Managing Behavioral Hazard: Value-Based Insurance Design and Inertia

Lynn M. Hua*

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Abstract

Health insurance may be used as a mechanism for more efficient health care decisions. While value-based insurance design (VBID) aligns cost-sharing with clinical value, it is unclear whether consumers reduce their medical expenses. I study the impact of a new value-based insurance design which decreased copays for primary care physician visits, increased copays for specialist visits, and introduced negative cost-sharing with preventive care incentives to reduce the deductible. I find consumers are persistent in their plan choice and there is entry of younger, new employees into the VBID plan. Old subscribers defaulted into VBID have a greater number of PCP visits, while new employees who actively choose VBID have a lower number of specialist visits compared to non-VBID subscribers. To study the demand for this new design and how selection and treatment effects interact with consumers experiencing inertia, I estimate a model of plan choice and level of deductible and investigate responses to counterfactual plan menus which i) reduce the number of plan options, ii) lower the switching cost to zero, and iii) mandate enrollment in the value-based plan. By switching to the value-based plan, enrollees can reduce their premium paid by as much as $4,351 with moderate expected increases in out-of-pocket payments of $85 for subscribers with good health and $245 for those with poor health, on average. These results highlight the importance of active choice coupled with decision aids, targeted information about coverage changes, and strong financial incentives to motivate changes in consumer behavior.

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1 Introduction

Effective incentives and thoughtful market design through choice architecture can have a profound impact on consumer decision-making. Information provision has limitations in changing behavior, and by nature, default options are effective in their ability to motivate important decisions such as those related to health behaviors. Incentives can also backfire, unwittingly encouraging the behavior they are meant to limit. How to reliably design incentive schemes for consumers remains a challenge for regulators to transition from prioritizing volume to value.

I study these issues in the context of health insurance markets, particularly with value-based insurance design (VBID). Traditionally, patient cost-sharing is thought to balance financial risk protection in the case of a health shock with managing moral hazard (Arrow 1963; Pauly 1968; Zeckhauser 1970). Theory would suggest that the more elastic the demand is for a particular medical service, cost-sharing should be set higher to curb overconsumption due to moral hazard. However, there also exists behavioral hazard as consumers under-use care with health benefits that greatly exceed costs (Baicker et al., 2015). Medical services can be coupled with financial incentives to make them more or less attractive to consumers.

Value-based insurance design has been introduced as an innovative policy to potentially reduce medical expenditures and improve health (Chernew et al. 2007; Chernew et al. 2010). Standard health insurance plans have cost-sharing that is constant across medical services even though the clinical value of the services may be very different. VBID varies the coverage of specific services through plan design elements so services deemed high-value and underused have lower out-of-pocket costs, thereby making them more affordable, and vice versa for low-value care. This is intended to encourage the consumption of beneficial services, which may reduce future spending.

This paper investigates three main questions. First, what types of individuals enroll in the value-based plan and how does this depend on what other plans are offered as part of the plan menu? Second, what is the effect of the value-based plan on spending and utilization? Third, how do these selection and treatment effects interact with consumers who experience inertia?

There are few studies on the effectiveness of VBID programs, despite their attractive features. Past value-based evaluations have been limited and do not consider market level effects. There is a key challenge of disentangling the selection effect with the treatment effect as consumers choose to enroll in the value-based plan among their other plan options. Specifically, if healthier individuals sort into the value-based plan rather than other plan options, then differences in spending may reflect the baseline health of the enrollee rather than the change in consumer behavior due to the implementation of value-based design. In particular, if a decrease in costs is observed, this could be due to a successful value-based design which promotes the use of high value-care and reduces the use of low-value care and consequently reduce spending or it could be driven by enrollment of

lower cost individuals that choose the value-based plan.

I study public employees in California who had one of their health insurance plan options, PERS Select, redesigned to be value-based with five $100 preventive care incentives available to reduce the deductible from $1,000 initially down to $500. It should be noted that across value-based programs, initiatives vary in their specific benefit designs. In this setting, preventive care and wellness activities were identified as high-value services. The subscriber can reduce their deductible by: (i) getting a flu shot, (ii) biometric screening, (iii) smoking cessation program, (iv) virtual second opinion support on surgery, and/or completing a (v) chronic condition management program. Plan cost-sharing was also updated to make primary care more affordable and specialty care more expensive with changes in copay. The rationale is that medical expenses due to behavioral health with smoking, obesity, and chronic conditions have steadily increased and access to preventive care can reduce expenditures.

My analysis utilizes individual-level insurance enrollment and health claims data from state and public employees and their dependents. To identify the effect of the value-based policy, I leverage the different types of employee cohorts and their differential responses to the benefit design changes. The employer's intended effect of introducing this policy is that consumers would increase their PCP visits and decrease specialist visits. However, increases in both or decreases in both PCP and specialist visits may suggest that the benefit design changes could be strengthened, enrollees need more time to respond, or that there are selection effects with the entry of high-risk and healthy subscribers, respectively.

I show that with the value-based policy change PERS Select attracts a healthier pool of individuals who have a lower total and out-of-pocket spending when enrolled in the value-based plan in comparison to new subscribers prior to the policy change. While new employees can actively choose the value-based plan, existing employees were defaulted into the new value-based design if they were enrolled in PERS Select prior to the change. Each year, incumbent employees are auto-enrolled in their prior plan unless they actively select another plan. Incumbent employees are observed to be much more likely to stay with their current plan than switch to a different plan (Samuelson and Zeckhauser, 1988).

There are differential responses to the VBID plan based on if the subscriber is an existing/old or new employee due to the presence of a default option. New subscribers use less care than old subscribers across many types of categories of medical utilization and spending. This variation may be due to the entry of healthy new employees or this may be because new subscribers in the first year of enrollment in a new plan need time to choose an in-network primary care physician. New VBID subscribers have fewer specialist visits than new non-VBID subscribers and fewer PCP visits, however this result is not significant. This is consistent with selection effects or because new

VBID subscribers make active plan choices, they pay attention to the new value-based design (Ho et al., 2017). Old VBID subscribers who were previously enrolled in PERS Select and defaulted into the value-based change do not have different utilization patterns than old subscribers in non-VBID plans. This suggests they may be unaware or unresponsive to changes in coverage generosity, consistent with past research showing that consumers experience substantial frictions when they have a default option each year and, consequently, exhibit inertia and do not actively engage (Ericson 2014; Polyakova 2016) or make dominated choices (Handel 2013; Sinaiko and Hirth 2011).

Consumers can complete up to five incentives to reduce the deductible from $1,000 to the $500. I find the high spending individuals complete the incentives at a higher rate in comparison to lower spending subscribers.

I estimate a model of plan choice which estimates consumer preferences for different plan characteristics and then use these parameters to show predicted responses to counterfactual policies of interest. Consumers have a high switching cost as old employees value staying in their previously enrolled plan as much as leaving over $20,000 of additional premium on the table to not switch plans. I then assess the attractiveness of the value-based plan and predicted spending across hypothetical scenarios of plan options. Consumer choice can be welfare enhancing as with a greater range options, the consumer can select their best match, however this may not hold true in the setting of health insurance (Enthoven et al. 2001; Chandra et al. 2019). Evidence suggests that consumers experience choice difficulties, including choice frictions that occur when actively engaged in the choice process, and do not make optimal choices among plans (Abaluck and Gruber 2011; Bhargava et al. 2017).

I generate out-of-sample predictions for these alternative plan menus: (i) reductions in the size and complexity of the plan menus, (ii) mandated enrollment in the value-based plan, and (iii) active choice requirements. When the choice set is restricted to PPO plans only, the value-based plan would be predicted to be the most popular alternative. An active choice policy is expected to motivate the majority of HMO subscribers to switch to the value-based plan. Lastly, mandated enrollment is expected to increase the out-of-spending per member by $85 for members with good health and $245 for members with poor health with possible reductions in premium paid as much as $4,351. Therefore, there are mixed results on the value of this value-based plan in comparison with other plan options.

This work contributes to the literature on the impact of insurance on consumer health care utilization and has important implications on how to structure value-based insurance plans, and optimal benefit design in general, in other markets. While value-based insurance may be used as a tool to help patients better understand the clinical value of recommended services, patients may not change their utilization behavior. There is inertia in plan choice and healthcare utilization; which may be due to loss aversion or bias in which there is a preference towards the status quo

despite the presence of new information (Tversky and Kahneman, 1991). Therefore, these results highlight the importance of multiple components for effecting behavioral changes: (i) new active choice policies coupled with decision aids to help consumers understand and choose among their plan options, (ii) targeted information about changes in their plan coverage to help consumers process their risk tradeoffs, and (iii) strong financial incentives to motivate changes in behavior.

The remainder of this paper is organized as follows. Section 2 presents the relevant literature. Section 3 presents the data and institutional setting. Section 4 describes the empirical model. In section 5, the results are discussed. Section 6 concludes with a summary.

2 Related Literature

2.1 Cost-Sharing

U.S. national health spending is projected to reach $6.2 trillion in 2028 with healthcare spending accounting for 19.7% of GDP, yet it is unclear if the returns to health are commensurate with the large scale of expenditures (Centers for Medicare and Medicaid Services, 2020). Many employers believe that improving the health of their workers can improve morale and productivity as well as reduce healthcare costs (Porter and Baron, 2009). There has been growing interest in demand side approaches to reduce spending such as increased consumer cost-sharing in health insurance benefit designs (Ellis and McGuire 1993; Baicker and Goldman 2011). Insurance cost-sharing is one form of cost-containment that provides financial protection.

Individuals enrolled in insurance plans with varying levels of cost-sharing have shown statistically significant and economically large estimates of impact (Newhouse 1993; Aron-Dine et al. 2013; Chandra et al. 2010). In fact, the RAND Health Insurance Experiment found that modest cost-sharing reduced the use of medical services with small effects on health except for the low-income and those with chronic conditions (Manning et al., 1987).

Individuals have been documented to overreact to non-linear insurance contracts in ways contrary to the neoclassical model. With a non-linear price schedule, a rational, dynamically optimizing consumer must forecast their future spending when making consumption decisions (Dalton et al., 2015). However consumers seem to respond more to spot prices, out-of-pocket expenses from care, by reducing spending relative to expected end-of-year prices (Aron-Dine et al. 2015, Guo and Zhang 2019, Keeler et al. 1977, Klein et al. 2020, Einav et al. 2015). Specifically, consumers who know they will meet their deductible by the end of the year are still reluctant at the beginning of the year to seek care, which may have undesirable or adverse consequences on health.

