Health Insurance Menu Design for Large Employers

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A   Additional Modeling, Estimation and Simulation Details

A.1   Optimal Medical Spending

We derive the analytic form of optimal medical spending for a household on plan j at time t. For exposition, we omit all τ subscripts and assume the following discussion is household-type (single, 2-party, or family with three or more members; and union-status) specific.

First, we derive a household's optimal level of positive medical spending, denoted $m^*_{>0;j,t}(\cdot)$, given the household's ex-post utility in (1) and (4). This is given by:

$$m^*_{>0;j,t}(\lambda;\omega) = \begin{cases} \lambda & \text{if } \lambda < \min(\bar{\lambda}^{ded}_{j,t}, \bar{\lambda}^{oopmax}_{j,t}), \\ \lambda(1 + \omega(1 - coins_{jt})) & \text{if } \lambda \in [\bar{\lambda}^{ded}_{j,t}, \bar{\lambda}^{oopmax}_{j,t}) \text{ and } \bar{\lambda}^{ded}_{j,t} < \bar{\lambda}^{oopmax}_{j,t}, \\ \lambda(1 + \omega) & \text{if } \lambda \geq \max(\bar{\lambda}^{ded}_{j,t}, \bar{\lambda}^{oopmax}_{j,t}), \end{cases} \quad \text{(A.1)}$$

where

$$\bar{\lambda}^{ded}_{j,t} = \frac{2ded_{j,t}}{2 + \omega(1 - coins_{j,t})}\,,$$

$$\bar{\lambda}^{oopmax}_{j,t} = \frac{2[oopmax_{j,t} - ded_{j,t}(1 - coins_{j,t})]}{2coins_{j,t}(1 + \omega) - coins^2_{j,t}\omega}\,,$$

and $ded_{j,t}$ is the deductible, $oopmax_{j,t}$ the out-of-pocket maximum, and $coins_{j,t}$ the coinsurance rate.

Optimal positive medical spending has the following properties (where we assume $\bar{\lambda}^{ded}_{j,t} < \bar{\lambda}^{oopmax}_{j,t}$ for clarity of exposition).[1] When health needs $\lambda < \bar{\lambda}^{ded}_{j,t}$ (where $\bar{\lambda}^{ded}_{j,t}$ is strictly less than the deductible), a household consumes exactly λ. This arises since, below the deductible, out-of-pocket costs increase one-for-one with spending. However, once the household's health needs reach the

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[1]If instead $\bar{\lambda}^{ded}_{j,t} \geq \bar{\lambda}^{oopmax}_{j,t}$, then a household will spend λ until its health needs reach $\bar{\lambda}^{oopmax}_{j,t}$; upon exceeding that threshold, the household will spend $\lambda(1 + \omega)$ as it will then have met its out-of-pocket maximum.

threshold $\bar{\lambda}_{j,t}^{ded}$, the household will discontinuously increase its spending to be greater than the deductible. This arises because the household anticipates that spending above the deductible realizes a coinsurance rate strictly less than 100%. In the range $\lambda \in [\bar{\lambda}_{jt}^{ded}, \bar{\lambda}_{j,t}^{oopmax})$, a household spends an extra $\lambda \times (\omega(1 - coins_{j,t}))$ above λ. Once $\lambda \geq \bar{\lambda}_{j,t}^{oopmax}$, similar logic explains why a household chooses to again discontinuously increase spending beyond the out-of-pocket maximum; beyond this point, a household spends an extra $\lambda \times \omega$ above λ.

Second, we examine whether a household consumes a strictly positive amount of medical care. It will do so if its increase in utility from consuming the optimal level of positive care $m_{>0;j,t}^*$ exceeds the incurred financial and hassle costs, as well as the opportunity cost of spending nothing; i.e., if:

$$h(\lambda, m_{>0;j,t}^*(\cdot); \omega) - h(\lambda, 0; \omega) - c_{j,t}(m_{>0;j,t}^*(\cdot)) \geq 0 . \tag{A.2}$$

Given the expressions for $m_{>0;j,t}^*(\cdot)$ and $c_{j,t}(\cdot)$, there exists a *threshold health need* $\underline{\lambda}_{j,t}(\omega) > 0$ such that equation (A.2) is satisfied for all $\lambda \geq \underline{\lambda}_{j,t}(\omega)$, and violated for all $\lambda < \underline{\lambda}_{jt}(\omega)$.[2] This threshold is given by:

$$\underline{\lambda}_{j,t}(\omega) = \begin{cases} \underline{\lambda}_{j,t,1}(\omega) \equiv 2\omega\zeta & \text{if } \underline{\lambda}_{j,t,1}(\omega) < \bar{\lambda}_{j,t}^{ded}, \text{ else} \\ \underline{\lambda}_{j,t,2}(\omega) \equiv \frac{2\omega(ded_{j,t}(1-coins_{j,t})+\zeta)}{(1+\omega(1-coins_{j,t}))^2} & \text{if } \underline{\lambda}_{j,t,2}(\omega) < \bar{\lambda}_{j,t}^{oopmax}, \text{ else} \\ \underline{\lambda}_{j,t,3}(\omega) \equiv \frac{2\omega(oopmax_{j,t}+\zeta)}{(1+\omega)^2} & \text{otherwise,} \end{cases} \tag{A.3}$$

and this threshold is strictly increasing in hassle cost ζ.

