Refining the Analysis of Medicare Plan Choices and Utilization: A Disaggregated Approach*

Michael DeDad† Austin Knies‡ Volodymyr Lugovskyy§ Alexandre Skiba¶

February 29, 2024

Abstract

Upon turning 65 years old, most US citizens can choose between government-run Traditional Medicare (TM) or a privately managed Medicare Advantage (MA) plan for their health insurance coverage. Extensive research has been conducted to compare patient choices and expenditures under these two plans. However, we argue that focusing solely on these two broad categories simplifies the scenario too much and can lead to misleading conclusions. This is because within each plan, there are options that are either subsidized by the government through Medicaid or supplemented with additional coverage from other entities. Leveraging comprehensive health care utilization and beneficiary data from the Medicare Current Beneficiary Survey (MCBS), we break down TM and MA into finer subgroups and present theoretical predictions regarding the prices, quality, and demand for healthcare services within each subgroup. Our empirical analysis reveals substantial heterogeneity across the subplans within TM and MA and shows significant quantitative and, in some instances, qualitative biases when merely comparing MA to TM. We also validate our theoretical predictions concerning the price and quality of the subplans. Notably, we are the first to estimate substantial quality differences between the TM and MA subplans based on the revealed preferences approach, rather than relying on survey methods.

Keywords: Medicare Plans, Medicare Pricing, Medicare Demand, Medicare Quality
JEL Codes: D83, H51, I13, I18

*We than the IHS Hayek Fund for Scholars and Indiana University for funding which enabled the data purchase used in this paper.

†Department of Economics, College of Business Rm 323, The University of Akron, Akron, OH 44325-1908; e-mail: mdedad@uakron.edu

‡Department of Economics, Indiana University, Wylie Hall, 100 S. Woodlawn, Bloomington, IN 47405-7104; e-mail: ausknies@iu.edu

§Department of Economics, Indiana University, Wylie Hall Rm 301, 100 S. Woodlawn, Bloomington, IN 47405-7104; e-mail: vlugovsk@iu.edu

¶Department of Economics and Finance, University of Wyoming, Dept 3985, 1000 E University Ave, Laramie, WY 82071, e-mail: askiba@uwyo.edu

1 Introduction

Medicare, a U.S. government-funded program, totaled $888 billion in 2021 and has traditionally provided healthcare coverage, mostly for retirees aged 65 and older, through its original fee-for-service program, commonly known as Traditional Medicare (TM). However, about four decades ago, an alternative private option, known as Medicare Advantage (MA), emerged, offering healthcare coverage through private insurance plans (CMS, 2023). This private option has grown in popularity over the years: in 2022, 48% of Medicare beneficiaries were enrolled in MA, and the Congressional Budget Office projects this number will increase to 61% by 2032 (Ochieng et al., 2023). This option has not only grown in popularity[1] but has also become the subject of extensive research. Numerous studies have compared MA and TM, scrutinizing their cost efficiency, coverage, and patient satisfaction levels.

However, it is crucial to note that these studies often compare MA and TM at an aggregated level, neglecting the fact that beneficiaries sometimes enhance their coverage by combining these plans with additional coverages, either through the government-funded program Medicaid or via private supplementary plans. This oversight might obscure the nuanced differences and benefits between MA and TM plans, highlighting a gap in the current research framework that fails to fully capture the complexity of beneficiaries' healthcare coverage choices.

Attempting to fill this gap, this paper demonstrates the critical role of a more disaggregated approach that accounts for additional coverage within each category when comparing MA against TM. Towards this goal, we categorize TM plans into three subplans: TM-Only, TM+Supplementary (TM+S), and TM+Medicaid (TM+M); similarly, we classify MA plans into three parallel subplans: MA-Only, MA+Supplementary (MA+S), and MA+Medicaid (MA+M). Such disaggregation allows us to disentangle the effects of additional coverage and focus on the key features distinguishing MA from TM, both theoretically and empirically.

Theoretically, we employ a utility-based approach wherein medical care is viewed as a utility-enhancing service. Beneficiaries maximize their utility subject to budget constraints and select the plan and amount of care based on their unique characteristics, and the prices and quality of subplans. Our main focus is

[1]In 2022, 48% of Medicare beneficiaries were enrolled in MA, and the Congressional Budget Office projects this number will increase to 61% by 2032 (Ochieng et al., 2023).

on comparing TM-Only versus MA-Only, as these subplans are the only ones without additional coverage from either Medicaid or other entities. Importantly, we derive a quantitative assessment of the excessive aggregation bias that would occur if we were comparing aggregated MA vs TM plans instead of MA-Only vs TM-Only subplans.

MA plans are known to be much more restrictive in terms of coverage compared to TM plans. Unlike TM, MA plans require referrals to see specialists and typically offer geographic coverage limited to just one county (CMS, 2023; Meyers et al., 2022). We incorporate this fact into our model in two ways. First, we assume that MA-Only plans are of lower quality than TM-Only plans. Second, we categorize beneficiaries into two types: the finicky ones, who care more about these differences in quality, and the frugal ones, who pay less attention to the quality differences and focus more on costs.

In equilibrium, we demonstrate that MA-Only insurers will set lower Out-Of-Pocket Costs (OOPCs) to compensate for the quality differential, thereby attracting frugal beneficiaries but not the finicky ones. MA-Only insurers benefit from keeping finicky beneficiaries in the TM-Only plan since their compensation from the government is calculated based on government expenditures on finicky beneficiaries in TM-Only, and finicky beneficiaries consume significantly more healthcare services than frugal beneficiaries. Importantly, our model lays the foundation for a quantitative assessment of the quality differences between the two subplans, accommodating heterogeneous preferences for quality.

Empirically, we leverage rich beneficiary-level information on demographic characteristics, individual preferences on health care and coverage options, and observed health care contained in the Medicare Current Beneficiary Survey (MCBS) and Cost Supplement data. Our sample from 2015 to 2019 includes detailed enrollment and survey data on over 37,000 Medicare beneficiaries and just under 1.3 million distinct medical events (categorized in various types), which, when combined with survey weights, provide insight on differences across coverage in the ever-enrolled Medicare population.

We test our model predictions by exploring differences in healthcare utilization and costs across Medicare beneficiaries enrolled in each coverage subplan. Our results strongly support our theoretical predictions. Firstly, we confirm that focusing solely on the broad categories of TM and MA, instead of adopting a more narrow focus on MA-Only and TM-Only, leads to pronounced aggregation bias and, in some instances, even erroneous qualitative conclusions about observed choices.[2] Secondly, TM-Only has 19% higher Out-Of-Pocket Costs (OOPCs) per event than MA-Only, but, despite this, also shows 60% higher utilization of medical services than MA-Only. As a result, TM-Only incurs $4,464 more per patient-year in payments to providers than MA-Only, which can be considered as the variable profit per patient-year for MA-Only (excluding differences in fixed costs between the two subplans).

Importantly, we also quantify the revealed-preference (RP) quality difference between the subplans. Specifically, we find that the quality is at least 3.5 times greater for TM-Only compared to MA-Only for finicky beneficiaries, and at most 3.5 times greater for frugal beneficiaries. This quantification allows for out-of-sample predictions. For example, if the quality of TM-Only were to decrease by 10%, the rate of healthcare utilization by TM-Only beneficiaries would drop by 4%.

In addition, the RP-approach offers a more reliable alternative to the survey-based approach for evaluating the quality of healthcare services. To illustrate this point, we utilize the quality-evaluation portion of the MCBS survey. According to these data and contrary to our RP-findings, the quality is actually lower in TM-Only than in MA-Only. We conjecture that these qualitative differences stem, at least partially, from the fact that beneficiaries in TM-Only and MA-Only plans are of different types. Specifically, our model suggests TM-Only attracts finicky beneficiaries, while MA-Only attracts frugal ones. The majority of beneficiaries have experienced only one type of plan, thus their evaluations reflect not necessarily the inherent quality differences between plans but rather the differences in the perception of quality across beneficiary types. This discrepancy is clarified when analyzing the changes in quality perception among switchers from MA-Only to TM-Only and vice versa. The ranking of both plans by switchers becomes reversed and aligns with our RP-results. This reversal in ranking by switchers demonstrates that the ranking of individuals who have experienced both subplans does not always align with a ranking based on the survey of individuals who have experienced only one plan. Thus, the traditional survey-based ranking of plans, subplans, and individual plans offered by different insurance companies can often be misleading.

We expand upon and contribute to several bodies of literature as follows. First, we explicitly demon-

[2]We attribute this outcome to the fact that both TM+M and MA+M plans are subsidized by the government via Medicaid, while TM+S and MA+S are enhanced with additional coverage provided by other entities. These subsidized plans result in lower OOPCs and higher rates of utilization of medical services.

strate the importance of more disaggregated analysis at the subplan level. A substantial body of interdisciplinary research over recent decades has dedicated itself to evaluating the broad differences between those enrolled in Traditional Medicare (TM) and those in Medicare Advantage (MA), spanning economics, health policy, and medical research (see, among others, Landon et al., 2012; Agarwal et al., 2021; Ochieng and Fuglesten Biniek, 2022; Landon et al., 2023; Ochieng and Clerveau, 2023). We contribute to these strands of research by arguing that, whenever possible, the unit of analysis should be more disaggregated—at least at the subplan level, as defined in our paper. Otherwise, the results of such analyses could be subject to both quantitative and potentially even qualitative biases. Our paper is complementary to a similar point recently raised by (Nicholas et al., 2024). However, their main focus was on the more disaggregated analysis of various plans within MA. In contrast, we target the comparison of MA and TM at a more disaggregated level. As a result, our empirical findings on the differences in health care utilization, costs, and quality levels of different Medicare subplans fill a void in the existing literature that studies these variables at a more aggregated level.

Second, our empirical analysis is guided by a theoretical framework and utility-maximization approach, which is virtually nonexistent in previous research on this topic. The existing literature using utility-maximization approaches has focused on Medicare Part D plan selection, not Medicare Advantage (Abaluck and Gruber, 2011, 2016; Ho et al., 2017; Heiss et al., 2021; Brown and Jeon, 2023). Thus, our findings related to differences in out-of-pocket costs, healthcare utilization, and quality are based on theoretical predictions rather than ad-hoc regression results.

Third, we contribute to the literature by proposing a novel for this literature way of measuring difference in quality. In the existing literature, quality has been measured by many metrics including star ratings, readmission rates, and quality perceptions from survey data. The results have been somewhat mixed. Relative to those in TM, MA beneficiaries have been found to have substantially lower probabilities of entering higher-quality skilled nursing facilities (Meyers et al., 2018), higher probabilities of being admitted to average-quality hospitals (Meyers et al., 2020), and higher probabilities of receiving treatment from lower-quality home health agencies (Schwartz et al., 2019). Focusing on provider networks, Meyers et al. (2022) found that higher-rated MA plans had narrower networks and that mental and behavioral health providers, cardiologists, psychiatrists, and primary care providers were underrepresented in MA networks overall. Haeder (2020) found that access to cardiac surgeons is relatively similar between MA and TM in metropolitan areas, but that there is significantly lower access among MA beneficiaries in rural areas. Conversely, other research has found evidence of higher quality levels among MA HMOs relative to TM (Newhouse and McGuire, 2014; Ayanian et al., 2013; Landon et al., 2012, 2015, 2023). As previously mentioned, our disaggregated results indicate higher quality in TM-Only vs. MA-Only using an RP approach, which we are the first to do, to the best of our knowledge. We also demonstrate the potential pitfalls of relying on perceived quality from survey data but nonetheless confirm our RP findings with our analysis of switchers.

Fourth, much attention has been paid to the relative costs and utilization in the aggregated MA and TM plans and the consequences this has for adverse selection and possible overpayments to MA plans by taxpayers. While there is conflicting evidence of post-2004 capitation payment reforms reducing favorable selection into MA (McWilliams et al., 2012; Brown et al., 2014; Newhouse and McGuire, 2014; Newhouse et al., 2015), recent research has generally found that MA beneficiaries still experience lower total costs and lower utilization than TM beneficiaries, even when controlling for risk scores. Using a difference-in-differences approach, Schwartz et al. (2021) found that, in the year following their transition from a commercial plan to Medicare, those who switched to MA saw significantly larger reductions in total spending than those who switched to TM and also had fewer inpatient stays, whereas inpatient stays increased among those in TM. Park et al. (2020a), conversely, found that MA beneficiaries actually had 5.40% more primary care visits per person than those in TM, but even so, still had 10.95% lower expenditures. Landon et al. (2015) and Landon et al. (2023) additionally found evidence of MA HMO beneficiaries having lower spending and lower emergency department usage than those in TM. Curto et al. (2019) found that, in 2010, MA plans profited off of these differences, with spending per enrollee-month being $642 in MA vs. $911 in TM, while the revenue MA plans received through capitation payments was 30% higher than than what they contributed to paying their beneficiaries' costs.

We contribute to this literature by analyzing both the annual, per-beneficiary costs and the event-level costs in not just TM and MA overall, but also disaggregated subplans. As specific subplans have substantially different cost-sharing agreements, we find that this finer level of detail reveals economically significant differences in relative costs and utilization between subplans that have not been uncovered by previous research. We find that, controlling for risk scores, there remained favorable selection into MA from 2015-2019 as evidenced by significantly lower annual non-emergency events, total costs, and out-of-pocket costs in MA-All than TM-All, but that these differences are less extreme when comparing MA-Only to TM-Only. Since some MA-All costs are paid by the government (e.g. through Medicaid) and some TM-All costs are paid by private plans (e.g. through Medigap), MA-Only vs. TM-Only is a more accurate private vs. public comparison. In this case, we see that while annual events were 91% higher and costs paid by the government and/or private plans were $7,158 higher in TM-All than MA-All, these numbers are reduced to 60% and $4,464, respectively, when comparing TM-Only to MA-Only. This is due, at least in part, to out-of-pocket expenditures per event being 19% higher in TM-Only than MA-Only, whereas they are 10% lower in TM-All than MA-All.

Lastly, our analysis of switchers also contributes to the literature focusing on the experiences of beneficiaries who switched between MA and TM after first enrolling (Batata, 2004; Meyers et al., 2019; Park et al., 2020b; McWilliams et al., 2012). However, as there is significant status quo bias (Sinaiko et al., 2013; Afendulis et al., 2015; Newhouse et al., 2015), we do not place great emphasis on switchers in most of our analysis.

2 Medicare Background

The Medicare program began with the signing of the Social Security Amendments of 1965, also known as the Medicare and Medicaid Act. The act established what is commonly known today as Traditional Medicare (TM), which is mainly provided by the government.[3] In 1982, the Tax Equity and Fiscal Responsibility Act created a private-health-plan alternative called Medicare Part C, also known as Medicare Advantage (MA), which has since undergone multiple revisions with the goal to more efficiently provide private insurance and more accurately reimburse MA plans for the costs of their enrollees. Over time, prospective Medicare enrollees have faced an increasingly complex array of choices. At its most basic, the decision involves choosing between TM and MA, but the choice is further complicated by the additional options of supplemental insurance policies that fill gaps in coverage. This includes Medigap

[3]Exceptions included retirees with employer-sponsored insurance, which in some cases were allowed to maintain patient-provider relationships.

plans (for those enrolled in TM), Part D plans (for prescription drug coverage), Medicaid (for those who are "dually eligible"), and employer-sponsored plans, among others. Medicaid, in particular, acts as an additional safety net for low-income, elderly, or disabled persons, cutting their out-of-pocket healthcare costs and broadening their access to healthcare services. As such, focusing only on the comparison between TM and MA misses out on important heterogeneity in beneficiary experiences that is likely to depend on their specific choices of supplemental insurance or lack thereof.

For beneficiaries enrolled in Traditional Medicare (TM), regardless of their optional enrollment in supplemental coverage, there are two main parts: Part A and Part B. Part A serves as hospital insurance, covering inpatient care and skilled nursing, whereas Part B functions as medical insurance, covering outpatient care and doctors' services. Part A premiums are waived for enrollees who have paid Medicare taxes for 40 or more quarters. However, in 2024, those who had paid taxes for 30-39 quarters could purchase Part A coverage for a monthly premium of $278, while for those who had paid less, the premium was $505 .[4] After a $1,632 deductible, enrollees are required to pay coinsurance, which starts at $0 but rises quickly after 60 inpatient days. Unlike Part A, Part B requires monthly premiums from all enrollees that escalate with income, although most enrollees pay the base premium ($170.70 per month in 2024). Following a $240 deductible, enrollees are responsible for 20% of the costs for most Part B services.

