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Do Medicare Advantage Plans Select Enrollees in Higher Margin Clinical Categories?

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Abstract

The CMS-HCC risk adjustment system for Medicare Advantage (MA) plans calculates weights, which are effectively relative prices, for beneficiaries with different observable characteristics. To do so it uses the relative amounts spent per beneficiary with those characteristics in Traditional Medicare (TM). For multiple reasons one might expect relative amounts in MA to differ from TM, thereby making some beneficiaries more profitable to treat than others. Much of the difference comes from differences in how TM and MA treat different diseases or diagnoses. Using data on actual medical spending from two MA-HMO plans, we show that the weights calculated from MA costs do indeed differ from those calculated using TM spending. One of the two plans (Plan 1) is more typical of MA-HMO plans in that it contracts with independent community providers, while the other (Plan 2) is vertically integrated with care delivery. We calculate margins, or Average Revenue/Average Cost, for Medicare beneficiaries in the two plans who have one of 48 different combinations of medical conditions. The two plans' margins for these 48 conditions are correlated ($r=0.39$, $p<0.01$). Both plans have margins that are more positive for persons with conditions that are managed by primary care physicians and where medical management can be effective. Conversely they have lower margins for persons with conditions that tend to be treated by specialists with greater market power than primary care physicians and for acute conditions where little medical management is possible. The two plan's margins among beneficiaries with different observable characteristics vary over a range of 160 and 98 percentage points, respectively, and thus would appear to offer substantial incentive for selection by HCC. Nonetheless, we find no evidence of overrepresentation of beneficiaries in high margin HCC's in either plan. Nor, using the margins from Plan 1, the more typical plan, do we find evidence of overrepresentation of high margin HCC's in Medicare more generally. These results do not permit a conclusion on overall social efficiency, but we note that selection according to margin could be socially efficient. In addition, our findings suggest there are omitted interaction terms in the risk adjustment model that Medicare currently uses.

Keywords

Selection; risk adjustment; Medicare

The possibility of selection by health insurance plans has been recognized for decades (Akerlof 1970; Rothschild and Stiglitz 1976). Indeed, selection in the individual health insurance market was a main reason behind the establishment of Medicare in 1965. Because individuals over 65 years of age were mostly retired, they lacked access to the pooling

mechanism of employment-based health insurance and so had to buy in the individual health insurance market. Selection in that market meant that available policies not only exhibited high premiums but also did not cover pre-existing conditions, which most elderly had. As a result, only about half those over 65 had any health insurance in 1962–1963 (National Center for Health Statistics 1964). Selection is also a prime motivation for the Affordable Care Act's reforms in the individual and small group health insurance markets, including guaranteed issue, guaranteed renewability, some standardization of benefits, individual and employer mandates, and risk adjustment.¹

Medicare initially avoided selection issues by offering only one plan and covering all medically necessary services, even those for pre-existing conditions.² Its Part A was an entitlement covering services at institutional providers such as hospitals and required no premium. Although its Part B, which covers outpatient services, was voluntary, its premium was heavily subsidized, with the result that over 95 percent of beneficiaries purchased it, thereby minimizing selection.³ Starting in 1984, however, Medicare began to offer multiple plans in many areas by contracting with private health plans on an at-risk basis, i.e., a plan accepted a monthly payment in return for bearing the risk of a beneficiary's medical expenses, a program now known as Part C or Medicare Advantage (McGuire, et al. 2011).⁴ Thus, since 1984 Medicare beneficiaries could choose to enroll in either traditional Medicare (TM), sometimes referred to as original Medicare, or in a Medicare Advantage plan (MA), opening the possibility of selection. In 2006 Medicare added drug coverage through Part D; like Part B, Part D was voluntary but subsidized; MA enrollees choosing to purchase drug coverage were generally required to do so from their MA plan.

With the advent of Part C, selection became an issue in Medicare because favorable selection in MA, together with Medicare's method of reimbursing MA plans, served to raise federal spending. As a result, Medicare took several steps, which we describe below, to reduce selection. There is controversy in the literature about how well these steps have worked – and even whether they have been counterproductive (Brown, et al. 2011; McWilliams, et al. 2012; Newhouse, et al. 2012). In this paper we bring new evidence to bear on this controversy, but first we provide some background for those unfamiliar with the MA program.

The Medicare Advantage Program

Prior to 1998 MA plans were reimbursed at a take-it-or-leave-it price that was 95 percent of the risk-adjusted TM spending per beneficiary in the beneficiary's county of residence. Between 1998 and 2006 there was a reimbursement formula that was complex, but usually was a take-it-or-leave-it price somewhat above 100 percent of the TM risk-adjusted spending per beneficiary. Since 2006 plans have bid against a benchmark, which is closely related to a voucher, and whose level was above 100 percent of TM risk-adjusted spending. The Affordable Care Act of 2010 set in motion a transition to a system in which the benchmark

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¹Guaranteed issue and renewability mean that the insurer must accept all applicants and renew them at a non-discriminatory rate. Pre-existing condition clauses mean insurance contracts can, at least for some specified period of time, exclude any pre-existing medical problems from coverage. The standardization of benefits is to plans with four levels of actuarial value, 60, 70, 80, and 90 percent. Risk adjustment is a transfer of funds from insurers with a more favorable pool of risks as determined by observable characteristics, for example diagnosis, to insurers with a less favorable pool.

²There was, however, substantial selection in the individual Medicare supplementary insurance market.

³When Medicare began the subsidy was only 50 percent, but now is 75 percent. Currently the subsidy is reduced for beneficiaries in the upper 5 percent of the income distribution, and the President's 2014 budget proposes to reduce that subsidy further and for a larger group.

is a percentage of the TM risk-adjusted spending per beneficiary in the beneficiary's county of residence, with the percentage varying from 95 to 115 percent, depending on the level of TM spending in the county.⁵ If the plan bids less than the benchmark, and almost all plans do, plans receive a rebate that varies between 50 and 70 percent of the difference between their bid and the benchmark; they must use the rebate to lower premiums, lower cost sharing, or cover additional services.⁶ The government keeps the other 30 to 50 percent of the difference.

