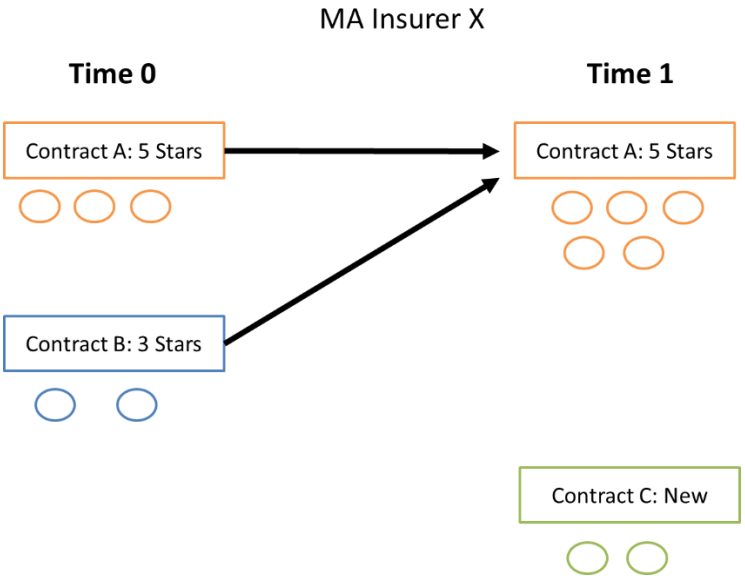
Meyers DJ, Trivedi AN, Wilson IB, Mor V, Rahman M. Higher Medicare Advantage star ratings are associated with improvements in patient outcomes. Health Aff (Millwood). 2021;40(2).

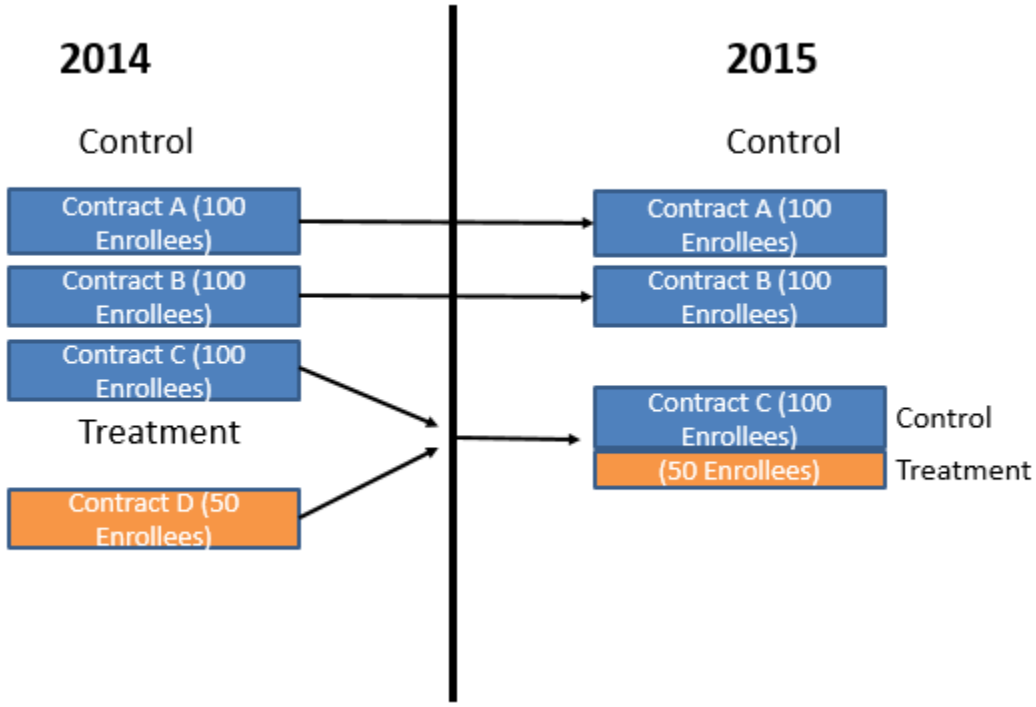
Appendix

Appendix A: Diagram of Contract Consolidation



Notes: This figure represents how consolidation can work for a single MA insurer, entitled here as X. This insurer in time 0 has two contracts, one rated 5 stars, and the other rated 3 stars. Between one year (time 0), and the following (time 1), the insurer can consolidate contract B into contract A. All of the enrollees in contract B are moved into contract A for the following year. Under the quality improvement program, the insurer would now be eligible for bonus payments on all enrollees in contract A. To continue this process, the insurer can also start a new contract, contract C, in the following year. In the first several years before the new contract is rated, it will also receive bonus payments.

Appendix B: Diagram of Study Design



Notes: This diagram provides a stylized depiction of our study design. In 2014 there are contracts that are not involved in consolidation (A, B). These contracts can be either high or low rated. There is also contract C which serves as a destination contract for a consolidation. Between 2014 and 2015, contract D is consolidated into contract C. The enrollees who were in contract D, and are now in contract C, serve as the primary treatment group. Enrollees who were already in contract C prior to the consolidation still remain in the treatment group. To control for the characteristics of enrollee's initial contracts, we include 2014 contract fixed effects in out models.