Despite the coverage provided by Parts A and B, there are numerous services that Traditional Medicare on its own does not cover, including most dental and vision care, as well as prescription medications. This base level of TM, additionally, does not impose a cap on out-of-pocket costs; therefore, to protect themselves against cost-sharing and potentially unlimited annual expenses, enrollees can opt to purchase a private supplemental insurance plan, known as a Medigap plan. Importantly, enrollees in Traditional Medicare can access any healthcare provider in the United States that accepts Medicare patients, generally without the need for referrals to specialists. This extensive network of providers ensures that most beneficiaries will not need to switch doctors when they turn 65. It also offers peace of mind, as enrollees know they are not constrained by a limited provider network if specialized treatment is necessary.

The alternative to TM, Medicare Advantage, was introduced to harness the efficiencies of the private

[4]For more details, see https://www.medicare.gov/your-medicare-costs/medicare-costs-at-a-glance. Certain low-income individuals qualify for subsidies and may be dually eligible with Medicaid.

sector to lower costs for beneficiaries and the government, while potentially providing more comprehensive benefits than TM. In fact, many standalone MA plans cover the extra services (i.e., dental, vision, and Part D prescription coverage) that are missing from the base level of TM. This means that enrollees potentially can have all of their services covered with only one plan, instead of needing to combine multiple plans with TM. Additionally, these plans are required to cover all services covered by Parts A and B and have an annual out of pocket maximum.

Unlike TM, however, the networks of healthcare providers in MA plans are likely to be much smaller than the virtually unrestricted network of TM, inducing high out-of-pocket costs for services received from out-of-network providers. Referrals might also be needed in many cases to see a specialist. The extent to which an MA plan's network is limited depends on the exact type of plan, which could be a Health Maintenance Organization (HMO), Preferred Provider Organization (PPO), Private Fee-for-Service (PFFS), or Medicare Special Needs Plan (SNP). Enrollees in any of these plans are still responsible for paying the standard Part B premium, but they might also be responsible for paying an additional, plan-specific premium. Some of these plans compare favorably to TM in terms of cost sharing, but many have greater cost-sharing. Despite the presence of star ratings that Medicare has assigned to various MA plans to identify their quality, finding the plan that compares most favorably to TM requires the enrollee to sift through dozens of plans and have the ability to understand a large amount of information related to the health insurance industry and medical services.

The proportion of beneficiaries enrolled in MA plans has been steadily rising since the early 2000s and reached 39% in 2019, the most recent year in our sample.[5] Of these, the vast majority were enrolled in plan types that generally have the most most restrictive networks, which can be seen in Figure 1 and is summarized in Stylized Fact 1. Specifically, in December 2019, 93.9% were enrolled in local coordinated care plans (CCPs), including HMOs (62.4% of total) or local PPOs, while the remaining beneficiaries were enrolled in private-fee-for-service, medical savings account, or regional PPO plans.[6]

[5]See Ochieng et al. (2023). This percentage increased to 51% in 2023.
[6]See the CMS.gov Monthly Contract and Enrollment Summary Report.

Stylized Fact 1. *Medicare Advantage (MA) beneficiaries typically have access to fewer providers than Traditional Medicare (TM) beneficiaries. The majority of MA subscribers (93.9% in December 2019) are enrolled in local coordinated care plans, which limit choices to providers within a county or several counties. Two-thirds of these subscribers are in HMO plans, which further limit provider choices.*

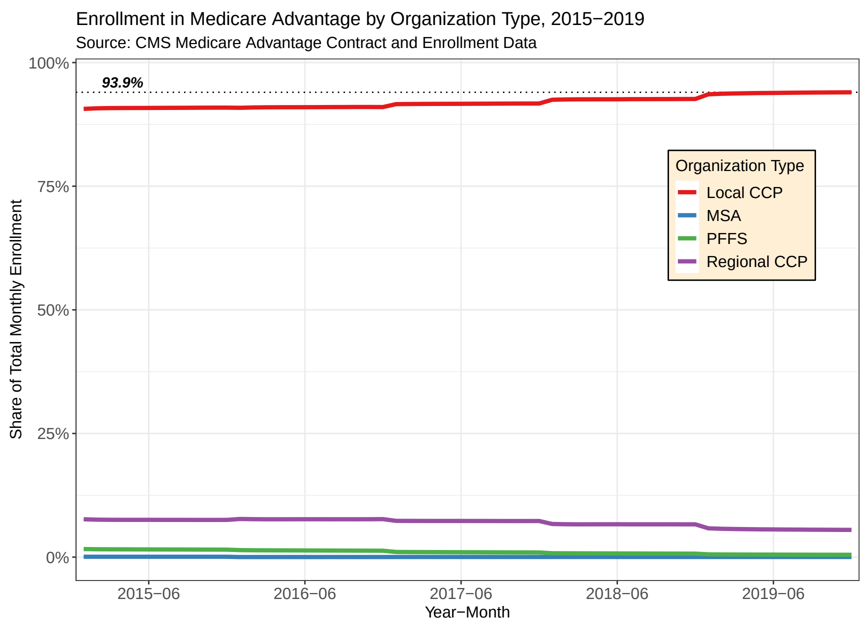

Figure 1: Enrollment in Medicare Advantage by Organization Type, 2015-2019

The upfront and future costs that enrollees face when choosing a Medicare plan depend on the premiums set for TM and MA plans and the degree of cost-sharing included in the plans' benefits. For TM, the pricing is straightforward, as it is determined unilaterally by the Centers for Medicare & Medicaid Services (CMS), the federal agency that administers the Medicare program. For MA, however, premiums and cost-sharing are determined by the participating insurance companies and influenced by Medicare regulations. The capitation system, which determines how much money per month the federal government pays MA plans for each beneficiary, has evolved over time, thus changing the profit maximization problem for participating plans. Before 2004, capitation payments varied depending on demographic characteristics (such as age and location) of enrolled beneficiaries, but since 2004, payments have been based on a beneficiary's "risk score" that attempts to account for their likely degree of healthcare utilization (Brown et al., 2014). The very availability of MA in different parts of the country has also depended on the formula for capitation payments, and in 1997 an MA floor rate was introduced to incentivize companies to offer MA plans in rural areas, where they were less successful negotiating with highly concentrated local providers (Afendulis et al., 2015).

3 Model

In this section, we develop a simplified model to analyze the demand for individual healthcare services. The medical literature does not use a utility-maximization approach to model demand for healthcare services and tends to model utilization of health providers as a function of being sick or as preventive care visits treated as exogenous factors.[7] Instead, the economic approach used in our paper rationalizes the choice of plans with a utility model subject to constraints. This method has been previously utilized by Abaluck and Gruber (2011) for the choice of health insurance plans and by Varkevisser et al. (2010) and Gutacker et al. (2016) for the choice of medical providers. We believe that this approach is useful in explaining various aspects of healthcare pricing and the healthcare services utilization.

In our theoretical and empirical analysis, we classify all Medicare plans into two broader plans, MA (Medicare Advantage) and TM (Traditional Medicare), and three sub-plans within each broader plan: "Only", "Plus Supplementary Coverage", and "Plus Medicaid." Broader plans are indexed by $b \in \{MA, TM\}$, and sub-plans are indexed by $s \in \{O, S, M\}$. To illustrate, a variable indexed by TM, O refers to TM-Only and one indexed by MA, S refers to MA+Supplementary (coverage), and TM, M denotes TM+Medicaid (coverage). All TM plans represent government-administered options, while all MA plans are provided by private, profit-oriented firms. A key distinction between the two is that government-run TM plans permit the use of any health care provider nationwide, whereas private MA plans typically limit their coverage to specific geographic locales, often at the county level—a fact underscored by our Stylized Fact 1.

[7] Recent literature review by Gliedt et al. (2023), after analyzing 6639 papers, identified four classes of models in the literature, but none of them used the utility-maximization approach.

3.1 Setup

Our analytical focus is on non-pharmaceutical healthcare events (i.e., visits). We denote the number of non-emergency visits by a beneficiary i enrolled in plan $\{b, s\}$ as $n_{i,b,s}$ and the corresponding number of emergency visits as $m_{i,b,s}$. The beneficiary maximizes the following utility function:

$$\max_{n_{i,b,s}, m_{i,b,s}} U_{i,b,s} = A + \frac{\varepsilon}{\varepsilon - 1} \boldsymbol{\delta_i} q_{i,b,s} n_{i,b,s}^{\frac{\varepsilon-1}{\varepsilon}} + \frac{\varepsilon_1}{\varepsilon_1 - 1} \boldsymbol{\beta_i} m_{i,b,s}^{\frac{\varepsilon_1-1}{\varepsilon_1}} \qquad \varepsilon, \varepsilon_1 > 1$$
$$\text{s.t. } A + n_{i,b,s} \overline{p}_{n,b,s} + m_{i,b,s} \overline{p}_{m,b,s} = I_i \tag{1}$$

where A is the numeraire composite of all other goods and services;[8]

$\boldsymbol{\delta_i} = \prod_j \left(d_{ij}^{\delta_j} \right)$ and $\boldsymbol{\beta_i} = \prod_j \left(d_{ij}^{\beta_j} \right)$ are the vectors of the beneficiary-specific demand shifters with variables d_{ij} representing i's age, income, health status, etc.;

$q_{i,b,s}$ is the non-price demand shifters or 'quality' of b; which may vary across plans and individuals;

$\overline{p}_{b,s}$ is a weighted-average beneficiary's price index of health services in b, s; and

ε and ε_1 denoting price elasticities of demand for non-emergency and emergency visits, respectively.

In our model, the quality of plan b, s depends on the quality of individual health providers in b, s. Previous research has established substantial heterogeneity in the quality of providers (Varkevisser et al., 2010; Gutacker et al., 2016; Meyers et al., 2018, 2020, 2022). For tractability, we use just two quality levels: regular and outstanding, labeled by q_r and q_o, respectively.[9] We assume that the quality and marginal cost of outstanding quality are higher than those of regular quality:[10]

$$q_o > q_r \qquad c_o > c_r. \tag{2}$$

The number of outstanding-quality providers is fixed and is set to N_o.[11] The number of the regular-quality providers is determined by free entry.

In line with Varkevisser et al. (2010) and Gutacker et al. (2016), we assume that beneficiaries are

[8]Note that pharmaceutical consumption is a part of A rather than separately entering our utility function. This abstraction allows us to have a more tractable model.

[9]A similar two-level classification has also been used by Meyers et al. (2018).

[10]To simplify, providers do not incur fixed costs.

[11]The scarcity of high-quality providers is documented by Haeder (2020) in the context of access to cardiac surgeons.

heterogeneous in their perception of quality. Specifically, we assume that there are two types of beneficiaries: the "finicky" ones—those with a high valuation of quality, and the "frugal" ones—those who have a low valuation of quality and thus are mainly cost-oriented. We denote the set of finicky beneficiaries as $\overline{q}$ and the set of frugal beneficiaries as $\underline{q}$. Naturally, finicky beneficiaries value the number of outstanding providers more than frugal beneficiaries:

$$\frac{\partial q_{i,b,s}(i \in \overline{q})}{\partial N_{o,b,s}} > \frac{\partial q_{i,b,s}(i \in \underline{q})}{\partial N_{o,b,s}} \geq 0. \tag{3}$$

Next, recall that MA plans typically limit members to providers within a specific county, while TM plans provide access to providers nationwide. Additionally, non-price barriers like referral requirements in MA plans further limit provider access, even within the same county. Consequently, as the number of outstanding providers is invariably lower in MA plans, TM plans are perceived as higher quality by all beneficiaries, including the frugal ones: $q_{i,TM,s} > q_{i,MA,s} \quad \forall i$. In line with the logic of eq. (3), finicky beneficiaries are more perceptive than the frugal ones about the quality difference between TM and MA:

$$\frac{q_{i,TM,s}(i \in \underline{q})}{q_{i,MA,s}(i \in \underline{q})} < \frac{q_{i,TM,s}(i \in \overline{q})}{q_{i,MA,s}(i \in \overline{q})}.$$

In the context of medical services and insurance companies, we can distinguish between two types of prices. The first, which we denote by p, is the beneficiary's price—the price paid by beneficiaries to providers. The second, denoted by P, is the provider's price—the price charged by providers. The difference between these two prices $(P - p)$ is paid to providers by insurance companies. To align with the terminology used in official government documents and in the medical field, we will refer to P and p as the Total Cost (TC) and Out-Of-Pocket (OOP) cost, respectively.

For TM beneficiaries, the TCs per event are set by the government, and providers can choose whether or not participate and accept Medicare's fee schedule as payment-in-full for covered services. If a provider accepts the schedule, or is "non-participating" but has not formally opted out, then there are significant limitations to what they are allowed to charge MA patients. Specifically, a participating provider may not charge an MA patient more than a TM patient for the same service, and a non-participating provider cannot charge more than 109.25% of the TM rate (Trish et al., 2017). Thus within a given geographic area covered by a particular MA plan (typically a county), the set of providers is effectively the same.[12] That implicitly sets a requirement for the MA plans not to deviate too much from the TM's TCs per event. Thus, in our model, we will assume that the difference in TCs is *economically insignificant* across all six plans.

While TM plans are predominantly operated by the government, and MA plans are predominantly operated by private companies, strictly speaking, these definitions apply only to TM-Only and MA-Only plans. Other insurance sub-plans, such as MA+Medicaid or TM+Supplementary Coverage, often combine both government and private coverage. Thus, our setup will differ for various types of sub-plans.

TM-Only and MA-Only. One key difference between these sub-plans is that TM-Only does not limit access to providers and does not cap the Total Cost (TC) per event. In contrast, MA-Only restricts access to providers outside a specified, limited geographic zone and may limit the TC per event. Of course, MA patients can still utilize out-of-network services, and as discussed above TCs will be similar for TM and MA beneficiaries. However, out-of-pocket costs for patients can be significantly higher for out-of-network services, making this option much less attractive for MA beneficiaries.

Importantly, private companies managing MA-Only plans are reimbursed by the government based on the government's average costs for similar beneficiaries in TM, considering the patients' demographics and health statuses. However, this reimbursement model does not account for differences in a patient's ability to discern high-quality providers.[13]

TM plus Supplementary Coverage and MA plus Supplementary Coverage. Some beneficiaries are able to obtain supplementary coverage, which allows them to pay higher premiums and, in return, face lower out-of-pocket costs. Supplementary coverage is offered by private companies and, in some cases, is restricted to retiring employees of certain firms which subsidize these plans (CMS, 2023). We aggregate all of these possible plans into two groups: TM+Supplementary Coverage (henceforth, TM+S) and MA+Supplementary Coverage (henceforth, MA+S). As in the case of MA-Only and TM-Only, TM+S provides access to all providers, while MA+S restricts access to in-network providers only within a certain

[12] In 2023, only 1.1% of non-pediatric providers formally opted-out, thus the vast majority of providers are limited by the regulations for participating and non-participating providers (Ochieng and Clerveau, 2023).

[13] A summary of the process for determining capitation payments can be found in Congressional Research Service (2019).

geographic location (typically at the county level).

TM plus Medicaid (TM+M) and MA plus Medicaid (MA+M). The supplementary coverage for both of these plans is covered by the government program Medicaid, and the beneficiaries have to meet certain criteria to be covered by Medicaid in addition to Medicare. Typical qualifications include sufficiently low income and/ or disabilities. The exact criteria that must be met to qualify for Medicaid also vary by state (CMS, 2023).