Advocates of high-deductible health plans believe that consumers will carefully assess their healthcare choices as they face the cost of their care, ultimately improving the efficiency and quality

of care. While high deductible plans can have an immediate impact on levels of healthcare spending, cost-sharing often induces poor decision making. Therefore, simply reducing coverage generosity may lead patients to be more price sensitive and reduce healthcare expenditures, but it may be a blunt instrument (Haviland et al. 2011; Haviland et al. 2016; Eisenberg et al. 2017; Lucarelli et al. 2020; Rabideau et al. 2021). With a forced switch to a high-deductible plan, beneficiaries seem to cut back on both high- and low-value care (Brot-Goldberg et al., 2017).

2.2 Value-Based Insurance Design: Theory and Background

To address conflicting incentives, cost-sharing can be aligned with clinical value to make high-value, under-used care affordable and steer consumers to make more informed healthcare decisions (Chernew et al. 2007; Chernew et al. 2010; Baicker and Levy 2015). This approach of aligning patients' out-of-pocket costs through benefit design features with the value of healthcare services is the basic premise of value-based insurance design (VBID).

An important assumption underlying the design of the PERS Select value-based plan is that increased primary care coverage would reduce total health care spending (Song and Gondi, 2019). As part of the Affordable Care Act, preventive services as identified by the US Preventive Services Task Force, typically thought of as high-value care, are fully covered by insurance. In contrast, low-value services are thought to be overused or not appropriate, as they provide little to no clinical benefit to patients but still expose them to both risk and expense (Schwartz et al., 2014). By tying the coverage of services with their clinical value, VBID may be a powerful tool to influence utilization and steer consumers to make more informed healthcare decisions.

There are many possible reasons why behavioral hazard exists. Consumers may not have knowledge of the health benefits from a service or have false beliefs about the efficacy of care (Pauly and Blavin, 2008). Other potential reasons include the salience of certain symptoms, present-bias of spot prices, and memory issues (Baicker et al., 2015).

Cost-sharing that addresses behavioral hazard should depend on the health benefit of the service in addition to the patient's price sensitivity to the service. It should be noted that patients are heterogeneous and services vary in their clinical value. Therefore, high-value services are generally recognized as providing substantial reliable and predictable gains for a majority of individuals. Cost-sharing can then also promote efficient utilization outcomes to potentially improve health by varying the degree to which specific procedures, services, and pharmaceuticals are covered.

Prior evidence shows value-based insurance design for pharmaceuticals can be effective (Hirth et al. 2016; Agarwal et al. 2018). A large-scale field experiment that eliminated some drug co-pays for recent heart attack victims found significant increases in medication use (Choudhry et al., 2011). One plan that lowered cost sharing reduced non-adherence to medication by about 10

percent over a year (Chernew et al., 2008). Empirical studies evaluating value-based insurance design on quality, outcomes, and cost and specifically its effect on medical services have been limited (Gibson et al. 2015; Gruber et al. 2020b; Zhang and Cowling 2023). The Mayo Clinic, for instance, found significant decreases in outpatient procedures and imaging with increased specialty care cost-sharing, but no observed effect on primary care use despite it being free for beneficiaries (Shah et al., 2011).

3 Institutional Setting and Data

3.1 CalPERS

The California Public Employees' Retirement System (CalPERS) is a government agency that administers health and retirement benefits to California public school, local agency and state employers. They are the largest public employer purchaser of health benefits in California and the second largest public purchaser in the United States after the federal government. CalPERS offers a large number of different health insurance plan options to over 1.5 million members comprised of State of California, public agency, and school employees. This includes active and retired employee subscribers and their dependents.

The CalPERS Board of Administration determines annually which plans are available, the covered benefits, premiums, and copayments. Open enrollment occurs each fall and changes made will take effect starting in January the following year.

3.2 PERS Select Value-Based Redesign

In 2019, CalPERS redesigned PERS Select, a currently offered PPO plan, to be a value-based health insurance plan. They state the goals for their program as, "Value-Based Insurance Design aims to improve the quality — while lowering the cost — of health care by empowering choice."

In this setting, the benefit-design changes included copays that decreased for primary care and increased for specialty care (**Table 1**). The copay for a primary care visit was reduced from $20 to $10, a specialist visit was increased from $20 to $35, and a mental health visit was decreased from $20 to $10. The rationale was that a lower primary care visit supports high-value care and increased specialist visit supports a reduction in low-value care, as defined by CalPERS. In practice, the use of primary care services could result in decreases (substitution) or increases (complementation) in the use and cost of specialist visits. Furthermore, specialist visits are not necessarily low-value care.

There were some design elements that stayed the same - the coinsurance rate was constant and remained at 20% and the maximum out-of-pocket amount was unchanged at $3,000 (individual) and $6,000 (family).

The value-based design also awards five possible $100 credits that can be completed to reduce the annual deductible from the initial $1,000 to $500 deductible for an single subscriber (**Table 2**). The subscriber can reduce their deductible by: (i) getting a flu shot, (ii) completing a biometric screening, (iii) completing a smoking cessation program or attesting that they are a non-smoker, (iv) getting a virtual second opinion on surgery, and/or completing a (v) chronic condition management program.

CalPERS did not make it difficult for enrollees to get a deductible credit. For example, unless patients have a major medical procedure with second opinion option members receive the second opinion credit. Also members also are first given the credit for the ConditionCare disease management program unless they are contacted by a nurse if they have asthma, diabetes, COPD, heart failure, or coronary artery/vascular disease and decline to participate. All preventive care screenings count toward the biometric screening incentive. To receive the non-smoking certification incentive, individuals must notify CalPERS that they do not smoke or if they do smoke, complete a smoking cessation program.

Figure 1, shows a plot of the predicted out-of-pocket spending to total medical cost of being enrolled in PERS Select. Specifically, it illustrates the difference in out-of-pocket spending pre and post VBID after completing five deductible incentives. The contract has a deductible of $1,000, coinsurance rate of 20%, and an out-of-pocket maximum of $3,000 for a single tier household. The deductible decreases by $100 (single) or $200 (family) per incentive completed. The line plotted in black is the PERS Select insurance contract with value-based insurance design prior to being value-based. The line plotted in blue is if the maximum number of incentives, five, are completed reducing the deductible to $500.

Table 3 shows the plan menu of benefit designs CalPERS subscribers can choose from. There are three PPO plan options in each market: PERS Select, PERS Choice, and PERSCare, in order of level of coverage generosity. The multiple HMO plans share the same benefit design and are horizontally differentiated by their provider network. PERS Select is the least generous PPO plan with a narrower provider network than PERS Choice and PERSCare. PERSCare is the PPO plan with the most generous coverage.

3.3 Risk-Adjustment Policy

In 2014, CalPERS implemented a risk-adjustment transfer policy with the goals of mitigating adverse selection by setting up transfers between insurers based on their enrollees' health risk. Handel et al. (2021) documents how this policy change led plan premiums to decrease for plans enrolling sicker consumers and vice versa for those enrolling healthier consumers.

In 2019, the same year that the value-based insurance design was introduced for PERS Select,

CalPERS discontinued its risk-adjustment transfer program so plan premiums that were decreased for plans enrolling sicker consumers were increased again. This lead to substantial premium decreases for plans enrolling healthier consumers and increases for plans with sicker consumers.

Table 4 shows the change in plan premiums and enrollment from 2018 and 2019. As PERS Select is the basic PPO plan enrolling healthier consumers and with the discontinuation of risk adjustment, annual plan premiums paid[1], decreased from $987 to $0 for single state employees with an 80/80 bargaining unit. PERS Select had an increase of about 9,341 subscribers. Despite meaningful premium changes, there is limited evidence of changes in enrollment responding in kind, likely due to consumer inertia.

Table 5 shows the movement of subscribers into different plans in 2019 based on their plan choice in 2018. For PERS Select subscribers in 2018, the majority ($N = 19,196$) remain in the same plan in 2019 when it was redesigned to be value-based while some ($N = 1,097$) chose to switch to one of the nine HMO plans. There was little switching to the other PPO options ($N = 670$).

3.4 Data

In this study, individual level administrative claims and enrollment data from 2015-2020 on plan choice and medical utilization was used. The data include information on (i) insurance plan features and where they are offered, (ii) plan premiums and employer contributions, (iii) beneficiary demographics, (iv) and health and pharmacy claims. The benefit designs of the plans are consistent across regions and types of employees, however depending on the region, the number of plans offered can vary. Some plans are available in certain regions.

The data contains a rich set of information including demographic and health plan information about each individual, detailed claim line spending information, and procedure and diagnosis information for each claim line. The primary analysis sample is constructed at the subscriber-year level—the claims data is collapsed to an annual household spending and it is further separated into spending components such as outpatient, inpatient, and pharmacy spending to calculate predicted out-of-pocket spending. Finally, age-adjusted Charlson Morbidity scores as an indicator of health status were constructed for each individual and averaged within a household [2]

The sample is restricted to the fourteen main health insurance plans with a handful of smaller, less popular plans excluded from the analysis. PERS Select, PERS Choice, and PERSCare were the three PPO plans while the other plans are HMO. The three PPO plans are present throughout the years of analysis while there is variation over the study period in the set of HMOs

[1] The annual premium paid varies by plan, region of residence, number of people in the household and the employer's contributions

[2] Details about how the Charlson scores were constructed are in **Appendix 8.2**

offered in different areas. For example, in 2014, the Anthem plans, Health Net plans, Sharp, and UHC entered. In 2017, Blue Shield NetValue was discontinued, with individuals in that plan defaulted into the Blue Shield Access+ plan if they did not choose to switch plans. In 2018, WHA entered.

3.5 Premiums and Premium Contributions

An important factor when choosing a plan is the expected premium paid by the subscriber, including the employer's contribution. I calculate the expected premium paid of the subscriber using information about the CalPERS regulatory design and subscriber characteristics. Consumers will face different premium paid or prices for the same plan j which depend on the type of employee, the number of dependents or people in their household tier, and their region of residence (**Appendix Figure 8.1**).

Table 6 outlines the plan options, plan premiums, and subscriber enrollment by percentage enrolled in each year. Consistently, Kaiser is the plan with the largest share of subscriber enrollment with approximately over 50% of subscribers. From 2015-2020, there has been an increase in the number of subscribers choosing PERS Select.

Premiums are set for state employees on a statewide basis depending on the plan and number of covered dependents (fixed by region). The plans subscribers are offered and the networks for a given plan are both regionally determined. Premiums are constructed by household size tiers: a single subscriber tier, a two-party tier if the subscriber has one dependent that pays double the single premium, and a family tier if the subscriber has two or more dependents that pays 2.6 times the single premium. The premium contributions provided by the employer depends on the bargaining unit due to different unions within state service. Either a premium contribution subsidy rules of 80-80 or 85-80 is followed. For non-state employees, premiums vary based on plan, region of residence, and household tier. The premium contributions vary — if they work for a California State University or public agency — region and tier.[3]

3.6 Descriptive Evidence

Defaults —what happens when individuals fail to act— have been shown to have a major impact on market outcomes. Although I cannot observe years of employment, I can observe the length of time individuals have been continuously enrolled in any CalPERS plan (**Figure 2**). There seems to be low employee turnover with about 27.8% of members enrolled in a CalPERS health insurance plan for over 9 years and over 58.5% of members enrolled in any CalPERS plan for at least 5 years.