Thus, optimal medical spending for a household is:

$$m_{j,t}^*(\lambda; \omega) = \begin{cases} m_{>0;j,t}^*(\lambda; \omega) & \text{if } \lambda \geq \underline{\lambda}_{j,t} \\ 0 & \text{otherwise.} \end{cases} \tag{A.4}$$

A.2 Estimation Details

Consider household i and its observed decisions $\boldsymbol{d}_i = \{j_t^o, m_t^o\}_{t=1,\dots,3}$, where j_t^o is the plan choice for the household at time t and m_t^o is its medical spending.[3] Denote by $\boldsymbol{\gamma} \equiv (\{F_{\lambda,i,t}\}_t, \omega_i)$ the objects associated with a given household i, drawn from distribution $F_{\gamma,i}(\boldsymbol{\gamma}; \boldsymbol{\theta})$ which is parameterized by $\boldsymbol{\theta}$. The likelihood of observing the household's decisions $\boldsymbol{d}_i$ is:

$$\mathcal{L}_i(\boldsymbol{d}_i; \boldsymbol{\theta}) = \int_\gamma \left(\left(\sum_{k \in \mathcal{J}_0} Pr_0(k; \boldsymbol{\gamma}, \boldsymbol{\theta}) \times Pr_1(j_1^o | j_0 = k; \boldsymbol{\gamma}, \boldsymbol{\theta}) \right) \times \left(Pr_2(j_2^o | j_1^o; \boldsymbol{\gamma}, \boldsymbol{\theta}) \right) \times \left(Pr_3(j_3^o | j_2^o; \boldsymbol{\gamma}, \boldsymbol{\theta}) \right) \right.$$
$$\left. \times \left(\prod_{t=1,\dots,3} f_{m,t}(m_t^o | j_t^o, \boldsymbol{\gamma}, \boldsymbol{\theta}) \right) \right) dF_{\gamma,i}(\boldsymbol{\gamma}; \boldsymbol{\theta}) ,$$

where $\mathcal{J}_t$ denotes the set of plans available in period t; $Pr_0(k; \cdot)$ denotes the probability the household's period-0 insurance plan choice (which is unobserved) was $j_0 = k$; $Pr_t(j_t | j_{t-1}; \cdot)$ denotes the

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[2]Given our restriction to concave cost-sharing rules characterized by a deductible, coinsurance rate, and out-of-pocket maximum, the expression $h(\lambda, m_{j,t}^*(\cdot); \omega) - h(\lambda, 0; \omega) - c_{j,t}(m_{j,t}^*(\cdot))$ is strictly increasing in λ. Since this expression is strictly negative when $\lambda = 0$ and strictly positive for some positive $\lambda > 0$, the result follows.

[3]For exposition, we focus on a household i that is present in all three periods $t = 1, \dots, 3$ of our data, and did not enter or exit in any of these periods. For households that enter or leave during our sample time frame, only the years where the household is present are used in estimation, and medical spending is annualized for years in which the household is only partially present.

probability of choosing plan j_t in period $t = 1\ldots,3$ given prior enrollment in j_{t-1} (which is relevant due to the presence of switching costs); and $f_{m,t}(\cdot)$ denotes the probability density of medical spending.

For any candidate parameter vector $\boldsymbol{\theta}$, we evaluate each household's likelihood contribution via simulation by taking N_S draws of $\boldsymbol{\gamma}$ (each simulation indexed by s) and computing:

$$\hat{\mathcal{L}}_i(\boldsymbol{d}_i; \boldsymbol{\theta}) = \frac{1}{N_S} \sum_{s=1}^{N_S} \left(\left(\sum_{k \in \mathcal{J}_0} Pr_0(k; \boldsymbol{\gamma}_s, \boldsymbol{\theta}) \times Pr_1(j_1^o | j_0 = k; \boldsymbol{\gamma}_s, \boldsymbol{\theta}) \right) \times \left(Pr_2(j_2^o | j_1^o; \boldsymbol{\gamma}_s, \boldsymbol{\theta}) \right) \times \left(Pr_3(j_3^o | j_2^o; \boldsymbol{\gamma}_s, \boldsymbol{\theta}) \right) \right.$$
$$\left. \times \left(\prod_{t=1,\ldots,3} f_{m,t}(m_t^o | j_t^o; \boldsymbol{\gamma}_s, \boldsymbol{\theta}) \right) \right),$$
(A.5)

where each object in (A.5) is computed as follows:

1. Each household's plan choice probabilities $Pr_t(j_t | j_{t-1}^o; \boldsymbol{\gamma}, \boldsymbol{\theta})$ for each plan and period $t = 1, \ldots, 3$ is computed using the modified smoothed Accept-Reject function from Handel, Hendel and Whinston (2015) (see also Train, 2003):

$$Pr_t(j_t | j_{t-1}; \boldsymbol{\gamma}, \boldsymbol{\theta}) = \left(\frac{(-v_{j,t}(\cdot))^{-1}}{\sum_{k \in \mathcal{J}_t}(-v_{k,t}(\cdot))^{-1}} \right)^{\eta} \bigg/ \sum_{l \in \mathcal{J}_t} \left(\frac{(-v_{l,t}(\cdot))^{-1}}{\sum_{k \in \mathcal{J}_t}(-v_{k,t}(\cdot))^{-1}} \right)^{\eta},$$

and the integral used to compute $\{v_{j,t}(\boldsymbol{\gamma}, j_{t-1}^o)\}_{\forall j}$ (corresponding to the household's expected utility from enrolling in plan j, given by (2)) is approximated using N_H draws of health shocks λ_t, and $\eta > 0$ is a smoothing parameter.

2. Each household's density of medical spending $f_{m,t}(m_t^o; j_t^o, \boldsymbol{\gamma}, \boldsymbol{\theta})$ for each year is computed as follows. We assume that the observed medical spending, if positive, is given by $m_{>0;j,t}^*(\lambda, \omega) \times \nu$, where $m_{>0;j,t}^*(\lambda, \omega)$ is the optimal positive level of medical spending for the household on plan j (see (4)), and ν is multiplicative measurement error, where $\log(\nu) \sim \mathcal{N}(-\sigma_\nu^2/2, \sigma_\nu)$ and ν has mean 1. Then $f_{m,t}(\cdot)$ can be written as:

$$f_{m,t}(m; j, \boldsymbol{\theta}) = \begin{cases} F_{\lambda,t}(\underline{\lambda}_{j,t}(\omega)) & \text{if } m_t^o = 0; \\ (1 - F_{\lambda,t}(\underline{\lambda}_{j,t}(\omega))) \times & \\ \quad \int \left(\left(\phi\left(\frac{\log(m/m_{>0;j,t}^*(\lambda,\omega)) + (\sigma_\nu^2/2)}{\sigma_\nu}\right) \big/ \sigma_\nu \right) \times & \text{if } m^o > 0, \\ \quad \underbrace{\left((m_{>0;j,t}^*(\lambda,\omega))^{-1} \right)}_{|d\nu/dm|} f_{\lambda,t}(\lambda | \lambda > \underline{\lambda}_{j,t}(\omega)) d\lambda \right) & \end{cases}$$
(A.6)

where $\phi(\cdot)$ is the probability density of the standard normal distribution. The presence of measurement error allows the model to rationalize any level of medical spending observed in the data.[4]

3. Each household's unobserved period-0 plan choice $Pr_0(j_0; \boldsymbol{\gamma}, \boldsymbol{\theta})$ is approximated as follows.

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[4]There may be discontinuities in the function $m_{>0;j,t}^*(\cdot)$ due to non-linearities in the each plan's cost-sharing schedule $c_{j,t}(\cdot)$. Hence, although there is a unique $m_{>0;j,t}^*(\cdot)$ for any value of $\lambda \geq 0$, absent measurement error, certain levels of observed medical spending cannot be rationalized by any value of λ.

Denote by $\boldsymbol{P}_0(\boldsymbol{\gamma}, \boldsymbol{\theta})$ the $|\mathcal{J}_0| \times 1$ vector with each element k corresponding to $Pr_0(k; \boldsymbol{\gamma}, \boldsymbol{\theta})$. Then:

$$\boldsymbol{P}_0(\boldsymbol{\gamma}, \boldsymbol{\theta}) \approx \boldsymbol{P}_1(\boldsymbol{\gamma}, \boldsymbol{\theta}) \times [\boldsymbol{T}_{j_t|j_{t-1}}(\boldsymbol{\gamma}, \boldsymbol{\theta})]^{tenure_i - 1}$$