Appendix C: Detailed Description of the Analysis

In this study, our primary question of interest is whether there is an effect of being enrolled in a higher rated plan on enrollee outcomes. This can be represented by the following model:

$$y_{itc} = \alpha + \beta_1 Stars_{itc} + \beta_2 Year_t + X_i + \delta_{c2014} + \varepsilon$$

Where y_{it} represents the outcome for enrollee *i* at time *t*. The explanatory variable of interest is $\beta_1 Stars_{itc}$ which is the star rating for an enrollee's contract, *c,* at time *t*. $\beta_2 Year_t$ is a flag for year. We also include X_i, a vector of patient covariates, and δ_{c2014} which is a fixed effect for the 2014 contract. ε is the error term. The problem with this approach is that there is likely selection bias or unmeasured confounding of the relationship between the plan's star rating and enrollee outcomes. For example, prior literature have found the enrollees who differ in key characteristics from each other enroll in,[4] and disenroll from[9] high and low quality contracts at different rates. Further, star ratings have been found to be closely linked to the socioeconomic status of enrollees.[12] Given the potential for confounding, we are unable to directly compare the relationship between star ratings and outcomes.

One method of addressing this concern is through the use of an instrumental variable.[24] In instrumental variable analyses, an additional variable, the instrument, is used in order to isolate the relationship between the explanatory variable of interest and the outcome.[25,26] For an instrument to be valid for this purpose, it needs to have a relationship with the explanatory variable of interest, and it needs to be plausibly exogenous from the outcome of interest. Instruments have been rising in prominence in the health services research literature.[27,28]

We use Medicare Advantage contract consolidation as an instrument.[17] Since 2012, MA insurers have consolidated contracts, moving all enrollees from a lower rated plan to a higher rated one.

When consolidation occurs, enrollees are informed of the change, however they are moved automatically without needing to opt into the change. As a result, enrollees are in one year enrolled in a lower rated plan, and the following year are enrolled in a higher rated plan, independent of their own selection choice. Some enrollees may disenroll from MA, or switch contracts independently, however most are moved to the higher rated plan.

We use this consolidation as a natural experiment to measure the relationship between star ratings and outcomes. We do this though the use of consolidation as an instrumental variable. While consolidation as an instrument is likely to reduce the role of enrollee selection bias in estimating the impact of plan quality, there may still be differences between the contracts that are consolidated and those that are not. To address this, we use multiple years of data, enabling us to compare outcomes between enrollees in the same contracts over time.

We constructed a dataset for all Medicare Advantage beneficiaries in 2014 and 2015. We merged HEDIS outcomes to each beneficiary in each year, and calculated other disenrollment and network quality outcomes in each year. For this analysis, we focused on consolidation between 2014 and 2015. We assign a 0/1 flag to all beneficiaries who were in a contract that consolidated, regardless of whether they enrolled in the new contract (an enrollee might be in a consolidated plan, but they might disenroll or switch contracts independently). We also create a variable for the enrollee's 2014 contract, that we assign to them in both 2014 and 2015 for use as a fixed effect. This allows us to set up a pre-post analysis, comparing enrollees in the same contracts who were consolidated against those who were not.

Our first stage can be represented by the equation:

$$Stars_{itc} = \alpha + \beta_1 Consolidate_c + \beta_2 year_t + \beta_3 Consolidate_c * year_t + X_i + \delta_{c2014} + \varepsilon$$

Where $Stars_{itc}$ represents the star rating for enrollee *i* at time *t* in contract *c*. $\beta_1 Consolidate_c$ is a 0/1 flag of if an enrollee's contract was consolidated between 2014 and 2015. It is equal to 1 in both years if a consolidation occurred and 0 if not. $\beta_2 year_t$ is an indicator of year, in our case a 0/1 flag for 2015. $\beta_3 Consolidate_c * year_t$ is the interaction between consolidation and year and is our primary instrument. If an enrollee is in a consolidated contract, in the year following consolidation, they may be exposed to a higher star rating. X_i is a vector of patient demographic characteristics. δ_{c2014} is a fixed effect for the enrollee's contract in 2014 in order to better compare enrollees who are in similar contracts pre- and post- consolidation. We estimate these models using the program xtivreg2 in Stata 15[29] and use robust standard errors.

To test whether consolidation is a strong instrument, meeting the first stage IV assumption, we check the F-statistics from the first stage. A F-statistic over 10 is considered to be a strong instrument.[18] We find that across our models, the F-statistics are over 1,000 for each outcome, indicating that consolidation is likely a sufficiently strong instrument. It is not possible to prove that contract consolidation is exogenous from enrollee outcomes, however it is reassuring that there are not substantial demographic differences between those who were consolidated and those who were not.

From these models, we are able to estimate the local average treatment effect (LATE) of star ratings on outcomes. In our case, this provides the treatment effects of an increased star ratings on the outcomes of enrollees who comply with the consolidation in moving to a higher rated contract.