[3]For more detailed information about how the premium contributions were calculated for state and non-state employees and originally developed in Handel et al. (2021), refer to **Appendix 8.3**

In **Figure 3**, I show plan tenure - long individuals have been enrolled in the same plan. Over 39.9% have remained in the same plan for five years or more. Year-to-year individuals can either choose to actively switch plans or otherwise remain enrolled in their existing plan.

The data also show evidence of adverse selection that the more comprehensive insurance contracts attract individuals with higher health risk. Across the plans, there are meaningful differences in the types of consumers enrolled. **Table 7**, shows that of the three PPO plans: PERS Select, PERS Choice, and PERSCare, PERS Select has the youngest enrollees, the lowest percent female, and the lowest median family income by zip code of residence. PERSCare, the most comprehensive PPO plan, has enrollees with highest average age, greater percent female, and highest median family income by zip code of residence. A positive correlation test can detect the presence of asymmetric information with adverse selection and moral hazard using ex post realized spending. Therefore, in **Table 7** I show the total and out-of-pocket spending across the multiple plan options. There are meaningful differences in spending across the heterogeneous plans. PERSCare, the most generous PPO option, has a median of $3,186 in total spending and $698 in out-of-pocket spending while Kaiser has a median of $1,553 in total spending and $60 in out-of-pocket spending. Health Net Salud y Mas and PERS Select have enrollees with the highest percentage of zero claims filed.

Table 9 reports the uptake rates for the five deductible incentives in the first year of the value-based program in 2019. High rates of use were observed for the Virtual Second Opinion program (89%) and ConditionCare Certification (98%). About half of PERS Select members received a flu shot (55%) and around 70% completed the non-smoking certification (69%) and biometric screening (74%). The nature of how certain incentives are credited should be considered when evaluating the rates of use.

I hypothesize that default policies strongly influence plan enrollment decisions, and enrollment in a plan with varying benefit design features in turn would affect medical utilization. If PERS Select subscribers experience inertia then one would expect there to be many enrollees defaulted into the value-based plan as a result of being enrolled in PERS Select prior to the value-based updates. It is possible that these individuals may be less aware of changes in plan design. In **Figure 4**, I examine subscribers enrolled in PERS Select in the first year of the value-based updates and find that higher spending consumers with greater than $500 in total spending, complete a greater number of deductible incentives on average than consumers with less than $500 in total spending. While it seems in **Figure 4** that these consumers are responding to the value-based changes, it is reasonable to believe that switching frictions may affect the implementation of the new policy. Given this, I investigate the effects of the introduction of the value-based plan in the next section.

4 Empirical Strategy

4.1 Identifying the Effect of VBID on Inertial and Active Choice Employees

Persistence in plan choice and medical utilization could be explained by strong preferences that stay constant. To potentially test for this persistence in preferences, one could study new employees who are free from any status quo bias or switching cost as these consumers choose plans in a neutral environment. Therefore, the population of new employees can serve as a control group to incumbent employees who experience inertia.

Table 10 examines differences between PERS Select subscribers who are new employees compared to incumbent employees and PERS Select subscribers before and after the value-based policy was in place. This exercise is descriptive and serves to highlight the characteristics of inertial consumers and what types of consumers select into the value-based plan. Column (1) describes subscribers pre-VBID and compares these subscribers to those post policy change in Columns (2) and (3). Consumer characteristics of value-based subscribers are similar pre- and post- policy change for old subscribers. New subscribers are younger ($Mean = 37.6$) compared to old subscribers ($Mean = 43.5$) and are relatively healthy ($Mean = 59\%$). New subscribers also have a smaller family size on average ($Mean = 50\%$, family size of 1) in comparison to old subscribers ($Mean = 37\%$).

How does the value-based insurance design affect new subscribers with active choice vs. old subscribers? The aim is the understand how patients respond with their consumption of health care to the introduction of the value-based policy in 2019. I examine from 2015-2019 how existing PERS Select subscribers who are defaulted into the value-based design (old subscribers) may have differential utilization and spending patterns in comparison to new subscribers who actively choose the value-based plan:

$$Y_{ijt} = \beta_1 NEW_{it} + \beta_2 VBID_{jt} + \Phi(NEW_{it} \times VBID_{jt}) + \Gamma X_{it} + \gamma_j + \tau_t + \varepsilon_{ijt} \quad (1)$$

$$= \beta_1 NEW_{it} + \beta_2 (Treat_j \times Post_t) + \Phi NEW_{it}(Treat_j \times Post_t) + \Gamma X_{it} + \gamma_j + \tau_t + \varepsilon_{ijt} \quad (2)$$

In Equation 1, Y_{ijt} is the utilization or spending outcome measure for subscribers i enrolled in plan j in year t. NEW_{it} or $[j_{t-1} = 0]$ is an indicator equals one if the subscriber is a new subscriber who was not observed to have a CalPERS plan in the previous year and must make an active choice. $VBID_{jt}$ is a treatment group indicator that equals one for subscribers enrolled in PERS Select post value-based policy change in 2019. The third term is the interaction of subscribers enrolled in the value-based plan and are new subscribers. Φ can be interpreted as the effect of the value-based insurance design for new subscribers relative to existing or old employees in other non-value-based

plans. γ_j and τ_t indicate plan and year fixed effects which includes an indicator for PERS Select. X_{it} is a vector of observable consumer characteristics (including age, sex, region of residence, and household tier).

4.2 Plan Choice Model

A plan choice model is estimated to assess the key determinants underlying a subscriber's decision to enroll in a plan on behalf of their household. There are multiple plans the consumer must choose among and this model investigates the value the consumer placed on different plan characteristics, given the their underlying health and preferences. This model utilizes individual level enrollment data from 2015 to 2020 on available plan options in a given region, plan choices made, plan characteristics, and observed consumer characteristics such as demographics and health risk.

The demand model is implemented as a conditional logit model and is estimated based on the following utility specification for subscriber i selecting plan j:

$$U_{ij} = \alpha + \beta_1 \mu_{ij} + \beta_2 P_{ij} + \beta_3 X_{ij} + \beta_4 \xi_{ij} * S + \beta_5 1[j_t = j_{t-1}] + \varepsilon_{ij} \tag{3}$$

In Equation 3, μ_{ij} denotes the mean of member-specific expected health out-of-pocket spending in plan j. μ_{ij} is quantified empirically with two elements: (i) a projection of total consumer health spending and (ii) the impact of benefit design features on predicted out-of-pocket spending. For (i), it relies on the subscriber simple spending projection using their spending in the prior year. Prior year's spending is not observed for new subscriber so that current year's spending is used.

P_{ij} denotes the component of the annual premium paid by the subscriber, as their employer pays a portion as well. X_{ij} reflects plan characteristics such as the level of the deductible, coinsurance, out-of-pocket maximum while ξ_{ij} reflects preferences for a specific insurance contract by health status. Here S, is an indicator variable equal to one if a consumer is among the least healthy 25% of the sample (as determined by the age adjusted Charlson index), and it is interacted with ξ_{ij} to reflect potential health status-specific preferences for different plans. This age adjusted Charlson index is used to estimate the projected individual health risk for the upcoming year using historical claims records at each annual enrollment period. Finally, $1[j_t = j_{t-1}]$ is an indicator variable for inertia or inertia duration. Inertia is defined if a plan option is the same as a consumer's previously chosen plan. Inertia duration counts the number of years a plan option is the same plan. New employees must select a plan and do not have a default option so both equal zero for those individuals. β_5 is thus the switching cost or value of inertia, which reflects how much money consumers are willing to leave on the table by remaining in the same plan compared to if the subscriber was a new employee in an active choice environment. ϵ_{ij} reflects unobserved idiosyncratic preferences for plan j.

With the assumption of a Type I extreme value term, this utility specification can be transformed into the following standard multinomial logit regression equation to estimate coefficients (α, β):

$$1[j_t'] = \alpha + \beta_1 \mu_{ij} + \beta_2 P_{ij} + \beta_3 X_{ij} + \beta_4 \xi_{ij} * S + \beta_5 1[j_t = j_{t-1}] + \varepsilon_{ij} \tag{4}$$

where $1[j_t'] = 1$ if a subscriber chooses a given plan j' and 0 otherwise.

4.3 Deductible Level Model

In the value-based plan, the consumer can complete up to five of the incentives to reduce the deductible. I use an ordered logit model to study the determinants of the decision to complete deductible lowering incentives.

If the PERS Select plan is chosen such that $j = VBID$, then suppose there are:

I = {0, 1, 2, 3, 4, 5} discrete and ranked values of deductible levels representing

$DED_j = \{\$1000, \$900, \$800, \$700, \$600, \$500\}$, respectively and there is a latent variable y_i* which is unobservable, however we can observe when it crosses thresholds μ which is reflected in the level of deductible k. Individuals vary in their observable and unobservable characteristics that determine their thresholds μ.

This can be expressed as an ordered logit model where the utility of individual i from choosing deducible level k is given by:

$$U_{ik} = \alpha + \beta_1 X_{ij} + \beta_2 \mu_{ik} * 1[j_{t-1} = 0] + \varepsilon_{ik} \tag{5}$$

Individuals have cutoff thresholds μ that determine the choice of I and deductible level k.

$$U[I_{x+1} - I_x | \omega_i, \gamma, X_i, \varepsilon_{ij}] = 0$$

$$I_x = \left\{ \begin{array}{ll} 0, & u_i \leq \mu_0 \\ 1, & \mu_0 < u_i \leq \mu_1 \\ 2 & \mu_1 < u_i \leq \mu_2 \\ 3, & \mu_2 < u_i \leq \mu_3 \\ 4, & \mu_3 < u_i \leq \mu_4 \\ 5, & \mu_4 < u_i \leq \mu_5 \end{array} \right\}$$

In Equation 5, ω_i is a private risk signal underlying the utility model. X_{ij} reflects observable consumer characteristics such as demographics, household tier, and region of residence. μ_{ik} denotes

the mean of member-specific expected spending. Finally, $1[j_{t-1} = 0]$ is an indicator variable equal to one if a subscriber is a new subscriber making an active choice, as indicated by not enrolling in a plan the previous year. This is interacted with μ_{ik} to reflect potential health status preferences for different levels of deductibles.

5 Results

Table 11 shows estimates from Equation 1 the effect of the value-based plan on utilization by type of subscriber relative to non-VBID subscribers. The specification includes enrollment in the value-based plan interacted being new subscriber. Plan, year, and household tier fixed effects were included as well as consumer characteristics such as age, gender, and region of residence. New subscribers use less care than old subscribers across many types of medical visits which may be due to the entry of healthy employees. **Figure 5** shows the predicted marginal effects of the value-based plan on number of primary care physician visits. Existing subscribers that were defaulted into the value-based plan used a greater number of primary care physician visits than non-VBID old subscribers. **Figure 6** shows that new VBID subscribers use less specialist visits than new non-VBID subscribers. Preventive service use was lower for both old VBID employees and new VBID employees with active choice.

