Online Appendix

"Healthcare Spending and Utilization in Public and Private Medicare"
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A. Construction of the baseline sample

A.1 Raw data files

HCCI Files We have data from HCCI on a convenience sample of 2010 Medicare Advantage (MA) enrollees in three insurers: Aetna, Humana, and UnitedHealthcare (hereafter, "HCCI insurers"). The data were provided to HCCI by the private insurers and exclude enrollees in highly capitated plans, Special Needs Plans, plans with various data issues, and other limitations.[1]

The HCCI data contain four main files. There is an enrollment file, which we use to define the sample and obtain basic demographic information. The unit of observation is an enrollee-month. The enrollment file contains monthly indicators for enrollment, age (in bins of 10 years), gender, the enrollee's state of residence, and the enrollee zip code (masked for zip codes with a 2010 census population of less than 1,350).[2] We observe "exit" within the year from the HCCI data but do not directly measure mortality. The data also contain an indicator as to whether the plan covering the enrollee is HMO, PPO, or other, but do not contain information as to the identity of the insurer or other coverage details. In addition, there are three claims files – inpatient, outpatient, and physician – which we use to measure medical spending. In these files the unit of observation is a claim, payable by one of the HCCI insurers to a medical provider.

CMS Files We have data from CMS on the universe of individuals enrolled in Medicare at any point in 2010. This includes both those enrolled in Traditional Medicare (TM) and those enrolled in MA. For all enrollees – both those in TM and those in MA – we have four main files: the enrollment data base (EDB), the common Medicare enrollment file (CME), the Health Plan Management System (HPMS), and the Risk Adjustment Processing System (RAPS). The two enrollment files allow us to observe for every enrollee: exact date of birth, date of death (if applicable), gender, and zip code. They also include monthly data on whether the individual is enrolled in TM Part A, enrolled in TM Part B, enrolled in MA, whether they are dually covered by Medicare and Medicaid, and whether the individual died; note that dual coverage and mortality are observed in the CMS files for both MA and TM enrollees.

For enrollee-months in MA we also observe a plan identifier. Using the HPMS plan-level data on the parent organization, we are able to identify which plans are provided by the HCCI insurers,

[1] The description of the exclusion criteria come from HCCI, except for the exclusion of SNPs, which we determined by looking at the type of plan codes that appear in the HCCI enrollment file.

[2] When we analyze counties separately by urban/rural status, we assume the pseudo counties are rural, since 2010 census data indicate that 80 percent of them are in fact rural.

and also whether the plan is a Special Needs Plan (SNP), specialized Medicare Advantage plans for particular types of individuals (e.g. those in long term care institutions). We assign an MA enrollee an MA plan based on the first plan in which she is enrolled in the year.

The RAPS file has a risk score and indicators for each health indicator (HCC) that goes into the calculation of the risk score, for every enrollee. These HCCs are then integrated using a predictive formula that combines them together to form a risk score, which is a predictor of the enrollee's healthcare spending in the subsequent year. We observe these indicator for MA enrollees since MA plans must submit HCCs to CMS to determine their CMS payments. The RAPS file also contains indicators for the enrollees' type – community (90%), new (9%), or long-term institutional (1%) – and three risk scores (one for each type), and we assign each enrollee her type-specific risk score.

For TM enrollees only, the CMS data allows us to measure healthcare utilization and spending through 6 claims files: inpatient, outpatient, SNF, home health, durable medical equipment, and physician. A seventh claims file – the hospice claims file – contains utilization and spending for both TM and MA enrollees (since hospice is reimbursed by CMS for MA enrollees as well as TM enrollees); the hospice file is the only CMS file where we can observe utilization and spending for MA enrollees.

Finally, for MA enrollees we use the Monthly Membership Detail Report and the HPMS to construct information on revenues to MA insurers. Specifically, for each individual enrolled in an MA plan, we observe the payment from CMS to the insurer. The payment from CMS to the insurer consists of a part that is retained by the insurer and the rebate which is passed on by the insurer to the enrollee. We observe, for each plan, this rebate amount, as well as the Part C premium that is paid by the enrollee to the insurer. We define MA revenue for a given enrollee-month as the payments from CMS to the insurer minus the rebate to consumers, plus the Part C premiums.

A.2 Sample definition

We use the HCCI data to analyze spending and healthcare utilization for individuals covered by the HCCI insurers. We use the CMS data for two primary purposes: to construct comparison spending and healthcare utilization estimates for "comparable" TM enrollees, and to create an independent measure of enrollment in the HCCI insurers' plans that we use to examine and validate the completeness of the HCCI enrollment data. Both of these exercises require that we define a TM and an MA enrollee in the CMS data.

Throughout this paper, in the CMS data we define an enrollee as enrolled in MA if she is enrolled in MA for at least one month during 2010; we define someone as enrolled in TM if she is not enrolled in MA during any month in 2010, and is enrolled in TM Part A and TM Part B in at least one month during 2010. We count the enrollee-months in MA as the total number of months in MA during the year. Within MA, we can further identify the subset of MA enrollees who are in the three HCCI insurers. We restrict our analysis to enrollee-months who are 65 and over, who reside in one of the 50 states or the District of Columbia; we do not require individuals to be enrolled for a full year.

We can measure the completeness of the HCCI data in terms of enrollment by the HCCI insurers by comparing enrollee-month counts in the HCCI data to enrollee-month counts for these HCCI insurers in the CMS data, which in principle records the universe of enrollees in those same plans. Appendix Table A1 shows enrollee-month counts for the three HCCI insurers according to the HCCI data and the CMS data, overall, and separately by state. To analyze how "complete" the HCCI data are, we compare counts of enrollee-month by state in the HCCI data (column 3) to analogous counts of enrollee-months in the HCCI insurers by state in the CMS data (column 5); we exclude from the CMS comparison enrollment counts in the HCCI insurers any enrollees in SNP plans since, as discussed, these are also excluded from the HCCI data. The HCCI data contain about 78 percent of total MA enrollees for the HCCI insurers; "missing" enrollees disproportionately concentrated in the Western US.