Appendix D: Detailed Description of Outcomes

Outcome	Source	External Link	Description	Sample Size	Additional Notes
Plan Disenrollment or Switching	Master Beneficiary Summary File	n/a	A 0/1 flag for if an enrollee disenrolled from Medicare Advantage or switched contracts within Medicare Advantage in the following year. Defined for 2014 observations based on 2015 enrollment, and for 2015 observations based on 2016 enrollment.	30,104,761	For enrollees who consolidated, we do not consider them to have switched contracts if they comply with the consolidation. As we cannot tell someone's enrollment decision if they have died, this outcome is calculated conditional on survival through the end of the following year. A potential source of bias in this measurement is that consolidated enrollees in 2015, who did not disenroll at the end of 2014, may be systematically different from non-consolidated enrollees. If someone choose to stay in the program from 2014 into 2015, they may be different than enrollees who first become eligible in 2015 and have not yet had an opportunity to disenroll. We test the extent to which this issue may introduce bias in two ways. First, we found that baseline disenrollment rates between consolidated and non-consolidated groups were not substantially different. Second, we tested the differences in disenrollment in 2016, condition on continued enrollment from 2014 to 2015, and found similar results.
30- and 90-day unplanned readmission	MedPAR	https://cmit.cms.gov/CMIT_public/ReportMeasure?measureRevisionId=609	A 0/1 flag for if an enrollee was readmitted to the hospital following a hospital discharge. Enrollees who were not hospitalized in a year do not contribute to this measure. Unplanned readmission status is based on the CMS algorithm. If an enrollee was hospitalized multiple times within a year, the readmission will only be assessed based on the first admission of the year.	4,132,632	In analyses of readmissions, there is often a competing risk of mortality. These competing risks may be best addressed by a multinomial model, however we cannot use such a model in our primary analysis due to the inclusion of fixed effects. As such, we assess readmissions unconditional on mortality.
Admission to high or low rated hospital	MedPAR and Hospital Compare	https://www.medicare.gov/hospitalcompare/About/What-Is-HOS.html	For the purposes of this analysis, we consider a hospital to be "high quality" if they received 4+ stars from hospital compare star ratings. We consider a hospital to be "low quality" if they receive fewer than 3 stars. This measure takes the form of a 0/1 indicator separately for if an enrollee was admitted to a high or low quality hospital for their first recorded hospitalization of a year. Those who were not hospitalized were not included in this analysis.	4,132,632	As there are some criticisms of the hospital compare 5-star ratings, we also ran sensitivity analyses using admission to a hospital in the highest or lowest quintile of readmission rates. We found similar results to when we used star ratings.

Admission to High or Low rated Nursing Home	Minimum Data Set 3.0, Nursing Home Compare	https://www.cms.gov/medicare/provider-enrollment-and-certification/certificationandcomplianc/fsqrs.html	For the purposes of this analysis, we consider a nursing home to be "high quality" if they received 4+ stars from nursing home compare star ratings. We consider a nursing home to be "low quality" if they receive fewer than 3 stars. This measure takes the form of a 0/1 indicator separately for if an enrollee was admitted to a high or low quality nursing for their first recorded nursing home admission of a year. Those who were not admitted to a nursing home were not included in this analysis.	1,342,226	
Breast Cancer Screening	HEDIS	https://www.ncqa.org/hedis/measures/breast-cancer-screening/	A 0/1 indicator of whether women aged 50-74 had at least one mammogram to screen for breast cancer in the past two years.	5,741,351	Not all enrollees are eligible for the denominator for this measure each year.
Colorectal Cancer Screening	HEDIS	https://www.ncqa.org/hedis/measures/colorectal-cancer-screening/	A 0/1 indicator of whether adults aged 50-75 had an appropriate screening for colorectal cancer with any of the following tests: annual fecal occult blood test, flexible sigmoidoscopy every 5 years, colonoscopy every 10 years, computed tomography colonography every 5 years, stool DNA test every 3 years.	1,079,010	Not all enrollees are eligible for the denominator for this measure each year.
Management of High Blood Pressure	HEDIS	https://www.ncqa.org/hedis/measures/controlling-high-blood-pressure/	A 0/1 indicator for if adults with a diagnosis of hypertension met any of the following criteria: Adults aged 18-59 years of age whose blood pressure was <140/90 mm Hg. Adults 60-85 years of age with a diagnosis of diabetes whose blood pressure was <140/90 mm Hg. Adults 60-85 years of age without a diagnosis of diabetes whose blood pressure was <150/90 mm Hg.	261,479	Not all enrollees are eligible for the denominator for this measure each year.
Follow-up after hospitalization for mental illness	HEDIS	https://www.ncqa.org/hedis/measures/follow-up-after-hospitalization-for-mental-illness/	A 0/1 flag for if an enrollee who was hospitalized for the treatment of a selected mental health disorder, had an outpatient visit with a mental health practitioner within 30 days of discharge.	107,369	Not all enrollees are eligible for the denominator for this measure each year.
Use of low value PSA exam	HEDIS	https://www.ncqa.org/hedis/measures/non-recommended-psa-based-screening-in-older-men/	A 0/1 flag for if a man over the age of 70 was screened for prostate cancer through the use of a PSA screening test.	6,128,042	Not all enrollees are eligible for the denominator for this measure each year.
Osteoporosis Management	HEDIS	https://www.ncqa.org/hedis/measures/osteoporosis-testing-and-	A 0/1 flag for if a woman aged 65-85 who has had a fracture, has had either a bone mineral density test or a	190,892	Not all enrollees are eligible for the denominator for this measure each year.

