population. While HSA members accounted for 37% of the CDHP members in 2006, the first follow-up year of this study, HSA market penetration increased to 52% of the CDHP population in 2011. This shifting toward HSA enrollment suggests that employers adding CDHPs are adding HSAs mostly, existing HRA employers are switching to HSAs, and more employers are offering full replacement HSAs.

Acknowledgements

The authors wish to acknowledge valuable suggestions made by Rachel Halpern, Craig Hankins, Bob Luchs, Regina Levin, Jim Tincher, Grace Shen, and Lisa Tomai.

References

1. American Association of Preferred Provider Organizations (2011). Nation's Largest Employers Lead CDHP Adoption in 2010. Available at: http://www.aappo.org/UserFiles/File/2011%20CDHP/CDHP_Final.pdf. [Accessed on June 20, 2011].
2. America's Health Insurance Plans (AHIP). Center for Policy and Research (2010). January 2010 census shows 10 million people Covered by HSA/high-deductible health plans [accessed on October 6, 2010]. Available at: http://www.ahipresearch.org/pdfs/hsa2010.pdf.
3. Fronstin, P. (2010). "What do we really know about consumer driven plans?" *Employee Benefit Research Institute (EBRI) Issue Brief*, 345, pp. 4-28.
4. Parente, S.T., R. Feldman and J.B. Christianson (2004b). Evaluation of the effect of a consumer driven health plan on medical care expenditures and utilization, *Health Services Research,* 39 (4, Pt. 2), pp. 1189-210.
5. Feldman, R., S.T. Parente and J.B. Christianson (2007). Consumer-directed health plans: new evidence on spending and utilization, *Inquiry* 44, (1), pp. 26-40.
6. Parente, S.T., R. Feldman and S. Chen (2008). Effects of a consumer driven health plan on pharmaceutical spending and utilization, *Health Services Research*, 43 (5, Pt. 1), pp. 1542-56.

[1] Tests on whether the coefficient of full replacement CDHP equals that of the optional CDHP, rather than test on whether the coefficient equals zero.

7. Feldman, R. and S.T. Parente (2010). Enrollee incentives in consumer directed health plans: spend now or save for later? *Forum for Health Economics & Policy,* The Berkeley Electronic Press.
8. Lo Sasso, A.T., M. Shah and B.K. Frogner (2010). Health savings accounts and health care spending, *Health Services Research*, 45 (4), pp. 1041-60.
9. Chen, S., R.A. Levin and J.A. Gartner, (2010). Medication adherence and enrollment in a consumer driven health plan, *The American Journal of Managed Care*, 16 (2), pp. 43-50.
10. Thomas, J.W., K.L. Grazier and K. Ward, (2004). Economic profiling of primary care physicians: consistency among risk-adjusted measures, *Health Services Research*, 39 (4, Pt. 1), pp. 985-1003.
11. Buntin, M.B. and A.M. Zaslavsky, (2004). Too much ado about two-part models and transformation? Comparing methods of modeling Medicare expenditures, *Journal of Health Economics,* 23 (3), pp. 525-542.
12. Manning, W.G., J.P. Newhouse, N. Duan, E.B. Keeler, A. Leibowitz and M.S. Marquis (1987). Health insurance and the demand for medical care: evidence from a randomized experiment, *American Economic Review*, 77 (3), pp. 251-77.