In contrast to TM, which contracts with virtually all physicians at a take-it-or-leave-it price and keeps the price of a medical service to a beneficiary largely independent of the choice of physician or hospital, MA plans negotiate prices with physicians and hospitals and establish networks, meaning beneficiaries pay more to use out-of-network or less preferred physicians.⁷ Although the prices MA plans pay hospitals and physicians are not public, conversations with actuaries indicate that they are somewhat above TM prices. To compete with TM MA plans must offset this input price differential, and they use two main methods to do so. They can control the utilization of services directly through command-and-control techniques such as utilization review and prior authorization (Keeler, et al. 1998), techniques that TM does not use, and they can use differential cost sharing across providers to steer beneficiaries to less costly providers.⁸ Through these techniques and the generally higher reimbursement that they receive and that they pass back to the beneficiary as additional benefits, they compete with TM by being less costly to the beneficiary. In effect, the beneficiary trades off network restrictions and utilization review, which potentially reduce moral hazard, for additional benefits and lower cost.⁹

Medicare has always required guaranteed issue and guaranteed renewal for MA plans, meaning a plan must accept any Medicare beneficiary who chooses to enroll and must continue to enroll the beneficiary at a non-discriminatory rate. Like TM, there are no pre-existing condition exclusions. Until 2006 Medicare beneficiaries could choose to leave MA and move to TM monthly. Not surprisingly under these conditions there was selection against TM; worse health risks valued TM's free choice of physician (i.e., absence of networks) and minimal utilization review and those who might want a medical procedure from an out-of-network physician could disenroll from MA and subsequently re-enroll. Although MA plans must accept all applicants, their actions can in principle affect selection through their choices of physician networks, drug formularies, and marketing (Frank, et al. 2000; Ma and McGuire 2002; Cao and McGuire 2003). Both networks and formularies, however, are regulated for standards of adequacy, and CMS, the agency administering Medicare, as well as senior assistance agencies seek to make the market more transparent to beneficiaries.¹⁰

In addition to regulating networks and formularies, Medicare risk adjusts plan payments to further blunt incentives of plans to engage in favorable selection. This means it calculates

⁴Beneficiaries enrolling in Part C must also enroll in Part B but receive those services through their plan.

⁵At the end of the transition in 2017 the benchmark will be 95 percent of TM spending in the highest quartile of counties, 100 percent in the next quartile, 107.5 percent in the third quartile, and 115 percent in the lowest quartile. Counties must be re-ranked no less often than every three years.

⁶The percentage any individual plan receives depends on its quality rating. Plans must be above a certain quality level to receive the rebate, but it is unlikely that a plan not receiving a rebate could effectively compete with plans that do.

⁷Most physicians accept assignment, but those who do not can bill up to 10% above the Medicare Fee Schedule.

⁸Providers may be less costly because the negotiated price with the MA plan is less or because they are clinically more conservative in treating an illness or both. Because coverage in MA must be at least as good as in TM, to deny a service an MA plan must show that it is not medically necessary, a decision that can be appealed. The description in the text applies to MA-HMO plans, which account for about two-thirds of the enrollment in MA. We describe the remaining third below.

⁹Medicare beneficiaries who have subsidized retiree health insurance from a private employer or who are eligible for Medicaid may not have lower cost in MA. Increasingly, however, employers are converting retiree health insurance to a defined contribution plan so that retirees do obtain additional benefits from MA plans and states are shifting their Medicaid eligible population into MA plans.

the expected cost of a beneficiary in TM based on certain observable characteristics and redistributes monies from plans with a lower expected cost mix of beneficiaries to those with a higher expected cost mix (Newhouse 1996; Newhouse 2002). This redistribution, however, occurs entirely among MA plans; there is no redistribution between MA and TM. Finally, CMS has the authority to exclude any plan that it deems to be engaging in selection, although as far as we know, it has never excluded a plan.¹¹

Historically MA experienced favorable selection; in 1997 the Congressional Budget Office estimated that the federal government paid 8 percent more for MA beneficiaries than it would have paid for them in TM despite paying only 95 percent of the cost of the average TM beneficiary (Congressional Budget Office 1997). At this time, however, the observable characteristics that Medicare used to risk adjust reimbursement were primarily age and gender. These variables only explained about 1 percent of the variation in individual health spending, raising the concern that plans might be taking actions to avoid beneficiaries whose expected cost was above average for their age-gender group. Put simply, plans could profit by disproportionately enrolling healthy beneficiaries within an age-gender cell. Alternatively, even with no effort by plans to select, sick patients could simply differentially value TM's lack of network provisions, which were of course inherent in MA. Note, however, that sorting of beneficiaries between TM and MA according to their preferences for cost savings versus restrictions on utilization or providers could improve social efficiency even if it raised federal spending.

To the degree plans were actively engaged in attracting less costly enrollees within an age-gender category, better risk adjustment would diminish their incentive to do so. Hence in 1997 the Congress mandated that a risk adjustment method that accounted for a beneficiary's health status be developed, and in 2003 it mandated that starting in 2006 enrollees could no longer disenroll monthly throughout the year, although they remained able to disenroll in the first months of a calendar year.

The new risk adjustment system that accounted for health status was based on diagnoses recorded on claims forms and was called CMS Hierarchical Condition Categories (CMS-HCC's), which for convenience we shorten to HCC's (Pope, et al. 2004). In determining the reimbursement a plan receives for a specific beneficiary, the HCC system accounts not only for the beneficiary's diagnoses on claims forms from the prior year, but also age, gender, the reason for original eligibility for Medicare (disabled or not), and whether the individual is Medicaid eligible.¹² For example, under this system a plan is paid more for a beneficiary with a diagnosis of lung cancer than for an otherwise similar beneficiary with a diagnosis of diabetes, whereas earlier it had been paid the same amount for persons with the same demographic characteristics who had those two diagnoses or for that matter who had no diagnosis at all. If a beneficiary has multiple diagnoses, the system in general simply adds the weights for the diagnoses.¹³ Thus, the risk adjustment system establishes a set of relative supply prices across beneficiaries according to their diagnoses and demographic characteristics. The structure of the relative price system – for example, how much more a plan is paid for a lung cancer patient than for a diabetic – is based on the cost of treating the average individual in TM with the given diagnoses and demographic characteristics.