Table 12 shows the effect of the value-based plan on spending by type of subscriber relative to non-VBID subscribers. New subscribers have lower spending than existing or old subscribers across multiple types of care: office visits, prescription pharmaceuticals, inpatient and outpatient care. This pattern of lower spending relative to old existing subscribers suggests that newer subscribers are healthier, on average. The existing or old employees are persistent in their plan choices and are defaulted into the value-based design. **Figure 7** shows the predicted marginal effects of the value-based plan on out-of-pocket spending. New subscribers with value-based insurance have higher inpatient spending, however they have much lower out-of-pocket spending relative to old subscribers with non-VBID plans. Old VBID subscribers have greater outpatient spending and greater out-of-pocket spending relative to new VBID subscribers.

Demand Estimation

To explore how financial plan characteristics and consumer characteristics may impact the choices consumers make, the plan choice model from equation 3 is estimated using data from 2015 and 2020. The results are presented in **Table 13** with three separate specifications:

Column (1) presents the model with out-of-pocket spending predictions from the previous year and inertia. Column (2) presents a similar specification but now inertia is a continuous variable. Finally, Column (3) includes plan-health status fixed effects to allow for different plan

preferences by health status. This flexible framework combines preferences for provider networks, any differences in cost-sharing, and other plan brand preferences into a fixed effect that is estimated as a function of health risk. Health status is defined using the age adjusted Charlson score with the cut-off of an average Charlson Score of 2 or lower from the previous year as considered to be good health (about 75% of the sample). Column (3) is the primary model of interest which will be used to generate predicted consumer responses to counterfactual plan menus that reduce the number of plan options and consumer inertia.

The estimates suggest that consumers dislike switching plans, paying premiums and out-of-pocket spending, and higher deductibles. The estimate from column (2) suggests that individuals who have been enrolled in the same plan for one year are willing to leave over $23,000 (5.062/0.00021) of additional premium on the table not to switch plans. This estimate increases with the number of years the subscriber is enrolled in the same plan from 5.1 with one year to 6.9 for over five years. This is consistent with prior research that demonstrate the strength of default policies.

Furthermore, subscribers overweight their annual consumer contributions to premiums to predicted out-of-pocket spending, by about 3 to 1 ($-0.00018/-0.000056$), which is similar to the level of bias that has been noted in prior work such as in Medicare Part D drug plan choice (Abaluck and Gruber, 2011) and others (Gruber et al., 2020a) which find that subscribers overweight premiums between 4-8 times that of the expected out-of-pocket spending.

Counterfactual Simulation Analysis

In this section, the demand estimates from **Table 13**, Column (3) are used to assess the attractiveness of the value-based plan and predicted spending across hypothetical scenarios of plan options.

I investigate (i) changes in enrollment decisions by simulating predicted responses to plan menu changes, and (ii) resulting changes in ex-ante expected total and out-of-pocket spending. These spending measures are constructed by applying plan benefit design features (e.g., deductible, coinsurance, out-of-pocket maximum) of alternative plans to realized spending in 2020. Here, the out-of-sample counterfactuals are generated for these hypothetical scenarios:

1. Reductions in the size and complexity of the plan menus
2. Active choice environment
3. Mandated enrollment in the value-based plan

It is important to note that these analyses are partial equilibrium results and rely on plan premiums and premium contributions being held fixed at their observed 2019 and 2020 values. Furthermore, it assumes the plan fixed effects estimated from the plan choice model as a function

of health status are constant. If a model with endogenous premiums is incorporated — in which premiums re-adjust dynamically in the environment — then we could study how the movement of less healthy consumers into and out of plans would cause the premiums to vary and reflect the updated average cost of those plans' risk pools. This is a potentially valuable topic for further research on the distributional impacts of policy transitions in health insurance markets.

Scenario I demonstrates how the complexity of the plan menus can be reduced through restrictions to only PPO plans. In this setting, the HMO plans are horizontally differentiated by provider networks with the same cost-sharing features. In particular, in the year PERS Select was redesigned to be value-based, individuals faced a large number of plan options - 9 HMO plans and 3 PPO plans. If PERS Select has more visibility through the reduction of plan options, how popular would the plan be among subscribers? **Table 14** and **Table 15** shows how for HMO subscribers who no longer have their previous plan as a plan option, the majority ($N = 172,018$) choose PERS Select. Furthermore, when looking at specific HMO plans in **Table 15**, we see that for Kaiser, the plan with the largest share of enrollment, the majority of their subscribers would switch to PERS Select ($N = 115,974$) in this PPO only setting. **Table 16** shows the predicted spending by plan with a restriction to PPO only plans. When subscribers are restricted to PPO plans only, the entry of new subscribers is reflected in the decrease in total spending, plan cost, and out-of-pocket spending for PERS Choice and PERSCare. Plan cost is defined as the difference between total spending and out-of-pocket spending. PERS Select is expected to have an increase in total spending, plan cost, and out-of-pocket spending relative to observed 2020 choices with HMO and PPO plan options.

Scenario II demonstrates how lowering the switching cost to zero would motivate otherwise inertial consumers to evaluate their plan options carefully and potentially switch plans. While active choice policies would yield clear benefits by allowing consumers to best match with plans that meet their preferences, the process of evaluating many plan options can be quite costly. To implement this scenario, observed enrollment decisions are taken as given and the inertia or switching cost parameter β_5 from equation 3 is reduced to 0 for 2020 enrollment choices. In practice, there are a multitude of potential policies one could implement to reduce inertia, and this model assumes a simple specification that would presume the switching cost is fully removed between the previous plan chosen and alternative options as if individuals would be choosing plans for the first time as new subscribers. In **Table 17** we see that unlike in a PPO only setting with inertia (**Table 14**), when individuals are required to make active choices, there is an influx of subscribers switching from an HMO plan to PERS Select ($N = 41,994$). Furthermore, while some PERS Select subscribers remain in the value-based plan ($N = 5,330$), the majority ($N = 29,729$) switch to an HMO plan. In **Table 18**, the changes in expected enrollment decisions are separated by plan and with an active choice policy, PERS Select has an increase in the number of members ($N = 47,436$) and an

expected increase in total and out-of-pocket spending.

Scenario III shows the consequences of mandated enrollment in the value-based plan for all subscribers. This allows us to examine the distributional effect of the value-based plan by health status. In **Table 19**, a value-based mandate would decrease the annual premium paid on average from $-\$63$ for individuals with Sharp to $-\$4,351$ for individuals with Anthem HMO Traditional. This reduction in premium paid is due to PERS Select being more affordable compared to alternative plans. While premium paid would decrease, expected out-of-pocket spending would increase. Subscribers would expect to experience an increase in OOP spending from $+\$50$ to $+\$596$ on average depending on the plan prior to switch. **Table 20** shows that there would be an increase in $N = 595,413$ subscribers with good health and $N = 312,475$ subscribers with poor health in PERS Select with the mandated VBID requirement. This would lead to an expected change in OOP spending by about $+\$245$ for members with poor health and increase in OOP spending by about \$85 for members with good health, compared PERS Select enrollees with no VBID mandate.

6 Conclusion

Developing insurance benefit designs to promote efficient utilization outcomes and affordable care is particularly timely given the present health care reform debates about a public option. This paper studies the introduction of a value-based health insurance plan when many consumers are inertial and face multiple plan options. I demonstrate that, in practice, consumers face significant switching costs in plan selection and may be inattentive to changes in benefit design. If consumers are incumbent employees, they have a default option of remaining in the same plan chosen in the prior year. Therefore, consumers are not motivated to change plans year-to-year, despite potentially meaningful changes in premiums and benefit design, due to a high switching cost.

I provide evidence that, when PERS Select is redesigned to be value-based, the plan attracts a healthy pool of individuals who have a lower total and out-of-pocket spending when enrolled in the value-based plan in comparison to new subscribers prior to the policy change. My estimates indicate that reductions to the size and complexity of the plan menu and active choice policies would lead the majority of HMO subscribers to switch to the value-based plan. I also examine when individuals are required to enroll in the value-based plan would would allow consumers to reduce their annual premium paid by as much as $\$4,351$ as it is a more affordable plan than the alternative options. However, as the entry of these new predicted subscribers are higher risk than the observed PERS Select subscribers, mandating enrollment is expected to increase the out-of-spending per member by \$85 for members with good health and \$245 for members with poor health, compared to observed PERS Select subscribers.

This work contributes to the literature on (i) consumer inertia in health insurance and (ii) the impact of insurance on consumer health care utilization. I find while value-based insurance may be used as a tool to help patients better understand the clinical value of recommended services, patients may not change their utilization behavior. As with any new policy, consumers may not be aware of design changes or be responsive to them.

In this setting, there is inertia in plan choice and healthcare utilization—a bias in which there is a preference towards the status quo despite the presence of new information. This means enrollment and utilization in the value-based plan partially reflects inertia and not solely an active choice reflecting risk preferences and information about a policy change. Therefore, these results highlight the importance of multiple components for effecting behavioral changes: (i) new active choice policies coupled with decision aids to help consumers understand and choose among their plan options, (ii) targeted information about changes in their plan coverage to help consumers process their risk tradeoffs, and (iii) strong financial incentives to motivate changes in behavior.

7 Tables and Figures

Table 1: PERS Select Benefit Design Change

	2015-2018 Standard Plan	2019-2020 Value-Based Insurance Design
Deductible	Individual: $500, Family: $1,000	Individual*: $500 - $1,000, Family*: $1,000 - $2,000
Coinsurance	20%	20%
Primary Care	$20 copay	$10 copay
Specialist	$20 copay	$35 copay
Inpatient Maternity (Delivery)	20% coinsurance	Inpatient covered in full with Future Moms program 20% coinsurance without enrollment
Mental Health, Behavioral Health, and Substance Abuse	$20 copay	$10 copay
Maximum Out-of-Pocket	$3,000 individual, $6,000 family	$3,000 individual, $6,000 family

Notes: There are a total of five possible deductible reducing incentives. PERS Select was redesigned to be value-based in the 2019 plan year. *From 2019-2020, the PERS Select deductible can be reduced by $100 (individual) or $200 (family) for each of the five incentives completed. Prior to VBID, the deductible was fixed.

