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Health care expenditures for university and academic medical center employees enrolled in a pilot workplace health partner intervention

Kenton J Johnston, MPH, MS,

Doctoral Student, Department of Health Policy and Management, Rollins School of Public Health, Emory University, 1518 Clifton Road NE, Atlanta, GA, 30322, Phone: 423/902-8126

Jason M Hockenberry, PhD,

Assistant Professor and Director of Graduate Studies, Department of Health Policy and Management, Rollins School of Public Health, Emory University, 1518 Clifton Road NE, Atlanta, GA, 30322, Phone: 404/727-7416, Fax: 404/727-9198

Kimberly J Rask, MD, PhD,

Associate Professor, Department of Health Policy and Management, Rollins School of Public Health, Emory University, 1518 Clifton Road NE, Atlanta, GA, 30322, Phone: 404/727-1483

Lynn Cunningham, MS, MBA,

Administrative Director, Emory-Georgia Tech Predictive Health Institute, Predictive Health Institute, 550 Peachtree Street, Suite 1850, Atlanta, GA 30308, Phone: 404/686-6180

Kenneth L Brigham, MD, and

Professor Emeritus, Emory University School of Medicine, 100 Woodruff Circle, Atlanta, GA, 30322, Phone: 404/686-6194

Greg S Martin, MD, MSc

Director, Emory-Georgia Tech Center for Health Discovery and Well-Being and Associate Professor, Emory University School of Medicine, 100 Woodruff Circle, Atlanta, GA, 30322, Phone: 404/616-8455

Abstract

Objective—To evaluate the impact of a pilot workplace health partner intervention (HPI) delivered by a predictive health institute to university and academic medical center employees on per-member, per-month (PMPM) health care expenditures.

Methods—We analyzed the health care claims of participants versus non-participants, with a 12-month baseline and 24-month intervention period. Total PMPM expenditures were analyzed using two-part regression models that controlled for gender, age, health benefit plan type, medical member months, and active employment months.

Correspondence to: Kenton J Johnston.

No conflicts of interest are reported.

Results—Our regression results found no statistical differences in total expenditures at baseline and intervention. Further sensitivity analyses controlling for high cost outliers, co-morbidities, and propensity to be in the intervention group confirmed these findings.

Conclusions—We find no difference in health care expenditures attributable to the HPI. The intervention does not appear to have raised expenditures in the short term.

Introduction

Employer-Sponsored Wellness Programs in University-based Settings

Given the large number of employers who offer wellness programs as a means of investing in employee health capital and constraining health care costs,^{1,2} it is to be expected that universities, as the premier large employers in many metropolitan areas, should follow suit. In some ways the American university is an ideal setting for the implementation of employer-sponsored wellness programs due to the availability of faculty and facilities at affiliated academic medical centers, schools of medicine, and schools of public health, as well as on-campus recreation facilities. Nonetheless, although there has been a good deal of research conducted on the impact of wellness programs on employee health care expenditures at large private employers,^{3,4} there has been relatively little published on the impact of such programs delivered in university-based settings.⁵ In the sole review of the literature on wellness programs delivered to employees in university-based settings, 13 published studies of such interventions at U.S. universities (during 1970-2013) were identified.⁵ However, only one of the identified studies evaluated the impact of wellness program participation on employee health care expenditures.⁵ In that single study, by Finkelstein et al., employee wellness program participants who successfully achieved a 5% loss in body weight had no subsequent reduction in health care expenditures or absenteeism costs during the 12-month intervention period or in the two years following the weight loss.⁶

Principles of Predictive Health

As employer-sponsored wellness programs have evolved over time they have increasingly been collecting more biometric and health risk data on participants.² Concurrent with this trend—as well as trends in genomic medicine—has been increased interest in the medical community in the related concept of predictive health.^{7,8} Also referred to as prospective medicine, predictive health may be conceptualized as an orientation toward preventive medicine that focuses on biological markers and environmental factors that precede a range of possible future health states with the goal of modifying current risks to promote future states of good health.⁷⁻¹⁰ As a result, interventions that are predicated on principles of predictive health involve collecting a wide array of individual biometric, genomic, and health risk assessment data. The goal of collecting such personalized and individualized data is to identify predictors of future disease states and use that information to intervene with individuals to modify and reduce risk for development of disease in the future.^{8,10} Given the integrated focus on “biology, environment, and behavior” characteristic of the predictive health movement,⁹ it seems evident that the objectives of wellness programs as conceptualized by large American employers are congruent with interventions predicated on the principles of predictive health.