¹⁰Formularies, for example, must have at least two drugs in each of 146 exhaustive classes, and CMS operates a web site that beneficiaries can use to compare plans in their area, <https://www.medicare.gov/find-a-plan/questions/home.aspx>.

¹¹Since a plan must have CMS approval to operate, any aspect of the plan that CMS objects to is likely changed as part of the approval process.

¹²For newly eligible Medicare beneficiaries, principally those turning 65 years of age, reimbursement does not account for diagnosis for the first year of eligibility because Medicare lacks claims data from the prior year and hence does not have information on diagnosis.

Because MA's relative supply prices are based on costs in TM, the current method effectively assumes that any saving an MA plan achieves relative to TM is proportional across all diagnoses or combinations of diagnoses that make up the HCC categories. The proportionality assumption may be poor for multiple reasons. First, the unit prices private plans pay to acquire inputs differ according to the market power of the suppliers relevant for treating a given disease, whereas TM sets a take-it-or-leave-it price for hospital and physician services that is largely independent of the amount of market power providers possess in the commercial market and that the great majority of physicians and hospitals take. Some conditions such as diabetes are primarily treated by primary care physicians while others such as cancer are primarily treated by specialists (oncologists in the case of cancer); because specialists are less numerous than primary care physicians in any local market, they tend to possess more market power. As a result, the prices or fees plans pay various physicians for services for different conditions likely vary from those paid by TM according to the market power of the providers primarily used for that condition.

Second, MA plans practice active medical management whereas TM tends to passively reimburse services at the take-it-or-leave-it price. But such management has potentially higher returns for some conditions than for others. For example, medical management can sometimes reduce the frequency of exacerbations of chronic diseases, for example by promoting compliance with prescribed regimens such as drugs or periodic examinations, thereby preventing hospitalizations. Utilization management and case management can also reduce the use of low value discretionary services. By contrast, such management may have at best modest effects for acute conditions that require rapid intervention, such as acute myocardial infarction or major trauma. As a result, the real resource costs of treating a patient in MA relative to those in TM are likely to be relatively lower for those with chronic conditions amenable to disease management and relatively higher for acute conditions.

A variant of this argument relates to benefits for drug coverage. MA enrollees obtain their drug coverage through their MA plan (Medicare Advantage – Plan D or MA-PD) whereas TM enrollees buy a stand alone Prescription Drug Plan (PDP). For patients with diagnoses for which compliance with drug regimens can have important effects on hospital and physician cost, MA plans have stronger incentives than do PDP's to encourage compliance, not only through disease management techniques but also by setting lower drug copayments.

The HCC risk adjustment system was phased in from 2004–2007.¹⁴ It explained much more of the explainable variation in individual annual spending than did the prior system of age and gender; the proportion of the explained variance rose from around 1 percent to 11–12 percent (McGuire et al. 2011).¹⁵ Starting in 2006 there have also been restrictions on disenrollment from MA plans, as mentioned above. The duration of the lock-in period that began in 2006 has steadily lengthened. In 2006 it only applied to the second half of the year, between 2007 and 2010 it applied to the last nine months, and starting in 2011 to the last 10.5 months of the year. Prior to 2006, when monthly changes from MA to TM were permitted, it was not difficult for an MA beneficiary who received a new diagnosis in the middle of the year and wanted to go out of network to have it treated to do so, but the lock-in has curtailed this ability.¹⁶

¹³There are a handful of diagnosis-diagnosis interaction terms.

¹⁴The weight on the HCC system was 30% in 2004, 50% in 2005, 75% in 2006, and 100% in 2007 and subsequent years.

¹⁵Much of the variation in annual spending is unpredictable, but one can predict on the order of 20–25% of the variance in annual spending across individuals using a model with an individual fixed effect and a first order autoregressive term (Newhouse 2002). In addition, some time varying variables that predict spending are observable by a plan, such as a new diagnosis or pregnancy. Hence, the 20–25% figure is a lower bound.

The MA Plan's Maximization Problem

In principle MA plans would like to enroll any beneficiary for whom reimbursement exceeds expected treatment costs. This is almost certainly not all beneficiaries in a market for several reasons, including variation in expected cost across patients with a given set of observable characteristics. Thus, assume the plan's goal is:

$$\max \pi = \sum_i \left(\sum_{j=1}^{n(i)} (R_i - C_{ij}) \right)$$

where i indexes the cells defined by the observable characteristics used in the reimbursement formula, that is, age, gender, disability status, Medicaid status, and their interactions plus diagnosis category or unique combination of diagnostic categories, and j indexes beneficiaries. The sum over j is from 1 to n_i where n_i is the number of beneficiaries enrolled in the plan with observable characteristics i . R_i is the revenue a plan receives for a person with observable characteristics i , and C_{ij} is the cost to the plan of treating beneficiary j with observable characteristics i . Following (Frank et al. 2000), (Cao and McGuire 2003) and (Ma and McGuire 2002), n_i is a function of the plan's choices with respect to networks, utilization management, and formulary choices.

Let j be ordered by the plan's cost of treating the individual with characteristics i such that $C_{ik} > C_{ij}$ for $k > j$. Since R_i is an average over the C_{ij} of those in TM with the same observable characteristics, it is almost certainly true that some $C_{ik} > R_i$ so that not all enrollees in a category are expected to be profitable and conversely that some are expected to be profitable. Hence, the first order condition for the plan is simple; make choices with respect to providers in its network, utilization management, and formularies to maximize the probability of attracting beneficiaries for whom $R_i \geq E(C_{ij})$ for all i and not others (Ma and McGuire 2002).

Apart from the main effects for age, gender, whether the individual was originally eligible for Medicare because of disability, whether the individual is eligible for Medicaid, and the interactions of those variables, R_i is constant for all j who share a similar set of diagnoses. In what follows we focus on the difference in relative cost between MA and TM in treating persons with various diagnoses or combinations of diagnoses although the variation in revenue and cost from the demographic terms is included in our empirical analysis.