3.2 Equilibrium and Predictions

From the first order conditions applied to eq. (1) (namely, $\frac{\partial U/\partial n_{i,b,s}}{\partial U/\partial A} = \frac{\overline{p}_{n,b,s}}{1}$), we get the inverse demand for non-emergency visits:

$$\overline{p}_{n,b,s} = \boldsymbol{\delta_i} q_{i,b,s} n_{i,b,s}^{-\frac{1}{\varepsilon}}, \tag{4}$$

from which we get the log-linearized demand function for non-emergency visits:

$$\ln n_{i,b,s} = \varepsilon \left(\ln \boldsymbol{\delta_i} + \ln q_{i,b,s} - \ln \overline{p}_{b,s} \right). \tag{5}$$

Next, we transform the above equation as follows:

$$\ln n_{i,b,s} = \varepsilon \left[\ln \boldsymbol{\delta_i} + \left(\ln q_{i,b,s} - \ln \overline{p}_{b,s} \right) \left(\sum_{b,s} \mathbb{1}_{i,b,s} \right) \right], \tag{6}$$

where $\mathbb{1}_{i,b,s}$ is a binary indicator that takes a value of 1 if individual i is enrolled in plan b, s, and 0 otherwise. It's important to note that Equations (5) and (6) are equivalent. This is because for any individual enrolled in plan b, s, the corresponding indicator variable will be 1, while all other plan indicators will be 0. We employed this transformation to bridge the gap between theory and the forthcoming empirical analysis. With the same goal in mind, we then designate the 'MA-Only' plan, indexed as MA, O, as the reference plan and adjust the right-hand side of Equation (6) by both adding and subtracting the MA, O

components:

$$\ln n_{i,b,s} = \varepsilon \left(\underbrace{\ln \boldsymbol{\delta_i} + \ln q_{MA,O} - \ln \overline{p}_{MA,O}}_{=\delta'_i} \right) + \underbrace{\varepsilon \left(\ln \frac{q_{i,b,s}}{q_{i,MA,O}} - \ln \frac{\overline{p}_{b,s}}{\overline{p}_{MA,O}} \right)}_{=\gamma_{b,s}} \left(\sum_{b,s} \mathbb{1}_{i,b,s} \right) \tag{7}$$

This transformation facilitates a direct comparison between the effects of each plan and those of the benchmark plan on demand. Consequently, we can express the theoretical demand function in observable terms as follows:

$$\ln n_{i,b,s} = \varepsilon \boldsymbol{\delta'_i} + \gamma_{b,s} \left(\sum_{b,s} \mathbb{1}_{i,b,s} \right) \tag{8}$$

where $\boldsymbol{\delta'_i}, \boldsymbol{\beta'_i}, \gamma_{b,s}, \delta_{b,s}$ are as defined in equation (7). This equation will serve as the basis for estimation in our empirical section because it connects estimated differences between plans to the theoretical parameters.

Next, we will provide predictions related to specific plans and sub-plans. Formally, we will categorize our predictions into Lemmas—for predictions that we cannot test empirically, and Propositions—for predictions that we will test empirically. The proofs are provided in Appendix A.

The Effects of Excess Aggregation. Our first proposition formally motivates the use of sub-plan distinction by establishing the effects of excess aggregation of sub-plans into plans. This type of aggregation is common in previous literature, which often compared MA to TM without considering finer distinctions such as supplements or Medicaid (Brown et al., 2014; Newhouse et al., 2015; Neuman and Jacobson, 2018; McWilliams et al., 2012). Aggregation makes sense due to data availability or specific research question. For our purposes aggregation creates a possibility that distinctions among sub-plans (see above for discussion) could be subsumed in the more aggregated plans making the aggregated results more difficult to interpret. To capture the effect of aggregation we can restate Equation (8) at a more aggregated level (TM vs. MA):

$$\ln n_{i,b} = \varepsilon \boldsymbol{\delta''_i} + \varepsilon \gamma_{TM} \left(\sum_{TM} \mathbb{1}_{i,TM} \right) \tag{9}$$

where $\boldsymbol{\delta''_i} \equiv \ln \boldsymbol{\delta_i} + q_{MA} - \ln \overline{p}_{MA}$;

$\gamma_{TM} \equiv \varepsilon \left(\ln \frac{q_{i,b,s}}{q_{i,MA,O}} - \ln \frac{\overline{p}_{b,s}}{\overline{p}_{MA,O}} \right)$; and

$\mathbb{1}_{i,TM} = 1$ if beneficiary i is enrolled in TM and to 0 otherwise.[14]

Note that aggregation into plans changes the base category from sub-plan MA, O to plan MA which includes all MA sub-plans. Because of this, the aggregated coefficients γ in equations (8) and (9) are not directly comparable. Equation (9) does not have MA, O as a separate category.

To enable direct comparison of coefficients across different aggregation levels, redefine $\gamma_{b,s}$ from Equation (8) as $\gamma_{b,s} = \tilde{\gamma}_b + \tilde{\gamma}_{b,s}$. In this context, $\tilde{\gamma}_b$ represents the difference between plans, allowing for variations within plans across b, s. Incidentally, $\tilde{\gamma}_b$ also represents the difference between plans in the absence of variations across sub-plans. [15]

Proposition 1. *If the plans are identified at the level of aggregated plans $b \in \{MA, TM\}$, the effect of aggregation by plans can be calculated as*

$$\gamma_b = \tilde{\gamma}_b + \sum_{s \in S_b} \tilde{\gamma}_{b,s}\omega_{b,s} - \sum_{s \in S_0} \tilde{\gamma}_{b0}\omega_{b0} \qquad \forall b \neq 0 \tag{10}$$

where $\omega_{b,s}$ is the share of observations of sub-plan b, s in plan b.

Proposition 1 shows how aggregated coefficient is driven by the differences within plan because if $\tilde{\gamma}_{b,s} = 0 \forall b, s$ then $\gamma_b = \tilde{\gamma}_b$. Since sub-plans may be subject to substantial differences even within the same broader plan, the aggregated plan coefficients γ_b likely subsume significant amount of within MA and within TM heterogeneity due to presence of supplemental coverage and Medicaid. This heterogeneity is important empirically as the results depend quantitatively and potentially even qualitatively on the level of aggregation. And while Proposition 1 is established for the model of $\ln n_{i,b}$ the aggregation creates a similar distortion for other dependent variables. We demonstrate the magnitude of the bias in the Results section (e.g, in our discussion of Tables 2 and 3). Furthermore, while we discussed the aggregation bias for the number of medical events, the same logic applies also to other variables, such as, for example, OOP costs and TCs.

As discussed above, even within TM and MA, there are substantial differences across sub-plans. These differences are reflected in the distinct sets of assumptions associated with each sub-plan. Conse-

[14]The summation operator is redundant but preserved for generality, the equation is valid for more than two plans, b.

[15]Note that for alternative direct estimation, such redefinition would require changing base categories and setting $\tilde{\gamma}_{MA} = 0$, $\tilde{\gamma}_{MA,Only} = 0$, $\tilde{\gamma}_{TM,Only} = 0$. This allows direct match to our estimates because $\gamma_{TM,Only} = \tilde{\gamma}_{TM} + \tilde{\gamma}_{TM,Only} = \tilde{\gamma}_{TM}$.

quently, the results will also vary, leading us to create separate subsections for different comparisons.

Comparison of TM-Only and MA-Only Sub-plans. Our model can elucidate the beneficiaries' choice of sub-plans. From the first-order conditions (Eq. 4), for an individual i to be indifferent between plans b, s and b', s' at the equilibrium level of consumption, the ratio of marginal utility to price must be equal for both plans, mirroring the condition that it is equal to one for the numeraire good:

$$\frac{\boldsymbol{\delta_i} q_{i,b,s} \left(n_{i,b,s}\right)^{-\frac{1}{\varepsilon}}}{\overline{p}_{n,b,s}} = \frac{\boldsymbol{\delta_i} q_{i,b',s'} \left(n_{i,b',s'}\right)^{-\frac{1}{\varepsilon}}}{\overline{p}_{n,b',s'}} = 1 \qquad \forall \{b, s\}, \{b', s'\}. \tag{11}$$

If, however, one of the ratios is greater than the other, then that plan will be preferred at equilibrium. By applying this rationale, we can make several predictions about the equilibrium self-selection of individuals into different plans. This fact allows us to establish the following Lemma about corner equilibria if out-of-pocket costs are the same for both MA and TM plans.

Lemma 1. *If the beneficiary's out-of-pocket cost index $\overline{p}$ is the same for TM-O and MA-O, both finicky and frugal individuals will strictly prefer TM-O to MA-O plan, resulting in a corner equilibrium.*

As shown in the data section under Table 1, both the TM-Only and MA-Only plans exhibit strictly positive and substantial numbers of beneficiaries. Consequently, given these numbers, our theoretical focus will be solely on analyzing interior equilibria. Building on the findings of Lemma 1, we predict the differences in OOP costs between these plans.

Proposition 2. *In an interior equilibrium, the Out-of-Pocket cost index is higher for TM-Only beneficiaries compared to MA-Only beneficiaries.*

Given the predicted OOP cost difference, we formulate the Lemma about the possible composition of finicky and frugal beneficiaries in TM-Only and MA-Only.

Lemma 2. *In an interior equilibrium, at least some finicky beneficiaries (and potentially all) will choose the TM-Only plan, while at least some frugal beneficiaries (and potentially all) will opt for the MA-Only plan.*

Building on Lemma 2 we provide our next prediction.

Proposition 3. *The annual number of events is lower under MA-Only than under TM-only:* $n_{i,MA,O} < n_{i,TM,O}$*. The corresponding difference between TC and OOPC is equal to or less under MA-Only than under TM-Only:* $n_{i,MA,O}(\overline{P}_{i,MA,O} - \overline{p}_{i,MA,O}) \leq n_{i,TM,O}(\overline{P}_{i,TM,O} - \overline{p}_{i,MA,O})$.

The intuition of Proposition 3 stems from the fact that private plans under MA-Only are subsidized by the government based on the insurance payments to providers under MA-only. Profit-oriented insurance companies will not operate if the compensation does not cover their expenditures, which guarantees the difference in insurance payments inequality. Given that TCs are similar across the plans by the government regulation, but OOP costs are lower under MA-Only (from Lemma 2), the number of events has to be lower under TM-Only than under MA-Only.

Next, we will show how the perception of quality by beneficiaries can be derived from their revealed preferences. The idea is based on the fact that given prices and observed quantities, beneficiary's choice of the sub-plans provides sufficient information to derive their perception of quality.[16]

Proposition 4. *For a given value of* $\gamma_{TM,O}$ *in equation* (8) *and out-of-pocket beneficiary's annual indices for TM-Only and MA-Only, we can calculate the upper bound in quality differences for frugal beneficiaries and the lower boundary of the quality differences for the finicky beneficiaries between TM-Only and MA-Only. This expression is given by*

$$\frac{q_{TM,O}(i \in \underline{q})}{q_{MA,O}(i \in \underline{q})} \leq \frac{\overline{p}_{TM,O}}{\overline{p}_{MA,O}} \exp\left(\frac{\tilde{\gamma}_{TM,O}}{\varepsilon}\right) \leq \frac{q_{TM,O}(i \in \overline{q})}{q_{MA,O}(i \in \overline{q})} \tag{12}$$

Note that our measure of quality is based on revealed preferences rather than patient surveys. This approach is standard in the Industrial Organization and International Trade literature.[17] This approach has two advantages over the survey approach. First, it allows to link difference in quality to the differences in price necessary to offset differences in quality. Second, it allows to compare quality in the presence of heterogeneous beneficiaries. Instead, survey approach often ignores self-selection of different types into different plans. which may have different preferences for quality.

Predictions for the $TM + S(upplementary)$ **and** $MA + S(upplementary)$**.** There are many different sup-

[16] The exact step-by-step derivations are provided in the Proofs in Appendix A.

[17] See, for example, Avery et al. (2012); Adão et al. (2023).

plementary options within $TM + S$ and $MA + S$. Without being able to observe specific details of supplementary option chosen by beneficiary i, we can make only general predictions about these sub-plans, which we formalize below.

Proposition 5. *The out-of-pocket costs per visit are lower and the number of medical events is greater for beneficiaries enrolled in the TM+S and MA+S subplans compared to those in the TM-Only and MA-Only subplans, respectively.*

Predictions for TM+M(edicaid) and MA+M(edicaid). As previously discussed, the criteria for qualifying for Medicaid are complex and the details of plans vary across states. Therefore, the only prediction we can make about these plans concerns their OOP costs:

Proposition 6. *The per-event out-of-pocket costs are lower under MA+M and TM+M than under MA-Only and TM-Only, respectively.*

4 Empirics

Guided by our theoretical predictions, in this section we analyze various aspects of healthcare utilization by Medicare beneficiaries using the MCBS data. Our analysis is presented at both the aggregated level, comparing Traditional Medicare (TM) versus Medicare Advantage (MA) plans, and at the disaggregated sub-plan level. It primarily focuses on non-pharmaceutical and non-emergency events, acknowledging that emergency care decisions are less influenced by considerations of provider price and quality, as they often need to be made based on proximity to the nearest hospital regardless of its network affiliation. However, for a comprehensive understanding, we also examine pharmaceutical and emergency care events.

4.1 Data Description

We use data from the Medicare Current Beneficiary Survey (MCBS) Survey and Cost Supplement Files for years 2015 through 2019. The MCBS is "a continuous, multipurpose survey of a nationally representative sample of the Medicare population, conducted by the Office of Enterprise Data and Analytics

(OEDA) of the Centers for Medicare & Medicaid Services (CMS) through a contract with NORC at the University of Chicago."[18]

The data include patient characteristics, care choices, and satisfaction with care as well as complete expenditure and source of payment data on all health services. For each person we observe demographic characteristics such as age, income, and education. These data are matched to costs and payments related to medical events like inpatient, primary care, or dental. These uniquely granular data allow for precise identification of expenses and utilization information. We exclude beneficiaries in the raw sample who are eligible for Medicare for reasons other than age, such as diagnosis with End Stage Renal Disease (ESRD) or disability. Through the use of survey weights, we evaluate beneficiaries as representative of the ever-enrolled Medicare population from 2015 to 2019, as well as through limiting to beneficiaries who appear in at least two consecutive years to construct a balanced two-year panel of beneficiaries during this time window.

In our empirical methodology, we focus on a subset of beneficiary-level health factors in comparing utilization, costs, and quality across Medicare coverages. We use month-level participation in Part D to differentiate between beneficiaries who have prescription drug coverage for a majority share of their Medicare eligibility period in a given year versus those who do not. We also account for beneficiary age as well as perceived health risk, using a constructed score that sums survey responses to questions of general health, chronic, mental health, and demographic conditions. By relying on patient perception of health risk captured through survey responses rather than raw diagnosis data, we hope to avoid the bias from upcoding that is documented in the literature (e.g., Nicholas et al. (2024)) when comparing across Medicare coverage types.

We also account for a subset of socioeconomic conditions that may lead to differences in beneficiary experience with Medicare coverage. These include beneficiary race, gender, education level, income, and rurality of home location. Beneficiaries are coded as a racial minority in our sample if they identify as any race other than white in the survey; similarly, beneficiaries who respond as female in the survey are coded with a female indicator variable. We allow for three levels of education: less than completion of high school, having received a high school diploma, or more than completion of high school. Income

[18] See https://www.cms.gov/Research-Statistics-Data-and-Systems/Research/MCBS for more details.

is reported in dollars as a continuous variable. Based on the Core Based Statistical Area (CBSA) of the beneficiary, we code beneficiaries as living in a metropolitan, micropolitan, or rural area.

Following Brown et al. (2014), we classify beneficiaries as having traditional Medicare or a Medicare Advantage plan depending on which broad form of Medicare coverage they possess for the majority share of their eligibility period, calculated out of number of months in a given year. Furthermore, we identify beneficiaries as either having supplemental coverage or Medicaid if ever having either form of coverage at any point in a given year, and for patients who never have any additional coverage in a given year, we classify them as having traditional Medicare or Medicare Advantage only.

Table 1 provides summary statistics for the demographic composition of the beneficiaries in each survey year and the coverage composition of those in all years, respectively.[19] Based on the numbers presented in the table, we formulate the following Stylized fact.