We restrict our analysis to the 36 "complete data" states, which we define as states where the count of enrollee-months in HCCI is within 10 percent of the corresponding count in CMS data. The 10 percent cutoff is arbitrary, but 30 of the 36 states are within 5 percent, and these 30 states would account for more than 70% of the enrollees in the baseline sample, so the results are unlikely to change much with more conservative sample definitions. Overall, a comparison of column 8 and column 6 of Table 1 shows that our baseline sample in HCCI has 1 percent more enrollees than the pseudo HCCI enrollment data set we create for the same baseline sample in CMS; this is in line with what we would expect, given that plan enrollment data is missing in CMS for 1 percent of MA enrollees.

Columns (1) and (2) of Appendix Table A1 show, by state, the MA share of Medicare enrollment and the HCCI insurer share of MA. Overall, the 36 states that we analyze comprise 61 percent of enrollment in HCCI insurers nation-wide. As can be seen in Appendix Figure A1, the states that are omitted from our baseline analysis are disproportionately in the Western US.

B. Construction of specific variables

We analyze MA medical spending and utilization in the HCCI data. We benchmark it against TM spending and utilization in the CMS data, for observably similar enrollees. We therefore construct parallel medical spending and healthcare utilization variables in the HCCI and CMS data. Unless explicitly noted, all MA medical spending and healthcare utilization measures are derived from HCCI data, and all TM spending measures are derived from CMS data. All measures are constructed at the enrollee-month level unless explicitly noted.

Total spending is defined as the sum of insurer spending plus out-of-pocket spending. **Insurer spending** is defined based on the actual amount paid by the plan (either MA or TM) to the provider. In other words, it is the transacted (as opposed to list) price. **Out-of-pocket spending** is the amount owed by the enrollee (i.e. the sum of any coinsurance, copay, and deductible). For individuals enrolled in TM, some of this "out of pocket" spending may be covered by supplemental private insurance (Medigap), which they may purchase separately.

Medical spending is divided across claims files based on who is billed, which does not map

perfectly to our concept of "place of care." In particular, institutional billing goes to the relevant institutional file (e.g., inpatient or outpatient) while individual provider billing (regardless of whether it is inpatient or outpatient) goes to the physician (aka carrier) file. The structure of claims files is slightly different across the two data sources. We use three HCCI claims files: Inpatient, outpatient and physician. We use seven CMS claims files: inpatient, outpatient, physician, SNF, home health, durable medical equipment, and hospice. In HCCI, the SNF spending is in the inpatient file; we identify SNF claims in the HCCI inpatient file based on their Place of Service (POS) codes (POS code of 31-33 determines a SNF). In HCCI, home health and durable medical equipment are in the outpatient and physician files. Hospice is reimbursed by TM for both TM and MA enrollees; there is therefore no hospice spending in the HCCI data, but we can observe hospice spending in the CMS data for both TM and MA enrollees. Finally, we note that in HCCI the inpatient file includes all admissions in 2010, while in CMS the inpatient and SNF files include discharges in 2010; we therefore supplement the 2010 SNF and inpatient discharge files in CMS with the 2011 SNF and inpatient discharge files, and in both files limit the analysis to admissions that occur in 2010; in this way we reconstruct a 2010 admission file that is parallel to the HCCI admission file.

Below we describe he construction of specific variables.

Total spending and components All of these measures are constructed at the enrollee-month level unless explicitly noted otherwise. Note that for inpatient and SNF spending, we associate the spending with the month in which the admission occurred even when the stay extends into subsequent months.

- **Total spending:** the sum of inpatient, outpatient, and SNF spending.
- **Inpatient spending:** in the CMS data it covers all spending on the inpatient file plus spending on the physician file associated with an inpatient hospital (POS code of 21). In the HCCI data it covers all spending on the inpatient file minus SNF spending (as mentioned, POS codes of 31-33) plus spending on the physician file associated with an inpatient hospital (POS code of 21).
- **Outpatient spending**: in CMS data it is the sum of all spending on the outpatient file, the home health file, and the durable medical equipment file, plus all spending on the physician file for which POS is not 21. In HCCI data is it the sum of all spending on the outpatient file (which, recall, includes home health and durable medical equipment), plus spending on the physician file for which POS is not 21.
- **SNF spending:** in CMS data it is the sum of all spending on the SNF file, while in HCCI file it is the sum of all spending on the inpatient file with POS codes 31-33.
- **Hospice spending**: hospice care is reimbursed by TM for both TM and MA enrollees. There is therefore no hospice spending in the HCCI data, but we can observe hospice spending in

the CMS data for both TM and MA enrollees. We use the hospice file in the CMS data to measure hospice spending in TM and in MA.

Healthcare utilization In addition to measuring spending, we also measure healthcare utilization. We define a number of standard measures of healthcare use for each enrollee-month. We measure inpatient utilization using the inpatient files. In the HCCI data we only count observations that are inpatient hospital admissions (i.e. we exclude SNF admissions based on POS codes of 31-33). We measure SNF utilization using the SNF file in the CMS data and the inpatient file in the HCCI data, only counting admissions with POS codes of 31-33.

- **Inpatient days:** the sum of the days associated with each inpatient admission that month; as with our inpatient spending measure, this will include all the days for each admission in a given month, even if those days extend beyond that month. We measure the days of a given admission as the difference between discharge date and admission date, plus 1.

- **SNF days:** is defined analogously to inpatient days. In the CMS file, discharge date is missing for about 18 percent of the observations, which appears to reflect discharges that extend beyond the 100-day coverage period for SNF in TM. Since we are interested in TM-covered utilization, we impute 100 days for such discharges.

