The Effects of Medicare Advantage Contract Concentration on Patients' Nursing Home Outcomes

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Objective. The Medicare Modernization Act of 2004 allowed Medicare Advantage (MA) contracts to form provider networks in order to concentrate their patients among preferred providers. We focus on the skilled nursing facility (SNF) industry to assess patients' health when treating SNFs concentrate more patients from the same MA contract.

Data Sources/Study Setting. We use Medicare Beneficiary Summary File and Health, HEDIS, and the Minimum Data Set for patient attributes and OSCAR, LTCfocus.org, and Nursing Home Compare for SNF attributes. We include 1,069,436 MA enrollees newly admitted to SNF between 2012 and 2014.

Study Design. Using a MA contract fixed-effect model, we examine the effect of prevalence of a patient's MA contract in the treating SNF on patient's health outcomes including 180-day survival, 30-day hospital readmission, 30-day home discharge, and nursing home length of stay. We use an Instrumental Variable (IV), the expected share of admissions in a SNF from patient's MA contract calculated using a McFadden choice model.

Principal Findings. We find no relationship between SNF contract concentration and patients' outcomes after applying the IV.

Conclusions. While MA plans appear to steer patients to specific SNFs, we do not observe significant returns to patient outcomes related to concentration.

Key Words. Medicare advantage, skilled nursing facility, preferred provider network

In Medicare Advantage (MA), the Medicare program pays private insurance companies on a capitated basis to manage Medicare beneficiaries' care needs. In 2003, Congress passed the Medicare Modernization Act (MMA) which increased payments and afforded greater flexibility to MA contracts¹ including allowing MA contracts to develop restricted networks of providers into which MA members can be concentrated. Since the MMA, not only has the

MA program undergone extraordinary growth (accounting for over one-third of all Medicare beneficiaries in 2018), but also MA enrollees face a more restricted set of options when choosing a health care provider. For example, MA networks include only about half of the hospitals in their county (Kaiser Family Foundation 2016). While the practice of concentrating MA patients to preferred providers is common, the effect of this practice on patients' health outcomes is not well studied. The objective of this paper was to assess how steering MA members to preferred providers may influence the outcomes they experience when receiving skilled nursing facility (SNF) care.

Most SNFs have at least some MA patients, but these beneficiaries tend to be highly concentrated, and there is little evidence if this concentration affects the patient outcomes (Jung et al. 2018). MA enrollees appear to be admitted to lower quality SNFs, based upon Medicare's 5-star rating system, than is the case for FFS beneficiaries from the same residential neighborhoods (Meyers, Mor, and Rahman 2018). On the other hand, several studies have reported that MA patients receiving SNF care experienced better outcomes than their FFS counterparts, including lower rates of hospital readmission and higher rates of return to the community (Huckfeldt et al. 2017; Kumar et al. 2018). However, the factors behind better health outcomes for MA beneficiaries remain unknown. Prior studies speculated that MA plans concentrating enrollees in specific facilities and building "networks" may provide better and more efficient care (Jung et al. 2018).

Concentration may have both a positive and negative impact on health outcomes. The positive impacts are mostly through the "economies of scale" effect as described by the published experience of the "EverCare" model of Managed Care in a long-term nursing home care setting (Pope and Burge 1996; Kane and Huck 2000; Cohen et al. 2012). First, concentration of residents from a single MA plan in a given SNF theoretically increases the ability of MA medical staff, physicians, and nurse practitioners, to monitor residents' condition efficiently allowing integration of different types of care providers and better coordination. Second, a higher concentration of residents from a MA plan may allow MA plans to acquire enough bargaining power to affect

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inputs (e.g., staffing) of care production. Third, a higher practice of managed care in a SNF may increase productivity of staff and enhance the implementation of cost-saving activities. Several studies have shown that higher penetration of MA in a market improves treatment quality and patient outcome (Heidenreich et al. 2002; Bundorf et al. 2004) and reduces costs of care for FFS patients (Baker 1999). The negative impacts are mostly through the lower price MA plans exact. As MA contracts bargain prices to form preferred provider relationships, a SNF that receives a disproportionately large share of patients from an MA contract is likely to receive lower payment for patients from that MA contract compared to FFS patients or patients in other MA contracts. This may reduce the quality of care and the number of care hours per patient.

In this study, we seek to evaluate how contracting may affect a patient's outcomes following admission. We used an MA contract fixed-effect model to compare patients from the same contract admitted to SNFs with different levels of provider concentration. We applied a unique instrumental variable (IV) approach leveraging the geographic distribution of enrollees in competing MA contracts in order to address endogeneity concerns in the selection of SNF.