		management-in-older-women/	prescription drug to treat osteoporosis in the six months after the fracture		
Poor Hba1c control	HEDIS	https://www.ncqa.org/hedis/measures/comprehensive-diabetes-care/	A 0/1 flag for adults aged 18-75 with type 1 or 2 diabetes who had an HbA1c measurement of >9%.	566,025	Not all enrollees are eligible for the denominator for this measure each year.
Diabetes Eye Screening	HEDIS	https://www.ncqa.org/hedis/measures/comprehensive-diabetes-care/	A 0/1 flag for adults aged 18-75 with type 1 or 2 diabetes who has had an eye exam performed.	558,198	Not all enrollees are eligible for the denominator for this measure each year.
Access to preventative/ambulatory health services	HEDIS	https://www.ncqa.org/hedis/measures/adults-access-to-preventive-ambulatory-health-services/	A 0/1 flag for if an enrollee had a ambulatory or preventive care visit during the year	28,487,694	
Count of Outpatient or Ambulatory Visits	HEDIS	https://www.ncqa.org/hedis/measures/frequency-of-selected-procedures/	A count variable for the number of outpatient visits an enrollee had in a year	33,454,558	

Appendix E: Comparison of Enrollee Characteristics before and after consolidation

	Non-Consolidated				Consolidated			
Variable	2014	2015	Difference (un-adjusted)	Difference (Adjusted for Contract FE)	2014	2015	Difference (un-adjusted)	Difference (adjusted for contract FE)
Enrollee Characteristics								
Star Rating	3.9	4.0	0.1	0.1	3.4	4.1	0.7	0.7
Age	71.9	71.9	0.0	0.9	72.6	73.4	0.8	0.8
% Black	11.4%	11.8%	0.4%	0.0%	10.5%	10.5%	0.0%	0.0%
% Hispanic	13.8%	14.0%	0.2%	0.1%	8.8%	8.9%	0.1%	0.1%
% Asian	3.5%	3.6%	0.2%	0.0%	2.7%	2.8%	0.0%	0.0%
% NA/AI	0.2%	0.2%	0.0%	0.0%	0.2%	0.2%	0.0%	0.0%
% Female	56.4%	56.3%	0.0%	0.0%	57.5%	57.7%	0.2%	0.2%
% Dual	19.3%	20.5%	1.2%	0.2%	15.4%	15.5%	0.1%	0.3%
% Disability	13.9%	14.1%	0.2%	-1.0%	11.6%	10.7%	-0.9%	-0.8%
Outcomes								
% Enter High Rated Hospital	25.0%	25.4%	0.4%	0.3%	27.2%	28.1%	0.9%	1.0%
% Enter Low Rated Hospital	30.3%	30.5%	0.2%	0.1%	26.8%	26.1%	-0.7%	-0.6%
30-Day Readmissions	12.6%	12.9%	0.2%	1.0%	11.6%	12.2%	0.6%	0.7%
90-Day Readmissions	19.7%	20.2%	0.5%	1.4%	18.3%	19.3%	1.0%	1.1%
Switching/Disenrollment %	7.1%	8.0%	0.8%	1.6%	6.6%	6.8%	0.2%	0.4%
% Enter High Rated SNF	50.3%	43.1%	-7.2%	-7.0%	49.7%	43.5%	-6.1%	-6.2%
% Enter Low Rated SNF	25.1%	30.5%	5.4%	5.0%	26.7%	30.9%	4.2%	4.3%
HEDIS Measures								
Mental health Follow-up	56.2%	54.9%	-1.3%	-0.2%	54.1%	53.9%	-0.2%	0.0%
Colorectal Cancer Screening	71.6%	84.5%	12.9%	1.1%	61.7%	65.1%	3.4%	2.6%
Breast Cancer Screening	77.0%	77.2%	0.3%	0.3%	70.5%	71.8%	1.4%	1.4%
Management of Osteoporosis	39.5%	42.6%	3.0%	3.4%	41.3%	44.2%	2.9%	3.0%
Management of High Blood Pressure	69.8%	66.7%	-3.1%	-1.7%	68.5%	67.9%	-0.6%	-0.3%
Poor HBa1c control	19.6%	20.9%	1.3%	0.1%	23.3%	24.8%	1.5%	1.4%
Diabetes eye screening	75.5%	76.0%	0.5%	2.2%	68.4%	68.2%	-0.2%	-0.2%
Use of low value PSA	39.6%	35.2%	-4.5%	-4.2%	40.4%	32.3%	-8.1%	-8.2%

Notes: In this table we show the differences between 2014 and 2015 characteristics and outcomes of enrollees who were and were not consolidated. The unadjusted difference column shows the crude differences between 2014 and 2015. The adjusted column estimates the difference using a simple linear model with 2014 contract fixed effects.