- **Inpatient admissions:** any inpatient admission that month.[3]

- **Physician visits:** is measured based on claims in the physician file (excluding claims with POS code of 21, which indicates that they occur in an inpatient setting). We define physician visits as the sum of **primary care visits** and **specialty care visits**. We allow a maximum of one primary care visit per patient-day, and one specialist visit per patient day. Following the approach in Finkelstein et al. (2016), our definition of primary care physicians and specialists follows the Dartmouth Atlas.[4] Specifically, we crosswalk the primary care and specialist definitions in the Dartmouth Atlas to the list of HCFA specialty codes in the CMS data. The HCCI data has a separate set of provider category codes which we crosswalk to the HCFA specialty codes.

- **ED visits:** we identify ED visits based on their revenue center codes. ResDAC identifies revenue center codes 0400-0459 and 0981 as indicating ER services.[5] We define ED visits as the sum of **outpatient ED visits** and **inpatient ED visits.** We allow a maximum of one outpatient ED visit per patient-day and a maximum of one inpatient ED visit per patient - admission date. We identify an outpatient ED visit by an outpatient claim line with the

[3] We do not define an analogous "SNF admission" measure because the HCCI data are not conducive to defining distinct admissions; we observe many consecutive short stays in SNFs for patients, and it is unclear whether these are distinct admissions.

[4] See http://www.dartmouthatlas.org/downloads/methods/research_methods.pdf, page 6

[5] Source: https://www.resdac.org/resconnect/articles/144.

relevant revenue code and identify an inpatient ED visit by a (non-SNF) inpatient claim line with the relevant revenue code.

- **Diagnostic Tests and Imaging Procedures.** Our definition of diagnostic tests and imaging procedures follows Song et al. (2010), and is based on BETOS codes: codes beginning with T are diagnostic tests, and codes beginning with I are imaging procedures. We examine all claims files for possible diagnostic tests and imaging procedures.

- **Surgery.** We define surgeries as the sum of **inpatient surgeries** and **outpatient surgeries.** We define an **inpatient surgery** using the inpatient claims file (excluding, in the case of the HCCI data, POS codes of 31-33 since these indicate SNF). We classify an inpatient admission as having an inpatient surgery if it is associated with a "surgical DRG".[6] We count each unique inpatient admission with a surgical DRG as one inpatient surgery. We define an **outpatient surgery** based on the HCPCS codes in the outpatient file explicitly identified as corresponding to "outpatient surgery"; we exclude any claims classified as "emergency room" claims from this definition. We restrict to a maximum of one outpatient surgery per patient-date.

Spending per encounter To measure spending per SNF day we use the above definitions of SNF spending and SNF days. To measure spending per inpatient admission or inpatient day, we use the above definition of inpatient admissions and inpatient days above; we measure inpatient spending however only counting spending on the inpatient file (i.e. not including physician spending with POS code of 21 as we do when breaking down spending by category). To measure spending per outpatient ED visit; we count all spending on the same date as the outpatient ED visit date that is on the outpatient file or is on the physician file with a POS code of 23 ("Emergency room"). For all of these measures, we take the average across enrollee-months of the ratio of spending to utilization for that enrollee-month..

Preventive care We analyze the set of preventive care measures in Finkelstein et al. (2016) that we can reasonably replicate in our data. These in turn are drawn from procedures measured in the Dartmouth Atlas and the Centers for Medicare and Medicaid (CMS). These measures are typically defined as rates of any care receipt during an observation period (an enrollee-month in the baseline analysis) for a denominator of "relevant" patients. In some cases, we have to modify the denominator due to limitations of the HCCI data (e.g. coarse age bins or the inability to do a two-year "look back" period). We highlight these modifications below, which we do in parallel for both MA and TM measures so that they are internally comparable:

[6] The primary source was https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/MedicareFeeforSvcPartsAB/downloads/DRGDesc10.pdf. Information on 6 DRGs (14, 16, 17, 570, 571, 572), which is not present in the above source, was added from https://www.cms.gov/Medicare/Coding/ICD10/Downloads/ICD-10-MS-DRG-v32-Definitions-Manual-Text.zip. Information on DRG 15 was added after manual search on-line.

- **Mammogram** is defined following the Dartmouth Atlas (see http://www.dartmouthatlas.org/data/table.aspx?ind=169). We define the denominator as women ages 65-74; due to the coarseness of the age variable in HCCI, this is a broader "risk set" than the Dartmouth Atlas denominator of women ages 67-69.

- **Diabetes screen** ("HbA1c test"), **cholesterol test** ("blood lipids test"), and **retinal eye exam (**"retinal or dilated eye exam") are defined following the Dartmouth Atlas (see http://www.dartmouthatlas.org/data/map.aspx?ind=160). For all of them the denominator (risk set) is defined as all enrollees aged 65-74 with a diagnosis of diabetes. Due to the coarseness of the age variable in HCCI, this is a slightly different "risk set" than the Dartmouth Atlas denominator of enrollees aged 65-75 with a diagnosis of diabetes. The definition of "a diagnosis of diabetes" also differs because we have only one year of data while the Dartmouth Atlas defines a diabetes diagnosis based on encounters with specific codes identifying diabetes during the year or prior year; we are able to replicate their coding exactly, but because we can only look during our one observation year, our definition is more stringent than theirs.

- **Seasonal influenza vaccine, cardiovascular screening blood test, colorectal cancer screening, pap smears, pelvic examinations,** and **prostate cancer screening** are defined following CMS' preventive care definitions (see https://www.cms.gov/Medicare/Prevention/PrevntionGenInfo/ Downloads/MPS_QuickReferenceChart_1.pdf; downloaded on 08/11/2016); for a list of relevant ICD-9 codes see https://www.cms.gov/Medicare/Prevention/ PrevntionGenInfo/ Downloads/MPS-QuickReferenceChart-1TextOnlywithICD9.pdf (downloaded on 08/11/2016). For influenza, cardiovascular screening, and colorectal cancer, the denominator is everyone. For pap smears and pelvic exams, the denominator is all women, and for prostrate cancer the denominator is all men.