where $\boldsymbol{P}_1(\boldsymbol{\gamma}, \boldsymbol{\theta})$ is the $|\mathcal{J}_1| \times 1$ vector with each element k corresponding to $Pr_1(j_1 = k | j_0 = \emptyset; \boldsymbol{\gamma}, \boldsymbol{\theta})$ (i.e., the plan choice probabilities for a household with no prior choice of insurance plan); $\boldsymbol{T}_{j_t|j_{t-1}}(\boldsymbol{\gamma}, \boldsymbol{\theta})$ is a $|\mathcal{J}_1| \times |\mathcal{J}_1|$ matrix where element m, n is $Pr_1(j_1 = m | j_0 = n; \boldsymbol{\gamma}, \boldsymbol{\theta})$ (i.e., the plan choice transition matrix derived from $Pr(j_1 | j_0, \boldsymbol{\gamma}, \boldsymbol{\theta})$); and $tenure_i$ is the number of years the household was employed at $t = 1$ (observed in our data). Our approximation is exact if all plan and household characteristics are the same in period 1 as they were in prior years, and the household was not enrolled in any plan in the employer's choice set prior to employment by the firm.

Note that to control of unobserved heterogeneity, this procedure draws household objects $\boldsymbol{\gamma}$ from the distribution $F_{\gamma,i}(\cdot)$ and simulates forward its choices in a manner similar to Pakes (1986). We set $N_S = 50$, $N_H = 200$, $\eta = 300$, and $\sigma_\nu = 0.1$ (which implies that ν has a standard deviation of 0.1).

Our estimate of $\boldsymbol{\theta}$ is $\hat{\boldsymbol{\theta}} = \arg\max_{\boldsymbol{\theta}} \sum_i \left(\ln(\hat{\mathcal{L}}_i(\boldsymbol{d}_i; \boldsymbol{\theta})) + C_i \right)$, where C_i is a first-order asymptotic bias correction term for simulated maximum likelihood.[5] Implementation relies on the JAX software package (Bradbury et al., 2018) for automatic differentiation, JIT compilation, and GPU support.

A.3 Simulations: Determination of Premiums and Enrollment with Selection

As discussed in the main text, we allow for an employer to manage adverse selection by allowing the premium difference between two plans to be less than the difference in their underlying costs: i.e., the employer can choose a subsidy level $\kappa \in [0, 1]$ that equals the ratio of the difference in plans' premiums to the difference in the plans' average costs (i.e., medical spending net out-of-pocket payments).

Formally, suppose there are N_1 enrollees in plan 1 and N_2 enrollees in the more-generous plan 2; for simplicity, suppose all households are individuals (there are no families). Define E_j to be total spending net of out-of-pocket payments in plan j for $j = 1, 2$; define average net spending across households to be $AC_j = E_j / N_j$. Then, the individual premium in plans 1 and 2 (denoted p_1 and p_2) are determined by the following two equations:

$$p_2 = p_1 + \kappa(AC_2 - AC_1) \qquad \text{(premium difference reflects κ of average cost difference)},$$
$$p_1 N_1 + p_2 N_2 = E_1 + E_2 \qquad \text{(premiums cover total spending)}.$$
$$(A.7)$$

To obtain outcomes for each (κ, c_1, c_2) triple, we utilize the following procedure. First, we initialize the premiums for each plan to equal average costs as if every household was enrolled on that plan; denote these premiums (p_1^0, p_2^0). Then, for each iteration $n = 1, 2, 3, \ldots$:

(i) Compute enrollment for each household given premiums (p_1^{n-1}, p_2^{n-1});

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[5]Following Gourieroux and Monfort (1997), we use the following correction term for each household i:

$$C_i = \frac{1}{2} \frac{\sum_s (L_{is}(\boldsymbol{\gamma}_s) - \bar{L}_i)^2 / N_S}{(\bar{L}_i)^2}$$

where $\bar{L}_i = (\sum_{s=1}^{N_S} L_{is}(\boldsymbol{\gamma}_s))/N_S$, and $L_{is}(\boldsymbol{\gamma}_s)$ represents all terms inside the outer summation on the right-hand-side of (A.5).

(ii) Given enrollment decisions in (i), compute expected net spending and average costs on each plan, and determine candidate premiums (p_1', p_2') to solve (A.7);[6]

(iii) For any household that switches plans in step (i) from iteration $n-1$, determine whether it still wishes to do so given updated premiums (p_1', p_2'); if not, re-assign that household to its plan choice in iteration $n-1$;

(iv) Given enrollment decisions in (iii), compute expected net spending and average costs on each plan, and update premiums (p_1^n, p_2^n) to solve (A.7).

We repeat steps (i)-(iv) until $\max_j |p_j^n - p_j^{n-1}| < \$1$.[7,8]

A.4 Simulations: Single Plan, Variable Deductible

We repeat the single-plan simulations from Section 4.2, and allow the level of coinsurance to vary from 0–100% while also allowing the individual deductible to vary in \$250 increments between \$0 and \$2000 (with the upper limit corresponding to the individual out-of-pocket maximum in our setting). Consistent with our empirical setting, two-party and family deductibles (like OOP maximums) are twice and three times the individual maximum.