While some workplace wellness interventions have shown a positive ROI,^{3,4} there is limited data on the impact on health care expenditures of an extensive program predicated on principles of predictive health. Although collecting biometric information and providing a health assessment can help establish plans to maintain health, it could also expose areas of potential poor health. If this leads to additional testing and more treatment, the intervention potentially induces more medical utilization in the short term, driving up health care expenditures.

Research Objective

The objective of this study was to evaluate the impact of a pilot workplace health partner intervention (HPI) delivered by a predictive health institute to university and academic medical center employees on per-member, per-month (PMPM) health care expenditures. The research question is whether there was a difference in the PMPM health care expenditures of HPI participants as compared with a control group of non-participating employees attributable to the HPI during the intervention time period after controlling for other factors. It is believed that this is the first study to evaluate the health care expenditure impact of a workplace wellness intervention predicated on the principles of predictive health in a university-based setting.

Methods

Description of Population and Setting

The population was drawn from Emory University and Emory Healthcare employees, a combined workforce of approximately 25,000 full-time equivalent persons. University employees comprise faculty and staff located in northeast Atlanta; Emory Healthcare employees comprise medical, professional, technical, and support staff at a large urban academic medical center as well as at five additional hospitals and several hundred provider locations throughout the metro Atlanta region. The workforce population includes exempt and non-exempt full-time employees, all of whom are offered comprehensive health coverage through the organization's self-funded group health plan administered by a third party.

The Predictive Health Institute is a collaborative initiative of Emory University and Georgia Tech University located within the urban center of Atlanta and predicated on the principles of predictive health. As described previously by Rask et al.,⁹ the Predictive Health Institute established a Center for Health Discovery and Well Being (the Center) at Emory in 2008 to be “a clinical center for predictive health care delivery” as well as a research laboratory to test the concepts of predictive health and preventive care.⁹ From the beginning, the Center established key partnerships with the Emory University Schools of Medicine, Nursing, and Public Health, as well as with the Centers for Disease Control and Prevention.⁹ The dual intent of the Center was to: 1) conduct an intervention integrating the areas of health promotion, population health, and prospective medicine; 2) promote “the discovery and translation of new knowledge” based on such an integrative approach.⁹

Description of the Intervention

In 2008, the Center began enrolling Emory employees as participants in a health partner intervention (HPI) that featured a wellness and health coaching program predicated on the principles of predictive health. The intervention consisted of two essential programmatic components. First, individual participants were screened in person to identify their current health status as well as generic bio-markers known to predict future disease risk and prognosis.⁹ These intensive screenings were provided annually to participants and included direct clinical hands-on testing and laboratory tests. A multitude of data were collected during the screenings, providing participants with extensive data on their current state of health. Trained health partners helped participants interpret the data and develop a personalized plan of action for maintaining a healthy lifestyle and reducing health risks.

The second programmatic component consisted of follow up interactions with health partners throughout the year as desired by participants. This follow up health coaching was mainly conducted with participants via email, but varied widely depending on the needs of the individual. Health partners were professionals other than physicians and nurses who aided participants with issues that time constraints in a usual medical care setting do not permit. These issues included providing adequate health education and motivation for behavior change. For instance, health partners conducted motivational interviewing and goal-setting with participants for a range of healthy lifestyle activities, such as dietary counseling and meal planning.⁹

Such annual screening and follow-up health coaching has potential benefits to the individual in terms of improving and/or sustaining health. In addition it is thought these types of interventions may have a return on investment (ROI) to participants' employers in terms of health care expenditure savings.