Appropriateness of ED visit: Billings et al. Algorithm We also classify visits using an algorithm developed by Billings et al. (2000) that is based on the primary ICD-9 diagnosis code for the visit. To construct this algorithm, a panel of emergency department and primary care physicians was given access to a sample of 6,000 full emergency department records. These full records contained detailed information about the patient including age, gender, vital signs, medical history, presenting symptoms and also information about the resources used on the patient in the emergency department, the diagnoses made and procedures performed. Based on this much more extensive information than available in typical discharge or claims data like ours, each physician classified each record into one of four categories. For each primary diagnosis, the algorithm assigns probabilities to each category of visit, based on averaging all the physicians' codings across all visits with that diagnosis. This reliance on probabilities derived from *ex post* diagnoses rather than *ex ante* symptoms is one of the major limitations of this measure, as has been noted elsewhere (e.g., Raven et al. 2013).

Several subsequent studies have validated the algorithm (e.g. Ballard et al., 2010, Gandi and Sabik 2014). Although originally created with ED discharge data, it has been applied to classify

ER visits from TM claims data (Joynt et al., 2013), and we follow that approach here. Like Joynt et al. (2013), we exclude from our analysis the few (in our case, less than 4 percent in either TM or MA data) ED visits with multiple primary diagnoses.

The algorithm classifies ED visits into 4 mutually exclusive categories. The fist distinction is between **non-emergent** and **emergent** cases. A non-emergent case is one where care is not required within 12 hours (for example, a toothache). Among emergent cases, a distinction is then made between **emergent, ED care needed** and **emergent, ED care not needed ("primary care treatable");** the latter refers to cases where care is needed within 12 hours but can be provided in a primary care setting (e.g. a lumbar sprain). Finally, among emergent cases where ED care is needed, the algorithm makes a final distinction between those that are "**emergent, but primary care preventable"** and those that are "**emergent but not primary care preventable."** This final classification distinguishes between emergencies that require ED care but could have been prevented with appropriate ambulatory care (e.g. a heart attack) and those that could not.

Finally, diagnoses are marked as "unclassified" if the algorithm does not assign a probability weight to it. Presumably these represent diagnoses that are too infrequent to have been included in the dataset of visits coded by the panel of physicians who created the algorithm. In our setting, we find that about a quarter of ED visits are unclassified by the algorithm; this is comparable to what has been found in other settings (e.g. Taubman et al. 2014).

C. Analysis of inpatient prices

Our objective is to compare the price of an admission at a given hospital for a given diagnosis (DRG) in MA to what this price would have been if (counterfactually) that admission had occurred under TM. For this analysis, we make two departures from our baseline. First, in measuring inpatient spending, we now only consider spending on the inpatient file, and not spending on the physician file associated with the inpatient admission (as we did previously in analyzing inpatient spending in e.g. Table 4). Second, we limit our analysis to the approximately 4,000 hospitals in our baseline MA sample that, for purposes of TM reimbursement, would have been covered by Medicare's Prospective Payment System (PPS). PPS covers virtually all standard (non-specialty) hospitals; limiting ourselves to MA admissions in these hospitals excludes about 5 percent of inpatient admissions, and about 7 percent of payments to inpatient hospitals. For these standard hospitals, pricing in TM (and to the best of our understanding in MA), is based primarily on the hospital at which the admission occurs and the DRG for which the patient was admitted.

We conduct two analyses, an analysis of average price differences by state, and an analysis of average price differences by DRG (for common DRGs). They are conceptually the same, just created at different units of aggregation.

State-level prices. To arrive at a state-level average price (in either MA or TM), we calculate the average price in the state for each MA admissions in a given DRG, and then take a weighted average of prices for each DRG in the state. We use as weights the DRG's (national) share of

admissions in MA;[7] differences in average prices within MA (or within TM) across states therefore reflect price differences for a common "DRG basket."

Measuring the MA price for each MA admission is straightforward: we simply calculate total payments to hospitals for that admission, as measured in the inpatient file.

Measuring the (counterfactual) TM price for each MA admission proceeds in two steps. First, we calculate the TM formula price for each MA admission as a function of the hospital and DRG for that admission.[8] We compute the average, TM formula price for each DRG in the state, and then construct the state average TM formula price by taking a weighted average of prices across DRGs, using each DRG's (national) share of admissions (in MA) in that DRG as weights.

Second, we adjust these state average TM formula prices for observed differences between the state-level transacted price and formula price in TM. The actual, transacted TM price will not always correspond exactly to the formula TM price. For example, in certain costly cases, hospitals receive additional "outlier payments" covering 80 percent of costs beyond a threshold. In addition, if the individual is transferred to another hospital, the actual reimbursement will be below the reimbursement formula. Since in MA we observe transacted prices, we want to compare to an estimate of TM transacted prices. We therefore adjust the TM formula price to account for the average difference between TM actual and TM formula price. We calculate this adjustment factor using CMS data in which we can observe actual TM prices (i.e. payments, as we do in MA data) and can also construct TM formula prices. We calculate a state-specific adjustment factor that is the ratio of actual TM prices to formula TM prices in that state.[9] We multiply the state's average TM formula price by this state-specific adjustment factor to arrive at our estimate of the state-specific average TM price. Appendix Table A3 shows the state-specific average MA and TM prices.

DRG-level prices. The DRG-level analysis proceeds in a similar manner except that we now

[7] For a few small states, there are a number of common (national) DRGs which, in that state, have no admissions. To address this, we impute the national average price for that DRG in that missing state-DRG pair, corrected by a state-specific correction factor. The state-specific correction factor is given by the ratio of the state price and average national price for the DRGs we do observe in that state.