In Figure A1, we plot the change in average employee surplus from different financial coverage levels relative to a single plan with a zero-dollar deductible and no coinsurance (i.e., full insurance). The top line of the figure plots the change in average surplus generated by varying the coinsurance rate with the deductible held fixed at the optimal zero level; this line corresponds to Figure 1 presented in the introduction. The other lines in Figure A1 depict how average surplus varies with coinsurance for different deductible levels.

Table A1 provides the optimal coinsurance rate and change in average surplus for the deductible levels shown in Figure A1. As discussed in the main text, we find that a zero-deductible is optimal for a single plan in our setting, and the average consumer surplus gain from the optimal coinsurance rate, relative to full insurance, decreases monotonically as the deductible increases.

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[6]In our setting, premiums for 2-party and family households equal 2.7 times the single household premium. To account for this, we modify the second-line of (A.7) as follows:

$$(p_1 \times N_{1,single} + 2.7 \times p_1 \times N_{1,fam}) + (p_2 \times N_{2,single} + 2.7 \times p_2 \times N_{2,fam}) = E_1 + E_2 \ ,$$

where $N_{j,single}$ and $N_{j,fam}$ are the number of single- and non-single coverage households on plan j.

[7]Although the convergence criterion is computed using the implied premiums (p_1^n, p_2^n) that solve (A.7), for each $j = 1, 2$ we use $\tilde{p}_j^n = \alpha p_j^n + (1-\alpha)p_j^{n-1}$ as the value of premiums for each subsequent iteration, where $\alpha \in (0,1)$ is a tuning parameter.

[8]Steps (iii)-(iv) resolve convergence issues that arise with a finite number of households and the potential impact that a single household with a large amount of spending can have on premiums. For example, it can be the case that some household i with high medical spending enrolled on plan 1 would prefer to be on plan 2 if the premiums for the two plans were set given household i was enrolled on plan 1; but, if household i switched to plan 2 and premiums adjusted, household i would prefer to switch back to plan 1. Steps (iii)-(iv) require that at any set of enrollment decisions and premiums, those households that are allowed to adjust their enrollment decisions are those that would wish to do so even if premiums accounted for these adjustments. Our requirement that such "deviations" remain profitable to certain "reactions" shares similarities with alternative equilibrium concepts developed to address equilibrium non-existence issues in markets characterized by adverse selection (e.g., Wilson, 1977; Riley, 1979; Budish, Lee and Shim, 2020).

Figure A1: Simulation A.II (Change in Average Employee Surplus Relative to Full Insurance)
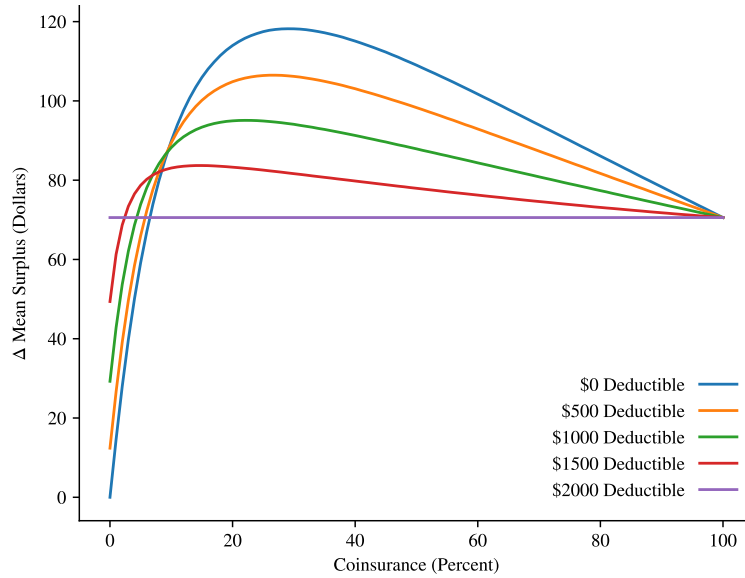
Notes: Each line corresponds to the change in estimated annual household-average level of employee surplus in dollars from offering a single HUGHP-HMO plan with a fixed deductible and positive coinsurance rate (horizontal axis), relative to a single HUGHP-HMO plan with a zero deductible and zero coinsurance rate (Simulation A.I). Deductibles listed correspond to individual amounts, and out-of-pocket maximums are fixed at $2000 per individual and $6000 per household.