HPI program costs were allocated based on the two complementary programmatic components: 1) annual health screening and counseling; 2) follow-up health partner coaching. The annual health screening and counseling component was the most costly programmatic component due to the labor and resource intensive nature of the services provided. As shown in Table 1, the annual health screening and counseling program costs were \$88.21 PMPM and the follow-up health partner coaching program costs were \$10.75 (in 2010 US dollars). Application of these PMPM costs to study participants' member-months of enrollment resulted in a total annual HPI cost allocation of \$627,631 in 2010 and \$1,910,206 across the three years of 2008-2010.

Study Design

The design was a nested three-year cohort study within the ongoing longitudinal HPI program, with an intervention and comparison group. We used a 12-month baseline period in 2008 and 24-month intervention period in 2009-2010. The study proposal was evaluated by Emory University's Internal Review Board and received approval prior to commencement.

Study Population

As described previously,⁹ the Emory human resources department recruited a stratified random sample of employees to participate in the HPI. Employees who responded to the recruitment invitation were screened and then enrolled in the HPI if they met inclusion and exclusion criteria for admission to the program. Such criteria included screening out those with acute and uncontrolled chronic conditions. In total, 7,444 invitations were sent and the enrollment process was followed until the previously specified target of 750 HPI participants was reached. For the purposes of this cohort study, the study population was further reduced to Emory employees who were also identified as health plan policy holders with medical coverage at some point during the three year study period. In addition, one individual outlier who had 189 inpatient hospital facility encounters in 2010 for mental health treatment was excluded from the intervention population. These restrictions reduced the total intervention population to a cohort of 556 unique participants across 2008-2010. Of these, 99% enrolled in the HPI at some point during the baseline year (2008). The non-intervention population consisted of a similar cohort of 27,650 Emory employees who did not ever participate in the HPI during the same timeframe.

Description of Data

The data source used was an administrative health care database provided by Emory's third party health plan data administrator. The database contained medical and pharmacy claims as well as health plan enrollment data on Emory employees for the study time period. A linked file was also provided that indicated HPI program participation by year and month. It should be noted that Emory made a major change in health insurance vendors between 2007 and 2008, limiting access to earlier data prior to 2008. The privacy, confidentiality, and security of the study data—including compliance with HIPAA requirements—were maintained throughout the study process.

Description of Variables

The dependent variables of interest were total PMPM health care expenditures, as well as the subcomponents of facility, professional and prescription drug expenditures. The independent variable was a binary indicator of participation in the HPI program during the study period. Other health care utilization variables measured from claims data for descriptive analysis were emergency department visits, hospital stays, professional visits, and prescriptions filled.

In order to measure and control for other factors known to impact health care expenditures apart from wellness program participation, additional variables were derived from the study database and included. Employee demographics were measured using age and gender at baseline from health plan enrollment data. Characteristics of employee health plan utilization were coded by year for health plan enrollment months and health benefits plan option chosen—preferred provider organization plan (PPO), point of service plan (POS), or high deductible health plan with health savings account (CDHP). Variables for employment circumstances were updated by year and consisted of active employment months and employment status (active full time, seasonal part time, COBRA, and retiree). Lastly, employee disease burden was assessed for each year using the Charlson Comorbidity Index

(CCI). We derived the global CCI score from ICD-9-CM diagnosis codes on employees' medical claims using a well-validated approach previously described elsewhere.^{11,12} Lastly, we included a dummy variable for each calendar year.

Statistical Analyses

For statistical analysis high cost outliers with PMPM expenditures greater than or equal to \$10,000 (annualized at \$120,000) were removed. This further reduced the HPI participant population from 556 unique members to 554, and reduced the non-participant population from 27,650 unique members to 27,486 (unique members across the years 2008-2010).

The main statistical analysis was performed using two-part regression modeling, described in the current econometrics literature by Belotti et al.¹³ This approach accounts for two features of health care expenditure data that are problematic for standard linear regression modeling. First is the fact that there are typically a non-ignorable number of individuals who do not use services in a given period and therefore have zero costs (giving rise to the so-called zero inflation problem). Second is that even conditional upon using health care in the period, the distribution is typically right-skewed and normality assumptions inherent in linear models are violated.¹³ The first part of the model that predicts any health care utilization in a given year was estimated via logistic regression; the second part of the model that predicts health care expenditures conditional on utilization was estimated using a generalized linear model with a gamma distribution and a log canonical link.