[8] As noted, under TM, these admissions would be reimbursed by Medicare's PPS; the PPS reimbursement formula is the product of a hospital-specific "base payment" rate times a diagnosis-specific (DRG) weight; both are publicly available from CMS.The DRG weights can be found here: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Acute-Inpatient-Files-for-Download-Items/CMS1247873.html (see file FY_2010_FR_Table_5). The hospital base payment rates can be found in the Medicare Impact File (available here: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Historical-Impact-Files-for-FY-1994-through-Present.html). The base payment rates for the hospital include hospital-specific adjustments for wage index reclassifications, indirect medical education payments, and disproportionate share payments. The HCCI data has encrypted hospital identifiers that can not be directly mapped to the publicly available data on hospital base payment rates. We are extremely grateful to Zack Cooper for providing us with a file containing these base payment rates linked to the encrypted hospital identifiers.

[9] Once again, for both actual and formula TM prices, we compute the average of admission prices by state-DRG, and then a weighted average by state, in which the weight associated to each DRG is the national share of MA admissions with that DRG.

compute the average price for each DRG by taking a weighted-average of prices for each state in the DRG, using as weights the state's share of admissions (across all DRGs) in MA; the differences in average prices across DRGs within MA (or within TM) therefore reflects price differences for a common "state basket," which mimics the geographic distribution of MA admission across states.

The measurement of the average TM price for each DRG proceeds in the same two steps. First, we calculate each DRG's average TM formula price using the same TM formula prices for each admission that we used in the state-level analysis, but now average these across states for each DRG, using the state's share of admission (in MA) as weights. Second, we adjust the average TM formula price in the DRG by a DRG-specific adjustment factor reflecting the DRG-specific ratio of actual TM prices to formula TM prices.[10] Appendix Table A2 shows the DRG-specific average MA and TM prices for the 20 most common DRGs.

Appendix References

Ballard, Dustin, Mary Price, Vicki Fung, Richard Brand, Mary Reed, Bruce Fireman, Joseph P. Newhouse, Joseph Selby, and John Hsu. 2010. "Validation of an Algorithm for Categorizing the Severity of Hospital Emergency Room Visits." *Medical Care* 48(1).

Gandhi, Sabrina and Linsday Sabik. 2014. "Emergency Department Visit Classification Using the NYU Algorithm." *The American Journal of Managed Care* 20(4): 315-320.

Joynt, Karen, Atul Gawande, E. John Oray and Ashish Jha. 2013. "Contribution of Preventable Acute Care Spending to Total Spending for High-Cost Medicare Patients." *Journal of the American Medical Association* 309(24): 2572-2578.

Raven, M.C., R.A. Lowe, J. Maselli, and R.Y. Hsia. 2013. "Comparison of presenting complaint vs discharge diagnosis for identifying 'nonemergency' emergency department visits." *Journal of the American Medical Association* 309, 1145-1153.

[10] For both actual and formula TM prices, we compute the average admission prices for each state-DRG, and then a weighted average by DRG, in which the weight associated with each state is the state's share of MA admissions.

Appendix Figure A1: States included in the baseline sample

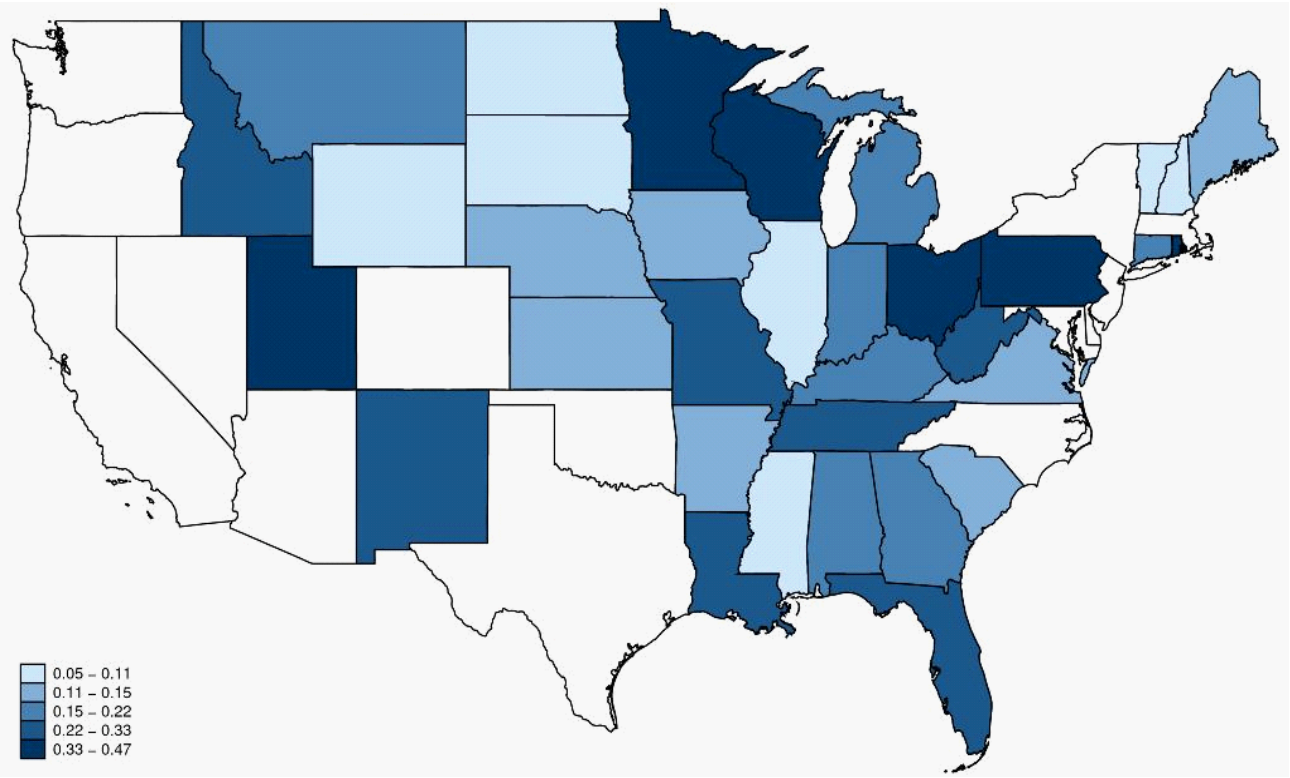

Figure shows MA share of Medicare enrollment by state; states that are white are omitted from baseline sample. Appendix A and Appendix Table A1 provide more detail.