Table A1: Single Plan, Optimal Coinsurance with Variable Deductibles

Deductible	Coins. (%)	Avg. Spending ($)	Δ Surplus ($)
$0	29	8260.72	118.20
$250	28	8262.35	113.19
$500	27	8263.37	106.48
$750	25	8264.17	100.68
$1,000	22	8263.67	95.09
$1,250	19	8261.87	89.50
$1,500	15	8259.60	83.70
$1,750	9	8257.26	77.44
$2,000	-	8254.74	70.57

Notes: Each row provides the optimal (average employee surplus maximizing) coinsurance rate, the level of average spending across households, and the change in average employee surplus relative to full insurance for a single HUGHP HMO plan at a given deductible level. The first row ($0 deductible) corresponds to Simulation A.II in Table 8.

B   Additional Tables and Figures

Table B1: Difference-in-Difference Results, DCG Quartile 4

| | | Fraction with zero spending | Percentile of Spending Distribution | | | | |
Observations	Mean		10th	25th	50th	75th	90th
Individuals							
Reduced-Form Diff-in-Diff, All Severity Scores							
Difference-in-Differences (Levels)	-576	0.017	0	-64	-154	-353	-1,643
Difference-in-Differences (Percentages)	-15.1%	12.6%	-	-18.2%	-10.7%	-8.5%	-19.0%
Reduced-Form Diff-in-Diff, Mean Severity Score Quartile 4							
Difference-in-Differences (Levels)	-1,575	-0.002	-313	-347	-1,140	-2,166	-5,643
Difference-in-Differences (Percentages)	-19.2%	-12.5%	-33.1%	-15.6%	-24.2%	-21.8%	-28.3%
Two-Party and Family Households							
Reduced-Form Diff-in-Diff, All Severity Scores							
Difference-in-Differences (Levels)	-1,001	0.002	-307	-96	-349	-886	-3,830
Difference-in-Differences (Percentages)	-7.7%	19.7%	-18.6%	-2.7%	-5.1%	-6.3%	-13.3%
Reduced-Form Diff-in-Diff, Mean Severity Score Quartile 4							
Difference-in-Differences (Levels)	-1,516	-0.005	-92	-396	336	-4,100	-9,770
Difference-in-Differences (Percentages)	-6.6%	-	-2.0%	-4.0%	2.7%	-15.1%	-16.8%

Notes: Basic difference-in-difference results summarizing annual household spending for individuals (top panel) and two-party households and families (bottom panel) that comprise the 'base (2014-5) sample' summarized in column 2 of Table 1. For each panel, first set of results are repeated from Table 4 for ease of comparison. Second set of results focus just on households (in treatment and control groups) whose mean DCG score is in the highest quartile of the distribution for their family type and year. See Section 3.1 for details.

Table B2: Difference-in-Difference Results, Outpatient Visits

| | Observations | Mean | Fraction with zero spending | Percentile of Spending Distribution | | | | |
				10th	25th	50th	75th	90th
Individuals								
Control (Union)								
2014 Spending	1,763	1,469	0.494	0	0	30	1,141	4,461
2015 Spending	1,763	1,673	0.493	0	0	36	1,201	4,838
Treated (Non-Union)								
2014 Spending	2,108	1,253	0.543	0	0	0	778	3,780
2015 Spending	2,108	1,286	0.558	0	0	0	798	3,470
Treated-Control Differences (Levels, Non-Union - Union)								
2014 Difference		-216	0.049	0	0	-30	-363	-680
2015 Difference		-387	0.064	0	0	-36	-403	-1,368
2015-2014 Differences (Levels)								
Control (Union)		204	-0.001	0	0	6	60	377
Treated		33	0.015	0	0	0	21	-311
Difference-in-Differences (Levels)		-171	0.015	0	0	-6	-40	-688
Difference (Percentages)								
Control		13.9%	-0.1%	-	-	19.8%	5.3%	8.5%
Treated		2.6%	2.7%	-	-	-	2.6%	-8.2%
Difference-in-Differences (Percentages)		-11.3%	2.8%	-	-	-	-2.6%	-16.7%
Two-Party and Family Households								
Control (Union)								
2014 Spending	1,141	5,109	0.15	0	345	1,956	5,964	13,631
2015 Spending	1,141	6,342	0.156	0	437	2,293	7,242	16,820
Treated (Non-Union)								
2014 Spending	2,695	4,774	0.164	0	338	1,823	5,764	12,534
2015 Spending	2,695	5,077	0.172	0	274	1,821	5,633	12,245
Treated-Control Differences (Levels, Non-Union - Union)								
2014 Difference		-335	0.014	0	-7	-133	-200	-1,097
2015 Difference		-1,265	0.016	0	-163	-473	-1,609	-4,575
2015-2014 Differences (Levels)								
Control (Union)		1,233	0.006	0	92	338	1,278	3,189
Treated		303	0.008	0	-64	-2	-131	-289
Difference-in-Differences (Levels)		-930	0.002	0	-155	-340	-1,409	-3,478
Difference (Percentages)								
Control		24.1%	4.1%	-	26.5%	17.3%	21.4%	23.4%
Treated		6.3%	5.0%	-	-18.9%	-0.1%	-2.3%	-2.3%
Difference-in-Differences (Percentages)		-17.8%	0.9%	-	-45.4%	-17.4%	-23.7%	-25.7%

Notes: Basic difference-in-difference results summarizing annual household outpatient spending for individuals (top panel) and two-party households and families (bottom panel) that comprise the 'base (2014-5) sample' summarized in column 2 of Table 1.