METHODS

Data

We linked three different individual-level Medicare data sets. First, the Medicare Beneficiary Summary File (MBSF) provided demographic characteristics and monthly enrollment information for 100 percent of the Medicare population. We used this file to identify which beneficiaries were enrolled in MA at any point in 2012–2014. The Medicare Healthcare Effectiveness Data and Information Set (HEDIS) file provided the MA contract and plan that every beneficiary was enrolled in. The Minimum Data Set (MDS 3.0) includes assessments for all patients admitted to Medicare-certified SNFs upon admission and then at least quarterly thereafter. The MDS instrument has numerous data elements and includes summary measures of cognitive and physical functioning and diagnoses (Mor 2004; Rahman et al. 2014). We used the On-line Survey & Certification Automated Record (OSCAR) (now known as CASPER) and *ltcfocus.org* (LTCFocus 2018) data to capture SNF characteristics and patient case mix. We merged zip code centroids from the zip code tabulation area file using patient residential zip codes from the MBSF in order to

identify the distance between any individual and all nearby SNFs. Finally, we include publically available CMS, SNF, and MA 5-star rating data.

Study Population

The study cohort includes all MA patients aged 65 and older who were admitted to any SNF in the United States between January 1, 2012, and December 31, 2014, following a hospitalization event, and who had not been admitted to a nursing facility in one full year prior to the index SNF admission. We excluded repeat nursing home users because they may be frailer than new postacute care patients and because prior choice of nursing home would likely systematically affect the next postacute care choice. We dropped individuals who did not reside in the 48 contiguous states and who were missing relevant MA contract, nursing home, and/or residential zip code information. Our final sample consisted of 1,069,436 Medicare beneficiaries enrolled in 465 MA contracts admitted to 13,495 SNFs.

Outcome Variables

We examined four outcome variables: (1) discharged to an acute setting within 30 days, (2) discharged to a nonacute setting within 30 days, (3) nursing home length of stay, and 4) 180-day survival. Both SNF discharge variables and length of stay in SNF are based on MDS 3.0 discharge records which are shown to be fairly complete and accurate (Rahman et al. 2014) and comparably available for both MA and FFS beneficiaries; 180-day survival is calculated comparing SNF admission date and date of death from the enrollment file.

Main Explanatory Variable

The main explanatory variable is the MA contract-specific concentration of patients in a SNF, defined as the proportion of SNF residents on the first Thursday of April in a year who are enrolled in a specific MA contract. We calculate this using the Residential History File (RHF) methodology which provides a snapshot at any point in time of where all Medicare beneficiaries are currently residing (Intrator et al. 2011). The first Thursday of April is an arbitrary date chosen at the time of the year when nursing homes have their greatest occupancy (LTCFocus 2018). Our concentration variable varies by MA contract, SNF, and year.

Control Variables

Patient Characteristics. We obtained age, gender, race, Medicaid eligibility, and residential zip code from the Medicare enrollment file. We used marital status and a host of diagnoses, clinical conditions (e.g., shortness of breath at rest), physical mobility, and cognitive functioning and impairment measures all drawn from patients' admission MDS record.

Nursing Home Characteristics. We included a series of SNF attributes from the OSCAR data that have been used as markers of SNF quality in previous studies: full-time equivalent (FTE) registered nurses (RNs), licensed practical nurses (LPNs), certified nursing assistants (CNAs), the total number of beds, the proportion of Medicaid paid residents, whether the SNF is run for profit, and whether the SNF is part of chain and occupancy rate. We included the overall star rating of SNFs published by CMS. Finally, we included the overall prevalence of MA in the SNF obtained from LTCfocus.org.

Contract-specific MA Penetration by ZIP Code. For each ZIP code, we calculated the share of all Medicare beneficiaries enrolled in a specific MA contract. We merged this variable to individual beneficiaries' records using their residential ZIP code and enrolled MA contract to create the penetration of individual's MA contract and other MA contracts in each individual's residential zip code. Similarly, we also created the penetration of individual's MA contract and other MA contracts in ZIP codes of alternative SNFs.

Distances. We calculated Haversine distances (as the crow flies) (Robusto 1957) of SNFs from the centroid of patients' residential zip code.² We geo-coded all the SNFs using the address on the OSCAR file and used zip code centroids as a proxy for individuals' residential location.