Table 2: PERS Select Deductible Reducing Incentives

Incentive	Description
(1) Flu Shot	Get a flu shot at an in-network pharmacy or at your doctor's office
(2) Non-Smoking Certification	Complete a health assessment to notify the plan that you do not smoke If you do smoke, complete a quit smoking program
(3) Biometric Screening	Test your blood pressure, cholesterol, glucose, A1C, and height and weight for your BMI
(4) Virtual Second Opinion Program	For a non-urgent, non-emergency scheduled surgery or procedure
(5) ConditionCare Certification	Disease management program: asthma, diabetes, COPD, heart failure, or heart disease

Notes: There are a total of five possible deductible reducing incentives. PERS Select was redesigned to be value-based in the 2019 plan year. From 2019-2020, the PERS Select deductible can be reduced by $100 (individual) or $200 (family) for each incentive completed. Prior to this, the deductible was fixed.

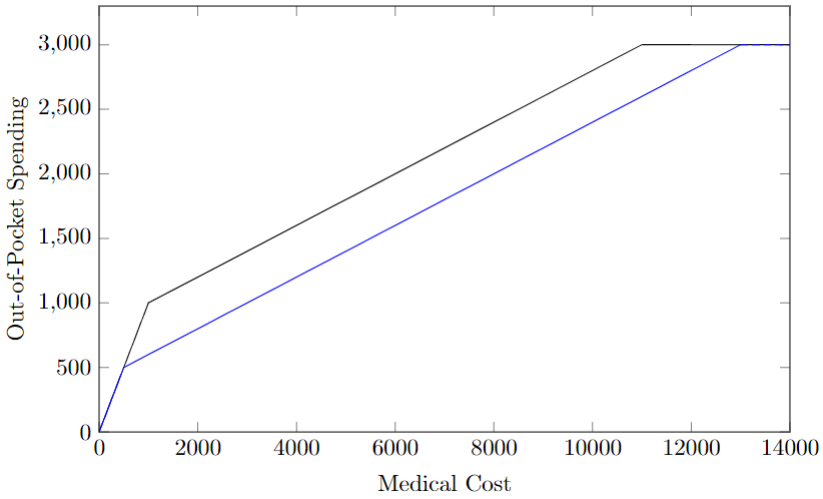

Figure 1: PERS Select Value-Based Insurance Design with all five deductible incentives completed

Notes: A PERS Select insurance contract with value-based insurance design before (black) and after (blue) completing all five value-based deductible reducing incentives with a standard deductible of $1,000, coinsurance rate of 20%, and an out-of-pocket maximum of $3,000 for a single tier household. The deductible decreases by $100 (single) or $200 (family) per incentive completed.

Table 3: 2019 Plan Benefit Designs

	HMO	PERS Select	PERS Choice	PERS Care
Deductible	-	Individual*: $500 - $1,000, Family*: $1,000 - $2,000	Individual: $500, Family: $1,000	Individual: $500, Family: $1,000
Coinsurance	-	20%	20%	10%
Primary Care	$15 copay	$10 copay	$20 copay	$20 copay
Specialist	$15 copay	$35 copay	$35 copay	$35 copay
Inpatient Maternity (delivery)	-	Future Moms program: 0%, 20% coinsurance otherwise	20% coinsurance	10% coinsurance
Mental Health, Behavioral Health, and Substance Abuse	$15 copay	$10 copay	20% coinsurance	10% coinsurance
Maximum Out-of-Pocket	$1,500 individual, $3,000 family	$3,000 individual, $6,000 family	$3,000 individual, $6,000 family	$2,000 individual $4,000 family

Notes: HMO refers to all nine available HMO plan options which share the same benefit design: Anthem HMO Select, Anthem HMO Traditional, Blue Shield Access+, Health Net Salud y Mas, Health Net SmartCare, Kaiser, Sharp, UHC Alliance HMO, and WHA. PERS Select was redesigned to be value-based in the 2019 plan year. From 2019-2021, the PERS Select deductible can be reduced by $100 (individual) or $200 (family) for each incentive completed.

Table 4: Change in Plan Premiums and Enrollment

	Premium Paid			Enrollment		
	2018	2019	Δ	2018	2019	Δ
Anthem HMO Select	$2,613	$1,919	-$694	10,016	14,178	4,162
Anthem HMO Traditional	$3,148	$5,418	$2,270	5,810	6,350	540
Blue Shield Access+	$2,080	$2,592	$513	58,562	43,833	-14,729
Health Net Salud y Mas	$0	$0	$0	3,929	4,323	394
Health Net SmartCare	$2,541	$1,748	-$792	7,126	9,441	2,315
Kaiser	$1,661	$1,505	-$156	208,253	217,003	8,750
PERS Choice	$1,742	$2,181	$439	46,943	46,592	-351
PERS Select*	$987	$0	-$987	23,162	32,503	9,341
PERSCare	$2,366	$4,163	$1,796	13,255	9,643	-3,612
Sharp	$548	$128	-$420	4,472	4,981	509
UHC Alliance HMO	$1,507	$1,353	-$154	27,201	28,066	865
WHA	$1,697	$1,485	-$212	2,232	3,616	1,384

Notes: The annual premium paid accounts for premium contributions for single state employees with an 80/80 bargaining unit. *In 2019, PERS Select was redesigned to be a value-based plan. As it is the basic PPO plan, with the discontinuation of risk adjustment, plan premiums decreased.

Table 5: Transition Matrix of 2018 to 2019 Subscriber Plan Enrollment

	HMO	PERS Choice	PERS Select	PERSCare	Total
New Subscribers	34,395	3,916	7,207	820	46,338
HMO	294,044	1,967	2,707	390	327,601
PERS Choice	1,629	37,758	2,744	186	46,943
PERS Select	1,097	619	19,196	51	23,162
PERSCare	626	2,332	649	8,196	13,255
Total	331,791	46,592	32,503	9,643	457,299

Notes: HMO refers to all nine available HMO plan options: Anthem HMO Select, Anthem HMO Traditional, Blue Shield Access+, Health Net Salud y Mas, Health Net SmartCare, Kaiser, Sharp, UHC Alliance HMO, and WHA. The columns designate subscriber plan enrollment in 2019 while the rows are the plans in 2018 the subscriber was enrolled in. The first row shows new subscribers in 2019.

Table 6: Subscriber Plan Premium and Enrollment Share by Year

	2015		2016		2017		2018		2019		2020	
	$	%	$	%	$	%	$	%	$	%	$	%
Anthem HMO Select	1,385	2.6	1,605	3.1	2,175	3.0	2,613	2.4	1,919	3.4	2,146	4.1
Anthem HMO Traditional	2,440	1.3	2,286	1.8	3,767	1.5	3,148	1.4	5,418	1.5	6,081	1.4
Blue Shield Access+	2,330	14.2	2,465	13.0	3,257	13.8	2,080	14.3	2,592	10.4	3,614	7.5
Blue Shield NetValue	1,756.3	12.8	2,390.4	7.2	–	–	–	–	–	–	–	–
Blue Shield Trio	–	–	–	–	–	–	–	–	–	–	1,105	0.8
Health Net Salud y Mas	144	0.3	0	0.4	0	0.7	0	1.0	0	1.0	0	1.1
Health Net SmartCare	1,770	0.1	1,071	1.3	1,607	3.4	2,541	1.7	1,748	2.2	3,024	1.5
Kaiser	1,309	44.6	1,197	46.9	1,247	50.0	1,661	50.7	1,505	51.6	1,453	52.3
PERS Choice	1,397	14.4	1,844	13.2	2,183	12.2	1,742	11.4	2,181	11.1	2,136	10.6
PERS Select	1,131	4.1	1,053	4.8	1,371	5.3	988	5.6	0	7.7	0	9.3
PERSCare	2,339	2.5	2,875	2.5	3,208	2.6	2,366	3.2	4,163	2.3	4,571	2.1
Sharp	749	0.8	153	1.0	690	1.0	548	1.1	128	1.2	0	1.3
UHC Alliance HMO	1,421	2.3	765	4.8	1,526	6.6	1,507	6.6	1,353	6.7	1,415	7.1
WHA	–	–	–	–	–	–	1,697.3	0.5	1,485.5	0.9	1,475.5	0.9

Notes: "$" is the annual premium paid including premium contributions for single state employees with an 80/80 bargaining unit and "%" is the percentage of subscribers enrolled in that plan by year. "–" are plans that have not been offered yet or have exited the market. "0" means the premium contributions by the employer exceeds the premium so the cost to the employee is zero.