The main set of regression models controlled for baseline gender and age, and health plan benefit type throughout the 2008-2010 study period. In addition, because some employees entered and exited active employment and health plan enrollment during the three-year study period, we controlled for medical member months and active employee months throughout the time period. Lastly, we controlled for secular trend with a calendar year fixed effect and 2008 as the reference year. Robust clustered standard errors were used to account for the potential within person serial correlation in variation in health care expenditures that might bias statistics used for inference (i.e. standard errors and hence p-values). Four separate identical models were run using the four dependent PMPM expenditure variables: total, facility, professional, and pharmacy.

Further sensitivity analyses were conducted under six alternative regression scenarios utilizing additional specifications and variables. The first two scenarios altered the main set of two-part regression models by removing the study population outlier expenditure restriction of \$10,000 PMPM and then imposing a narrower outlier restriction of \$5,000 PMPM, respectively.

The second two sensitivity analyses entered the baseline 2008 CCI score as an additional right hand side covariate in ordinary least squares (OLS) regression equations that included all the covariates listed previously in the main set of regression models. These two analyses included a 12-month continuous enrollment requirement for 2008 in the first set of models and a 36-month continuous enrollment requirement for 2008-2010 in the second set of models.

The last two sensitivity analyses replicated the prior two sets of OLS regression models, but this time with individual observations weighted by the inverse propensity score estimated using all covariates from the prior models (including the CCI score) using the standard approach.¹⁴ The propensity score represents the individual probability of participating in the HPI program, conditional on all observable covariates (gender, age, health plan benefit type, health plan enrollment months, active employment months, and CCI score). It is thought that weighting regression model estimates by the inverse propensity score achieves a balancing of covariates that mimics pseudo-randomization on observables.¹⁵

Data management and statistical analyses were performed with SAS 9.3 and STATA 12.

Results

Descriptive Statistics

Table 2 lists by year the number of individual HPI participants vs. non-participants, health plan enrollment months, active employment months, health plan type, employee type, demographic information, disease comorbidity burden, selected rates of health care utilization, and unadjusted average allowable PMPM expenditures.

As can be seen in Table 2, the gender distribution of the participant vs. non-participant populations was similar; however, the mean age of participants at baseline was approximately four years older than non-participants. This age difference was largely driven by a higher proportion of non-participants in the 20-29 and 30-39 age groups.

The majority of employees were listed as active full time; however, there were also employees flagged as part time/seasonal, COBRA, and retired in the population. The proportion of active full time employees in the participant population was 11 percentage points higher than in the non-participant population (96% vs. 85%). In addition, there was a higher uptake of CDHP benefits among participants as compared to non-participants (6.5% vs. 3.8% in 2010).

As can be seen in Table 2 in the section on disease comorbidity burden and health care utilization, the HPI participant population had a 37% *lower* burden of disease at baseline than the non-participant population, as measured by the CCI score. This lower disease burden is consistent with the HPI inclusion criteria which were designed to obtain a relatively healthy adult intervention group. In addition, the participant population had much lower rates of emergency department visits, hospital stays, and average length of hospital stay in the baseline year 2008. However, during the period 2008-2010 the participant population experienced a marked increase in trend for hospital facility utilization so that by the end of the 3-year period participants' facility utilization rates were much closer to non-participants' facility utilization rates than they were in the baseline year.

Unadjusted calculations are shown in Table 2 and Figure 1. Total PMPM expenditures for participants were less than for non-participants throughout the 3 year period. Intervention participants started with PMPM expenditures 19% lower than non-participants in the first year 2008 of the analysis (\$329 vs. \$407) and ended with PMPM expenditures 2% lower

than non-participants in the last year 2010 (\$404 vs. \$414). However, the unadjusted total PMPM trend among intervention participants was 21 percentage points higher than the trend among non-participants (23% vs. 2%) during the period 2008-2010. The higher overall trend among participants was driven mainly by a higher trend for facility expenditures. The 70% increase from \$80 PMPM for facility expenditures in 2008 to \$136 PMPM in 2010 is shown in Table 1.