Table B3: Difference-in-Difference Results, Physician Office Visits

| | Observations | Mean | Fraction with zero spending | Percentile of Spending Distribution | | | | |
				10th	25th	50th	75th	90th
Individuals								
Control (Union)								
2014 Spending	1,763	1,370	0.201	0	130	667	1,902	3,755
2015 Spending	1,763	1,532	0.175	0	187	831	2,070	4,106
Treated (Non-Union)								
2014 Spending	2,108	1,213	0.202	0	112	595	1,620	3,164
2015 Spending	2,108	1,293	0.192	0	128	610	1,727	3,395
Treated-Control Differences (Levels, Non-Union - Union)								
2014 Difference		-157	0.0	0	-19	-72	-282	-591
2015 Difference		-238	0.017	0	-59	-221	-343	-712
2015-2014 Differences (Levels)								
Control (Union)		162	-0.027	0	57	164	169	352
Treated		80	-0.01	0	16	15	107	231
Difference-in-Differences (Levels)		-82	0.017	0	-41	-148	-61	-121
Difference (Percentages)								
Control		11.8%	-13.2%	-	43.7%	24.6%	8.9%	9.4%
Treated		6.6%	-4.9%	-	14.4%	2.6%	6.6%	7.3%
Difference-in-Differences (Percentages)		-5.2%	8.3%	-	-29.3%	-22.0%	-2.3%	-2.1%
Two-Party and Family Households								
Control (Union)								
2014 Spending	1,141	4,054	0.041	543	1,579	3,134	5,489	8,487
2015 Spending	1,141	4,173	0.036	620	1,657	3,295	5,688	8,717
Treated (Non-Union)								
2014 Spending	2,695	4,519	0.017	930	1,873	3,509	5,989	9,326
2015 Spending	2,695	4,593	0.017	908	1,877	3,473	6,012	9,590
Treated-Control Differences (Levels, Non-Union - Union)								
2014 Difference		465	-0.024	387	294	375	499	839
2015 Difference		420	-0.019	288	219	178	324	873
2015-2014 Differences (Levels)								
Control (Union)		119	-0.005	77	78	161	199	230
Treated		74	0.0	-22	4	-36	24	264
Difference-in-Differences (Levels)		-44	0.005	-99	-75	-196	-175	34
Difference (Percentages)								
Control		2.9%	-12.8%	14.2%	5.0%	5.1%	3.6%	2.7%
Treated		1.6%	0.0%	-2.4%	0.2%	-1.0%	0.4%	2.8%
Difference-in-Differences (Percentages)		-1.3%	12.8%	-16.5%	-4.8%	-6.1%	-3.2%	0.1%

Notes: Basic difference-in-difference results summarizing annual household spending on physician office visits for individuals (top panel) and two-party households and families (bottom panel) that comprise the 'base (2014-5) sample' summarized in column 2 of Table 1.