Appendix Figure A2: Mortality-Spending Relationship in TM and MA

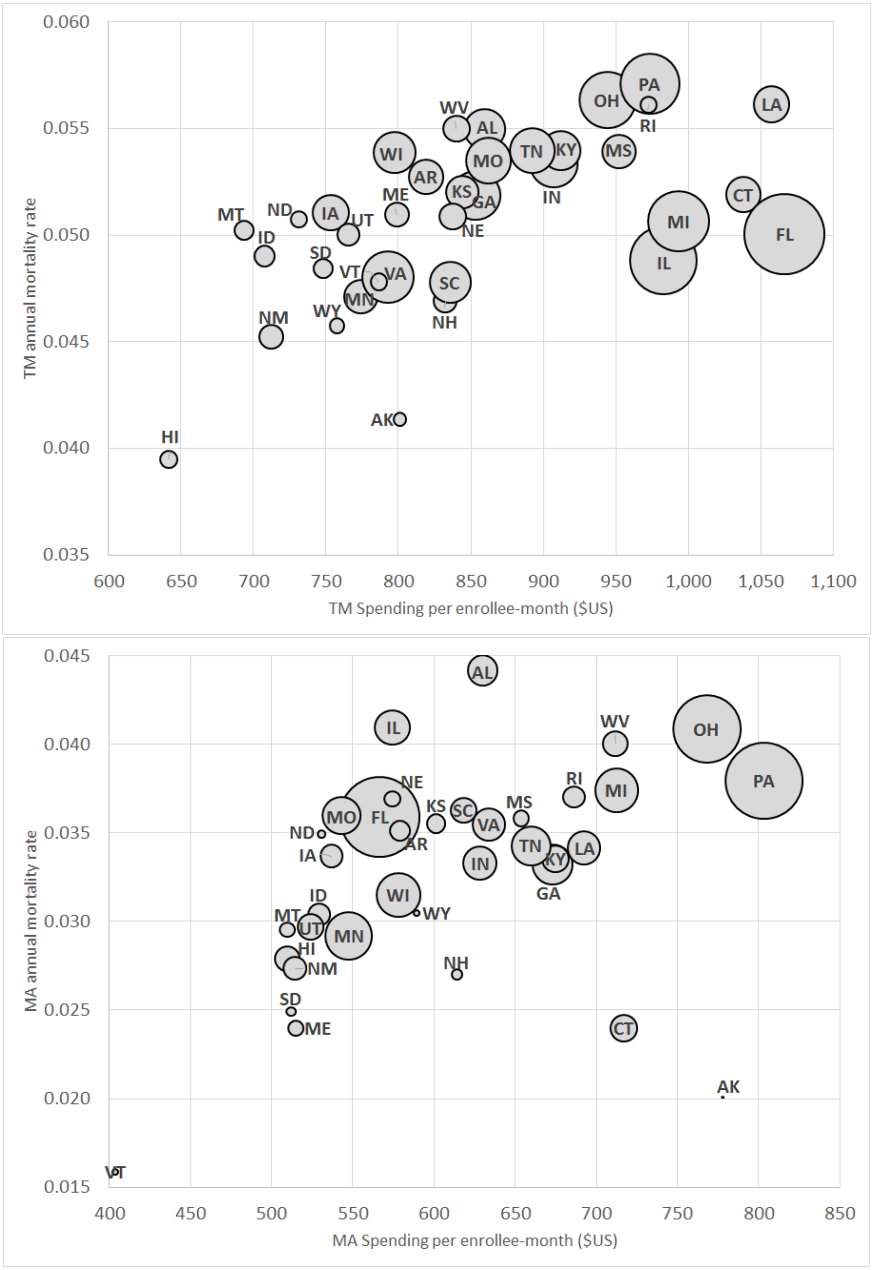

Figure shows relationship between annual mortality rate and spending for each state, separately for TM (top panel) and MA (bottom panel). In the top panel, the size of each bubble is proportional to the number of TM enrollees in the state. In the bottom panel, the size of each bubble is proportional to the number of MA enrollees in the state.