Glazer and McGuire have recently taken up the issue of the optimal allocation of beneficiaries between MA and TM (Glazer and McGuire 2013).¹⁷ In answering that question, they focus on differences in consumers' tastes for care unrelated to health status and the socially efficient sorting of individuals with heterogeneous tastes between TM and MA. Whereas an implicit assumption in many discussions of MA is that selection is inefficient, their results imply that individual's with the weakest and strongest tastes for medical care unrelated to health status should be in TM and those whose tastes cluster around the average should be in MA.

We are addressing the positive question of actual sorting or selection given a plan's goal of attracting profitable patients conditional upon the risk adjustment methods Medicare employs and the lock-in period. We do not take up the question of socially efficient sorting given variation in tastes unrelated to health status for several reasons. First, we lack information on tastes. Second, the relevant first order conditions are a function of the

¹⁶Over half the beneficiaries disenrolling from MA in the years 2003–2008 had re-enrolled in MA within a year (Newhouse et al. 2012)

marginal enrollee's revenue and expected cost, but our data, described next, relate to average revenue and average realized cost for various i . Third, an unknown amount of the variation in cost that we observe comes from variation in unit price rather than real resource use. Brown, et al. (2011) have also addressed the effect of the HCC system on selection by looking at selection within HCC rather than across HCC's, that is selection across j within i rather than selection across i . We comment further on Brown, et al. below.

Data

We have obtained data on the cost of care from two MA-HMO plans and have used those data to calculate how margins, or average revenue/average cost, vary across 48 HCC's or unique combinations of HCC's.¹⁸ As a condition of obtaining the data, we agreed to keep actual margins confidential; therefore we have subtracted a fixed constant from each HCC or combination of HCC's.¹⁹

The first plan, Plan 1, is more typical of the universe of MA-HMO plans because it is not vertically integrated with the delivery of care, meaning it does not produce any services in house but rather contracts with independent hospitals and physicians for all care. The second plan is vertically integrated with the delivery of care. In the case of Plan 1, the cost data are the plan's payouts to medical providers; they do not include the plan's administrative cost. Plan 2's data also exclude administrative costs connected with the insurance function, but do include the overhead costs that the plan's internal accounting system allocates to clinical services. For example, Plan 2's costs for HCC i include the costs for utilities, space, and supplies that it uses to produce the services used to treat diagnosis i . Although these costs are implicitly in the costs that Plan 1 pays, the cost allocations to specific services and hence the margin data for the two plans are not strictly comparable.²⁰

If a plan's cost to treat a person with a given diagnosis or diagnoses and the same demographic characteristics were proportional to the costs in TM for all persons, these margins would be constant across all 48 categories, but as we shall show below, they are not. The principal aim of this paper is to examine whether the varying margins across HCC's influence selection; i.e., whether beneficiaries in HCC's with higher margins are overrepresented in MA plans. Because the first order condition yields conditions for the marginal patient within HCC based on expected cost whereas we have data on realized average cost across HCC's, we must assume that the distribution of expected cost within groups across different diagnoses is sufficiently similar across HCC's such that if $(R_i/C_i) > (R_k/C_k)$ for all $k \neq i$, the plan maximizes profit by enrolling a higher proportion of beneficiaries in category i than in category k and conversely. In effect, we assume the varying cost advantage for MA plans across diagnoses shifts the entire distribution of cost for a diagnosis such that it makes it profitable to enroll a greater fraction of Medicare beneficiaries for diagnoses for which the MA plan has a cost advantage. Thus, we rely on the very large differences in margins that we observe across diagnoses to swamp any differences in the rate of profit or loss on the inframarginal beneficiaries across HCC's.

¹⁷In that paper Glazer and McGuire establish that both what they term "health-status-based risk adjustment," which is the intent of HCC adjustment and the focus of this paper, as well as "taste-for-medical-care-related premiums" are necessary to achieve economic efficiency. Most of their attention, however, is devoted to taste-related premiums, and they show that persons with greater tastes for medical care should face higher premiums. The present paper is also related to the earlier optimal risk adjustment paper of Glazer and McGuire (Glazer and McGuire 2000). In that paper Glazer and McGuire show that optimal assignment does not base risk adjustment on expected cost for a given set of observables but rather overweights observables that are correlated with unobservables that predict cost in order to reduce selection. The results in this paper suggest that the need to overweight be less of a concern.

¹⁸In order to minimize sampling error, Plan 1 selected 48 common HCC's or combinations of HCC's and provided us with total revenue, total medical cost, and member-months in those HCC's or combination of HCC's. This set of 48 HCC's was duplicated for Plan 2.

¹⁹We used a different constant for each plan.

In addition to the two MA-HMO plans for which we have cost data, we have used the data from Plan 1, the plan we consider more typical, to look at whether its margins predict selection in all MA-HMO plans. In addition to the HMO option, which enrolled the majority of MA beneficiaries, MA has a Private Fee-for-Service (PFFS) option that until 2011 had no network restrictions and no utilization management and typically had higher cost sharing amounts than MA-HMO plans.²¹ In many geographic areas this plan dominated TM. We also have used the margins of Plan 1 to look at selection in all PFFS plans, although the cost data we have did not come from and likely do not apply to PFFS plans. Thus, using PFFS data is in the spirit of a falsification test.

Methods

We obtained the data from the two plans with a promise of confidentiality; thus, we are necessarily vague about the characteristics of the plans. But both plans are reasonably large; we have over 2 million member-months of data for one plan and over 1 million for the other for the HCC's that we use in the analysis. In order to minimize sampling error, Plan 1 selected 48 common HCC's or combinations of HCC's and provided us aggregate revenue and cost data for those HCC's. This set of 48 HCC's was duplicated for Plan 2. For Plan 1 the data are from 2010 and 2011; for Plan 2 they are from 2006 and 2007. For both plans we have pooled the data from the two years to reduce sampling error. In the case of both plans, we have accounted for the revenue from and the cost of drugs used to treat the beneficiary, since the great majority of each plan's enrollees enroll in each plan's Part D offering and thus their drug use affects the profitability of each enrollee.