Stylized Fact 2. *Even within TM and MA, there is substantial heterogeneity in the types of coverage. Specifically, TM can be split into TM-Only, TM+Supplementary Coverage and TM+Medicare, while MA can be split into MA-Only, MA+Supplementary Coverage and MA+Medicare.*

4.2 Methodology

4.2.1 Number of Medical Events across Plans and Subplans

Based on our theoretical equation (8), we construct the estimation equation for the annual demand for non-emergency services by an individual i, enrolled in the sub-plan s of plan b in year t

$$\ln n_{i,b,s,t} = \boldsymbol{\delta}'_{\boldsymbol{i},\boldsymbol{t}} + \gamma_{b,s}\left(\sum_{b,s} \mathbb{1}_{i,b,s}\right) + \epsilon_{i,b,s,t} \tag{13}$$

An obvious issue is that a beneficiary i may not have any events in period t in a given category. To address this possibility and to explicitly account for the count nature of the dependent variable we estimate

[19] Additional summary statistics are provided in Tables 11 and 12 and in Figure 3 in Appendix B. Table 13 in Appendix B details the construction of the health risk measure used in the empirical methodology.

Table 1: Demographic Summary by Year
Sample Derived from the Medicare Current Beneficiary Survey, 2015-2019

	2015	2016	2017	2018	2019	Overall
Number of obs	8025	6977	7414	7349	7897	37662
Share of obs. by Medicare Coverage						
MA Only$_{it}$	16.6%	19.5%	20.9%	22.8%	24.5%	20.8%
TM Only$_{it}$	7.3%	7.3%	7.1%	6.9%	6.6%	7.0%
TM + Sup. Cov$_{it}$	45.4%	44.0%	43.0%	41.8%	39.9%	42.8%
MA + Sup. Cov$_{it}$	7.5%	6.4%	7.0%	7.0%	7.3%	7.1%
TM + Medicaid$_{it}$	15.0%	14.6%	12.7%	11.4%	10.4%	12.8%
MA + Medicaid$_{it}$	8.1%	8.3%	9.3%	10.1%	11.3%	9.4%
Part D Coverage **(Indicator)**						
Mean	0.772	0.782	0.791	0.802	0.808	0.791
(Standard Deviation)	(0.420)	(0.413)	(0.407)	(0.399)	(0.394)	(0.407)
Full Risk **(Aggregated Health Score)**						
Mean	15.5	14.5	14.7	14.6	14.7	14.8
(Standard Deviation)	(6.34)	(5.39)	(5.50)	(5.44)	(5.55)	(5.68)
Age **(Years)**						
Mean	77.7	78.3	78.7	78.4	78.1	78.2
(Standard Deviation)	(8.02)	(8.02)	(8.24)	(8.17)	(8.14)	(8.12)
Racial Minority **(Indicator)**						
Mean	0.200	0.203	0.192	0.205	0.221	0.205
(Standard Deviation)	(0.400)	(0.402)	(0.394)	(0.404)	(0.415)	(0.403)
Income **($)**						
Mean	50600	49000	51800	53800	55900	52300
(Standard Deviation)	(96300)	(68000)	(59800)	(59700)	(62800)	(71200)
High School Education **(Categorical)**						
Mean	2.32	2.34	2.37	2.38	2.39	2.36
(Standard Deviation)	(0.782)	(0.776)	(0.773)	(0.767)	(0.767)	(0.774)
Female **(Indicator)**						
Mean	0.564	0.565	0.579	0.561	0.561	0.566)
(Standard Deviation)	(0.496)	(0.496)	(0.494)	(0.496)	(0.496)	(0.496)
Share of obs. by CBSA Designation						
Metro	75.6%	75.5%	75.2%	75.6%	76.0%	75.6%
Micro	16.2%	16.4%	15.3%	15.3%	15.2%	15.7%
Rural	8.2%	8.1%	9.5%	9.1%	8.8%	8.7%

Note: Summary statistics for health and demographic data on ever-enrolled Medicare beneficiaries included in the the 2015-2019 Medicare Current Beneficiary Survey. Medicare coverage status distinguished by a combination of possessing traditional Medicare vs. Medicare Advantage through the majority of one's eligibility period in a given year and additional supplemental or Medicaid coverage or lack thereof. Baseline group in italics. Part D status determined if covered for majority share of eligibility period in a given year. Full risk measure determined by survey responses to questions of chronic risk, perception of health risk, and mental health status. Demographic controls include age in years, racial minority status, annual income in dollars, education level relative to high school diploma, gender, and CBSA designation.

the following Poisson specification.

$$E(n_{i,b,s,t}) = \exp\left[\boldsymbol{\delta'_{i,t}} + \gamma_{b,s}\left(\sum_{b,s}\mathbb{1}_{i,b,s}\right)\right] \tag{14}$$

where, as defined in equation (8), $\boldsymbol{\delta'_{i,t}}$ is a vector of controls summarized in Table 1 including time fixed effects and $\mathbb{1}_{i,b,s,t}$ is the dummy variable equal to 1 if beneficiary i in time t is enrolled in $\{b, s\}$ and to 0 otherwise. The error term $\epsilon_{i,b,s,t}$ in eq. (13) captures random differences across beneficiaries that are not captured by the set of our independent variables determine utilization as well as potential measurement errors.[20] We estimate the regressions using the Poisson regressions, which allows us to include in our sample also patients which had zero events in a given year. We use exactly the same methodology for the comparison of more aggregated plans, TM-All versus MA-All. Towards this goal, we use the same specification as in (14), but drop the subplan subscript s for the indicator variable $\mathbb{1}_{i,b}$. We report the results in Table 2.

4.2.2 Total Cost and Out-of-Pocket Cost

Various types of costs may vary across plans and subplans. Our model does not provide structural determinants of each type of costs, except for some predictions and expectations related to the variation of these costs across plans. We want to control for patient's demographic characteristics since the type of service and thus their cost may depend on the beneficiaries demographic characteristic. As a result, our Poisson regression specification is very similar to that above used to explore the number of visits:

$$X = \exp\left[\boldsymbol{\delta'_{i,t}} + \gamma_{b,s}\left(\sum_{b,s}\mathbb{1}_{i,b,s}\right)\right] \tag{15}$$

where X sequentially denotes one of the following dependent variables: per-visit TC (P) and OOP Cost (p); and $\boldsymbol{\delta'_{i,t}}$ and $\mathbb{1}_{i,b,s}$ are as defined under equation (14). We will also use the same specification at the more aggregated level. Towards this goal, we will us a more aggregated (without subplans) depen-

[20]There is no error term in the Poisson specification (14) because the exponentiated expression is the arrival rate of the events and the randomness in the dependent variable is generated by the realization of the Poisson process across individuals Silva and Tenreyro (2006)

dent variable and the indicator variable $\mathbb{1}_{i,b}$. This estimation equation will also allow us to compare TCs and OOPCs across all other subplans, thus helping us to test Propositions 5 and 6.

4.2.3 Annual Differences between TC and OOP Costs

To test Proposition 3 we will modify eq. (13) in two ways. First, instead of n, the dependent variable will be the difference between the TC and OOPC: $n(\overline{P} - \overline{p}$. Second, for expositional purposes, we focus on the comparison in levels rather than in logs and thus the dependent variable will be in levels:

$$n_{i,b,s,t}(\overline{P}_{i,b,s,t} - \overline{p}_{i,b,s,t}) = \boldsymbol{\delta'_{i,t}} + \gamma_{b,s}\left(\sum_{b,s}\mathbb{1}_{i,b,s}\right) + \epsilon_{i,b,s,t}, \tag{16}$$

where the rest of the variables are as defined in eq. 13.

4.2.4 Quality

Building on theoretical Proposition 4, we will use eq. (12) to recover the difference in quality between TM-Only and MA-only. For parameter ε, we will rely on the carefully executed estimation of the demand elasticities by Ellis et al. (2017), which is based on the 171 million person-month observations spanning between 2008 and 2014. The estimate of the demand elasticity is (-0.44). Our parameter ε represents the absolute value of the price elasticity of demand. Thus, we will use the value fo $\varepsilon = 0.44$.

To evaluate quality differences, we need to use the value of the price elasticity of demand for health-care services. We take the range of the elasticities from the carefully executed estimation of the demand elasticities by Ellis et al. (2017).[21] They estimate that the overall demand elasticity to be (-0.44), meaning that we need to use $\varepsilon = 0.44$ given our utility function (1).[22]

[21]It is based on the 171 million person-month observations spanning between 2008 and 2014.
[22]With this utility function ε can be interpreted as the absolute value of the price elasticity of demand.

4.3 Results

4.3.1 Number of Medical Events

Table 2 presents the estimation results of the demand for healthcare services from equation (14). We formalize the results for total non-emergency medical events under TM-All vs. MA-All and the effects of aggregation in Result 3 by comparing TM-All coefficient in columns (3) to TM-Only coefficient in column (7). To interpret the quantitative results as percent differences relative to the baseline, we exponentiate dummy-variable coefficients and subtract 1.[23] We formalize our results as following.

> **Result 1.** *The number of annual non-emergency events is 91% greater for TM-All than for MA-All but only 60% greater for TM-Only than for MA-Only. Thus, the aggregation bias is 31 percentage points, which is roughly 1.5 times.*

This result holds significance for two key reasons. Firstly, it demonstrates that the magnitude of the aggregation bias in this context is both statistically and economically significant. This underscores the importance of our Proposition 1, highlighting its critical implications for empirical analysis. Specifically, it underscores the necessity of conducting comparisons of Medicare choices at the sub-plan level rather than at the broader plan level. Secondly, this result lends support to our theoretical prediction outlined in Proposition 3, by illustrating that the level of healthcare utilization is significantly higher among TM-Only beneficiaries compared to those with MA-Only plans.

Figure 2 illustrates the decomposition of the aggregation bias for column 3 of Table 2 as compared to disaggregated estimates in column 7. The difference between TM-Only and MA-Only controlling for the subplan differences is substantially smaller than the difference between TM-All and MA-All as stated in Result 1. The figure shows dispersion of the coefficients for the subplans. The TM subplans are averaged out in TM-All contributing to the bias. The position of TM-All equals the value of the positive terms in equation (10) where the weights ω are sampling-weighted observation counts. The choice of base as an aggregated MA-All category also contributes to the bias. This is why MA-All is not at zero, even though it is the base category, but rather the absolute value of the negative term in equation (10). The

[23] For example, in order to interpret the coefficient of 0.649 for the TM-All dummy in column (3), we calculate $(e^{0.649} - 1) = 0.91$, which corresponds to 91.0%.

comparison of TM-All and MA-All as often done in the literature is informative but it captures not only the differences between TM and MA but also the choices of supplementary coverage and Medicaid.

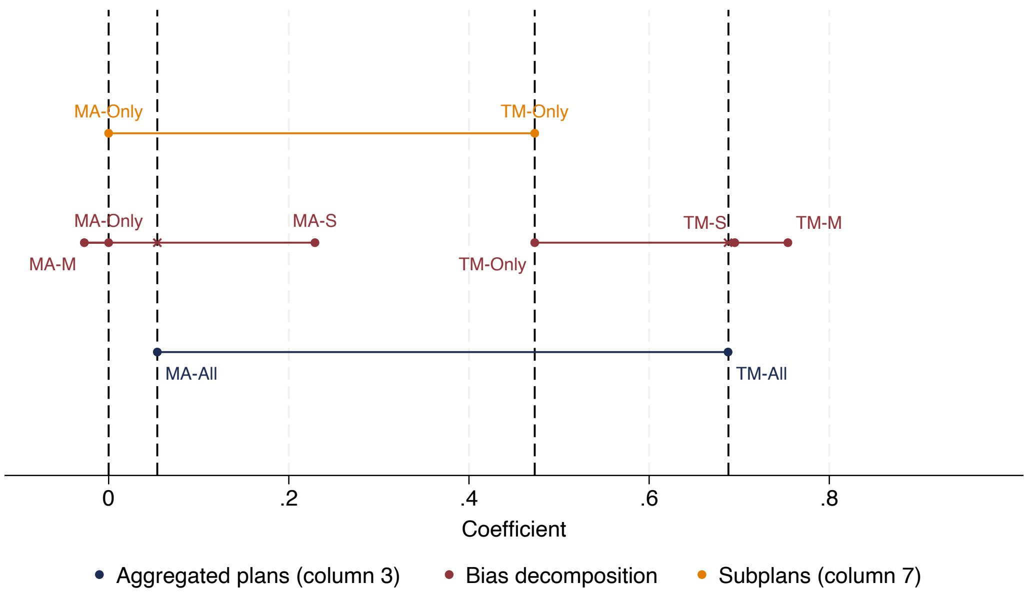

Figure 2: Decomposition of the plan aggregation bias

Note: Figure represents coefficients from columns 3 and 7 of Table 2. The position of TM-All equals the value of the positive terms in equation (10) where the weights ω are sampling-weighted observation counts. The position of MA-All is calculated as the absolute value of the negative term in equation (10) and represents the bias due to the difference in the reference category.

The results in Table 2 also support our theoretical predictions in Proposition 6 as they relate to the relative utilization of non-emergency events between different subplans. We find TM+S to have 100% more non-emergency events than MA-Only, all else equal, which is far greater than the 60% difference between TM-Only and MA-Only. We also find that the number of non-emergency events is 26% higher in MA+S than MA-Only. These results support the theoretical prediction that decreasing OOP costs with a supplemental plan increases demand for non-emergency care in both TM and MA.

In addition to the results supporting our theoretical predictions, we can make several other notable observations from the results in Table 2. First, we observe that while the incidence of non-emergency events is 60% greater for TM-Only relative to MA-Only, ER events are 24% lower. This can be a direct result of greater healthcare utilization and higher quality of TM-Only compared to MA-Only. At the same time, PM events are not significantly different between the two groups. Regarding Medicaid,

Table 2: Impact of Medicare Coverage on Annual Medical Events
Cross-Sectional Analysis by Beneficiary

Base category:	*All Medicare Advantage, MA-All*				*Medicare Advantage Only, MA-Only*			
	Total Events$_{it}$	PM Events$_{it}$	Non-PM/ER Events$_{it}$	ER Events$_{it}$	Total Events$_{it}$	PM Events$_{it}$	Non-PM/ER Events$_{it}$	ER Events$_{it}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TM-All$_{it}$	0.350***	0.055***	0.649***	0.018				
	(0.013)	(0.015)	(0.021)	(0.036)				
TM Only$_{it}$					0.215***	−0.021	0.473***	−0.279***
					(0.025)	(0.030)	(0.034)	(0.074)
TM + Sup. Cov$_{it}$					0.416***	0.138***	0.695***	0.113**
					(0.015)	(0.015)	(0.023)	(0.045)
MA + Sup. Cov$_{it}$					0.150***	0.094**	0.229***	0.034
					(0.030)	(0.043)	(0.035)	(0.070)
TM + Medicaid$_{it}$					0.388***	0.013	0.754***	−0.102*
					(0.022)	(0.024)	(0.031)	(0.062)
MA + Medicaid$_{it}$					0.043	0.051**	−0.027	−0.020
					(0.028)	(0.023)	(0.060)	(0.069)
Part D$_{it}$	0.453***	0.685***	0.307***	0.013	0.443***	0.688***	0.288***	0.010
	(0.015)	(0.017)	(0.019)	(0.044)	(0.015)	(0.017)	(0.019)	(0.044)
Full Risk$_{it}$	0.060***	0.065***	0.056***	0.066***	0.060***	0.065***	0.055***	0.066***
	(0.001)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.002)	(0.003)
Constant	2.270***	1.801***	1.251***	−2.707***	2.328***	1.899***	1.278***	−2.429***
	(0.078)	(0.079)	(0.110)	(0.213)	(0.080)	(0.079)	(0.118)	(0.221)
Demographic Controls	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	37,662	37,662	37,662	37,662	37,662	37,662	37,662	37,662

Note: Results display impact of Medicare coverage on annual medical events by Medicare beneficiary. Medical events are broken down by category: total (all) events, prescribed medicine (PM) events, non-PM and non-ER events, and emergency room (ER) events. Estimation performed using Poisson regression and data from the 2015-2019 MCBS Survey and Cost Supplement files. Survey weights are used for the ever-enrolled Medicare population. Medicare coverage status either distinguished by traditional Medicare vs. Medicare Advantage or by combination of TM vs. MA and additional supplemental or Medicaid coverage. Baseline group in italics. Part D status determined if covered for majority share of eligibility period in a given year. Full risk measure determined by survey responses to questions of chronic risk, perception of health risk, and mental health status. Demographic controls include age (demeaned), racial minority status, annual income (in logs, transformed as $\log(1+x)$), education level relative to high school diploma, gender, and CBSA designation. *p<0.1; **p<0.05; ***p<0.01. Robust SEs in parentheses.

which we theoretically predict reduces OOP costs per event for those who are eligible (Proposition 6), we estimate a 32% higher utilization of non-emergency visits for those in TM+M relative to TM-Only; however, there is no significant difference in non-emergency visits between MA+M and MA-Only. While we do not take a stance on what is driving these results, they provide important context to the importance of disaggregation discussed in paper and hint at possible directions for further research.