Appendix Figure A3: Propensity score distributions

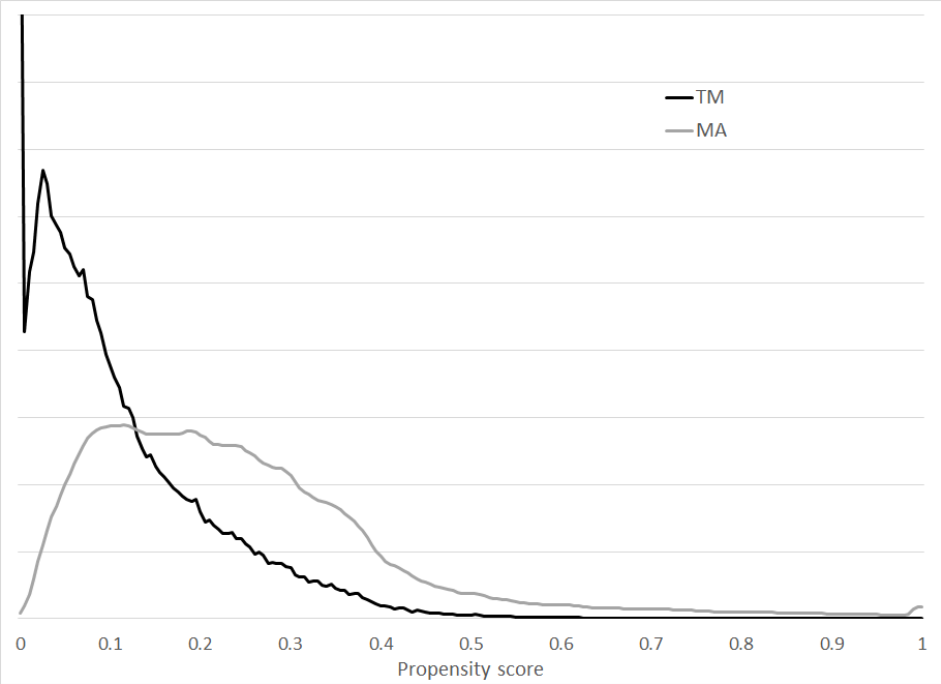

Figure shows the distribution of propensity scores in the baseline sample for the TM (black) and MA (gray) populations. The figure uses the specification reported in column (2) of Table 2, Panel B.row 3 of Table 9, where propensity scores are generated from a logit regression of an MA indicator on the components of the risk score formula: age, gender, Medicaid (dual) indicator, and HCC fixed effects, which is estimated county by county.

Appendix Table A1: Construction of baseline sample

	MA Share (%)	HCCI insurers share of MA (%)	Counts of Enrollee-Months in HCCI Insurers			
			All HCCI	All CMS	cleaned CMS	% Difference: ((3) - (5))/(5)
	(1)	(2)	(3)	(4)	(5)	(6)
All	28.0	37.4	32,505,844	44,371,265	41,684,486	-22.0
AL	**22.4**	**28.2**	**421,380**	**449,306**	**383,695**	**9.8**
AK	**0.8**	**58.6**	**2,602**	**2,680**	**2,631**	**-1.1**
AZ	39.2	53.9	648,500	1,807,922	1,628,786	-60.2
AR	**14.5**	**43.3**	**272,328**	**285,038**	**284,887**	**-4.4**
CA	42.9	22.6	642,277	4,169,255	4,071,737	-84.2
CO	39.2	47.9	354,798	1,076,124	1,013,937	-65.0
CT	**21.5**	**20.9**	**210,161**	**236,303**	**194,975**	**7.8**
DE	3.8	72.0	39,199	37,995	35,596	10.1
DC	13.6	12.4	6,317	10,271	5,019	25.9
FL	**32.8**	**56.6**	**5,097,850**	**6,019,462**	**5,458,355**	**-6.6**
GA	**24.4**	**69.1**	**1,739,812**	**1,821,869**	**1,729,667**	**0.6**
HI	**49.1**	**23.1**	**151,329**	**220,785**	**153,906**	**-1.7**
ID	**33.0**	**37.9**	**244,680**	**266,744**	**259,697**	**-5.8**
IL	**11.1**	**59.7**	**1,094,149**	**1,119,609**	**1,091,129**	**0.3**
IN	**18.2**	**47.4**	**784,123**	**795,364**	**778,536**	**0.7**
IA	**14.7**	**61.5**	**444,714**	**455,813**	**454,166**	**-2.1**
KS	**12.3**	**61.1**	**300,774**	**306,948**	**302,071**	**-0.4**
KY	**18.2**	**60.9**	**685,965**	**696,447**	**696,236**	**-1.5**
LA	**28.0**	**57.2**	**932,542**	**953,417**	**935,861**	**-0.4**
ME	**15.6**	**25.0**	**87,411**	**90,216**	**90,087**	**-3.0**
MD	9.3	27.9	180,940	183,320	154,445	17.2
MA	25.4	8.2	140,131	194,537	103,079	35.9
MI	**18.5**	**16.2**	**446,674**	**453,679**	**444,670**	**0.5**
MN	**49.8**	**9.2**	**321,824**	**340,132**	**340,008**	**-5.3**
MS	**10.0**	**49.2**	**197,121**	**205,978**	**205,846**	**-4.2**
MO	**24.6**	**46.7**	**999,750**	**1,037,740**	**999,320**	**0.0**
MT	**19.9**	**54.6**	**166,173**	**173,636**	**173,559**	**-4.3**
NE	**13.0**	**68.1**	**230,020**	**237,516**	**235,717**	**-2.4**
NV	36.0	87.9	337,836	1,021,319	1,020,570	-66.9
NH	**8.5**	**35.1**	**56,321**	**57,540**	**57,242**	**-1.6**
NJ	14.4	60.1	706,632	1,060,082	1,028,209	-31.3
NM	**30.0**	**20.6**	**142,307**	**169,552**	**148,360**	**-4.1**
NY	35.9	14.6	539,254	1,405,315	1,270,208	-57.5
NC	19.5	53.5	1,324,226	1,401,748	1,138,093	16.4
ND	**9.0**	**59.9**	**54,576**	**57,067**	**57,052**	**-4.3**
OH	**39.4**	**57.0**	**3,856,644**	**3,957,898**	**3,855,415**	**0.0**
OK	16.8	46.9	183,566	428,148	416,256	-55.9
OR	47.8	15.1	205,505	416,014	401,139	-48.8
PA	**43.1**	**18.4**	**1,539,253**	**1,676,370**	**1,583,624**	**-2.8**
RI	**44.2**	**44.4**	**302,571**	**308,224**	**283,232**	**6.8**
SC	**16.5**	**36.3**	**396,921**	**409,194**	**408,879**	**-2.9**
SD	**9.0**	**69.2**	**78,564**	**82,584**	**82,534**	**-4.8**
TN	**26.9**	**48.0**	**1,086,782**	**1,192,598**	**1,073,406**	**1.2**
TX	21.6	52.6	1,478,223	3,092,452	2,753,984	-46.3
UT	**38.8**	**51.4**	**480,772**	**517,799**	**500,744**	**-4.0**
VT	**5.1**	**56.9**	**29,216**	**29,260**	**29,244**	**-0.1**

All data except from column (3) are from CMS. Columns (1) and (2) show the MA share of total Medicare enrollment and the HCCI insurers' share of MA enrollment, respectively. Columns (3) through (5) show counts of enrollee-months in the HCCI insurers in different data sets. Columns (3) and (4) are based on the full sample of data (see columns (7) and (3) of Table 1, respectively). Column (5) excludes enrollees in SNP plans. States that are in bold are those that are included in our baseline sample (using our criteria of being within 10%), and correspond to columns (8) and (6) of Table 1, respectively.