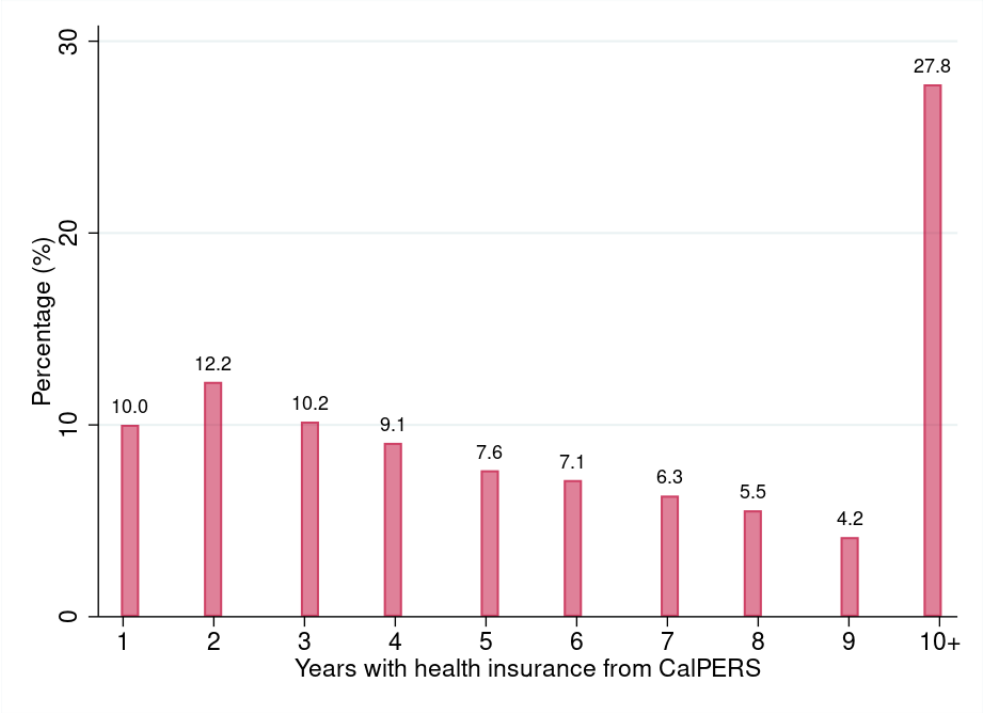

Figure 2: Observed Employee Tenure - Years Enrolled in a CalPERS Plan

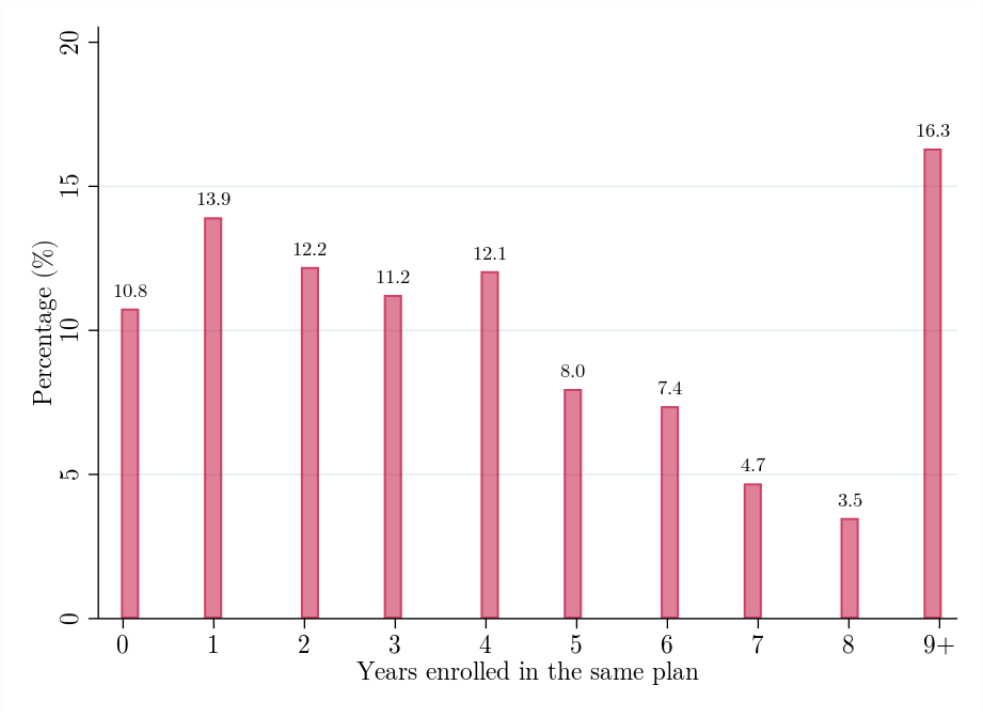

Figure 3: Observed Degree of Inertia - Years Enrolled in the Same Plan

Table 7: Enrollee Characteristics Across Plans in 2019

	N		Family Size			Age	Age Bins				Female
	Subscribers	Members	1	2	3+		<30	30-44	45-64	65+	
Anthem HMO Select	14,178	34,073	41%	20%	40%	44.1	13%	40%	47%	3%	51.5%
Anthem HMO Traditional	6,350	13,214	52%	18%	30%	46.8	11%	34%	55%	6%	54.1%
Blue Shield Access+	43,833	107,719	38%	21%	41%	48.2	6%	32%	62%	5%	49.7%
Health Net Salud y Mas	4,323	10,310	42%	18%	40%	41.7	15%	46%	39%	1%	47.5%
Health Net SmartCare	9,441	23,531	37%	20%	42%	47.7	7%	34%	59%	5%	52.5%
Kaiser	217,003	504,968	43%	20%	38%	44.2	12%	42%	46%	4%	51.5%
PERS Select	32,503	78,518	40%	20%	40%	42.3	15%	45%	40%	2%	48.4%
PERS Choice	46,592	108,405	39%	23%	37%	48.6	7%	33%	60%	8%	51.6%
PERSCare	9,643	18,769	53%	22%	25%	49.5	8%	32%	60%	12%	53.4%
Sharp	4,981	12,787	33%	20%	46%	44.0	11%	43%	47%	2%	49.8%
UHC Alliance HMO	28,066	72,828	34%	20%	46%	44.9	9%	41%	49%	3%	53.5%
WHA	3,616	9,381	33%	21%	45%	46.3	8%	35%	57%	3%	59.7%

Table 8: Total and out-of-pocket spending across plans in 2019

	Premium Paid	Zero Claims	Total Spending			OOP Spending		
			25%	50%	75%	25%	50%	75%
Anthem HMO Select	$1,919	10.0%	$353.5	$1,457.1	$4,494.4	$21.1	$72.5	$172.0
Anthem HMO Traditional	$5,418	8.1%	$568.6	$2,107.4	$6,763.0	$30.0	$97.7	$235.3
Blue Shield Access+	$2,592	5.5%	$708.5	$2,159.8	$6,000.2	$37.5	$97.9	$218.0
Health Net Salud y Mas	$0	17.9%	$82.1	$581.5	$2,253.9	$4.5	$48.5	$133.4
Health Net SmartCare	$1,748	7.2%	$552.3	$1,804.2	$5,147.6	$46.9	$135.1	$301.3
Kaiser	$1,505	7.1%	$630.4	$1,553.7	$3,821.9	$21.3	$60.0	$130.9
PERS Select	$0	12.3%	$237.9	$1,021.1	$3,218.2	$49.6	$310.8	$790.1
PERS Choice	$2,181	5.9%	$735.6	$2,293.7	$6,385.2	$190.8	$586.3	$1,236.6
PERSCare	$4,163	6.0%	$949.4	$3,186.2	$9,440.0	$243.2	$698.3	$1,350.4
Sharp	$128	7.3%	$512.1	$1,300.5	$3,493.6	$28.8	$69.8	$148.0
UHC Alliance HMO	$1,353	6.1%	$561.7	$1,616.7	$4,340.8	$32.5	$82.3	$169.1
WHA	$1,486	5.0%	$772.2	$2,003.0	$4,713.8	$30.0	$83.4	$186.2

Notes: The reported premium paid is the annual premium single state employees with an 80/80 bargaining unit pay.

Table 9: Uptake Rates for Deductible Incentives

$100 Deductible Reducing Incentives	Rate Completed*
(1) Flu Shot	55%
(2) Non-Smoking Certification	69%
(3) Biometric Screening	74%
(4) Virtual Second Opinion Program	89%
(5) ConditionCare Certification	98%

Notes: *Percentage of preventive care activities completed by PERS Select members in 2019, the first year of the new value-based design.

Figure 4: Number of Deductible Incentives Completed by High and Low Spending

Table 10: Summary Statistics of PERS Select Subscribers

	(1) Pre-VBID		(2) Post-VBID New Subscriber		(3) Post-VBID Old Subscriber	
	Mean	SD	Mean	SD	Mean	SD
Age	42.68	11.36	37.56	11.10	43.35	10.97
Female	0.50	0.50	0.48	0.50	0.48	0.50
Good Health	0.67	0.47	0.59	0.49	0.70	0.46
Family Size						
1	0.44	0.50	0.50	0.50	0.37	0.48
2	0.19	0.39	0.17	0.37	0.20	0.40
3+	0.36	0.48	0.33	0.47	0.43	0.50
Region						
Bay Area	0.13	0.34	0.16	0.37	0.13	0.33
Los Angeles	0.14	0.35	0.15	0.36	0.17	0.37
Other Northern California	0.43	0.50	0.36	0.48	0.41	0.49
Other Southern California	0.22	0.42	0.24	0.43	0.22	0.42
Sacramento	0.07	0.26	0.09	0.29	0.08	0.26
Observations	79,831		12,965		59,088	

Notes: Health status is defined using the age adjusted Charlson score with the cut-off of an average Charlson Score of 2 or lower from the previous year as considered to be good health (about 75% of the sample).

Table 11: Effect of VBID on Utilization of Visits for Active vs. Inertial PERS Select Subscribers, 2015-2019

	(1)	(2)	(3)	(4)
	# of PCP Visits	# of Specialist Visits	# of ED Visits	# of Preventive Services
VBID	1.392*	-0.0369	-0.909*	-0.906***
	(0.382)	(0.0338)	(0.221)	(0.0907)
New Subscriber	-0.704*	-0.471*	-0.496	-3.597***
	(0.198)	(0.124)	(0.217)	(0.210)
VBID × New Subscriber	-0.696*	-0.709*	0.433	-0.470
	(0.215)	(0.177)	(0.258)	(0.315)
Plan, Year, Tier FE	X	X	X	X
Controls	X	X	X	X
Observations	2,027,331	2,027,331	2,027,331	2027331