Table B4: Parameter Estimates

Parameter			Estimate	SE
$\boldsymbol{\theta}_1$	Plan Choice ($\boldsymbol{\beta}_x$)	POS(P)	-1.391	0.072
		HP	-0.441	0.048
		HP x POS(P)	0.828	0.066
		HP x Cambridge	-0.893	0.083
	(interacted w/ λ)	POS(P)	0.179	0.012
		HP	0.249	0.015
		HP x POS(P)	-0.129	0.012
		HP x Cambridge	-0.060	0.014
	Switching Cost	δ	3.789	0.123
$\boldsymbol{\theta}_2$	Health: Mean ($\boldsymbol{\beta}_\lambda$)	Tier 2	0.284	0.026
		Tier 3	0.408	0.032
		Age 40+	0.131	0.026
		Age 50+	0.032	0.029
		DCG Q2	0.727	0.029
		DCG Q3	1.225	0.032
		DCG Q4	1.831	0.038
		Single x Union	-1.226	0.044
		2-Party x Union	0.267	0.054
		Family x Union	0.549	0.047
		Single x Non-Union	-1.498	0.039
		2-Party x Non-Union	-0.044	0.055
		Family x Non-Union	0.415	0.043
		Single x 2015	0.020	0.025
		2-Party x 2015	0.031	0.045
		Family x 2015	0.035	0.024
		Single x 2016	0.111	0.024
		2-Party x 2016	0.075	0.043
		Family x 2016	0.064	0.031
	Health: Variance ($\ln(\boldsymbol{\sigma}_\lambda)$)	Single	0.083	0.017
		2-Party	-0.061	0.033
		Family	-0.312	0.025
	Health: Unobs. Variance in Mean	$\ln(\sigma_\mu)$	-0.388	0.027
	Moral Hazard	$\ln(\omega_1)$	-3.348	0.182
		$\ln(\omega_2)$	-1.335	0.235
		$\beta_{\omega,1}$	-0.565	0.083
	Risk Aversion	β_ψ	-5.785	0.036
	Hassle Costs ($\boldsymbol{\beta}_\zeta$)	Single x Union	-0.492	0.174
		2-Party x Union	-0.161	0.213
		Family x Union	0.538	0.196
		Single x Non-Union	-0.592	0.179
		2-Party x Non-Union	-0.487	0.256
		Family x Non-Union	-0.175	0.231

Notes: Parameter estimates from health plan choice and utilization model in Section 3 (utility is measured in $000s). We estimate the natural logarithm of parameters that are restricted to be positive (σ_μ, ω_1, ω_2).

Table B5: Regression of Optimal Tailored Coinsurance Rate on Household Characteristics

	Coefficient	SE
Single x Union	0.787	0.005
Two-Party x Union	0.652	0.008
Family x Union	0.724	0.008
Single x Non-Union	0.853	0.004
Two-Party x Non-Union	0.705	0.007
Family x Non-Union	0.732	0.006
Tier 2	-0.065	0.006
Tier 3	-0.096	0.006
Age 40+	-0.034	0.005
Age 50+	-0.009	0.005
DCG Q2	-0.184	0.005
DCG Q3	-0.312	0.005
DCG Q4	-0.440	0.005
N	8827	
R^2	0.598	

Notes: OLS Regression of the optimal (average employee surplus maximizing) household-specific coinsurance rate (HUHGP HMO) from Simulation A.III (Table 8) on household characteristics.

Table B6: Simulated Results (HUGHP HMO Plans Only), Robustness to Risk Aversion

(HUGHP HMO Plans Only)		Main Estimates ($\beta_\psi = -5.8$)			Robustness ($\beta_\psi = -2$)		
		Coins.	Δ Surplus	$\frac{\Delta \text{Surplus}}{(a)}$	Coins.	Δ Surplus	$\frac{\Delta \text{Surplus}}{(b)}$
Single Plan (Section 4.2)							
A.I Fixed Coins.		0	0	-	0	0.00	-
		-	-	-	-	-	-
A.II Optimal Coins.		29	118.20[a]	1.00	15	129.62[b]	1.00
		[28, 31]	[60.38, 127.67]	-	[9, 16]	[50.25, 143.45]	-
Multiple Plans with Assignment (Section 4.3)							
A.III Tailored Plans	Mean	48	150.84	1.28	28	171.80	1.33
		[46, 49]	[76.49, 161.91]	[1.25, 1.28]	[19, 29]	[69.39, 188.36]	[1.30, 1.37]
A.IV Two Plans	Plan A	15	137.08	1.16	8	154.99	1.20
		[14, 16]	[69.79, 147.95]	[1.15, 1.17]	[5, 9]	[61.75, 170.01]	[1.18, 1.22]
	Plan B	51			32		
		[49, 53]			[19, 35]		
Multiple Plans with Selection (Section 4.4)							
A.V Two Plans	Plan A	20	119.68	1.01	10	136.74	1.05
		[15, 25]	[61.29, 129.14]	[1.01, 1.02]	[5, 10]	[52.30, 149.70]	[1.04, 1.06]
	Plan B	35			20		
		[30, 35]			[15, 30]		
By Family-Type (Section 4.5)							
B.I Two Plans	Single	47	120.51	1.02	31	132.92	1.03
		[44, 49]	[61.49, 130.60]	[1.01, 1.02]	[19, 33]	[51.68, 146.58]	[1.02, 1.03]
	Non-Single	26			13		
		[25, 27]			[8, 14]		

Notes: Simulation results corresponding to Table 8 (see main text for additional details). "Main Estimates" corresponds to results presented in the main text; "Robustness" presents results from adjusting each household's CARA coefficient to approximately 1×10^{-4} ($\beta_\psi = -2$). Coinsurance rates are in percentages; Δ Surplus is in dollars. 95% confidence intervals are reported below results in brackets, and are obtained by re-estimating the model over 200 bootstrap samples of households and re-computing simulations.

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