Appendix F: First Stage Regression Summary Table

Outcomes	First Stage Coefficient	F-Statistic
% Enter High Rated Hospital	0.66	>10000
% Enter Low Rated Hospital	0.66	>10000
30-Day Readmissions	0.66	>10000
90-Day Readmissions	0.66	>10000
Disenrollment %	0.66	>10000
% Enter High Rated SNF	0.65	>10000
% Enter Low Rated SNF	0.65	>10000
HEDIS Measures		
Mental health Follow-up	0.66	5126
Colorectal Cancer Screening	0.41	>10000
Breast Cancer Screening	0.68	>10000
Management of Osteoporosis	0.63	>10000
Management of High Blood Pressure	0.52	6961
Poor HBa1c control	0.56	>10000
Diabetes eye screening	0.55	9925
Use of low value PA	0.65	>10000

Notes: The first stage coefficient is the coefficient from the consolidation in 2015 interaction term and represents the association between consolidation and star rating. Each row comes from a separate model.

Appendix G: Sample full first stage output

Variable	Coefficient	Standard Error	T	p	95% CI	
Consolidation in 2015	0.617585	0.000965	639.92	0	0.615693	0.619476
Age	0.000203	1.23E-05	16.47	0	0.000179	0.000227
Race: Black	-0.01054	0.000416	-25.33	0	-0.01135	-0.00972
Race: Hispanic	-0.00894	0.0005	-17.87	0	-0.00992	-0.00796
Race: Asian	-0.00484	0.000942	-5.14	0	-0.00669	-0.003
Race: na/ai	-0.00286	0.002665	-1.07	0.282	-0.00809	0.002359
Female	0.000307	0.000261	1.18	0.24	-0.00021	0.000819
Dual	-0.03092	0.00035	-88.29	0	-0.03161	-0.03023
Year 2015	0.042067	0.000277	151.9	0	0.041524	0.042609

Notes: The table above is output from the first stage when modeling entrance to a high quality hospital. The above model also includes 2014 contract fixed effects. * denotes significance at the p<0.05 level.** denotes significance at the p<0.001 level.

Appendix H: Full OLS and IV Regression Output

	Admission to High Quality Hospital		Admission to Low Quality Hospital		30 Day Readmission		90 Day Readmission		% Switch/Disenroll		Admission to High Quality Nursing Home		Admission to Low Quality Nursing Home	
VARIABLES	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Star Rating	0.004** (0.003 - 0.006)	0.008** (0.003 - 0.012)	-0.011** (-0.012 - - 0.009)	-0.009** (-0.014 - - 0.004)	-0.001* (-0.003 - - 0.000)	-0.003 (-0.007 - 0.000)	-0.001 (-0.002 - 0.001)	-0.005* (-0.010 - - 0.000)	-0.005** (-0.006 - - 0.005)	-0.027** (-0.028 - - 0.026)	0.004* (0.000 - 0.007)	0.010* (0.001 - 0.019)	0.004** (0.001 - 0.007)	-0.011* (-0.020 - - 0.003)
Age	0.000** (0.000 - 0.000)	0.000** (0.000 - 0.000)	-0.001** (-0.001 - - 0.001)	-0.001** (-0.001 - - 0.001)	0.001** (0.001 - 0.001)	0.001** (0.001 - 0.001)	0.001** (0.001 - 0.001)	0.001** (0.001 - 0.001)	0.001** (0.001 - 0.001)	0.001** (0.001 - 0.001)	0.001** (0.001 - 0.001)	0.001** (0.001 - 0.001)	-0.001** (-0.001 - - 0.001)	-0.001** (-0.001 - - 0.001)