4.3.2 Out-of-Pocket Costs

Table 3 presents the estimation results of the Total Costs and OOP Costs from equation (15). We formalize the results for the OOP Costs in Result 2 by analyzing the magnitude of the TM-Only coefficient in columns (4) and TM-All coefficient in column (2).[24]

Table 3: Impact of Medicare Coverage on Total and OOP Expenses
Cross-Sectional Analysis by Event (Non-PM and Non-ER Events)

Baseline:	*All Medicare Advantage, MA-All*		*Medicare Advantage Only, MA-Only*	
	Total Costs$_{e,it}$	OOP Costs$_{e,it}$	Total Costs$_{e,it}$	OOP Costs$_{e,it}$
	(1)	(2)	(3)	(4)
TM-All$_{it}$	0.023*	$-$0.106***		
	(0.013)	(0.024)		
TM Only$_{it}$			0.035	0.176***
			(0.029)	(0.038)
TM + Sup. Cov$_{it}$			0.019	$-$0.280***
			(0.017)	(0.028)
MA + Sup. Cov$_{it}$			$-$0.043*	$-$0.157***
			(0.024)	(0.040)
TM + Medicaid$_{it}$			$-$0.016	$-$0.711***
			(0.022)	(0.041)
MA + Medicaid$_{it}$			$-$0.020	$-$0.838***
			(0.028)	(0.054)
Part D$_{it}$	$-$0.049***	$-$0.152***	$-$0.044***	$-$0.120***
	(0.015)	(0.024)	(0.015)	(0.024)
Full Risk$_{it}$	$-$0.006***	$-$0.014***	$-$0.006***	$-$0.013***
	(0.001)	(0.002)	(0.001)	(0.002)
Constant	5.834***	4.230***	5.884***	5.203***
	(0.083)	(0.173)	(0.087)	(0.160)
Demographic Controls	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Type FE	Y	Y	Y	Y
Observations	1,294,837	1,294,837	1,294,837	1,294,837

Note: Results display impact of Medicare coverage on total expenses (all payers) and out-of-pocket expenses by each medical event over non-prescribed medicine and non-emergency room events. Estimation performed using Poisson regression and data from the 2015-2019 MCBS Survey and Cost Supplement files. Survey weights are used for the ever-enrolled Medicare population. Medicare coverage status either distinguished by traditional Medicare vs. Medicare Advantage or by combination of TM vs. MA and additional supplemental or Medicaid coverage. Baseline group in italics. Part D status determined if covered for majority share of eligibility period in a given year. Full risk measure determined by survey responses to questions of chronic risk, perception of health risk, and mental health status. Demographic controls include age (demeaned), racial minority status, annual income (in logs, transformed as $\log(1+x)$), education level relative to high school diploma, gender, and CBSA designation. *p<0.1; **p<0.05; ***p<0.01. Robust SEs in parentheses.

Result 2. *For non-emergency events, the per-event Out-of-Pocket Cost is 19% greater for TM-Only than for MA-Only beneficiaries but 10% lower for TM-All than for MA-All beneficiaries.*

The first part of Result 2 directly confirms Proposition 2. The second shows that the excessive ag-

[24]As before, to interpret results in percentage terms, we exponentiate dummy-variable coefficients and subtract 1.

gregation bias highlighted by Proposition 1 applies not only to the number of visits but also to the OOP Costs. For the OOP Costs, the bias is not just quantitative but also qualitative as the results at different levels of aggregation point in different directions. This bias is due to differences between subplans with differences being more pronounced within TM than within MA. Specifically, the OOP costs are 36.6% lower for TM+S and 58.8% lower for TM+M than for TM-Only, but only 14.5% lower for MA+S and 56.7% lower for MA+M than for MA-Only.

The above-mentioned differences in OOP Costs across subplans also provide direct support for Propositions 5 and 6: (i) per-visit OOP Costs under TM+S and TM+M are significantly lower than under TM-Only, and (ii) OOP Costs under MA+S and MA+M are significantly lower than under MA-Only.

Finally, estimates in column (3) of Table 3 show that the differences in TCs between TM-Only and MA-Only is economically negligible (3.6%) and statistically insignificant. This result is consistent with our theoretical assumption (motivated by the government regulation) that TCs do not differ much across subplans (the result is virtually the same for other subplans comparisons).

4.3.3 Annual Per-beneficiary Difference Between TCs and OOP Costs

Table 4 presents the estimation results of annual per beneficiary differences between TC and OOP Cost from equation (16). We formalize the results for the OOP Costs in Result 3 by analyzing the magnitude of the TM-Only coefficient in columns (7) and TM-All coefficient in column (3).

Result 3. *The difference between the annual per-beneficiary Total Cost and Out-Of-Pocket Cost is $4,464 dollars greater under TM-Only than under MA-Only; and $7,158 greater under TM-All than under MA-All.*

This result provides a direct support to Proposition 3. It also shows that if insurance companies in MA-Only plans are subsidized based on the government per-patient expenditures in TM-Only plans, they gain $4,464 extra per beneficiary. The result also provides an indirect support to Proposition 1 in showing that there is significant discrepancy in cost differences when moving from less aggregated comparison at subplan level to a more aggregated comparison at broader plans level.

Table 4: Impact of Medicare Coverage on Annual Cost Differences
Per-Person Annual Difference in Total Costs and Out-of-Pocket Costs, Cross-Sectional Analysis by Beneficiary

Baseline:	*All Medicare Advantage, MA-All*				*Medicare Advantage Only, MA-Only*			
	Total Diff.$_{it}$	PM Diff.$_{it}$	Non-PM/ER Diff.$_{it}$	ER Diff.$_{it}$	Total Diff.$_{it}$	PM Diff.$_{it}$	Non-PM/ER Diff.$_{it}$	ER Diff.$_{it}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
TM-All$_{it}$	7,158***	767***	6,561***	157**				
	(294)	(152)	(233)	(68)				
TM Only$_{it}$					4,464***	71	4,482***	-51
					(564)	(196)	(526)	(123)
TM + Sup. Cov$_{it}$					6,475***	1,143***	5,571***	149
					(338)	(184)	(256)	(99)
MA + Sup. Cov$_{it}$					1,075***	559***	783***	-55
					(367)	(191)	(288)	(118)
TM + Medicaid$_{it}$					14,474***	2,180***	12,705***	257**
					(588)	(257)	(525)	(131)
MA + Medicaid$_{it}$					3,971***	1,891***	2,199***	56
					(447)	(278)	(334)	(114)
Part D$_{it}$	4,845***	1,815***	2,843***	-126	4,133***	1,671***	2,245***	-149
	(345)	(149)	(302)	(94)	(350)	(150)	(306)	(94)
Full Risk$_{it}$	608***	247***	266***	8	600***	243***	261***	7
	(31)	(14)	(26)	(5)	(31)	(14)	(26)	(5)
Constant	$-1,972$	$-3,849^{***}$	4,601***	592*	$-9,587^{***}$	$-5,468^{***}$	$-1,573$	505
	(1,978)	(1,094)	(1,601)	(350)	(1,995)	(1,077)	(1,612)	(338)
Demographic Controls	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	37,662	35,813	37,087	6,731	37,662	35,813	37,087	6,731

Note: Results display impact of Medicare coverage on annual differences in total expenses (all payers) and out-of-pocket expenses by Medicare beneficiary. Cost differences are broken down by event category: total (all) events, prescribed medicine (PM) events, non-PM and non-ER events, and emergency room (ER) events. Estimation performed using OLS regression and data from the 2015-2019 MCBS Survey and Cost Supplement files. Survey weights are used for the ever-enrolled Medicare population. Medicare coverage status either distinguished by traditional Medicare vs. Medicare Advantage or by combination of TM vs. MA and additional supplemental or Medicaid coverage. Baseline group in italics. Part D status determined if covered for majority share of eligibility period in a given year. Full risk measure determined by survey responses to questions of chronic risk, perception of health risk, and mental health status. Demographic controls include age (demeaned), racial minority status, annual income (in logs, transformed as $\log(1+x)$), education level relative to high school diploma, gender, and CBSA designation. Results rounded to the nearest dollar (USD). *p<0.1; **p<0.05; ***p<0.01. Robust SEs in parentheses.

4.3.4 Quality

As described in Section 4.2.4, we need three components to calculate the relative quality of TM-Only plan compared to MA-Only plan: (i) corresponding ratio of OOP Costs, the estimate of the TM-Only dummy in eq. (14), and the absolute value of the price elasticity of demand ε. From Proposition 1, the ratio of OOP Costs is 1.176; from column (7) of Table 2, the estimate of TM-Only dummy coefficient in eq. (14) is 0.473, and, as discussed in Section 4.2.4, $\varepsilon = 0.44$. By plugging these values in to eq. (12), we calculate the relative quality $\left(1.19 \times \exp\left(\frac{0.473}{0.44}\right) = 3.5\right)$ and formulate the result as following.

Result 4. *The quality of TM-Only is at least 3.5 times greater than that of MA-Only for the finicky beneficiaries and at most 3.5 times greater for frugal beneficiaries.*

Importantly, while the magnitude of the above results is sensitive to the chosen value of the price elasticity ε, its direction is not.

Result 4 has several important implications. Firstly, in the absence of quality differences, the 17% OOPCs would have resulted in TM-Only beneficiaries utilizing healthcare services 6.7% less than MA-Only beneficiaries. Thus, quality is the major driver of relative demand, as it reverses the price effect, leading to a significant 66.7% greater utilization by TM-Only beneficiaries compared to MA-Only beneficiaries, despite TM-Only beneficiaries facing 19% higher OOPCs.

Second, our measure of quality is based on revealed preferences and is directly linked to the observed choices of consumers. This allows us to predict how these choices may change if quality were to change. For example, if the quality of the TM-Only plan were to decrease by 10%, from 3.5 to 3.15, then, all else being equal, the rate of utilization by TM-Only beneficiaries would drop by 5%.[25]

Third, our model accounts for different types of beneficiaries with varied valuations of quality. Thus, the difference in quality between subplans can vary for different consumer types. Our approach, based on revealed preference, differs from quality assessments based on surveys. If one takes our model seriously, then surveys may not be as informative since different individuals may have different expectations and perceptions of quality.

All these features clearly distinguish our approach to evaluating quality from that based on surveys. Consequently, we also expect our approach to produce different results from the survey-based one. To demonstrate this point, we utilize the portion of the MCBS survey which asks beneficiaries about their perception of quality on a $1, 2, 3, 4$ scale, with 1 being very satisfied, 2 satisfied, 3 unsatisfied, and 4 very unsatisfied.[26] Given that a higher number corresponds to lower quality, we call this measure a "Reverse Quality Index," or RQI. In our sample, the average RQI is 1.48, with the vast majority of beneficiaries

[25]The corresponding estimate of the TM-Only dummy variable coefficient in Table 2 would have to decrease from 0.472 to $0.44 \ln(3.15/1.19) = 0.428$, which corresponds to a 53.4% greater utilization of healthcare services under TM-Only than under MA-Only instead of the original 60%. The ratio $1.534/1.60 = 0.96$ corresponds to a 4% decrease in the utilization of medical services by TM-Only beneficiaries.

[26]Other responses to these survey questions, such as a beneficiary not knowing or refusing to answer, are considered missing and not included in our analysis.

Table 5: Satisfaction with Quality of Care Survey Response Measures
Summary Statistics for Beneficiaries in Medicare Current Beneficiary Survey, 2015-2019

	2015	2016	2017	2018	2019	Overall
Sample: Cross-Section	(N=6632)	(N=5825)	(N=6321)	(N=6337)	(N=6957)	(N=32072)
QUALITY						
Mean (SD)	1.50 (0.578)	1.46 (0.561)	1.48 (0.579)	1.49 (0.586)	1.48 (0.577)	1.48 (0.577)
Median [Min, Max]	1.00 [1.00, 4.00]	1.00 [1.00, 4.00]	1.00 [1.00, 4.00]	1.00 [1.00, 4.00]	1.00 [1.00, 4.00]	1.00 [1.00, 4.00]
Sample: Two-Year Panel	(N=3967)	(N=7408)	(N=7167)	(N=7721)	(N=4103)	(N=30366)
QUALITY						
Mean (SD)	1.49 (0.575)	1.44 (0.555)	1.48 (0.574)	1.49 (0.580)	1.48 (0.571)	1.47 (0.571)
Median [Min, Max]	1.00 [1.00, 4.00]	1.00 [1.00, 4.00]	1.00 [1.00, 4.00]	1.00 [1.00, 4.00]	1.00 [1.00, 4.00]	1.00 [1.00, 4.00]

Note: Samples constructed using beneficiaries from the 2015-2019 MCBS Survey and Cost Supplement files. Sample used, whether full cross-section of beneficiaries or only beneficiaries who appear in two consecutive years, in italics. In surveys, Quality refers to satisfaction with the quality of medical care received within the year, with responses that range from very satisfied (1) to very dissatisfied (4). Other responses to these survey questions, such as a beneficiary not knowing or refusing to answer, are considered missing and not included here.

choosing either 1 (55%) or 2 (42%). For more intuitive comparisons, consider applying a mean-preserved spread to this distribution for it to consist of only 1s and 2s and name it the standardized distribution. For the mean of 1.48, the unique standardized distribution will consist of 52% 1s and 48% 2s. Now, if the mean of the first distribution is 5 percent greater than the mean of the second distribution, the interpretation is that, based on the standardized distribution, 5% of beneficiaries believe that quality is greater in the second distribution based on the differences in the mean RQI.

With this interpretation in mind, let us apply regression analysis to compare the RQI measure of quality across subplans. We do this by building on the specification in Equation (eq), but with RQI as the dependent variable. The results are presented in Table 6. They indicate that the RQI is 5% higher under TM-Only than under MA-Only, suggesting that the average perceived quality is actually higher under MA-Only compared to TM-Only. Specifically, according to our MPS RQI interpretation, 5% fewer TM-Only beneficiaries ranked quality at the highest level compared to MA-Only beneficiaries. This result directly contrasts with our RP analysis of quality, which found the quality to be 3.5% higher under TM-Only than under MA-Only.