Specifically, we calculate margins for a given HCC or combination of HCC's i as:

$$\text{Average Margin HCC}_i = \left(\sum_j \text{Revenue HCC}_{ij} / \text{Cost HCC}_{ij} \right) - 1,$$

where i indexes a unique combination of HCC's that apply to person j (this could be only one HCC) and j indexes persons with the HCC or HCC's that make up i . The Revenue term in this expression includes any adjustment for demographic variables in the risk adjustment formula, so i varies only over diagnosis.

The term in parentheses in this expression is equivalent to 1/Medical Loss Ratio (MLR) for category i .²² To keep actual margins confidential we have subtracted a constant from each value we calculated, thus preserving the pattern and magnitude of variation in margins across the HCC's. One can infer that on average across all HCC's, including those omitted in this analysis, margins are positive, or the plans would exit the market. Nonetheless, some of the HCC categories in this analysis do exhibit actual realized negative margins or, equivalently, MLR's that exceed 100 percent.

²⁰We published an earlier paper using Plan 2's data, in which we replicated the specification of the regression used to produce the CMS-HCC weights using the plan's cost accounting data rather than TM data as the dependent variable (Newhouse, et al. 2011). We then compared the resulting weights (regression coefficients) with the weights that Medicare uses that are derived from TM. The striking results from that work were that the plan suffered large losses for the two HCC's that it did not produce in house but instead contracted with outside providers to provide, namely major organ transplant status and dialysis status and that the weights using the plan data were very different than those derived from TM. In the case of the two HCC's that the plan did not produce in house, the outside providers possessed substantial market power that they could not exert against TM. Because the plan's reimbursement for those two HCC's was based on TM, it suffered accounting losses. In that paper we did not examine the amount of any deadweight loss from this mispricing. We also did not account for HCC's coming bundled with a person for the many beneficiaries with multiple chronic diseases, a flaw we remedy in this paper.

²¹Starting in 2011 private fee-for-service plans were required to have networks and such plans have largely disappeared from the market.

To examine selection across HCC's we used data on each plan's share of enrollees in each of the 48 categories for which we had margin data and asked whether the plan's margins predicted any difference in MA and TM shares in those categories. If either plan were engaging in selection, we would expect higher margin HCC's to be overrepresented in that plan compared with the share in TM in the plan's service area and thus the difference in share to be positively related to the margin. As a test of robustness, we also asked whether the margins predicted the ratio of the MA and TM shares. Finally, we used the margins of Plan 1 to see if they predicted over- or underrepresentation of beneficiaries in these HCC's in all MA-HMO and all MA-PFFS plans in 2008 relative to TM.²³

The HCC model that CMS uses for risk adjustment is mainly additive; that is, if a Medicare Advantage enrollee has two or more conditions, the risk score, which governs reimbursement, is generally the sum of the main effects for each condition. The initial model's specification had only six HCC-HCC interactions among the 70 HCCs (Pope et al. 2004). Using TM data, the Medicare Payment Advisory Commission has shown that the CMS-HCC model underpredicts TM cost for those with five or more HCCs and underpredicts TM cost even more for those with eight or more HCCs (Medicare Payment Advisory Commission 2012). A correctly specified model should show approximately constant cost as the number of HCC's varies, so this result suggests omission of positive HCC-HCC interaction terms.

At our request Plans 1 and 2 carried out two similar tests using actual MA cost data rather than the TM cost data that the Medicare Payment Advisory Commission used. It is, of course, these costs that are relevant to MA plans' decisions. First, we asked whether the Medical Loss Ratio (MLR) was approximately constant with respect to the number of HCCs a beneficiary had. Second, we asked whether the MLR relates to the risk score, which is the sum of the weights for all HCC's of a given beneficiary including any relevant HCC-HCC interaction terms.

Results

Both plans have margins that vary greatly across the 48 HCCs or combinations of HCC's (Figures 1 and 2); the range is 160 percentage points in the case of Plan 1 and 98 percentage points in the case of Plan 2. The two plans' margins are related ($r=0.39$, $p < 0.003$).²⁴ The observed correlation is diminished by sampling error, the accounting attribution of administrative cost to specific services in the case of Plan 2, and any changes in medical technology in the four year interval separating the data from Plan 1 and Plan 2.

Data from both plans suggest that margins are related to the market power of the providers that treat the given condition and to plan's ability to manage the condition medically. The highest margins are found for the conditions to the left in both Figures 1 and 2. For Plan 1 these include diabetes, both with and without additional HCC's, as well as congestive heart failure and chronic obstructive pulmonary disease. More specifically, among the 48 HCC's or combinations of HCC's shown in Figure 1, 12 involve diabetes; four of these 12 are among the seven HCC's or combinations of HCC's with the highest margins, and eight of the 12 are in the top third. There are six HCC's involving congestive heart failure; four of the six are among the ten highest margin HCC's. The three HCC's involving chronic obstructive pulmonary disease are all in the top half of margins. These are conditions that are usually managed by primary care physicians, where the plan's negotiating position is

²²The medical loss ratio (MLR) is the ratio of the plan's payout to providers of health care to its premium; under the provisions of the Affordable Care Act, Medicare Advantage plans must have MLR's of at least 85 percent.

²³We used data from 2008 because those are the data we could obtain.

typically stronger because of the greater number of such physicians. These conditions are also amenable to medical management because disease control can be achieved through a mix of cognitive evaluation and management services, medications, and case management, without need for specialized procedures.²⁵ In other words, successful outpatient management can avoid complications and hospitalizations.