Appendix

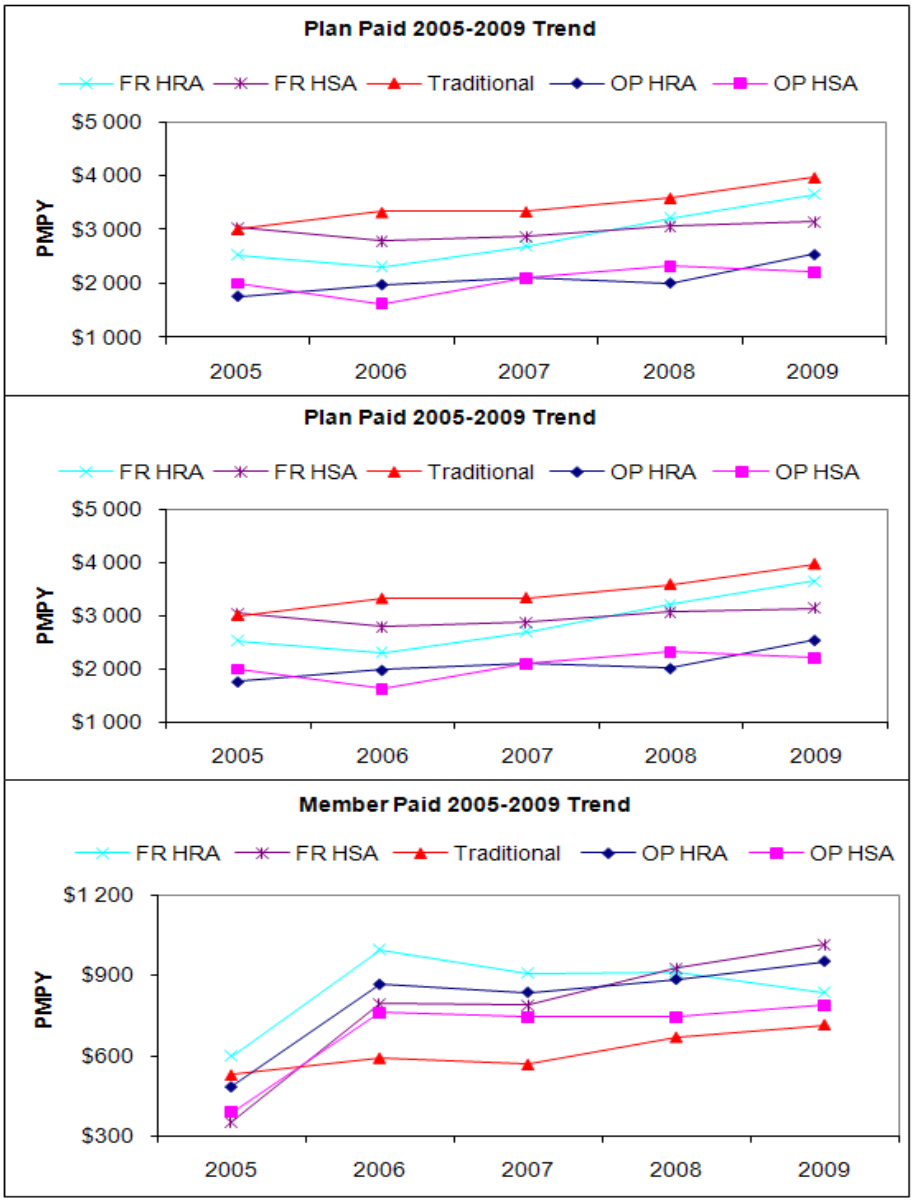

Fig. 1. Trend of raw total paid amount, member paid, and plan paid 2005-2009

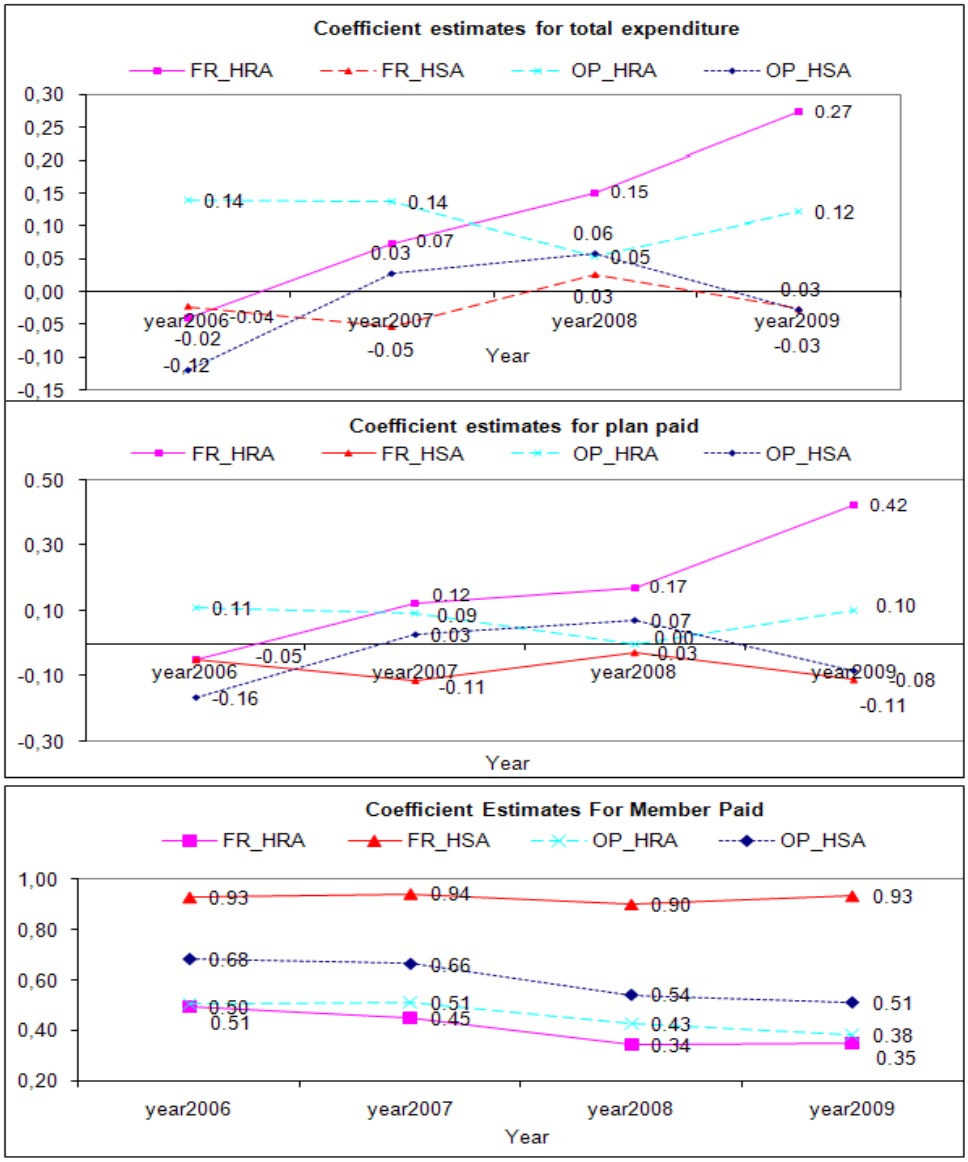

Fig. 2. Coefficient estimates of difference-in-difference model for total expenditure, plan paid, and member paid