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

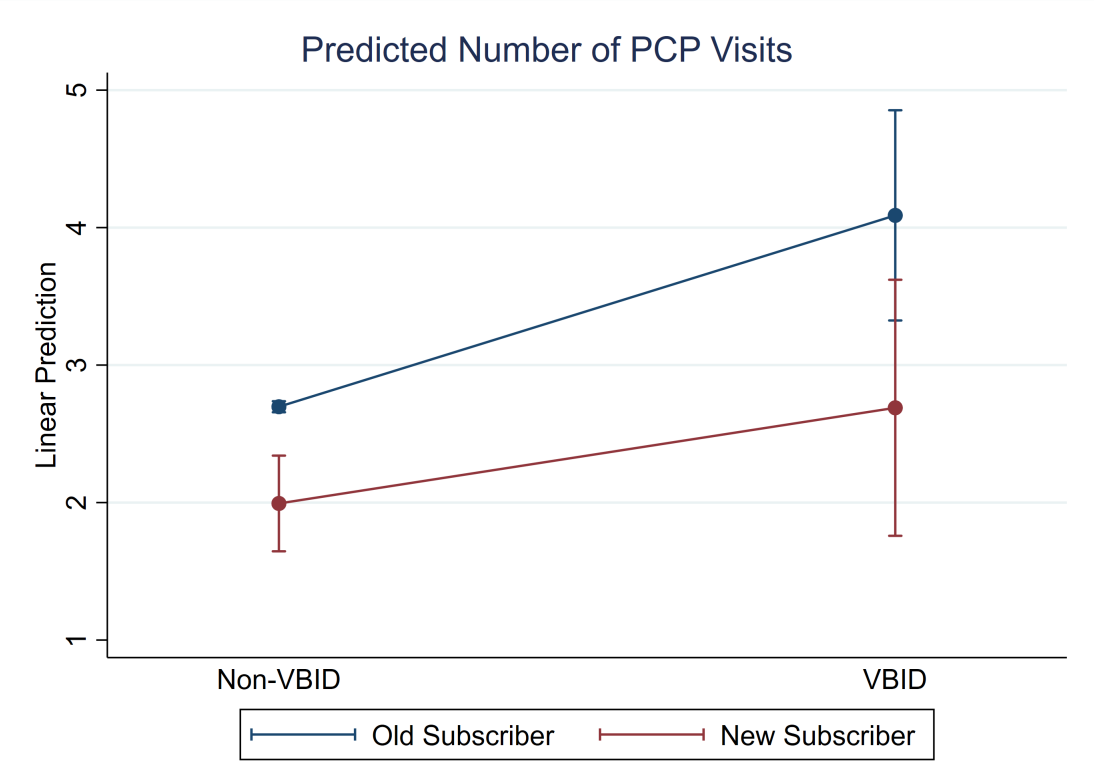

Figure 5: Predicted Marginal Effects of VBID on Primary Care Physician Visits

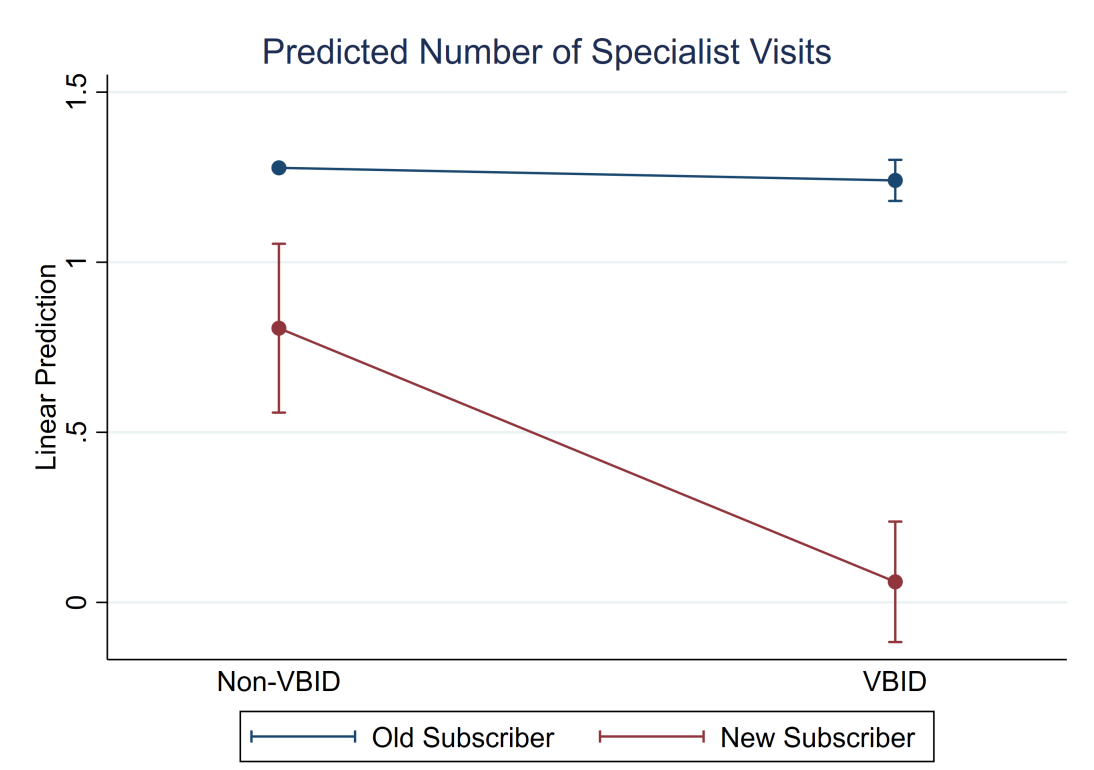

Figure 6: Predicted Marginal Effects of VBID on Specialist Visits

Table 12: Effect of VBID on Spending for New vs. Old PERS Select Subscribers, 2015-2019

	(1) Total Spending	(2) OOP Spending	(3) Office Visit	(4) Rx	(5) Inpatient	(6) Outpatient
VBID	-249.4	159.6**	10.53	-111.1	-126.6	324.6*
	(295.4)	(32.37)	(33.18)	(47.04)	(154.2)	(113.5)
New Subscriber	-4,670.9***	-172.7**	-266.1***	-646.3***	-1,384.6***	-1,020.9***
	(240.5)	(22.49)	(14.20)	(34.21)	(64.50)	(84.53)
VBID × New Subscriber	-176.5	-600.6**	-35.51	-80.27	346.9**	-637.0***
	(144.4)	(76.23)	(22.94)	(58.61)	(72.02)	(37.67)
Plan, Year, Tier FE	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Observations	2,027,331	2,027,331	2,027,331	2,027,331	2,027,331	2,027,331

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

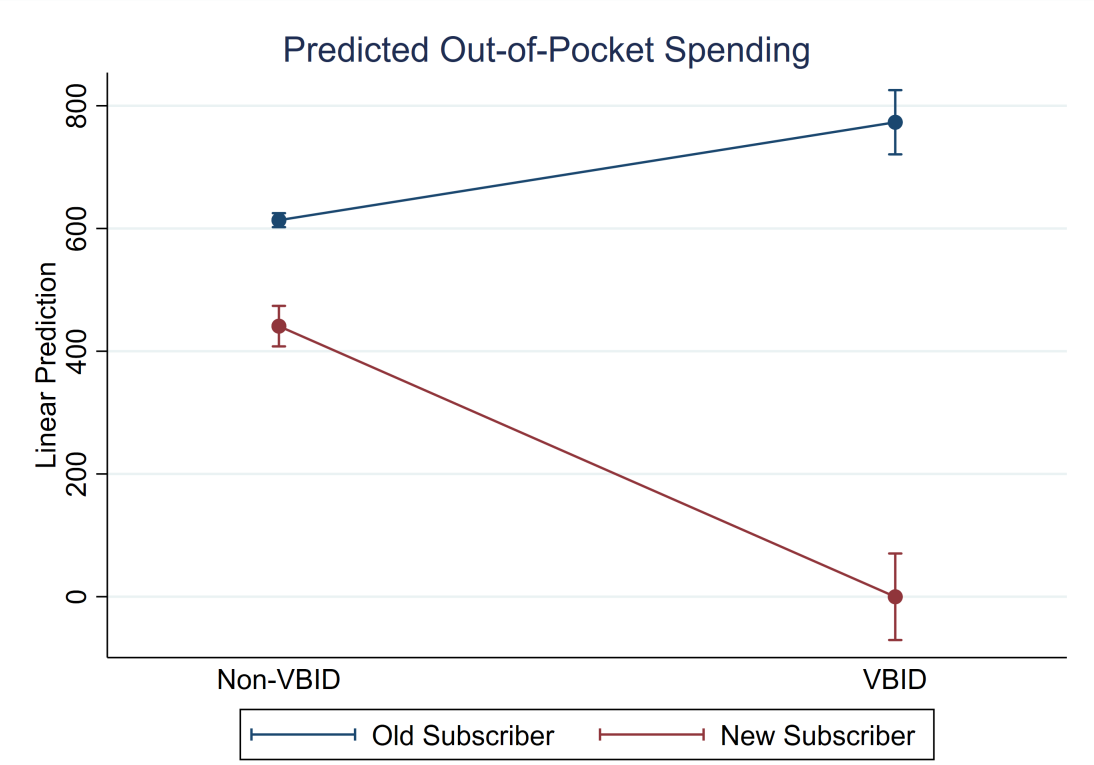

Figure 7: Predicted Marginal Effects of VBID on Out-of-Pocket Spending

Table 13: Plan Choice Model for Subscribers, 2015-2020

	(1)	(2)	(3)
	Inertia	Inertia Duration	Health Preferences
Observed Plan Selection			
Premium Paid	-0.000180***	-0.000211***	-0.000183***
	(0.000000897)	(0.00000104)	(0.000000979)
OOP Estimate (Last Year)	-0.0000543***	-0.0000607***	-0.0000567***
	(0.00000414)	(0.00000490)	(0.00000406)
Deductible	-0.000115***	0.000185***	0.00000970
	(0.0000143)	(0.0000147)	(0.0000148)
MOOP	0.0000156*	-0.000107***	-0.0000450***
	(0.00000625)	(0.00000662)	(0.00000662)
Inertia	4.917***		4.828***
	(0.00363)		(0.00377)
Inertia Duration = 1		5.062***	
		(0.00595)	
Inertia Duration = 2		5.392***	
		(0.00698)	
Inertia Duration = 3		5.771***	
		(0.00892)	
Inertia Duration = 4		6.203***	
		(0.0134)	
Inertia Duration = 5+		6.927***	
		(0.0282)	
Health x Plan FE			X
Observations	13,428,005	13,428,005	13,428,005

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 14: Scenario 1 - PPO Plans Only: Change in Predicted Plan Enrollment

	PERS Choice	PERS Select	PERS Care
HMO	113,294	172,018	46,883
PERS Choice	40,153	3,474	1,591
PERS Select	5,491	32,492	1,567
PERSCare	992	785	6,979

Notes: Predicted plan enrollment in a counterfactual policy in which only PPO plans are offered using demand estimates from Table 13, Column (3). "HMO" refers to the total enrollment in all HMO plans. The rows designate subscriber enrollment in 2020. The columns designate predicted subscriber enrollment for the three PPO plans.

Table 15: Scenario 1 - PPO Plans Only: Change in Predicted Plan Enrollment

	PERS Choice	PERS Select	PERSCare
Anthem HMO Select	6,080	8,986	2,420
Anthem HMO Traditional	2,126	2,880	856
Blue Shield Access+	11,310	15,962	4,702
Blue Shield Trio	1,126	1,705	472
Health Net Salud y Mas	1,675	2,356	721
Health Net SmartCare	2,162	3,424	860
Kaiser	75,406	115,974	31,453
PERS Choice	40,153	3,474	1,591
PERS Select	5,491	32,492	1,567
PERSCare	992	785	6,979
Sharp	1,894	2,819	738
UHC Alliance HMO	10,248	15,762	4,125
WHA	1,267	2,150	536

Notes: Predicted plan enrollment in a counterfactual policy in which only PPO plans are offered using demand estimates from Table 13, Column (3). The rows designate subscriber enrollment in 2020. The columns designate predicted subscriber enrollment for the three PPO plans.

Table 16: Scenario 1 - PPO Plans Only: Changes in Predicted Enrollment and Spending per Member

	Δ Number of		Δ Total Spending*	Δ Plan Cost*	Δ OOP Spending*
	Subscribers	Members			
PERS Choice	+114,712	+246,363	-1,431.63	-1,337.89	-93.74
PERS Select	+169,219	+452,786	+509.24	+403.40	+105.84
PERSCare	+48,264	+86,877	-5,126.58	-4,934.50	-192.09

Notes: *Changes in predicted spending per member. Based on predicted plan enrollment in a counterfactual policy in which only PPO plans are offered using demand estimates from Table 13, Column (3).

Table 17: Scenario 2 - Active Choice: Change in Predicted Plan Enrollment

	HMO	PERS Choice	PERS Select	PERSCare
HMO	253,269	26,179	41,994	10,753
PERS Choice	34,487	3,716	5,509	1,506
PERS Select	29,729	3,239	5,330	1,252
PERSCare	6,614	772	1,002	368

Notes: Predicted plan enrollment in a counterfactual policy in which the switching cost is lowered to zero using demand estimates from Table 13, Column (3)."HMO" refers to the total enrollment in all HMO plans. The rows designate subscriber enrollment in 2020. The columns designate predicted subscriber enrollment for the three PPO plans.