At the other end of the spectrum, many of the HCC's with relatively low margins in Figure 1 are typically treated by specialists who may possess market power in many local markets. They also tend to be diseases that are less amenable to medical management. Plan 1's lowest margin is for unstable angina and other acute ischemic heart disease, potentially reflecting the lesser ability of the plan to manage treatment because of the acute nature of the disease and the established protocols for treating it. Nine of Plan 1's 12 lowest margin HCC's are the six cancer HCC's, plus those for multiple sclerosis, inflammatory bowel disease, and rheumatoid arthritis. The treatment of all nine of these conditions is often by specialists and may involve expensive injectable or intravenous drugs for which the specialist likely receives a higher markup than Medicare pays.²⁶ Care for other conditions associated with lower margins, either as a single HCC or when paired with another condition, often involves discretionary procedures. These conditions include heart arrhythmias, vertebral fractures, and angina pectoris/old myocardial infarction (or chronic stable angina). Elective procedures for these conditions may produce limited clinical benefits but nevertheless garner high margins from private payers, making them difficult targets for utilization management.²⁷

Consistent with the positive correlation between the two plans' margins, the pattern of margins in Plan 2 is similar to that of Plan 1. HCC's with diabetes also tend to have high margins in Plan 2; 10 of the 12 HCC's involving diabetes are in the top 18 HCC's. Also like Plan 1, four of Plan 2's six lowest margin HCC's include unstable angina and other acute ischemic heart disease, inflammatory bowel disease, rheumatoid arthritis, and multiple sclerosis.²⁸

Turning to potential selection, Table 1 shows descriptive data from each plan on over- and under-representation of persons in MA relative to TM in HCC's with varying margins. Although the margins cover a wide range, the distribution of shares across HCC's in each plan do not much depart from the distribution of shares in TM, especially Plan 1's distribution. The standard deviation of the difference in shares across the 48 HCC's in Plan 1 is only 0.6 percentage points, and the maximum deviation in either direction is 2.2 percentage points (which increases to 3.2 percentage points among those age 65–74, probably because of a higher proportion of sampling error). The standard deviation of the difference in shares in Plan 2 is 1.2 percentage points, and the maximum deviation is 4.7 percentage points.

Table 2 shows the results of a regression in which the dependent variable is the difference between each plan's share of the members in the 48 HCCs or HCC groups and the corresponding share in TM. The explanatory variable is the margin shown in Figures 1 and 2. Figure 3 shows the corresponding scatterplots for these two regressions and also illustrates the closeness of the distribution of shares in MA and TM, especially in Plan 1. For

²⁴This value is a weighted correlation using the number of member months as weights and is a one-tail test. The unweighted correlation is 0.32, $p = 0.012$ using a one-tail test.

²⁵For example, see references 19–24 in (McWilliams, et al. 2009) and 57–63 in the appendix to (McWilliams et al. 2009) as well as references 36–44 in (McWilliams, et al. 2007).

²⁶Medicare reimburses the physician the average national sales price of the drug plus 6 percent; the markup can be much higher for private plans. The weight on the HCC, however, which governs revenue to the plan, reflects the 6 percent markup that traditional Medicare pays.

²⁷See for example (Buchbinder, et al. 2009) showing that vertebroplasty has negligible benefit and (Boden, et al. 2007) that primary care angioplasty for stable coronary artery disease had no additional benefit given optimal medical therapy.

robustness Table 2 also shows specifications in which the dependent variable is the ratio of the two shares and specifications in which the sample is restricted to those aged 65–74 since older beneficiaries are underrepresented in MA. There is no detectable relationship in any of the specifications; that is, neither plan appears to have an overrepresentation of members in the more profitable HCC categories nor an underrepresentation among the less profitable categories.

In the case of Plan 1, the point estimate of the coefficient is negative, meaning higher margin HCCs are, if anything, more likely to be underrepresented. The upper end of the 95% CI indicates that a 1 percentage point increase in the margin is associated with a 0.16 percentage point increase in the difference in shares. The specifications using ratios are more variable than those using differences because several of the HCCs have small shares in the denominator of the ratio, and so the effect of margin is less precisely estimated than using differences.

Table 3 shows similar regressions using differences and ratios of shares for the entire MA program as a function of Plan 1's margins (since it is the more typical plan). Again there is no association, but attenuation bias diminishes the ability to detect any true relationship given that margins surely differ for other MA plans.²⁹ Nor is there any relationship for PFFS plans, although that is not surprising since the pattern of margins likely differs for PFFS plans.

Figures 4 and 5 show how margins vary with the beneficiary's number of HCC's. In the case of Plan 1, the MLR's steadily rise, indicating that margins steadily fall. This regular pattern, however, is not found in Plan 2, although margins are hardly constant as the number of HCC's varies. Figures 6 and 7 show the samples for each plan divided into three roughly equal size groups that are ordered by risk score, which are the sum of the HCC weights. A well performing model would show reasonably constant MLR's across the three risk score groups. Neither plan shows constant MLR's, suggesting that the largely additive model underlying the CMS-HCC weights is missing disease-disease interaction terms.

DISCUSSION

Historically there has been favorable selection into MA, but the data demonstrating that favorable selection came from a time prior to use of the CMS-HCC risk adjustment mechanism and the institution of a partial year lock-in. More recent data are consistent with a substantial decline in favorable selection (McWilliams et al. 2012; Newhouse et al. 2012). Specifically, the percentage of MA beneficiaries who rate their health as fair or poor is no longer significantly different from the percentage of TM beneficiaries who do so, although in earlier years it was different. Age-sex adjusted mortality differences between MA and TM enrollees, which earlier strongly favored MA, have fallen by a factor of two and have essentially vanished for those enrolled in MA more than five years.

This paper has sought to address the current extent of selection into MA by examining differences between the shares of beneficiaries in two MA-HMO plans relative to TM in their respective service areas in 48 HCC's or combinations of HCC's. These data come from a period after the full or nearly full implementation of the CMS-HCC risk adjustment method and the implementation of a lock-in period.

We have five main findings:

²⁸As mentioned in a prior footnote, in an earlier paper that the regression weights for the two HCC's the plan contracted out and paid market prices for, dialysis status and major organ transplants, had by far the two lowest weights relative to reimbursement. The first plan had too few cases in these two HCC's to compute a reliable margin, so we did not include them in the set of 48 analyzed here.