Statistical Model

Our analyses focused on the relationship between a given MA contract's prevalent concentration within a SNF and the health outcomes of a patient enrolled in that contract, who enters that SNF. The goal of this paper was to estimate the effect of such concentration, *net* of SNF quality effects and MA contract effects. Such a relationship is described by equation (1).

$$\text{Outcome}_{\text{inc}} = \alpha \text{NH_concen}_{\text{nc}} + X_i \gamma + XN_n \delta + \theta_c + u_{\text{inc}} \quad (1)$$

Here, Outcome_{inc} is an outcome variable experienced by an MA beneficiary enrolled in contract c and admitted to SNF n . NH_concen_{nc} is our main explanatory variable: the share of SNF n 's prevalent patients enrolled in the patient's same MA contract c . X_i is a vector of patient characteristics obtained from the enrollment file and SNF MDS admission assessments. θ_c reflects MA contract fixed effects. XN_n is a vector of SNF characteristics. u_{inc} is the error term.

The main challenge of estimating α is that NH_concen_{nc} is endogenous. The concentration of a particular MA contract in a given SNF is determined by the admissions of FFS patients and MA patients from different plans along with patients' length of stay and switching between Medicare plans. For instance, Meyers, Mor, and Rahman (2018) found that MA enrollees are receiving care in lower quality of SNFs implying that higher MA concentration may reflect lower quality care. To address this in part, we include SNF characteristics, including the overall share of MA and star rating in our model; however, contract-specific concentration may still capture unobserved SNF quality. Additionally, patients with different levels of care needs might systematically enter SNFs with different levels of concentration. Finally, MA enrollees have a shorter SNF length of stay (Kumar et al. 2018) and disenroll from plans at higher rates after SNF stays (Goldberg et al. 2017). These factors contribute to concentration and the outcomes simultaneously. If these factors are not addressed, then any estimate of the relationship between concentration and outcomes may be biased in either direction.

To address this endogeneity, we used the "natural" variation in the contract-specific concentration of patients in a SNF that is determined by the geographic distribution of patients in an MA contract. It has been established that proximity to a SNF relative to other competing SNFs is perhaps the most important determinant of SNF selection (Froebe et al. 1982; Zwanziger, Mukamel, and Indridason 2002; Rahman and Foster 2015). At the same time, MA contracts are likely to steer their patients to their preferred SNF. We argue that in the presence of a difference in the prevalence of an MA contract across neighborhoods, distance preference can generate variation in the prevalence of an MA contract across SNFs. We illustrate this point with Figure 1. We propose a linear city model for a single MA contract where enrollees are not uniformly distributed along the street. There are three SNFs denoted by the letters A, B, and C. Given this setup, we assume SNF choice is determined by two possible factors: distance preference and steering by MA contract. There are four possible scenarios. First, if neither distance nor steering mattered, patients will be

Figure 1: A Framework of Nursing Home Choice Given the Geographic Distribution of Nursing Homes and Enrollees in a Medicare Advantage Contract

evenly distributed across the three SNFs. Second, if only steering mattered, all the patients will go to the same SNF regardless of their residential neighborhood. Third, if only distances mattered, SNF B would have received most of the patients and SNF A and C would admit fewer patients. Finally, if both distances and steering matter, then distance preference would increase the prevalence of patients in SNF B and patients from zip codes that are further away from SNF B (e.g., zip codes 1 or 2) would have been steered toward SNF B since it is the nearest SNF to the majority of enrollees in that contract. In this case, the prevalence of this MA contract in a SNF not only depends on the prevalence of this contract to its nearby zip codes, but also on the prevalence of its competitors in nearby zip codes.

To operationalize this idea, we estimated a McFadden's conditional logit model to quantify the importance of distances and penetration of different MA contracts in SNFs' neighborhood in a patient's SNF choice. We followed SNF choice models estimated in the literature (Rahman et al. 2013; Rahman and Foster 2015). We assumed each patient faces a choice set, that is, a set of alternative SNFs to choose from. SNF choice is influenced by distance, observable SNF characteristics, and prevalence of patient's MA contract in SNF zip code (capturing the steering effect). Using this choice model, we predicted the number of a SNF's admitted patients enrolled in a specific MA contract which we use as our IV. The creation of the IV involved the following steps.

First, we created choice sets which consist of the following: (1) all SNFs used by all Medicare beneficiaries from a given zip code, (2) the nearest 15

SNFs by distance to the resident's zip code centroids, and (3) all SNFs within a 22 km radius. Thus, all patients from the same zip code face the same choice set. We excluded the out-of-state SNFs from the choice set following (Rahman and Foster 2015) in order to cluster errors in the choice function by state.