Race/ethnicity=black	-0.051** (-0.053 - - 0.050)	-0.053** (-0.054 - - 0.052)	0.065** (0.064 - 0.067)	0.069** (0.068 - 0.070)	0.017** (0.016 - 0.018)	0.017** (0.016 - 0.018)	0.029** (0.027 - 0.030)	0.029** (0.027 - 0.030)	-0.001** (-0.002 - - 0.001)	-0.001** (-0.001 - - 0.001)	-0.047** (-0.050 - - 0.044)	-0.046** (-0.049 - - 0.043)	0.050** (0.048 - 0.053)	0.051** (0.048 - 0.053)
Race/ethnicity=Hispanic	-0.036** (-0.038 - - 0.034)	-0.040** (-0.042 - - 0.039)	0.005** (0.003 - 0.006)	0.007** (0.005 - 0.008)	-0.007** (-0.008 - - 0.006)	-0.007** (-0.009 - - 0.006)	-0.012** (-0.014 - - 0.011)	-0.012** (-0.014 - - 0.011)	-0.017** (-0.018 - - 0.017)	-0.018** (-0.018 - - 0.018)	-0.029** (-0.032 - - 0.025)	-0.029** (-0.032 - - 0.026)	-0.001 (-0.004 - 0.002)	-0.002 (-0.005 - 0.001)
Race/ethnicity=Asian	0.020** (0.017 - 0.023)	0.010** (0.007 - 0.012)	-0.052** (-0.055 - - 0.049)	-0.055** (-0.058 - - 0.052)	-0.015** (-0.017 - - 0.012)	-0.015** (-0.017 - - 0.013)	-0.027** (-0.030 - - 0.024)	-0.027** (-0.030 - - 0.024)	-0.015** (-0.015 - - 0.014)	-0.015** (-0.015 - - 0.014)	0.012** (0.005 - 0.019)	0.017** (0.010 - 0.023)	-0.042** (-0.048 - - 0.036)	-0.049** (-0.054 - - 0.043)
Race/ethnicity=NA/AI	-0.028** (-0.036 - - 0.019)	-0.028** (-0.036 - - 0.020)	0.035** (0.027 - 0.044)	0.031** (0.022 - 0.039)	0.003 (-0.004 - 0.010)	0.003 (-0.004 - 0.009)	0.012** (0.004 - 0.020)	0.010* (0.002 - 0.018)	0.014** (0.012 - 0.016)	0.015** (0.013 - 0.017)	-0.031** (-0.049 - - 0.013)	-0.032** (-0.050 - - 0.015)	0.014 (-0.002 - 0.030)	0.010 (-0.006 - 0.025)
Female	-0.000 (-0.001 - 0.000)	-0.000 (-0.001 - 0.001)	-0.009** (-0.010 - - 0.008)	-0.009** (-0.010 - - 0.009)	-0.013** (-0.013 - - 0.012)	-0.013** (-0.013 - - 0.012)	-0.016** (-0.017 - - 0.015)	-0.016** (-0.017 - - 0.015)	-0.011** (-0.011 - - 0.011)	-0.011** (-0.011 - - 0.010)	0.020** (0.018 - 0.022)	0.020** (0.019 - 0.022)	-0.025** (-0.026 - - 0.023)	-0.024** (-0.026 - - 0.023)
Dual with Medicaid	-0.016** (-0.017 - - 0.015)	-0.020** (-0.021 - - 0.019)	0.021** (0.019 - 0.022)	0.023** (0.022 - 0.025)	0.040** (0.039 - 0.041)	0.040** (0.039 - 0.041)	0.067** (0.066 - 0.068)	0.067** (0.066 - 0.068)	0.047** (0.047 - 0.047)	0.048** (0.048 - 0.048)	-0.061** (-0.063 - - 0.059)	-0.063** (-0.065 - - 0.061)	0.073** (0.071 - 0.075)	0.072** (0.070 - 0.073)
2015	0.003** (0.002 - 0.004)	0.002** (0.001 - 0.003)	0.001** (0.000 - 0.002)	0.001* (0.000 - 0.002)	0.003** (0.003 - 0.004)	0.003** (0.003 - 0.004)	0.006** (0.005 - 0.007)	0.006** (0.005 - 0.007)	0.005** (0.005 - 0.005)	0.007** (0.007 - 0.007)	-0.067** (-0.069 - - 0.066)	-0.068** (-0.070 - - 0.066)	0.046** (0.045 - 0.048)	0.048** (0.046 - 0.049)
Observations	4,132,632	4,132,632	4,132,632	4,132,632	4,132,632	4,132,632	4,132,632	4,132,632	30,104,761	30,104,761	1,342,227	1,342,227	1,342,227	1,342,227
R-squared	0.129	0.003	0.158	0.004	0.006	0.003	0.010	0.006	0.029	0.006	0.130	0.011	0.085	0.011