1. Margins in the two plans vary greatly across the 48 HCC's or combination of HCC's for which we obtained data; the range is 160 percentage points for Plan 1 and 98 percentage points for Plan 2. Thus, the cost of treatment in both plans is not a constant proportion of the cost of treatment in TM, suggesting that both plans have a stronger incentive to attract beneficiaries in certain HCC's than in others.
2. The margins for the two plans across the 48 HCC's are correlated ($r = 0.39$, $p < 0.01$). The observed correlation is diminished by sampling error and some inevitable non-comparability in the cost data for the two plans.
3. Both plans make higher margins on patients with chronic diseases that are amenable to medical management and that tend to be treated by primary care physicians, especially diabetes. They make smaller margins on diseases that are less amenable to medical management and/or where they must purchase inputs from specialist physicians who have more market power than the more numerous primary care physicians.
4. We find no evidence of selection across HCCs by the size of the margin; higher margin HCCs are not overrepresented in either plan when compared with their representation in TM in the plans' respective service areas using the plans' respective margins. Nor, using the first plan's margins, which we believe are more typical of the universe of MA plans, are higher margin HCC's overrepresented in all MA-HMO plans.
5. In both plans margins are not constant with respect to the number of HCC's nor with respect to risk scores, implying that the CMS-HCC model is misspecified and should have (probably many) more terms that interact one HCC with another. Using TM rather than MA data, MedPAC recently came to the same conclusion (Medicare Payment Advisory Commission 2012).

A profit maximizing plan seeks to configure its networks and formularies, including the cost sharing "tiers" that it places various providers and drugs on, and carry out its marketing to maximize the likelihood of enrolling enrollees within an HCC that it expects to be profitable and minimize the likelihood of enrolling those that it expects not to be. We could not observe expected profitability at the margin, only average realized profitability of various HCC's. But given the range of ex post margins that we observed in two different plans, we would expect to find an overrepresentation of enrollees in the more profitable HCC's in the two plans had either been able to successfully select across HCC's. Instead we observed no relationship in two different MA plans and in fact a rather similar distribution of enrollees across the HCC's as in TM.

Why did we observe no association? Plans must accept all enrollees who apply and cannot vary cost sharing or premiums across enrollees by HCC, although plans could have larger networks in the higher margin HCC's and could cover more drugs and/or cover them more extensively if they are used in the higher margin HCC's. CMS, however, regulates both of these instruments, limiting plans' discretion; in particular, there are minimum standards for both networks and formularies. In principle, plans also have marketing as an instrument, although we have not observed any plan marketing to, say, diabetics as opposed to cancer patients.

Using the Medicare Current Beneficiary Sample (MCBS) linked with Medicare claims, Brown, et al. (2011) reached the conclusion that plans are able to attract lower cost members within HCCs. The results in Newhouse, et al. (2012), however, show that Brown, et al.'s results from the MCBS do not hold up using the much larger 20 percent sample of claims and adding one additional year; on the contrary, selection within HCCs appears to have

decreased as the HCCs phased in, contrary to Brown, et al.'s conclusion. Comparisons of self-reported health and utilization between new and incumbent MA enrollees in the Medicare Current Beneficiary Survey also do not show selection within HCCs in 2006 and 2007 (McWilliams, et al. 2012).

The results in the present paper cast further doubt on the conclusions of Brown, et al. For plans that are not integrated, as most MA plans are not, it is almost certainly less costly to select across HCCs, the subject of this paper, than to select within HCCs, the subject of the Brown, et al., paper, and we find no evidence of selection across HCC's. As just pointed out, in principle the MA plan could structure its networks or formularies to favor or disfavor certain HCCs, but it is surely much more difficult to do so in a way that would disproportionately attract only the less costly beneficiaries within an HCC.

The results in this paper have the limitation that they rely on data from only two MA plans. Although both plans are reasonably large, one is atypical because it is more integrated than most MA plans; the other, however, is reasonably typical with respect to its degree of integration. Nonetheless, their margins show similarities. Of course, margins by HCC may well differ in other plans just as the margins in these two plans differed.

Finally, the results suggest a flaw in the calibration of the HCC model. As noted, that model is for the most part additive across HCCs; that is, if a beneficiary has diagnoses that qualify in two or more HCCs, for example diabetes and cancer, the reimbursement for that beneficiary is the sum of the weight for each HCC. Although there are 70 main effects in the model there are only six first order interaction terms (Pope et al. 2004). One might improve the model by adding more interaction terms, or, if the resulting weights cannot be precisely estimated, by including dummy variables for the number of HCCs for beneficiaries with multiple conditions, and/or interacting the number of HCCs an individual has with the HCC of each individual, i.e., estimating a separate set of weights for all beneficiaries with a given number of HCCs. Using TM rather than MA data, MedPAC has recently found the same phenomenon and made the same suggestion (Medicare Payment Advisory Commission 2012). To the degree that plans are not selecting by margin, however, such recalibration would not improve in social efficiency.

In conclusion we return to the question Glazer and McGuire asked, "Who Belongs in Managed Care?" Medicare Advantage appears to be relatively less costly than TM in treating patients with certain diagnoses than others. Basing the CMS-HCC weights on TM data thus appears to give MA plans a strong incentive to select such patients, even to specialize in them.³⁰ Although such selection could be socially efficient, there is no evidence here that plans act on this incentive – or perhaps regulations effectively prevent them from doing so. We emphasize, however, that these data do not permit overall conclusions on social efficiency.

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²⁹Another explanation for the lack of relationship is that the MA enrollment data are from 2008 whereas the margin data for Plan 1 are from 2010 and 2011.

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Highlights

Margins of two Medicare Advantage plans vary systematically by condition.

Margins vary widely by condition.

Margins are higher for conditions whose input suppliers have less market power.

Higher margin conditions are not overrepresented in Medicare Advantage.

The risk adjustment model used by CMS appears misspecified.

Figure 1. Margin (less a constant)* Varies by HCC, Plan 1

*Margin is Revenue from HCC_i/Cost of HCC_i-1. In addition, an arbitrary constant has been subtracted from each value to preserve confidentiality.

Figure 2. Margin (less a constant)* Varies by HCC, Plan 2

*Margin is Revenue from HCC_i/Cost of HCC_i-1. In addition, an arbitrary constant has been subtracted from each value to preserve confidentiality.

Figure 3. Scatterplot of Fitted Line of Regressions in Table 2
 Note the scale of the vertical axis differs between Plan 1 and Plan 2.