Main Regression Results

The estimated impact of changes in health care expenditures over time due to the intervention on participating employees using the two-part modeling approach described above are shown in Table 3. In addition, the impact of health benefit plan type on expenditures throughout the period is also shown.

As can be seen, there was no difference in total PMPM health care expenditures for HPI participants versus non-participants at baseline; however, participants had significantly lower facility costs (\$33.66 PMPM) and higher professional costs (\$22.80 PMPM) at baseline than non-participants.

Our regression results showed no statistically significant differences in total or categorical PMPM health care expenditures attributable to the HPI in participants for 2009 and 2010. This is in contrast to the unadjusted data in Table 2 that show a higher expenditure trend among participants than non-participants. Thus, after removing high cost outliers and controlling for demographic and benefit plan differences, our models could not detect any health care expenditure differences attributable to the HPI in 2009 and 2010.

Table 3 also shows statistically significant differences in total and categorical expenditures detected by our models for benefit plan type. In this case, the CDHP plan is the referent group. Our estimates indicate that Emory employees in the POS and PPO plans had \$155 and \$131 higher total PMPM expenditures respectively than employees in the CDHP plan. This is to be expected given the higher cost-sharing experienced by employees in the CDHP plan.

Sensitivity Analyses

None of the sensitivity analyses we conducted under the six alternative regression scenarios contradicted the result from our main model of no statistically significant difference in *total* PMPM health care expenditures attributable to the HPI during the 2009-2010 intervention.

Removing the outlier expenditure restriction of \$10,000 PMPM had no statistically significant impact on total or categorical expenditures. Imposing an outlier restriction of \$5,000 PMPM narrowed the difference in baseline PMPM facility expenditures so that it was no longer statistically significant. Adding the CCI score as a covariate and weighting the regression estimates by inverse propensity scores both resulted in regression model estimates of statistically significantly lower pharmacy expenditures in 2010 (point estimates between \$10 and \$14) in HPI participants—but they did not have an impact on total expenditures or other categorical expenditures. These new significant estimates for pharmacy expenditures were also in the same direction as the estimates from our main model. Lastly, in one of the

two specified CCI score models, and in both of the propensity-weighted models, the difference in baseline PMPM facility expenditure estimates was narrowed so that it was no longer statistically significant.

Discussion

Summary of Findings

After excluding high expenditure outliers as well as controlling for demographic, health benefit plan, and employment differences our regression analysis found no significant difference in PMPM expenditures attributable to the HPI during the period 2008-2010. In analyzing trends in health care expenditure data in small samples over time one concern is that a very small number of outliers can drive cost findings in spite of the attempts to model the data using the methods described above. However, further sensitivity analyses around high cost outliers, burden of disease, and propensity to be in the intervention group confirmed the findings in our main expenditure model. Our analysis also indicated that employees in traditional health benefit plans had significantly higher total PMPM expenditures than employees in the high deductible CDHP.

Limitations

Several important limitations should be acknowledged. First, as previously noted, due to a change in third party health plan administrators, we lacked health care claims data on employees prior to 2008. Given that most HPI participants initiated the intervention at some point during 2008 it would have been better to treat 2007 as the baseline year. However, our regression models treated 2008 as the baseline year. Second, we did not have access to individual-level linked data on the extent of HPI participants' program engagement over time. Availability of such data would enable the testing of a dose-response relationship between HPI engagement and PMPM health care expenditures. Last, the intervention was introduced in 2008 during a period of poor macroeconomic conditions, which are known to impact health services use and cost.^{16,17} As a result, caution should be taken in ascribing baseline and intervention differences between participants and non-participants to the HPI program over the period.

Conclusions and Implications

We find no difference in health care expenditures attributable to the HPI. The intervention does not appear to have raised cost in the short term, despite the increased provision of diagnostic, testing, and preventive care which could potentially induce more treatment. It may be possible to introduce intensive health interventions predicated on the principles of predictive health without increasing short-term health care costs.