	Mental Health Followup		Colorectal Cancer Screening		Breast Cancer Screening		Management of Osteoporosis		Management of High Blood Pressure		Poor HBa1c control		Diabetes Eye Screening		Low value PSA Exam	
VARIABLES	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Star Rating	0.021**	0.024	0.007*	0.036*	0.010**	0.018**	0.003	-0.006	0.044**	0.053**	-0.028**	0.013	0.027**	-0.029	-0.007**	-0.066**
	(0.010 - 0.033)	(-0.013 - 0.060)	(0.000 - 0.014)	(0.008 - 0.065)	(0.008 - 0.011)	(0.013 - 0.022)	(-0.007 - 0.013)	(-0.033 - 0.020)	(0.037 - 0.052)	(0.017 - 0.089)	(-0.033 - -0.022)	(-0.013 - 0.039)	(0.021 - 0.034)	(-0.058 - 0.000)	(-0.009 - -0.005)	(-0.070 - -0.061)
Age	-0.004**	-0.004**	0.003**	0.003**	0.000	-0.000	-0.002**	-0.002**	0.002**	0.002**	-0.005**	-0.005**	0.005**	0.005**	-0.015**	-0.014**
	(-0.005 - -0.004)	(-0.005 - -0.004)	(0.003 - 0.003)	(0.003 - 0.003)	(-0.000 - 0.000)	(-0.000 - 0.000)	(-0.002 - -0.001)	(-0.002 - -0.001)	(0.001 - 0.002)	(0.001 - 0.002)	(-0.005 - -0.005)	(-0.005 - -0.005)	(0.005 - 0.005)	(0.005 - 0.005)	(-0.015 - -0.014)	(-0.015 - -0.014)
Race/ethnicity=black	-0.071**	-0.077**	0.016**	0.015**	0.066**	0.065**	-0.010*	-0.010*	-0.080**	-0.082**	0.029**	0.029**	0.013**	0.013**	-0.020**	-0.019**
	(-0.080 - -0.062)	(-0.085 - -0.068)	(0.014 - 0.019)	(0.013 - 0.018)	(0.065 - 0.067)	(0.064 - 0.067)	(-0.020 - -0.001)	(-0.020 - -0.001)	(-0.086 - -0.075)	(-0.088 - -0.077)	(0.026 - 0.032)	(0.026 - 0.032)	(0.009 - 0.017)	(0.010 - 0.017)	(-0.021 - -0.018)	(-0.021 - -0.018)
Race/ethnicity=Hispanic	0.011*	0.013*	0.011**	0.011**	0.062**	0.062**	0.025**	0.026**	-0.010**	-0.014**	0.022**	0.022**	0.028**	0.032**	0.016**	0.019**
	(0.000 - 0.023)	(0.002 - 0.024)	(0.009 - 0.014)	(0.009 - 0.013)	(0.061 - 0.064)	(0.061 - 0.064)	(0.016 - 0.033)	(0.018 - 0.035)	(-0.016 - -0.003)	(-0.020 - -0.008)	(0.019 - 0.025)	(0.019 - 0.025)	(0.025 - 0.031)	(0.029 - 0.035)	(0.015 - 0.018)	(0.018 - 0.021)
Race/ethnicity=Asian	0.001	0.001	0.023**	0.024**	0.019**	0.021**	0.019*	0.020*	0.004	0.001	-0.017**	-0.020**	0.033**	0.038**	0.051**	0.051**
	(-0.025 - 0.027)	(-0.024 - 0.026)	(0.020 - 0.026)	(0.021 - 0.026)	(0.017 - 0.021)	(0.019 - 0.023)	(0.004 - 0.035)	(0.005 - 0.035)	(-0.006 - 0.014)	(-0.009 - 0.010)	(-0.021 - -0.013)	(-0.024 - -0.016)	(0.029 - 0.038)	(0.034 - 0.043)	(0.049 - 0.053)	(0.049 - 0.053)
Race/ethnicity=NA/AI	-0.041	-0.036	-0.014	-0.014	-0.021**	-0.021**	-0.012	-0.012	-0.059**	-0.064**	0.065**	0.074**	-0.005	-0.007	-0.043**	-0.047**
	(-0.092 - 0.009)	(-0.084 - 0.013)	(-0.030 - 0.003)	(-0.030 - 0.002)	(-0.029 - -0.013)	(-0.029 - -0.014)	(-0.052 - 0.029)	(-0.052 - 0.029)	(-0.091 - -0.028)	(-0.095 - -0.034)	(0.048 - 0.082)	(0.058 - 0.091)	(-0.024 - 0.014)	(-0.026 - 0.011)	(-0.053 - -0.034)	(-0.057 - -0.038)
Female	0.076**	0.075**	0.003**	0.003**	0.387**	0.376**	0.093	0.108	-0.001	-0.001	-0.012**	-0.012**	0.028**	0.029**	-0.288**	-0.284**
	(0.070 - 0.082)	(0.069 - 0.081)	(0.002 - 0.005)	(0.001 - 0.004)	(0.360 - 0.415)	(0.349 - 0.403)	(-0.135 - 0.320)	(-0.113 - 0.329)	(-0.005 - 0.002)	(-0.004 - 0.003)	(-0.014 - -0.010)	(-0.014 - -0.010)	(0.026 - 0.030)	(0.027 - 0.031)	(-0.318 - -0.257)	(-0.314 - -0.254)
Dual with Medicaid	-0.061**	-0.062**	-0.034**	-0.036**	-0.063**	-0.065**	-0.054**	-0.054**	-0.004	-0.007*	0.027**	0.030**	-0.009**	-0.011**	-0.056**	-0.057**
	(-0.068 - -0.053)	(-0.069 - -0.055)	(-0.037 - -0.031)	(-0.039 - -0.033)	(-0.064 - -0.062)	(-0.066 - -0.064)	(-0.060 - -0.048)	(-0.060 - -0.048)	(-0.009 - 0.002)	(-0.013 - -0.001)	(0.024 - 0.030)	(0.027 - 0.033)	(-0.012 - -0.006)	(-0.015 - -0.008)	(-0.058 - -0.055)	(-0.058 - -0.055)
2015	-0.004	-0.004	0.010**	0.010**	0.003**	0.003**	0.034**	0.034**	-0.011**	-0.010**	-0.002	-0.003*	0.020**	0.021**	-0.047**	-0.041**
	(-0.010 - 0.002)	(-0.011 - 0.003)	(0.008 - 0.013)	(0.007 - 0.012)	(0.002 - 0.004)	(0.002 - 0.003)	(0.029 - 0.038)	(0.030 - 0.039)	(-0.014 - -0.007)	(-0.014 - -0.007)	(-0.004 - 0.000)	(-0.005 - -0.000)	(0.018 - 0.022)	(0.018 - 0.023)	(-0.047 - -0.046)	(-0.042 - -0.040)
Observations	107,377	107,377	1,079,016	1,079,016	5,741,366	5,741,366	190,898	190,898	261,478	261,478	566,031	566,031	558,204	558,204	6,128,045	6,128,045
R-squared	0.094	0.023	0.094	0.004	0.038	0.005	0.146	0.004	0.060	0.006	0.117	0.010	0.065	0.008	0.088	0.035