Figure 4. (Medical Cost + a Constant)/Reimbursement and Proportion of Enrollees, by number of HCCs, Plan 1

Figure 5. (Medical Cost + a Constant)/Reimbursement and Proportion of Enrollees, by number of HCCs, Plan 2

Figure 6. Medical Loss Ratio plus a Constant, by Tertiles of Risk Score, Plan 1

Figure 7. Medical Loss Ratio by Tertiles of Risk Score, Plan 2

Table 1
Descriptive Data on Plan Shares by Category and Over- and Underrepresentation*

	n	Mean	SD	Min	Max
Plan 1					
MA Plan 1 margin less a constant, by HCC	48	-0.444	0.392	-1.333	0.266
MA Plan 1 share, by HCC	48	0.021	0.030	0.004	0.185
TM share by HCC, all ages	48	0.021	0.029	0.001	0.164
Difference = (MA Plan 1 share - TM share), all ages	48	0.000	0.006	-0.022	0.016
Ratio = (MA Plan 1 share/TM share), all ages	48	1.018	0.233	0.541	1.542
TM share by HCC, ages 65-74	48	0.021	0.035	0.003	0.217
Difference = (MA Plan 1 share - TM share, ages 65-74)	48	0.000	0.06	-0.0	0.012
Ratio = (MA Plan 1 share/TM share), ages 65-74	48	1.155	0.328	0.623	1.915
Plan 2					
MA Plan 2 margin less a constant, by HCC	48	-0.172	0.209	-0.527	0.462
MA Plan 2 share, by HCC	48	0.021	0.029	0.003	0.164
TM share by HCC, all ages	48	0.021	0.030	0.003	0.186
Difference = (MA Plan 2 share - TM share), all ages	48	0.000	0.012	-0.026	0.047
Ratio = (MA Plan 2 share/TM share), all ages	48	1.175	0.897	0.211	1.463
TM share by HCC, ages 65-74	48	0.021	0.037	0.002	0.239
Difference = (MA Plan 2 share - TM share), ages 65-74	48	0.000	0.015	-0.074	0.045
Ratio = (MA Plan 2 share/TM share), ages 65-74	48	1.325	1.013	0.304	4.853
All MA					
HMO share, by HCC	48	0.021	0.031	0.002	0.184
PFFS share, by HCC	48	0.021	0.035	0.002	0.225

	n	Mean	SD	Min	Max
TM share, by HCC	48	0.021	0.030	0.003	0.184
HMO Difference = HMO share – TM share	48	0.000	0.014	–0.037	0.055
HMO Ratio = HMO share / TM share	48	1.092	1.018	0.311	6.591
PFFS Difference = PFFS share – TM share	48	0.000	0.012	–0.032	0.041
PFFS Ratio = PFFS share / TM share	48	0.997	0.634	0.388	3.273

TM shares are matched to plan's service area. The acronyms used in this table are as follows: MA = Medicare Advantage or Part C of Medicare; HCC = Centers for Medicare and Medicaid Services Hierarchical Coexisting Conditions, a system of classifying patients using the diagnoses recorded on claims forms from the prior year as well as demographic variables. The system assigns a weight to each patient based on the average cost of treating an observationally similar patient in traditional Medicare and revenues to each plan are adjusted up or down based on the average of the weights of their enrollees. TM = Traditional Medicare, or a beneficiary enrolled in Parts A and B. HMO = Health Maintenance Organization, a Medicare Advantage plan that uses controls on utilization and differential cost sharing among providers to reduce cost; TM uses neither of these tools. PFFS = Private Fee for Service, a Medicare Advantage plan that until 2011 allowed free choice of physician and had better benefits than TM. One would not expect the margin data we computed to predict behavior by PFFS plans.

Table 2

Over- or Underrepresentation in the MA Plans as a Function of Margin^{*}

Outcome [*]	R ²	Coeff	SE	95% CI
Plan 1				
MA Plan 1 - TM, all ages	0.0100	Margin -0.0014	0.0021	-0.0057 0.0028
		Constant 0.0006	0.0013	-0.0032 0.0019
MA Plan 1/TM, all ages	0.0013	Margin -0.0216	0.0875	-0.1977 0.1545
		Constant 1.3161	0.1670	0.9799 1.6523
MA Plan 1 - TM, 65-74	0.0083	Margin -0.0015	0.0024	-0.0064 0.0034
		Constant -0.0007	0.0014	-0.0035 0.0022
MA Plan 1/TM, 65-74	0.0002	Margin 0.0125	0.1234	-0.2359 0.2608
		Constant 1.1606	0.0727	1.0142 1.3069
Plan 2				
MA Plan 2 - TM, all ages	0.0135	Margin 0.0064	0.0081	-0.0099 0.0227
		Constant -0.0011	0.0022	-0.0033 0.0055
MA Plan 2/TM, all ages	0.0366	Margin 0.8195	0.6199	-0.4283 2.0673
		Constant 1.0087	0.0516	0.9049 1.1125
MA Plan 2 - TM, 65-74	0.0003	Margin 0.0011	0.0105	-0.0200 0.0223
		Constant 0.0002	0.0028	-0.0055 0.0059
MA Plan 2/TM, 65-74	0.0064	Margin 0.3861	0.7111	-1.0453 1.8175
		Constant 1.39180	0.1916	1.0061 1.7775

^{*} MA Plan *i* - TM is proportion of member-months in each HCC in MA Plan *i* less the corresponding TM proportion in Plan *i*'s service area; similarly, MA Plan *i*/TM is the ratio of the two proportions.

Table 3

Over- and Underrepresentation in the Medicare Advantage Program*

Outcome	R ²	Coeff	SE	95%	CI
All HMO – All TM	0.0038	Margin	0.0022	–0.0083	0.0126
		Constant	0.0010	–0.0052	0.0071
All HMO / All TM	0.0661	Margin	0.6683	–0.0772	1.4138
		Constant	1.3888	0.9494	1.8281
All PFFS – All TM	0.0007	Margin	0.0008	–0.0086	0.0102
		Constant	0.0004	–0.0052	0.0059
All PFFS / All TM	0.0341	Margin	0.2989	–0.1731	0.7708
		Constant	1.1301	0.1382	1.4082