It is important to note that although the HPI program does not appear to have *raised* participants' health care expenditures in the short term, neither does it appear to have reduced participants' health care expenditures as was originally hypothesized. Two possible reasons merit discussion here. First, given the intentional selection of healthy employee participants for the HPI program, it is plausible that a regression-to-the-mean effect may have been in operation whereby the healthy outlier employees selected for the program

gradually regressed to the population average. This explanation is supported by the increase in hospital utilization observed among the participant cohort that was not observed among the non-participant cohort.

Second, and relatedly, it seems likely that an intervention predicated on the principles of predictive health, and therefore oriented toward promoting future states of good health among currently healthy individuals,^{7–10} may require substantially longer than two years to demonstrate a reduction in health care expenditures. By implication, organizations undertaking such interventions may want to budget and plan for a longer time horizon in evaluating such programs than is typical for conventional workforce health promotion and disease management interventions.

Finally, it is important to again emphasize that caution should be taken when interpreting these findings given the time period of the intervention. Macroeconomic conditions such as recessions are known to impact health services use, and therefore cost.^{16,17} The Great Recession of 2008 and 2009 was unprecedented in most of our lifetimes. As reported by Martin et al.,¹⁶ growth in private health insurance spending and consumer out-of-pocket spending during the 2008–2009 period was at a historic low point. In addition, during 2009 employers increased employee health care cost-sharing and introduced more high deductible health plans.¹⁸

Relatedly, the Emory University Human Resources department substantially restructured health benefits over this period in response to a variety of factors, including the recession. In particular there was an increase in employee cost sharing and a shift away from the PPO plan and toward the POS plan and the high deductible CDHP. These changes may have altered employee behavior, particularly given the observed increase in the proportion of employees adopting CDHP benefits and the large significant differences in health care expenditures observed in employees who did not adopt such benefits. Given the healthier risk profile of HPI participants as compared with non-participants it is possible that these benefits changes altered employee health care utilization in different ways among the two groups. Although every attempt was made to control for benefit plan type and burden of disease, it is nonetheless possible that unobserved (and hence, uncontrolled) factors in the two groups interacted with the recession and changes in employee cost sharing to produce a differential effect on health care expenditures.

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The study was approved by the Emory University institutional review board.

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Figure 1. Unadjusted PMPM Health Care Expenditures for 2008-2010

Table 1
Health Partner Intervention Program Costs

	Emory Employee HPI Population		
	Year 2008	Year 2009	Year 2010
Population (Unique Members)	548	551	538
Study Intervention Member Months	6,431	6,529	6,342
HPI PMPM Program Costs			
Annual Health Screening and Counseling	\$88.21	\$88.21	\$88.21
Follow-up Health Partner Coaching	\$10.75	\$10.75	\$10.75
Total Program Costs	\$98.96	\$98.96	\$98.96
Total Program Expenditures	\$636,439	\$646,137	\$627,631

Program costs and expenditures in 2010 US dollars

Emory health plan members flagged as HPI participants and identified as policy holders in the insurance enrollment file were counted as employees and included in study population; insurance enrollment months used to calculate total program expenditures

Table 2
Unadjusted Descriptive Statistics on Emory Employee HPI vs. Non-HPI Population

	Emory Employee HPI Population			Emory Employee Non-HPI Population		
	Year 2008	Year 2009	Year 2010	Year 2008	Year 2009	Year 2010
Population (Unique Members)	548	551	538	22,161	22,223	22,679
Health Plan Member Months	6,431	6,529	6,342	232,835	240,259	241,266
Active Employment Months	6,165	6,329	6,185	196,156	205,394	208,472
Plan Type as %						
CDHP	4.2%	5.1%	6.5%	2.0%	2.9%	3.8%
POS	68.4%	69.0%	93.3%	66.6%	67.3%	94.5%
PPO	27.4%	26.0%	0.2%	31.5%	29.8%	1.7%
Demographics						
Percent Male	31.9%	31.9%	31.4%	32.7%	32.6%	32.8%
Mean Age in 2008	46.7	46.6	46.5	42.8	42.3	41.6
Age 20-29 % in 2008	4.9%	5.1%	5.2%	17.4%	19.4%	21.5%
Age 30-39 % in 2008	21.2%	21.4%	21.0%	28.0%	26.9%	26.2%
Age 40-49 % in 2008	30.7%	30.5%	31.0%	24.3%	24.2%	23.8%
Age 50-59 % in 2008	35.6%	35.4%	35.1%	19.3%	19.0%	18.3%
Age 60+ % in 2008	7.7%	7.6%	7.4%	10.8%	10.2%	9.5%
Employee Type as %						
Active Full Time	95.8%	96.2%	97.8%	84.9%	86.0%	87.1%
Active Part Time Seasonal	3.6%	2.7%	0.7%	7.7%	7.6%	6.2%