How can we explain this difference? We conjecture that it stems, at least partially, from the fact that the beneficiaries are of different types in TM-Only and MA-Only plans, with TM-Only mainly consisting of finicky individuals, while MA-Only consists of frugal ones. Therefore, the difference in the RQI also

Table 6: Impact of Medicare Coverage on Satisfaction with Quality of Care
Beneficiary-Level Analysis

Baseline:	*All Medicare Advantage, MA-All*		*Medicare Advantage Only, MA-Only*	
Sample:	*Cross-Section*	*Two-Year Panel*	*Cross-Section*	*Two-Year Panel*
	Quality$_{it}$			
	(1)	(2)	(3)	(4)
TM-All$_{it}$	-0.018^{**}	-0.016^{**}		
	(0.009)	(0.009)		
TM Only$_{it}$			0.054^{***}	0.065^{***}
			(0.020)	(0.020)
TM + Sup. Cov$_{it}$			-0.053^{***}	-0.044^{***}
			(0.011)	(0.011)
MA + Sup. Cov$_{it}$			-0.040^{**}	-0.032^{**}
			(0.016)	(0.016)
TM + Medicaid$_{it}$			-0.011	-0.019
			(0.017)	(0.018)
MA + Medicaid$_{it}$			-0.037^{**}	-0.034^{**}
			(0.018)	(0.019)
Part D$_{it}$	-0.020^{*}	-0.012	-0.017	-0.007
	(0.011)	(0.011)	(0.011)	(0.011)
Full Risk$_{it}$	0.015^{***}	0.014^{***}	0.014^{***}	0.015^{***}
	(0.001)	(0.001)	(0.001)	(0.001)
Constant	1.697^{***}	1.664^{***}	1.658^{***}	1.630^{***}
	(0.065)	(0.065)	(0.066)	(0.066)
Demographic Controls	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Observations	32,072	30,366	32,072	30,366
R^2	0.055	0.056	0.057	0.058
Adjusted R^2	0.054	0.055	0.057	0.058

Note: Results display impact of Medicare coverage on satisfaction with quality of care. Survey responses are to questions about satisfaction with elements of medical care, with responses that range from very satisfied (1) to very dissatisfied (4). QUALITY refers to satisfaction with the quality of medical care received within the year. Other responses to these survey questions, such as a beneficiary not knowing or refusing to answer, are considered missing and not included here. Estimation performed using OLS and data from the 2015-2019 MCBS Survey and Cost Supplement files. Survey weights are used for the ever-enrolled Medicare population. Medicare coverage status either distinguished by traditional Medicare vs. Medicare Advantage or by combination of TM vs. MA and additional supplemental or Medicaid coverage. Baseline group and sample used, whether full cross-section of beneficiaries or only beneficiaries who appear in two consecutive years, in italics. Part D status determined if covered for majority share of eligibility period in a given year. Full risk measure determined by survey responses to questions of chronic risk, perception of health risk, and mental health status. Demographic controls include age (demeaned), racial minority status, annual income (in logs, transformed as $\log(1+x)$), education level relative to high school diploma, gender, and CBSA designation. *p<0.1; **p<0.05; ***p<0.01. Robust SEs in parentheses.

reflects the difference in the perception of quality among these types. To test our conjecture, we focus on switchers—beneficiaries who switched from either MA-Only to TM-Only or vice versa, from TM-Only to MA-Only. The advantage of this approach is that the type within a beneficiary remains the same.

Table 7: Quality of Care Survey Response Measures for Those with MA Only in Year 0
Summary Statistics for Two-Year Balanced Panel of Beneficiaries in Medicare Current Beneficiary Survey, 2015-2019

MA Only in Year 0	Non-Switchers	Switchers	All
	(N=2740)	(N=30)	(N=2770)
Year 0 (before switching)			
Mean (SD)	1.47 (0.564)	1.63 (0.615)	1.47 (0.565)
Median [Min, Max]	1.00 [1.00, 4.00]	2.00 [1.00, 3.00]	1.00 [1.00, 4.00]
Year 1 (after switching)			
Mean (SD)	1.49 (0.568)	1.40 (0.498)	1.49 (0.568)
Median [Min, Max]	1.00 [1.00, 4.00]	1.00 [1.00, 2.00]	1.00 [1.00, 4.00]

Note: Sample constructed as the two-year balanced panel of beneficiaries from the 2015-2019 MCBS Survey and Cost Supplement files. Survey responses are to questions about satisfaction with elements of medical care, with responses that range from very satisfied (1) to very dissatisfied (4). In surveys, Quality refers to satisfaction with the quality of medical care received within the year. Other responses to these survey questions, such as a beneficiary not knowing or refusing to answer, are considered missing and not included here.

To analyze switchers, we construct a new sample, comprising a two-year balanced panel of beneficiaries from the 2015-2019 MCBS Survey and Cost Supplement files. We then present the RQIs of those in the sample in Tables 7 and 8.

From Table 7, it is evident that switchers who started in MA-Only and then switched to TM-Only were originally much less satisfied with the quality than those MA-Only beneficiaries who did not switch. Specifically, according to our MPS RQI interpretation, 16% more switchers ranked quality as 2 compared to non-switchers. Another important observation is that their valuation of quality greatly improved after switching. Specifically, 23% more switchers ranked quality as 1 after switching than before. This indicates that, according to this measure, the average perceived quality is significantly higher under TM-Only than under MA-Only, aligning with our RP quality analysis.

The support for our conjecture from Table 8 is weaker, indicating that switchers from TM-Only had a level of satisfaction that was about the same (within 3%) as non-switchers before the switch, and their perception did not change much after the switch (remaining within a 2% range). However, by combining information from both Tables 7 and 8, we find that, if we focus only on switchers analyzed in these tables, their average RQI of TM-Only is 1.486, which is 7.6 percentage points lower than the average MA-Only RQI of 1.562. [27]

[27] From Tables 7 and 8, the average TM-Only RQI can be calculated as $\frac{48*1.54+1.40*30}{48+30} = 1.486$, while the average MA-Only RQI can be calculated as $\frac{48*1.52+1.63*30}{48+30} = 1.562$.

Table 8: Quality of Care Survey Response Measures for Those with TM Only in Year 0
Summary Statistics for Two-Year Balanced Panel of Beneficiaries in Medicare Current Beneficiary Survey, 2015-2019

TM Only in Year 0	Switchers	Non-Switchers	All
	(N=48)	(N=689)	(N=737)
QUALITY, Year 0			
Mean (SD)	1.54 (0.544)	1.57 (0.641)	1.57 (0.635)
Median [Min, Max]	2.00 [1.00, 3.00]	2.00 [1.00, 4.00]	2.00 [1.00, 4.00]
QUALITY, Year 1			
Mean (SD)	1.52 (0.545)	1.58 (0.628)	1.58 (0.623)
Median [Min, Max]	1.50 [1.00, 3.00]	2.00 [1.00, 4.00]	2.00 [1.00, 4.00]

Note: Sample constructed as the two-year balanced panel of beneficiaries from the 2015-2019 MCBS Survey and Cost Supplement files. Survey responses are to questions about satisfaction with elements of medical care, with responses that range from very satisfied (1) to very dissatisfied (4). QUALITY refers to satisfaction with the quality of medical care received within the year. Other responses to these survey questions, such as a beneficiary not knowing or refusing to answer, are considered missing and not included here.

5 Conclusion

Our paper explores the importance of a disaggregated approach in comparing Medicare Advantage (MA) to Traditional Medicare (TM), highlighting the differences in coverage and utility between TM and MA plans, including supplementary and Medicaid subplans. It employs a utility-based approach to predict beneficiaries' choices based on quality and cost, leveraging extensive data from the Medicare Current Beneficiary Survey. The findings suggest significant aggregation bias and potential errors in broad group comparisons. The study quantifies quality differences, showing TM's higher quality and utilization rates, and discusses the implications for insurance payments and beneficiary choices, emphasizing the need for a nuanced understanding of Medicare plan selection.

In our analysis, we aimed to compare the features of TM and MA Advantage independently of additional coverages. To achieve this goal, we primarily focused on analyzing TM-Only and MA-Only subplans. This approach facilitates a clearer understanding of the core differences between TM and MA. However, one limitation of this focus is the exclusion of other subplans from our analysis. Although we conducted numerous exploratory comparisons across these subplans, we did not provide detailed explanations for these results. We suggest that this area of research be pursued in future studies.

References

J. Abaluck and J. Gruber. Evolving choice inconsistencies in choice of prescription drug insurance. *Am Econ Rev*, 106(8):2145–2184, 2016. doi: 10.1257/aer.20130778.

Jason Abaluck and Jonathan Gruber. Choice Inconsistencies among the Elderly: Evidence from Plan Choice in the Medicare Part D Program. *American Economic Review*, 101:1180–1210, 2011.

Rodrigo Adão, Arnaud Costinot, Dave Donaldson, and John A Sturm. Why is Trade Not Free? A Revealed Preference Approach. Working Paper 31798, National Bureau of Economic Research, October 2023. URL http://www.nber.org/papers/w31798.

Christopher C. Afendulis, Anna D. Sinaiko, and Richard G. Frank. Low cognitive ability and poor skill with numbers may prevent many from enrolling in medicare supplemental coverage. *Journal of Economic Behavior & Organization*, 119:1847–1854, 2015. doi: http://dx.doi.org/10.1016/j.jebo.2015.07.009.

Rajender Agarwal, John Connolly, Shweta Gupta, and Amol S. Navathe. Comparing medicare advantage and traditional medicare: A systematic review. *Health Affairs*, 40(6):937–944, 2021. doi: 10.1377/hlthaff.2020.02149. URL https://doi.org/10.1377/hlthaff.2020.02149. PMID: 34097516.

Christopher N. Avery, Mark E. Glickman, Caroline M. Hoxby, and Andrew Metrick. A Revealed Preference Ranking of U.S. Colleges and Universities. *The Quarterly Journal of Economics*, 128(1):425–467, 12 2012. ISSN 0033-5533. doi: 10.1093/qje/qjs043. URL https://doi.org/10.1093/qje/qjs043.

J. Z. Ayanian, B. E. Landon, A. M. Zaslavsky, R. C. Saunders, L. G. Pawlson, and J. P. Newhouse. Medicare beneficiaries more likely to receive appropriate ambulatory services in hmos than in traditional medicare. *Health Aff (Millwood)*, 32(7):1228–35, 2013. doi: 10.1377/hlthaff.2012.0773.

A. Batata. The effect of hmos on fee-for-service health care expenditures: evidence from medicare revisited. *J Health Econ*, 23(5):951–63, 2004. ISSN 0167-6296 (Print) 0167-6296. doi: 10.1016/j.jhealeco.2004.02.004. Batata, Amber Journal Article Research Support, Non-U.S. Gov't Research Support, U.S. Gov't, Non-P.H.S. Research Support, U.S. Gov't, P.H.S. Netherlands 2004/09/09 J Health Econ. 2004 Sep;23(5):951-63. doi: 10.1016/j.jhealeco.2004.02.004.

Jason Brown, Mark Duggan, Ilyana Kuziemko, and William Woolston. How does risk selection respond to risk adjustment? new evidence from the medicare advantage program. *American Economic Review*, 104(10):3335–3364, 2014. doi: http://dx.doi.org/10.1257/aer.104.10.3335.

Zach Brown and Jihye Jeon. Endogenous Information and Simplifying Insurance Choice. *Working Paper*, August 2023.

CMS. Centers for Medicare & Medicaid Services. Medicare & You 2024: The Official U.S. goverment Medicare handbook. Baltimore, MD: CMS Product No. 10050, September 2023.

Congressional Research Service. Medicare Advantage (MA)–Proposed Benchmark Update and Other Adjustments for CY2020: In Brief. Washington, DC: R45494, February 2019.

Vilsa Curto, Liran Einav, Amy Finkelstein, Jonathan Levin, and Jay Bhattacharya. Health care spending and utilization in public and private medicare. *American Economic Journal: Applied Economics*, 11(2): 302–32, April 2019. doi: 10.1257/app.20170295. URL https://www.aeaweb.org/articles?id=10.1257/app.20170295.

Randall P. Ellis, Bruno Martins, and Wenjia Zhu. Health care demand elasticities by type of service. *Journal of Health Economics*, 55:232–243, 2017. ISSN 0167-6296. doi: https://doi.org/10.1016/j.jhealeco.2017.07.007. URL https://www.sciencedirect.com/science/article/pii/S0167629616303757.

JA Gliedt, AL Spector, MJ Schneider, J Williams, and S. A Young. Description of theoretical models for health service utilization: A scoping review of the literature. *Inquiry : A journal of medical care organization, provision and financing*, 60, 2023. URL https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10240870/.

Nils Gutacker, Luigi Siciliani, Giuseppe Moscelli, and Hugh Gravelle. Assessing hospital competition when prices don't matter to patients: the use of time-elasticities. *Journal of Health Economics*, 50:230–246, 2016.

Simon F. Haeder. Quality Advantage? Provider Quality and Networks in Medicare Advantage. *Journal of Public and Nonprofit Affairs*, 6(2):138–158, 2020.

Florian Heiss, Daniel McFadden, Joachim Winter, Amelie Wuppermann, and Bo Zhou. Inattention and switching costs as sources of inertia in medicare part d. *American Economic Review*, 111(9):2737–81, September 2021. doi: 10.1257/aer.20170471. URL https://www.aeaweb.org/articles?id=10.1257/aer.20170471.

Kate Ho, Joseph Hogan, and Fiona Scott Morton. The impact of consumer inattention on insurer pricing in the medicare part d program. *The RAND Journal of Economics*, 48(4):877–905, 2017. doi: https://doi.org/10.1111/1756-2171.12207. URL https://onlinelibrary.wiley.com/doi/abs/10.1111/1756-2171.12207.

B. E. Landon, A. M. Zaslavsky, R. Saunders, L. G. Pawlson, J. P. Newhouse, and J. Z. Ayanian. A comparison of relative resource use and quality in medicare advantage health plans versus traditional medicare. *Am J Manag Care*, 21(8):559–66, 2015.

Bruce E. Landon, Alan M. Zaslavsky, Robert C. Saunders, L. Gregory Pawlson, Joseph P. Newhouse, and John Z. Ayanian. Analysis of medicare advantage hmos compared with traditional medicare shows lower use of many services during 2003–09. *Health Affairs*, 31(12):2609–2617, 2012. doi: 10.1377/hlthaff.2012.0179. URL https://doi.org/10.1377/hlthaff.2012.0179. PMID: 23213144.

Bruce E. Landon, Alan M. Zaslavsky, Timothy S. Anderson, Jeffrey Souza, Vilsa Curto, and John Z. Ayanian. Differences in use of services and quality of care in medicare advantage and traditional medicare, 2010 and 2017. *Health Affairs*, 42(4):459–469, 2023. doi: 10.1377/hlthaff.2022.00891. URL https://doi.org/10.1377/hlthaff.2022.00891. PMID: 37011314.

J. Michael McWilliams, John Hsu, and Joseph P. Newhouse. New risk-adjustment system was associated with reduced favorable selection in medicare advantage. *Health Affairs*, 31(12):2630–2640, 2012.

David J. Meyers, Vincent Mor, and Momotazur Rahman. Medicare Advantage Enrollees More Likely To Enter Lower-Quality Nursing Homes Compared To Fee-For-Service Enrollees. *Health Affairs*, 37(1): 78–85, 2018.

David J. Meyers, Emmanuelle Belanger, Nina Joyce, John McHugh, Momotazur Rahman, and Vincent Mor. Analysis of Drivers of Disenrollment and Plan Switching Among Medicare Advantage Beneficiaries. *JAMA Internal Medicine*, 179(4):524–532, 04 2019.

David J. Meyers, Amal N. Trivedi, Vincent Mor, and Momotazur Rahman. Comparison of the Quality of Hospitals That Admit Medicare Advantage Patients vs Traditional Medicare Patients. *JAMA Network Open*, 3(1):e1919310, 2020.

David J. Meyers, Momotazur Rahman, and Amal N. Trivedi. Narrow primary care networks in medicare advantage. *Journal of General Internal Medicine*, 37:488–491, 2022. URL https://doi.org/10.1007/s11606-020-06534-2.

Patricia Neuman and Gretchen A. Jacobson. Medicare advantage checkup. *The New England Journal of Medicine*, 379(22):2163–2172, 2018.

Joseph P. Newhouse and Thomas G. McGuire. How successful is medicare advantage? *The Milbank Quarterly*, 92(2):351–394, 2014. doi: https://doi.org/10.1111/1468-0009.12061. URL https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-0009.12061.

Joseph P. Newhouse, Mary Price, J. Michael McWilliams, John Hsu, and Thomas G. McGuire. How much favorable selection is left in medicare advantage? *American Journal of Health Economics*, 1(1):1–26, 2015.

Lauren Hersch Nicholas, Dan Polsky, Michael Darden, Jianhui Xu, Kelly Anderson, and David J. Meyers. Is there an advantage? considerations for researchers studying the effects of the type of medicare coverage. *Health Services Research*, 59(1):e14264, 2024. doi: https://doi.org/10.1111/1475-6773.14264. URL https://onlinelibrary.wiley.com/doi/abs/10.1111/1475-6773.14264.