Appendix Table A2: MA-TM prices differences for most common DRGs

DRG Code (1)	DRG Description (2)	MA Admissions (3)	MA price (4)	TM price (5)	(MA-TM)/TM (6)
All DRGs (weighted by MA admission shares)		488,008	10,054	9,945	1.1%
470	Major Joint Replacement Or Reattachment Of Lower Extremity W/O Mcc	23,879	12,387	12,005	3.2%
392	Esophagitis, Gastroent & Misc Digest Disorders W/O Mcc	10,897	4,203	4,328	-2.9%
871	Septicemia Or Severe Sepsis W/O Mv 96+ Hours W Mcc	10,035	11,490	11,540	-0.4%
291	Heart Failure & Shock W Mcc	9,595	8,917	9,009	-1.0%
292	Heart Failure & Shock W Cc	9,113	5,939	6,075	-2.2%
312	Syncope & Collapse	8,032	4,255	4,476	-4.9%
690	Kidney & Urinary Tract Infections W/O Mcc	8,024	4,544	4,729	-3.9%
194	Simple Pneumonia & Pleurisy W Cc	7,488	6,017	6,049	-0.5%
310	Cardiac Arrhythmia & Conduction Disorders W/O Cc/Mcc	7,185	3,513	3,495	0.5%
247	Perc Cardiovasc Proc W Drug-Eluting Stent W/O Mcc	6,710	11,865	11,510	3.1%
313	Chest Pain	6,682	3,182	3,381	-5.9%
190	Chronic Obstructive Pulmonary Disease W Mcc	6,599	7,021	7,238	-3.0%
378	G.I. Hemorrhage W Cc	6,396	6,010	6,098	-1.4%
287	Circulatory Disorders Except Ami, W Card Cath W/O Mcc	6,291	6,351	6,387	-0.6%
641	Nutritional & Misc Metabolic Disorders W/O Mcc	6,129	4,155	4,255	-2.3%
193	Simple Pneumonia & Pleurisy W Mcc	5,682	8,670	8,717	-0.5%
192	Chronic Obstructive Pulmonary Disease W/O Cc/Mcc	5,508	4,300	4,355	-1.3%
191	Chronic Obstructive Pulmonary Disease W Cc	5,424	5,724	5,835	-1.9%
683	Renal Failure W Cc	5,395	6,197	6,391	-3.0%
65	Intracranial Hemorrhage Or Cerebral Infarction W Cc	5,176	6,967	7,051	-1.2%

Table reports average prices for a hospital admission in TM and MA for the top 20 DRGs, and overall across all DRGs (not limited to the top 20). Averages are computed for each DRG using a common (MA) "basket" of state admission shares. Sample is a subset of our baseline sample; it is limited to all MA inpatient admissions to hospitals that are paid (by CMS) under prospective payment system (PPS).

Appendix Table A3: MA-TM price differences, by state

State	MA Admissions	MA price	TM price	(MA-TM)/TM
(1)	(2)	(3)	(4)	(5)
AL	9,411	8,984	8,862	1.4%
AR	4,733	9,461	9,056	4.5%
CT	2,894	11,495	12,778	-10.0%
FL	104,424	10,291	9,851	4.5%
GA	27,876	10,300	9,944	3.6%
HI	1,351	13,275	13,350	-0.6%
IA	5,925	9,656	9,693	-0.4%
ID	2,189	10,297	9,700	6.2%
IL	19,359	10,183	10,356	-1.7%
IN	11,953	9,703	9,522	1.9%
KS	5,261	9,428	9,533	-1.1%
KY	13,794	9,684	9,733	-0.5%
LA	20,905	9,948	9,841	1.1%
ME	996	10,341	10,869	-4.9%
MI	8,674	10,097	10,948	-7.8%
MN	5,264	10,911	10,969	-0.5%
MO	17,550	9,657	9,594	0.7%
MS	4,033	9,728	9,446	3.0%
MT	2,133	9,777	9,512	2.8%
ND	719	9,532	9,230	3.3%
NE	3,998	10,215	10,319	-1.0%
NH	591	11,229	11,010	2.0%
NM	1,748	10,949	11,198	-2.2%
OH	89,716	9,574	9,916	-3.5%
PA	35,344	11,130	10,401	7.0%
RI	5,149	11,575	12,144	-4.7%
SC	6,800	10,003	10,376	-3.6%
SD	1,073	10,831	10,802	0.3%
TN	24,161	9,756	8,959	8.9%
UT	6,112	9,638	9,363	2.9%
VA	14,409	9,773	9,908	-1.4%
VT	146	11,936	13,690	-12.8%
WI	19,099	10,334	10,521	-1.8%
WV	9,834	9,238	9,647	-4.2%
WY	350	12,930	13,034	-0.8%

Table reports average prices for a hospital admission in TM and MA for each state in our baseline sample (except Alaska which is omitted because it had too few inpatient admissions for us to report). Averages are computed for each state using a common (MA) "basket" of DRG admission shares. Sample is a subset of our baseline sample; it is limited to all MA inpatient admissions to hospitals that are paid (by CMS) under prospective payment system (PPS).