Notes: All models include 2014 contract fixed effects.

Appendix I: Summarized OLS and Sensitivity Results

Outcome	Baseline Rate in 2014	Primary OLS Results (percentage point differences associated with one star increase)	Primary IV Results (percentage point differences associated with one star increase)	IV Results from in-state consolidations (percentage point differences associated with one star increase)	Reduced Form (percentage point difference associated with consolidation)	IV Results among those Dually Eligible with Medicaid (percentage point differences associated with one star increase)
Switching/Disenrollment	7.3	-0.5** (-0.6 , -0.5)	-2.7** (-2.8 , -2.6)	-0.9** (-1.4 , -0.5)	-1.3** (-1.3 , -1.2)	1.0* (0.7, 1.2)
Admission to 4+ Star Hospital	23.4	0.4** (0.3 , 0.6)	0.8** (0.3 , 1.2)	0.4 (-1.4 , 2.3)	0.7** (0.4 , 1.0)	0.8** (0.0, 1.7)
Admission to <3 Star Hospital	33	-1.1** (-1.2 , -0.9)	-0.9** (-1.4 , -0.4)	-5.7** (-7.6 , -3.8)	-0.6** (-0.9 , -0.3)	-0.5 (-1.6, 0.4)
MedPAR 30-day Readmissions	17	-0.1* (-0.3 , -0.0)	-0.3 (-0.7 , 0.0)	-0.5 (-2.1 , 1.2)	-0.3* (-0.5 , -0.0)	-0.8* (-1.6, -0.1)
MedPAR 90-day Readmissions	19.5	-0.1 (-0.2 , 0.1)	-0.5* (-1.0 , -0.0)	-0.8 (-2.9 , 1.2)	-0.3* (-0.6 , -0.0)	-0.8 (-1.8, 0.1)
Admission to 4+ Star Nursing Home	42.4	0.4* (0.0 , 0.7)	1.0* (0.1 , 1.9)	7.1** (2.7 , 11.4)	0.9** (0.3 , 1.4)	2.2** (0.7, 3.7)
Admission to <3 Star Nursing Home	32.3	0.4** (0.1 , 0.7)	-1.1* (-2.0 , -0.3)	-4.9* (-8.9 , -0.9)	-0.7** (-1.2 , -0.2)	-1.0 (-2.4, 0.4)
Mental health Follow-up Visit	53.4	2.1** (1.0 , 3.3)	2.4 (-1.3 , 6.0)	-3.9 (-15.7 , 7.9)	0.2 (-2.0 , 2.5)	0.3 (-1.7, 7.8)
Colorectal Cancer Screening	65.1	0.7* (0.0 , 1.4)	3.6* (0.8 , 6.5)	5.6 (-3.9 , 15.0)	1.5* (0.2 , 2.8)	3.5 (-4.0, 10.9)
Breast Cancer Screening	72.3	1.0** (0.8 , 1.1)	1.8** (1.3 , 2.2)	0.7 (-1.1 , 2.5)	1.2** (0.9 , 1.5)	2.5** (1.6, 3.5)
Management of Osteoporosis	39.8	0.3 (-0.7 , 1.3)	-0.6 (-3.3 , 2.0)	-6.4 (-19.0 , 6.2)	-0.5 (-2.2 , 1.1)	0.5 (-4.1, 5.2)
Management of High Blood Pressure	64.3	4.4** (3.7 , 5.2)	5.3** (1.7 , 8.9)	1.4 (-8.1 , 10.9)	1.4 (-0.1 , 3.0)	8.2 (-0.6, 17.1)
Poor HBa1c Control	28.1	-2.8** (-3.3 , -2.2)	1.3 (-1.3 , 3.9)	-2.0 (-6.7 , 2.6)	1.1 (-0.1 , 2.4)	3.2 (-2.1, 8.4)
Diabetes Eye Screenings	69.1	2.7** (2.1 , 3.4)	-2.9 (-5.8 , 0.0)	-0.1 (-5.4 , 5.2)	-2.2** (-3.6 , -0.8)	-4.6 (-9.9, 0.1)
Use of low value PSA exam	37.1	-0.7** (-0.9 , -0.5)	-6.6** (-7.0 , -6.1)	-12.0** (-14.7 , -9.4)	-3.9** (-4.2 , -3.7)	-3.4** (-4.6, -2.1)
Any Primary Care Visit	86.1	0.3** (0.3 , 0.3)	0.5** (0.4 , 0.6)	-1.0 (-1.7 , 0.4)	0.2** (0.1 , 0.3)	0.0 (-0.2, 0.2)
Count of Outpatient Visits	8.4	0.9** (0.8 , 1.0)	0.8* (0.8 , 0.8)	0.7** (0.5 , 0.8)	0.1** (0.0 , 0.1)	0.1* (0.0, 0.2)

Notes: All results come from models adjusting for age, gender, race/ethnicity, dual eligibility, reason for entitlement and contract fixed effects. The first results column are the OLS results for the primary model specification. The second results column are the primary IV results. The third column restricts the consolidated contracts only to those that were consolidated in the same state as defined by CMS service area files. Enrollees who are in contracts consolidated nationally are excluded. The forth results column are from the reduced form model which estimates the association between being consolidated and each of the outcomes of interest.