	Emory Employee HPI Population			Emory Employee Non-HPI Population		
	Year 2008	Year 2009	Year 2010	Year 2008	Year 2009	Year 2010
COBRA Continuee	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%
Early Retiree	0.0%	0.4%	0.4%	0.6%	0.5%	0.5%
Medicare Eligible Retiree	0.0%	0.2%	0.4%	3.7%	3.8%	3.9%
Other/Unknown	0.5%	0.5%	0.7%	2.5%	2.2%	2.3%
Comorbidity Burden and Healthcare Utilization						
Charlson Comorbidity Index <i>Mean</i>	0.15	0.15	0.16	0.23	0.25	0.23
ED Visits <i>per 1000 members</i>	31.7	38.6	54.9	76.5	73.5	56.3
Hospital Stays <i>per 1000 members</i>	14.9	33.1	49.2	58.5	56.6	59.9
Average Length of Stay <i>in days</i>	2.5	2.9	3.6	4.1	3.7	3.5
Professional Encounters <i>Mean PMPY</i>	11.5	12.3	11.1	10.3	10.8	10.0
Prescriptions Filled <i>Mean PMPY</i>	11.6	12.0	11.7	12.1	12.7	12.2
Mean Expenditures - Per Member Per Month						
Total	\$ 329.15	\$ 389.10	\$ 404.16	\$ 406.73	\$ 437.03	\$ 414.07
Facility	\$ 80.07	\$ 117.95	\$ 135.88	\$ 154.62	\$ 168.15	\$ 159.57
Professional	\$ 155.10	\$ 169.37	\$ 168.72	\$ 148.17	\$ 157.75	\$ 143.41
Pharmacy	\$ 93.98	\$ 101.78	\$ 99.55	\$ 104.37	\$ 111.13	\$ 111.08

Only Emory members identified as policy holders in the insurance enrollment file were counted as employees and included in study population

Individual person-member-months with no medical coverage indicated in the insurance enrollment file were excluded from the study population

One individual outlier who had 189 inpatient hospital facility encounters in 2010 for mental health treatment was excluded from the study population

Table 3
Main Regression Results: Health Care Expenditures by HPI Participation & Plan Type

	Total Expenditures		Facility Expenditures		Professional Expenditures		Pharmacy Expenditures	
	PMPM	P-Value	PMPM	P-Value	PMPM	P-Value	PMPM	P-Value
HPI Participants	\$ 0.004	1.000	\$ (33.66)	0.009	\$ 22.80	0.009	\$ 3.46	0.681
HPI Participants in 2009	\$ 25.74	0.275	\$ 24.95	0.177	\$ 5.09	0.551	\$ (0.87)	0.860
HPI Participants in 2010	\$ 4.24	0.881	\$ 8.90	0.621	\$ 4.08	0.777	\$ (8.01)	0.230
(HPI non-participants and year 2008 are the referent groups)								
POS Plan Type (vs CDHP)	\$ 154.71	<.001	\$ 51.36	<.001	\$ 42.55	<.001	\$ 53.17	<.001
PPO Plan Type (vs CDHP)	\$ 130.79	<.001	\$ 53.79	<.001	\$ 25.40	0.011	\$ 49.85	<.001
(CDHP plan type is the referent group)								
HPI Participant Unique Members	554	--	554	--	554	--	554	--
HPI Non-Participant Unique Members	27,486	--	27,486	--	27,486	--	27,486	--

p-values are robust clustered at the individual member level

model controlled for: age, gender, medical member months, active full-time employee months, and plan type PMPM: per-member, per-month

employees with \$10,000 PMPM in total expenditures in any year were removed from regression analysis (in addition to exclusions noted for Table 1)