Nancy Ochieng and Gabrielle Clerveau. How Many Physicians Have Opted Out of the Medicare Program? *Kaiser Family Foundation*, 2023. URL https://www.kff.org/medicare/issue-brief/how-many-physicians-have-opted-out-of-the-medicare-program/.

Nancy Ochieng and Jeannie Fuglesten Biniek. Beneficiary Experience, Affordability, Utilization, and Quality in Medicare Advantage and Traditional Medicare: A Review of the Literature. *Kaiser Family Foundation*, 2022. URL https://www.kff.org/medicare/report/beneficiary-experience-affordability-utilization-and-quality-in-medicare-advantage-and-traditional-medicare-a-review-of-the-literature/.

Nancy Ochieng, Jeannie Fuglesten Biniek, Meredith Freed, Anthony Damico, and Tricia Neuman. Medicare Advantage in 2023: Enrollment Update and Key Trends. *Kaiser Family Foundation*, 2023. URL https://www.kff.org/medicare/issue-brief/medicare-advantage-in-2023-enrollment-update-and-key-trends/.

Sungchul Park, Jose F. Figueroa, Paul Fishman, and Norma B. Coe. Primary Care Utilization and Expenditures in Traditional Medicare and Medicare Advantage, 2007–2016. *Journal of General Internal Medicine*, 35:2480–2481, 2020a. doi: https://doi.org/10.1007/s11606-020-05826-x.

Sungchul Park, Paul Fishman, Lindsay White, Eric B Larson, and Norma B Coe. Disease-specific plan switching between traditional medicare and medicare advantage. *The Permanente Journal*, 24(1):19.059, 2020b. doi: 10.7812/TPP/19.059. URL https://www.thepermanentejournal.org/doi/abs/10.7812/TPP/19.059.

Aaron L. Schwartz, Khalil Zlaoui, Robin P. Foreman, Troyen A. Brennan, and Joseph P. Newhouse. Health Care Utilization and Spending in Medicare Advantage vs Traditional Medicare: A Difference-in-Differences Analysis. *JAMA Health Forum*, 2(12):e214001–e214001, 12 2021. ISSN 2689-0186. doi: 10.1001/jamahealthforum.2021.4001. URL https://doi.org/10.1001/jamahealthforum.2021.4001.

Margot L. Schwartz, Cyrus M. Kosar, TracyM. Mroz, Amit Kumar, and Momotazur Rahman. Quality of Home Health Agencies Serving Traditional Medicare vs Medicare Advantage Beneficiaries. *JAMA Network Open*, 2(9):2480–2481, 2019. doi: https://doi.org/10.1007/s11606-020-05826-x.

J. M. C. Santos Silva and Silvana Tenreyro. The Log of Gravity. *The Review of Economics and Statistics*, 88(4):641–658, 11 2006. ISSN 0034-6535. doi: 10.1162/rest.88.4.641. URL https://doi.org/10.1162/rest.88.4.641.

A. D. Sinaiko, C. C. Afendulis, and R. G. Frank. Enrollment in medicare advantage plans in miami-dade county: evidence of status quo bias? *Inquiry*, 50(3):202–15, 2013. ISSN 0046-9580 (Print) 0046-9580. doi: 10.1177/0046958013516586. 1945-7243 Sinaiko, Anna D Afendulis, Christopher C Frank, Richard G P01 AG032952/AG/NIA NIH HHS/United States Journal Article Research Support, N.I.H., Extramural United States 2014/07/30 Inquiry. 2013 Aug;50(3):202-15. doi: 10.1177/0046958013516586.

Erin Trish, Paul Ginsburg, Laura Gascue, and Geoffrey Joyce. Physician Reimbursement in Medicare Advantage Compared With Traditional Medicare and Commercial Health Insurance. *JAMA Internal Medicine*, 177(9):1287–1295, 09 2017. ISSN 2168-6106. doi: 10.1001/jamainternmed.2017.2679. URL https://doi.org/10.1001/jamainternmed.2017.2679.

Marco Varkevisser, Stéphanie A. van der Geest, and Frederik T. Schut. Assessing hospital competition when prices don't matter to patients: the use of time-elasticities. *International Journal of Health Care Finance and Economics*, 10(1):43–60, 2010.

A Theoretical Proofs

Proof of Proposition 1

Proof. In some cases, researchers do not observe sub-plans s and thus compare various characteristics only across broader plans $b \in \{MA, TM\}$.

In order to separate the effect of aggregation on the estimated magnitudes we redefine dummies to correspondingly separate the effect of aggregated plans $b \in$ ("TM", "MA") from the dis-aggregated sub-plans *bs* as ... . The effect of aggregation can then be shown to be

$$\tilde{\gamma}_b = \gamma_b + \sum_{s \in S_b} \gamma_{b,s}\omega_{b,s} - \sum_{s \in S_0} \gamma_{b0}\omega_{b0} \qquad \forall b \neq 0 \tag{17}$$

where $\omega_{b,s}$ is the share of *bs* in s PROOF HERE first note that $\tilde{\gamma}_b$ captures the difference in the expected value of the dependent variable relative to the base level, say $b = 0$, so for $b \neq 0$

$$\tilde{\gamma}_b = \mathrm{E}(\ln n_{ib} | D_{ib} = 1, d_i) - \mathrm{E}(\ln n_{ib} | D_{i0} = 1, d_i) \tag{18}$$

I think we need to drop $_i$ because it is expected value and $_b$ because of comment above.

$$\tilde{\gamma}_b = \mathrm{E}(\ln n | D_b = 1, d) - \mathrm{E}(\ln n_b | D_0 = 1, d) \tag{19}$$

where d_i is a vector of all characteristics j of individual i.

If there are differences across sub-plans s within a plan b then the estimated value of γ_b' will also reflect differences in sub-plans included in (**??**). Taking the difference in expectation across plans b in equation (**??**) we get:

$$\mathrm{E}(\ln n | D_b = 1, d) - \mathrm{E}(\ln n_b | D_0 = 1, d) = \sum_{b \neq 0, s \neq 0} \gamma_{b,s}\, \mathrm{E}(D_{b,s} | D_b = 1, d) - \sum_{b \neq 0, s \neq 0} \gamma_{b,s}\, \mathrm{E}(D_{b,s} | D_0 = 1, d) \tag{20}$$

This notation does not quite work because we need to be able to set $b = 0$ but let s vary for each b including $b = 0$. Like MA-Supplement dummy even in the case of MA being the base. Also, the composition effect is not obvious because there is no D_b in (**??**) only $D_{b,s}$. I suggest to rewrite the notation of dummies as $\sum_b \gamma_b D_b + \sum_b \sum_{s \in S_b} \gamma_{b,s} D_{b,s}$ or equivalently $\sum_b \left(\gamma_b D_b + \sum_{s \in S_b} \gamma_{b,s} D_{b,s}\right)$ where S_b is the set of sub-plans s available in plan b except for a base sub-plan.

$$\tilde{\gamma}_b = \mathrm{E}(\ln n | D_b = 1, d) - \mathrm{E}(\ln n | D_0 = 1, d) = \gamma_b + \sum_{s \in S_b} \gamma_{b,s}\, \mathrm{E}(D_{b,s} | D_b = 1, d) - \sum_{s \in S_0} \gamma_{b,s}\, \mathrm{E}(D_{b,s} | D_0 = 1, d) \qquad \forall b \neq 0 \tag{21}$$

In the above equation if for a given value of demographic characteristics d the breakdown into sub-plans does not matter the difference with the base plan collapses to γ_b. Otherwise, the difference will reflect not only the difference between plans b but also by within-plan share weighted effects of sub-plans s. $\mathrm{E}(D_{b,s} | D_b = 1, d)$ is the sample share of s in b. The two terms with summation sign represent the composition effects on b and the base plan. □

Proof of Lemma 1.

Proof. From eq. (11), for any given $\overline{p}$, n, and $\boldsymbol{\delta}$, the ratio of marginal utility over price for finickybeneficiaries is always strictly greater under TM-Only than under MA-Only because of quality differences.

Therefore, finickybeneficiaries will strictly prefer TM-Only to MA-Only. □

Proof of Proposition 2.

Proof. From Lemma 1, if OOP Costs of TM-Only and MA-Only are the same, the resulting equilibrium is a corner one with all of the beneficiaries being enrolled in the TM-Only. Thus, based on eq. (11), the only way to compensate for lower quality and to attract beneficiaries from MA-Only to TM-Only, MA-Only OOP Costs should be lower than TM-Only OOP costs. □

Proof of Lemma 2.

Proof. Given that the perception of quality differences between TM-Only and TM-Only plans is weaker for frugal beneficiaries, based on eq. (11), they require a smaller price reduction to choose MA-Only than finicky beneficiaries. Thus, it is impossible to have an interior equilibrium without finicky beneficiaries in TM-Only and without frugal beneficiaries in MA-Only. □

Proof of Proposition 3.

Proof. Recall that MA-Only plans are reimbursed by the government based on the per-patient expenditures by the government of the TM-Only patients. Thus, if the proposition above does not hold, private insurance companies will incur losses with each patient. Private insurance companies have a choice of not incurring losses by exiting the market. □

Proof of Proposition 4.

Proof. From equation eq. (7), $\gamma_{b,s}$ is defined as:

$$\gamma_{b,s} \equiv \varepsilon \left(\ln \frac{q_{i,b,s}}{q_{i,MA,O}} - \ln \frac{\overline{p}_{b,s}}{\overline{p}_{MA,O}} \right)$$

Thus, for $\gamma_{TM,O}$, we can rewrite the expression above as

$$\gamma_{TM,O} \equiv \varepsilon \left(\ln \frac{q_{i,TM,O}}{q_{i,MA,O}} - \ln \frac{\overline{p}_{TM,O}}{\overline{p}_{MA,O}} \right). \tag{22}$$

From Lemma 2, our model can have two types of interior equilibria: the first type in which finicky beneficiaries can choose either TM-Only or MA-Only (and all frugal beneficiaries choose MA-Only), and the second type in which frugal consumer can choose either TM-Only or MA-Only (and all finicky beneficiaries choose TM-Only).[28] In addition , there is also a corner equilibrium in which all finicky beneficiaries choose TM-Only and all frugal beneficiaries choose MA-Only.

In the first type of interior equilibria, in which finicky beneficiaries can consume either TM-Only or MA-Only, and all frugal beneficiaries choose MA-Only, eq. (22) transforms into the following:

$$\frac{q_{TM,O}(i \in \underline{q})}{q_{MA,O}(i \in \underline{q})} < \frac{\overline{p}_{TM,O}}{\overline{p}_{MA,O}} \exp\left(\frac{\tilde{\gamma}_{TM,O}}{\varepsilon}\right) = \frac{q_{TM,O}(i \in \overline{q})}{q_{MA,O}(i \in \overline{q})}. \tag{23}$$

[28]We refer to them as interior equilibria because there exists one type of beneficiaries which is indifferent between two plans.

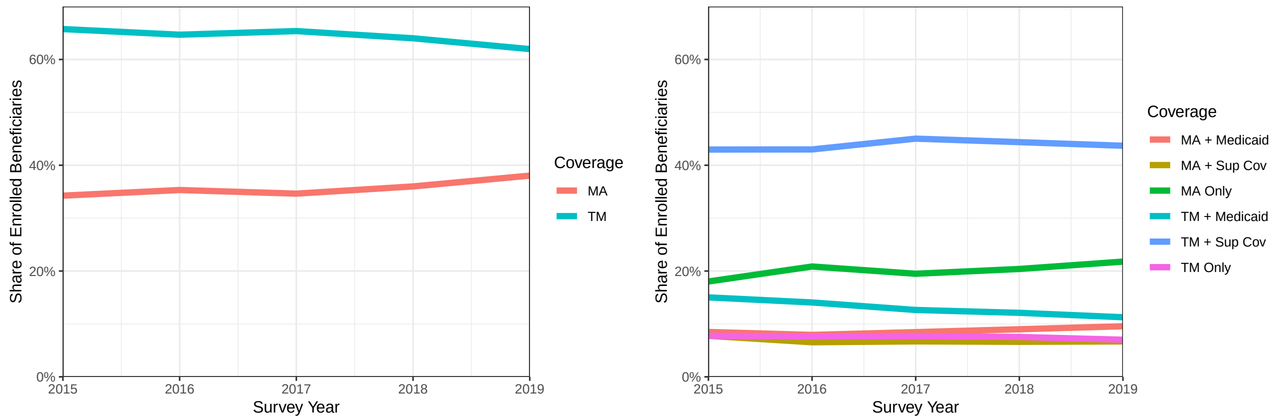

Figure 3: Enrollment in Medicare by Coverage Type, 2015-2019

In the second type of interior equilibria, in which frugal beneficiaries can consume either TM-Only or MA-Only, and all finicky beneficiaries choose TM-Only, eq. (22) transforms into the following:

$$\frac{\overline{p}_{TM,O}}{\overline{p}_{MA,O}} \exp\left(\frac{\tilde{\gamma}_{TM,O}}{\varepsilon}\right) = \frac{q_{TM,O}(i \in \underline{q})}{q_{MA,O}(i \in \underline{q})} < \frac{q_{TM,O}(i \in \overline{q})}{q_{MA,O}(i \in \overline{q})}. \tag{24}$$

Finally, in the corner equilibrium with all finicky beneficiaries in TM-only and all frugal beneficiaries in MA-Only, eq. (22) transforms into the following:

$$\frac{\overline{p}_{TM,O}}{\overline{p}_{MA,O}} \exp\left(\frac{\tilde{\gamma}_{TM,O}}{\varepsilon}\right) = \frac{q_{TM,O}(i \in \underline{q})}{q_{MA,O}(i \in \underline{q})} < \frac{q_{TM,O}(i \in \overline{q})}{q_{MA,O}(i \in \overline{q})}. \tag{25}$$

Equation (12) in Proposition 4 effectively combines all possible cases described by equations (23), (24), and (25) into one equation which describes all possible combinations. □

Proof of Proposition 5

Proof. By definition, the network for TM+S and TM-Only plans is identical. However, the supplementary plan reduces the out-of-pocket expenses for beneficiaries under TM+S relative to those under TM-Only. This reduction in prices leads to an increase in the quantity demanded.

By definition, the network is the same for MA+S and MA-Only. However, the supplementary plan decreases the out-of-pocket prices for MA+S beneficiaries compared to MA-Only beneficiaries. These lower prices lead to a greater quantity demanded. □

Proof of Proposition 6

Proof. Medicaid supplementary coverage reduces the regular out-of-pocket expenses for both TM and MA plans. □

B Tables

Table 9: Impact of Medicare Coverage on Total and OOP Expenses
Cross-Sectional Analysis by Event (Non-PM and Non-ER Events; Excluding Dental, Vision, and Hearing Events)

Baseline:	*All Medicare Advantage*		*Medicare Advantage Only*	
	Total Costs$_{e,it}$	OOP Costs$_{e,it}$	Total Costs$_{e,it}$	OOP Costs$_{e,it}$
	(1)	(2)	(3)	(4)
TM-All$_{it}$	0.023	-0.137^{***}		
	(0.014)	(0.033)		
TM Only$_{it}$			0.038	0.144^{***}
			(0.031)	(0.046)
TM + Sup. Cov$_{it}$			0.016	-0.408^{***}
			(0.019)	(0.042)
MA + Sup. Cov$_{it}$			-0.057^{**}	-0.105
			(0.027)	(0.068)
TM + Medicaid$_{it}$			-0.012	-0.784^{***}
			(0.023)	(0.047)
MA + Medicaid$_{it}$			-0.012	-0.942^{***}
			(0.030)	(0.062)
Part D$_{it}$	-0.049^{***}	-0.223^{***}	-0.045^{***}	-0.188^{***}
	(0.017)	(0.032)	(0.017)	(0.032)
Full Risk$_{it}$	-0.006^{***}	-0.014^{***}	-0.006^{***}	-0.014^{***}
	(0.001)	(0.002)	(0.001)	(0.002)
Constant	10.564^{***}	8.400^{***}	10.605^{***}	9.762^{***}
	(0.084)	(0.211)	(0.089)	(0.200)
Demographic Controls	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Type FE	Y	Y	Y	Y
Observations	1,202,688	1,202,688	1,202,688	1,202,688

Note: Results display impact of Medicare coverage on total expenses (all payers) and out-of-pocket expenses by each medical event over non-prescribed medicine and non-emergency room events. Analysis excludes dental, vision, and hearing medical events identified by any dental, vision, or hearing event source, medical provider specialty, or medical expense. Estimation performed using Poisson regression and data from the 2015-2019 MCBS Survey and Cost Supplement files. Survey weights are used for the ever-enrolled Medicare population. Medicare coverage status either distinguished by traditional Medicare vs. Medicare Advantage or by combination of TM vs. MA and additional supplemental or Medicaid coverage. Baseline group in italics. Part D status determined if covered for majority share of eligibility period in a given year. Full risk measure determined by survey responses to questions of chronic risk, perception of health risk, and mental health status. Demographic controls include age (demeaned), racial minority status, annual income (in logs, transformed as $\log(1+x)$), education level relative to high school diploma, gender, and CBSA designation. *p<0.1; **p<0.05; ***p<0.01. Robust SEs in parentheses.