Table 18: Scenario 2 - Active Choice: Changes in Predicted Enrollment and Spending per Member

	Δ Number of		Δ Total Spending*	Δ Plan Cost*	Δ OOP Spending*
	Subscribers	Members			
Anthem HMO Select	14,790	32,861	-303.54	-240.65	-62.89
Anthem HMO Traditional	4,886	6,710	-2,673.46	-2,574.35	-99.11
Blue Shield Access+	-9,533	-33,226	-1,262.61	-1,215.32	-47.29
Blue Shield Trio	35,204	81,046	790.00	781.66	8.36
Health Net Salud y Mas	25,372	73,313	1,603.93	1,593.50	10.43
Health Net SmartCare	16,076	34,279	-1,423.85	-1,300.82	-123.03
Kaiser	-156,161	-363,351	1,090.85	1,019.60	71.25
PERS Choice	-11,312	-33,697	-1,846.72	-1,717.71	-129.01
PERS Select	14,285	47,436	628.12	514.76	113.36
PERSCare	5,123	7,844	-5,659.43	-5,446.47	-212.96
Sharp	18,835	53,021	384.77	430.82	-46.05
UHC Alliance HMO	17,061	29,317	710.53	762.95	-52.42
WHA	25,373	64,443	446.49	558.65	-112.16

Notes: *Changes in predicted spending per member. Based on a counterfactual policy in which the switching cost is lowered to zero using demand estimates from Table 13, Column (3).

Table 19: Scenario 3 - VBID Plan Only: Changes in Premium Paid and Spending per Member

Plan Prior to Switch	Number of		Δ Premium Paid	Δ Plan Cost*	Δ OOP Spending*
	Subscribers	Members			
Anthem HMO Select	17,486	42,702	-1,296	-494.46	+494.46
Anthem HMO Traditional	5,862	11,950	-4,351	-590.80	+590.80
Blue Shield Access+	31,975	76,143	-2,538	-601.44	+601.44
Blue Shield Trio	3,303	8,385	-648	-588.92	+588.92
Health Net Salud y Mas	4,752	11,480	0	-347.81	+347.81
Health Net SmartCare	6,446	15,476	-2,049	-492.55	+492.55
Kaiser	222,833	517,999	-940	-596.14	+596.14
PERS Choice	45,218	105,206	-1,390	-50.49	+50.49
PERSCare	8,756	16,652	-3,488	-251.04	+251.04
Sharp	5,451	13,886	-63	-487.71	+487.71
UHC Alliance HMO	30,135	77,989	-889	-529.11	+529.11
WHA	3,953	10,020	-909	-531.61	+531.61

Notes: *Changes in predicted spending per member. Based on predictions in a counterfactual policy in which only PERS Select is offered.

Table 20: Scenario 3 - VBID Plan Only: Changes in Predicted Enrollment and Spending per Member by Health Status

		Δ Number of		Δ Total Spending*	Δ Plan Cost*	Δ OOP Spending*
		Subscribers	Members			
PERS Select	Poor Health	+150,746	+312,475	+2,397.36	+2,152.39	+244.97
	Good Health	+235,424	+595,413	+238.16	+153.35	+84.81

Notes: *Changes in predicted spending per member. Health status is defined using the age adjusted Charlson score with the cut-off an average Charlson Score of 2 or lower being considered in good health (about 75% of the sample). Based on predictions in a counterfactual policy in which only PERS Select is offered

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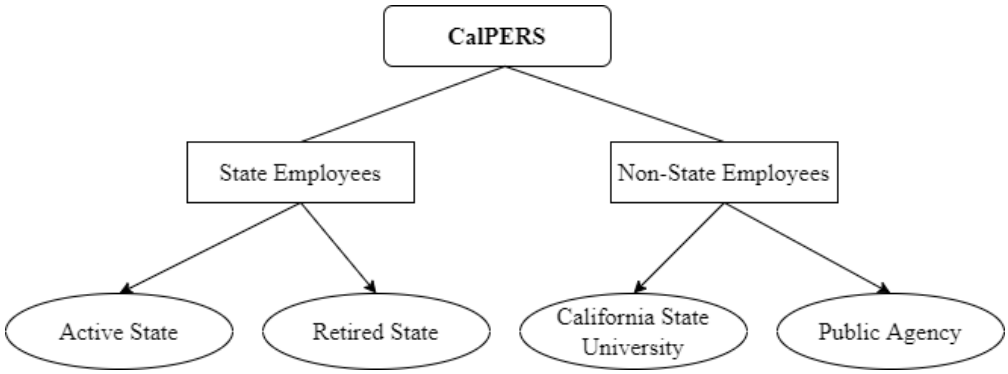
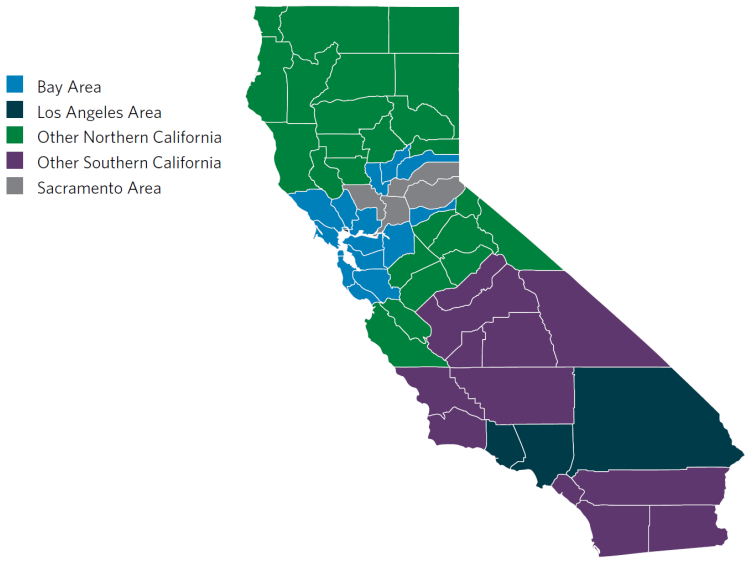
8 Appendix

8.1 Premiums and Premium Contribution Figures



Types of CalPERS Employees



CalPERS Regions used for Premium and Employer Contribution Variation

8.2 Charlson Health Status Measure

The subscriber's Charlson Comorbidity Index was calculated to provide a medically-motivated measure of predicted health risk to model whether a consumer is "more healthy" or "less healthy." A related statistic is the Age-Adjusted Charlson Comorbidity Index (ACCI), as defined by Charlson et al. (1994), which combines the age equivalence index and original Charlson Comorbidity Index (CCI) to measure estimated relative risk of death. For each decade after age 40, a point is added until a maximum of 4 points for ages 80 and older is reached. This age score is added to the Charlson Comorbidity Index (CCI), which is calculated by the presence of certain diagnosis codes, to calculate the ACCI. This risk measure reflects both the (i) independent influence of age and (ii) the burden of co-morbidites in the survival of patients. While the Charlson Comorbility Index is a well-known and widely used measure of health risk, it is also relatively crude and can be an imperfect proxy for actual patient health. For members in a household, the average ACCI for each subscriber is calculated. A higher ACCI score reflects a decrease in estimated 10-year survival, which has been shown to be directly related to higher medical spending.

8.3 Premium Contribution Calculation Details

Contributions for State Employees

For state employees, the primary modification made to the blanket "80-20" rule is that we used the more precise rule actually employed by CalPERS which is:

1. In a given year, take the average total premium for the top 4 statewide health plans by statewide market share. Do this separately for each of the three dependent tiers (single, spouse, family).
2. Classify subscribers into one or two groups: those whose status implies and "80-80" rule and those whose status implies an "85-80" rule. The "85-80" rule implies that a subscriber gets 85% of the total single premium as their own subsidy, but their dependents get 80% of the subsidy difference between the tier in question (spouse or family) and the single tier. The "80-80" subscribers get an 80% subsidy for the entire set of family members, including themselves. So, for "80-80" subscribers you multiply the output of 1) above by 0.8 to get the subsidy, while for "85-80" you multiply the subscriber contribution for the single tier by 0.85 and the incremental premium to get to the family premium average by 0.8, then add these two contributions together.
3. The state employee subscriber premium contribution is then equal to (Total Premium – Fixed Subsidy). If this number is negative, their premium contribution is set to 0.

It is also important to note that supervisor manager state employees receive lump sum subsidies that follow a slightly different structure than that specified above. Lump sum subsidies for these employees apply to health, dental and vision benefits bundled together. For simplicity, we assume that these employees receive subsidies following the "80-80" rule as specified above.

We have integrated datasets that tell us which (i) families are in which bargaining units and (ii) provide historical data on tier-specific plan subsidy contributions for bargaining units. The final dataset subsumes this information.

Another key group with a different contribution formula is CSU employees. According to CalPERS staff, for one of the union groups their contributions are the same as the retired state employees (with maximum service) in 2020. Consequently, we use the formula for premium contributions for retired employees and apply it in our data to all CSU employees across the different CSU unions.

Non-State Public Agency Employees

This group of CalPERS beneficiaries is harder to model because their premium contributions depend on the specific contribution amounts used by the non-state public employer in question. To model premium contributions for these employees, we use some estimates of local agency contributions made by CalPERS that has some characteristics of employers. To do this we:

1. Use the employee contributions from employer agencies that provide fixed premium contributions that apply to all plans in a choice set.
2. Take the weighted mean across these fixed agency-specific contributions, where the weights are the number of employees in each agency. We treat PA and School categories separately.
3. Since contributions for the two party tier (subscriber with one family member) are not included in this resource, we need to estimate these numbers. We do this using the rule listed in the footnote here, where "Actives" implies an 80-80 rule.[4]
4. Extrapolate numbers to years before 2020 using between-year ratios of fixed contributions from state employees following the "80-80" rule.

While this contribution model is coarser, since we don't observe the specific local public agency each employee works for, we use this model to better hone in on broad categories of non-state employees and assess a contribution value that is likely to be closer to their true contributions than a blanket application of the state employee rule.

[4]

$$
\begin{aligned}
&(\text{PA/School Contribution for Region X Tier 2 in 2020}) \\
&\quad = (\text{PA/School Contribution for Region X Tier1 in 2020}) \\
&\quad \times \frac{(\text{Contribution for Actives Tier 3 in Year 2020}) - (\text{Contribution for Actives Tier 2 in Year 2020})}{(\text{Contribution for Actives Tier 3 in Year 2020}) - (\text{Contribution for Actives Tier 1 in Year 2020})} \\
&\quad + (\text{PA/School Contribution for Region X Tier3 in 2020}) \\
&\quad \times \frac{(\text{Contribution for Actives Tier 2 in Year 2020}) - (\text{Contribution for Actives Tier 1 in Year 2020})}{(\text{Contribution for Actives Tier 3 in Year 2020}) - (\text{Contribution for Actives Tier 1 in Year 2020})}
\end{aligned}
$$