Table 10: Impact of Medicare Coverage on Annual Medical Events
Cross-Sectional Analysis by Beneficiary; Excluding Dental, Vision, and Hearing Events

Baseline:	*All Medicare Advantage*		*Medicare Advantage Only*	
	Total Events$_{it}$	Non-PM/ER Events$_{it}$	Total Events$_{it}$	Non-PM/ER Events$_{it}$
	(1)	(2)	(3)	(4)
TM$_{it}$	0.361***	0.695***		
	(0.014)	(0.023)		
TM Only$_{it}$			0.234***	0.532***
			(0.026)	(0.036)
TM + Sup. Cov$_{it}$			0.423***	0.735***
			(0.015)	(0.025)
MA + Sup. Cov$_{it}$			0.138***	0.212***
			(0.031)	(0.040)
TM + Medicaid$_{it}$			0.409***	0.823***
			(0.022)	(0.033)
MA + Medicaid$_{it}$			0.056*	0.009
			(0.029)	(0.064)
Part D$_{it}$	0.470***	0.324***	0.460***	0.303***
	(0.015)	(0.020)	(0.015)	(0.021)
Full Risk$_{it}$	0.062***	0.058***	0.061***	0.058***
	(0.001)	(0.002)	(0.001)	(0.002)
Constant	2.272***	1.234***	2.305***	1.204***
	(0.078)	(0.114)	(0.081)	(0.123)
Demographic Controls	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Observations	37,662	37,662	37,662	37,662

Note: Results display impact of Medicare coverage on annual annual medical events by Medicare beneficiary. Medical events are broken down by category: total (all) events, prescribed medicine (PM) events, non-PM and non-ER events, and emergency room (ER) events. Analysis excludes dental, vision, and hearing medical events identified by any dental, vision, or hearing event source, medical provider specialty, or medical expense. Estimation performed using Poisson regression and data from the 2015-2019 MCBS Survey and Cost Supplement files. Survey weights are used for the ever-enrolled Medicare population. Medicare coverage status either distinguished by traditional Medicare vs. Medicare Advantage or by combination of TM vs. MA and additional supplemental or Medicaid coverage. Baseline group in italics. Part D status determined if covered for majority share of eligibility period in a given year. Full risk measure determined by survey responses to questions of chronic risk, perception of health risk, and mental health status. Demographic controls include age (demeaned), racial minority status, annual income (in logs, transformed as $\log(1+x)$), education level relative to high school diploma, gender, and CBSA designation. *p<0.1; **p<0.05; ***p<0.01. Robust SEs in parentheses.

Table 11: Demographic Summary by Year
Sample Derived from the Medicare Current Beneficiary Survey, 2015-2019

	2015	2016	2017	2018	2019	Overall
	(N=8025)	(N=6977)	(N=7414)	(N=7349)	(N=7897)	(N=37662)
Medicare Coverage						
MA Only$_{it}$	1336 (16.6%)	1358 (19.5%)	1551 (20.9%)	1674 (22.8%)	1932 (24.5%)	7851 (20.8%)
TM Only$_{it}$	586 (7.3%)	510 (7.3%)	527 (7.1%)	506 (6.9%)	523 (6.6%)	2652 (7.0%)
TM + Sup. Cov$_{it}$	3644 (45.4%)	3068 (44.0%)	3187 (43.0%)	3069 (41.8%)	3152 (39.9%)	16120 (42.8%)
MA + Sup. Cov$_{it}$	603 (7.5%)	444 (6.4%)	519 (7.0%)	518 (7.0%)	576 (7.3%)	2660 (7.1%)
TM + Medicaid$_{it}$	1204 (15.0%)	1019 (14.6%)	944 (12.7%)	840 (11.4%)	820 (10.4%)	4827 (12.8%)
MA + Medicaid$_{it}$	652 (8.1%)	578 (8.3%)	686 (9.3%)	742 (10.1%)	894 (11.3%)	3552 (9.4%)
***Part D Coverage* (Indicator)**						
0	1831 (22.8%)	1518 (21.8%)	1552 (20.9%)	1456 (19.8%)	1518 (19.2%)	7875 (20.9%)
1	6194 (77.2%)	5459 (78.2%)	5862 (79.1%)	5893 (80.2%)	6379 (80.8%)	29787 (79.1%)
***Full Risk* (Aggregated Health Score)**						
Mean (SD)	15.5 (6.34)	14.5 (5.39)	14.7 (5.50)	14.6 (5.44)	14.7 (5.55)	14.8 (5.68)
Median [Min, Max]	14.0 [1.00, 45.0]	13.0 [2.00, 37.0]	14.0 [2.00, 41.0]	14.0 [1.00, 39.0]	14.0 [1.00, 40.0]	14.0 [1.00, 45.0]
***Age* (Years)**						
Mean (SD)	77.7 (8.02)	78.3 (8.02)	78.7 (8.24)	78.4 (8.17)	78.1 (8.14)	78.2 (8.12)
Median [Min, Max]	77.0 [65.0, 106]	78.0 [65.0, 107]	78.0 [65.0, 108]	78.0 [65.0, 105]	78.0 [65.0, 105]	78.0 [65.0, 108]
***Race* (Indicator)**						
Unknown	66 (0.8%)	68 (1.0%)	73 (1.0%)	88 (1.2%)	116 (1.5%)	411 (1.1%)
White	6416 (80.0%)	5561 (79.7%)	5988 (80.8%)	5841 (79.5%)	6151 (77.9%)	29957 (79.5%)
Black	686 (8.5%)	588 (8.4%)	596 (8.0%)	611 (8.3%)	669 (8.5%)	3150 (8.4%)
Other	50 (0.6%)	35 (0.5%)	38 (0.5%)	55 (0.7%)	58 (0.7%)	236 (0.6%)
Asian	118 (1.5%)	94 (1.3%)	103 (1.4%)	101 (1.4%)	120 (1.5%)	536 (1.4%)
Hispanic	657 (8.2%)	592 (8.5%)	576 (7.8%)	608 (8.3%)	748 (9.5%)	3181 (8.4%)
NA Native	32 (0.4%)	39 (0.6%)	40 (0.5%)	45 (0.6%)	35 (0.4%)	191 (0.5%)
***Income* ($)**						
Mean (SD)	50600 (96300)	49000 (68000)	51800 (59800)	53800 (59700)	55900 (62800)	52300 (71200)
Median [Min, Max]	30000 [0, 3520000]	30000 [0, 1860000]	33000 [0, 864000]	35400 [0, 1000000]	36800 [0, 1740000]	33000 [0, 3520000]
***High School Education* (Categorical)**						
1 (<HS)	1575 (19.6%)	1313 (18.8%)	1352 (18.2%)	1297 (17.6%)	1383 (17.5%)	6920 (18.4%)
2 (HS)	2268 (28.3%)	1944 (27.9%)	1993 (26.9%)	1955 (26.6%)	2040 (25.8%)	10200 (27.1%)
3 (>HS)	4182 (52.1%)	3720 (53.3%)	4069 (54.9%)	4097 (55.7%)	4474 (56.7%)	20542 (54.5%)
***Sex* (Categorical)**						
Male	3495 (43.6%)	3033 (43.5%)	3122 (42.1%)	3225 (43.9%)	3469 (43.9%)	16344 (43.4%)
Female	4530 (56.4%)	3944 (56.5%)	4292 (57.9%)	4124 (56.1%)	4428 (56.1%)	21318 (56.6%)
CBSA Designation						
Metro	6064 (75.6%)	5268 (75.5%)	5572 (75.2%)	5557 (75.6%)	6003 (76.0%)	28464 (75.6%)
Micro	1302 (16.2%)	1145 (16.4%)	1138 (15.3%)	1125 (15.3%)	1200 (15.2%)	5910 (15.7%)
Rural	657 (8.2%)	563 (8.1%)	703 (9.5%)	667 (9.1%)	694 (8.8%)	3284 (8.7%)

Table 12: Demographic Summary by Coverage
Sample Derived from the Medicare Current Beneficiary Survey, 2015-2019

	Medicare Advantage			Traditional Medicare		
	MA Only	MA + Sup. Cov	MA + Medicaid	TM Only	TM + Sup. Cov	TM + Medicaid
	(N=7851)	(N=2660)	(N=3552)	(N=2652)	(N=16120)	(N=4827)
Year						
2015	1336 (17.0%)	603 (22.7%)	652 (18.4%)	586 (22.1%)	3644 (22.6%)	1204 (24.9%)
2016	1358 (17.3%)	444 (16.7%)	578 (16.3%)	510 (19.2%)	3068 (19.0%)	1019 (21.1%)
2017	1551 (19.8%)	519 (19.5%)	686 (19.3%)	527 (19.9%)	3187 (19.8%)	944 (19.6%)
2018	1674 (21.3%)	518 (19.5%)	742 (20.9%)	506 (19.1%)	3069 (19.0%)	840 (17.4%)
2019	1932 (24.6%)	576 (21.7%)	894 (25.2%)	523 (19.7%)	3152 (19.6%)	820 (17.0%)
***Part D Coverage* (Indicator)**						
0	204 (2.6%)	221 (8.3%)	38 (1.1%)	1181 (44.5%)	5584 (34.6%)	647 (13.4%)
1	7647 (97.4%)	2439 (91.7%)	3514 (98.9%)	1471 (55.5%)	10536 (65.4%)	4180 (86.6%)
***Full Risk* (Aggregated Health Score)**						
Mean (SD)	14.4 (5.26)	14.3 (5.40)	17.2 (6.32)	14.2 (5.47)	14.3 (5.28)	16.2 (6.63)
Median [Min, Max]	14.0 [2.00, 39.0]	13.0 [2.00, 37.0]	16.0 [4.00, 42.0]	13.0 [1.00, 38.0]	13.0 [1.00, 41.0]	14.0 [2.00, 45.0]
***Age* (Years)**						
Mean (SD)	78.0 (7.54)	77.5 (7.53)	78.8 (8.79)	78.6 (8.75)	77.9 (7.59)	79.6 (9.86)
Median [Min, Max]	78.0 [65.0, 103]	77.0 [65.0, 100]	79.0 [65.0, 104]	78.0 [65.0, 108]	77.0 [65.0, 105]	80.0 [65.0, 107]
***Race* (Indicator)**						
Unknown	79 (1.0%)	53 (2.0%)	19 (0.5%)	23 (0.9%)	202 (1.3%)	35 (0.7%)
White	6265 (79.8%)	2268 (85.3%)	1733 (48.8%)	2141 (80.7%)	14447 (89.6%)	3103 (64.3%)
Black	648 (8.3%)	177 (6.7%)	677 (19.1%)	251 (9.5%)	699 (4.3%)	698 (14.5%)
Other	59 (0.8%)	13 (0.5%)	26 (0.7%)	11 (0.4%)	81 (0.5%)	46 (1.0%)
Asian	83 (1.1%)	22 (0.8%)	76 (2.1%)	47 (1.8%)	142 (0.9%)	166 (3.4%)
Hispanic	683 (8.7%)	124 (4.7%)	1004 (28.3%)	144 (5.4%)	503 (3.1%)	723 (15.0%)
NA Native	34 (0.4%)	3 (0.1%)	17 (0.5%)	35 (1.3%)	46 (0.3%)	56 (1.2%)
***Income* ($)**						
Mean (SD)	50000 (70300)	64400 (69900)	20600 (28700)	43700 (62700)	67900 (81400)	25000 (38300)
Median [Min, Max]	34000 [0, 3520000]	46000 [0, 1670000]	13300 [0, 713000]	27000 [0, 1670000]	48000 [0, 2520000]	13300 [0, 1000000]
***High School Education* (Categorical)**						
1 (<HS)	1273 (16.2%)	272 (10.2%)	1577 (44.4%)	498 (18.8%)	1397 (8.7%)	1903 (39.4%)
2 (HS)	2251 (28.7%)	703 (26.4%)	959 (27.0%)	789 (29.8%)	4108 (25.5%)	1390 (28.8%)
3 (>HS)	4327 (55.1%)	1685 (63.3%)	1016 (28.6%)	1365 (51.5%)	10615 (65.8%)	1534 (31.8%)
***Sex* (Categorical)**						
Male	3517 (44.8%)	1188 (44.7%)	1247 (35.1%)	1328 (50.1%)	7354 (45.6%)	1710 (35.4%)
Female	4334 (55.2%)	1472 (55.3%)	2305 (64.9%)	1324 (49.9%)	8766 (54.4%)	3117 (64.6%)
CBSA Designation						
Metro	6556 (83.5%)	2202 (82.8%)	3038 (85.5%)	1753 (66.1%)	11575 (71.8%)	3340 (69.2%)
Micro	766 (9.8%)	235 (8.8%)	341 (9.6%)	557 (21.0%)	3102 (19.2%)	909 (18.8%)
Rural	529 (6.7%)	223 (8.4%)	173 (4.9%)	342 (12.9%)	1440 (8.9%)	577 (12.0%)

Table 13: Construction of Full Risk Score Measure
Derived from Survey Responses to the Medicare Current Beneficiary Survey, 2015-2019

Survey Question	Lowest Risk Response	Highest Risk Response
General Health Survey		
General health compared others same age	0	4
General health compared to one year ago	0	4
How rate health 6 months from now	0	4
Limited social activities (past month)	0	3
BMI Categories (kg/m^2)	0	3
Demographic Survey		
Income to Poverty Ratio	0	4
Chronic Conditions Survey		
Hysterectomy (ever)	0	1
Hardening of arteries (ever)	0	1
Hypertension/high BP (ever)	0	1
MI/heart attack (ever)	0	1
Angina pectoris/CHD (ever)	0	1
Congestive heart failure (ever)	0	1
Problems with heart valves (ever)	0	1
Problems with heart rhythm (ever)	0	1
Other heart conditions (ever)	0	1
Stroke/brain hemorrhage (ever)	0	1
High cholesterol (ever)	0	1
Skin cancer (ever)	0	1
Body part cancer (ever)	0	1
One for each: colon/bowel/rectum, breast, uterus, prostate, bladder, ovary, stomach, cervix, brain, kidney, throat, head, back, female organs, other		
Rheumatoid arthritis (ever)	0	1
Non-rheumatoid arthritis (ever)	0	1
Mental retardation (ever)	0	1
Alzheimer's (ever)	0	1
Dementia (ever)	0	1
Depression (ever)	0	1
Mental disorder (not depress) (ever)	0	1
Osteoporosis/soft bones (ever)	0	1
Broken hip (ever)	0	1
Parkinson's disease (ever)	0	1
Emphyseman/asthma/COPD (ever)	0	1
Complete/partial paralysis (ever)	0	1
Lost an arm or a leg (ever)	0	1
Enlarged prostate (ever)	0	1
Diabetes/high blood sugar (ever)	0	1
How often felt sad/depressed (past year)	0	4
Lost interest (past year)	0	1
How often lost urine control (past year)	0	7
Told on 2+ visits had high BP (ever)	0	1
SUM TOTAL: Full Risk Score Measure	0	78