Second, estimation of the SNF conditional logit model: Using a 10 percent random sample of patients in our study population, we set up the data at a patient-choice set level such that each patient has observations equal to the number of SNFs in their choice set. The outcome is a binary variable of choice that was equal to 1 for the single SNF that the beneficiary was admitted to. We then estimated the following choice model:

$$P_{ij} = \exp(V_{ij}) / \sum_{j \in \text{CS}^i} \exp(V_{ij}) \text{ where } V_{ij} \text{ is :} \quad (2)$$

$$V_{ij} = \alpha^d \text{DIS_Z}_{zj} + \beta_1 \text{ZIPcontsame}_{ji} + \beta_2 \text{ZIPcontdiff}_{ji} + \mathbf{X}_j \boldsymbol{\alpha} \quad (3)$$

P_{ij} is the probability of beneficiary i in zip code z entering SNF j . DIS_Z_{zj} is the distance from the patient's residential zip code to the SNF. ZIPcontsame_{ji} is the percent beneficiaries in the SNF's zip code that are enrolled in the same MA contract as beneficiary i , and ZIPcontdiff_{ji} is the percent of beneficiaries in the SNF's zip code that are enrolled in a different MA contract than beneficiary i . $\mathbf{X}_j \boldsymbol{\alpha}$ is a vector of other SNF characteristics described previously that may influence the beneficiary's choice of a SNF.

Third, predicting probabilities of all individuals going to each SNF in their choice set: Using the choice set and the estimated model, we predicted the probability that a patient (using the 100 percent sample) would select a SNF for each SNF in the patient's choice set. Since our objective is to calculate probabilities that are not due to SNF quality, we set all SNF characteristics in vector $\boldsymbol{\alpha}$ to zero so their role would drop out of the prediction. Thus, the predicted probabilities are based on distances and concentration of different MA contracts in SNF's zip code alone.

Finally, aggregating probabilities to create our instrumental variable: We summed up the predicted probabilities by MA contract, SNF, and year, in order to calculate the predicted number of admissions in a given SNF of patients enrolled in a given MA contract. This is used to calculate the predicted percentage of a SNF's admissions enrolled in the patient's MA contract, which serves as our primary instrument.

Thus, the above stated four steps are used as "stage zero" to create our IV. We then used this IV, to estimate equation (1) using a typical two-stage least-squares (2SLS) regression as our primary model, instrumenting for the

prevalent contract concentration within a SNF with the predicted percentage of SNF admissions enrolled in the patient's MA contract, with standard errors clustered on MA contract.

Robustness checks: As an additional sensitivity check, we ran alternative specifications of the model, using tertiles of MA contract concentration in a SNF, and the IV in tertile form as opposed to the continuous format in the primary model specifications. We also used differential distances to SNFs in different tertiles of concentration as alternative IVs. We also estimated our model for alternative subsamples such as dual eligible, and those enrolled in high-quality MA plans. Finally, we used an alternative measure of concentration based on newly admitted patients instead of prevalent patients in SNF.

RESULTS

Demographic characteristics of our sample are presented in Table 1, as well as summary statistics of the outcomes of interest, and summary characteristics of the SNFs to which beneficiaries were admitted. These patients had a 30-day rehospitalization rate of 15 percent and a six-month mortality rate of 18 percent. The mean length of stay was 46 days. There was a mean concentration of 9.52 percent and a standard deviation of 7.6 percent with respect to the proportion of SNF residents in the exact same plan as the entering SNF patient.

In Table 2, we present the coefficients from the choice model that was used in the creation of the instrument. The two key predictors of nursing home choice were the patient's distance to the nursing home (with a log odds coefficient of -0.103 and a z -statistic of -10.56) and the share of beneficiaries in a SNF's zip code that were enrolled in the same MA contract as the beneficiary. Since the conditional logit coefficients are not directly interpretable, we calculated the marginal effects of distance and penetration of patient's MA contract in SNF's zip code (see Figure S2). The distance coefficient from the choice model implies that a patient is about 6 percentage points more likely to choose the nearest SNF in the choice set than the second nearest SNF in choice set. An increase in penetration of patient's MA contract in the nearest SNF's zip code by 10 percentage points increases the likelihood of entering the nearest SNF by 6 percentage points. This marginal effect of MA contract penetration tends toward zero as distance increases (Figure S2).

Table 3 shows the first-stage relationship between concentration and our IV which was calculated using the estimated choice model in Table 2. The coefficients of the IV imply that a one-point increase in the predicted

Table 1: Descriptive Characteristics of Patients and Skilled Nursing Facilities (*N* = 1,069,436)

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>
Patient-level outcomes		
Discharged to an acute setting within 30 days (%)	14.6	35.3
Discharged to a nonacute setting within 30 days (%)	59.4	49.1
Nursing home length of stay (days)	45.5	51.9
180-day survival (%)	82.3	38.2
Main explanatory variable		
% of SNF's patients enrolled in patient's MA contract	11.4	8.0
Demographic characteristics		
Age (years)	80.3	7.9
Female (%)	63	48
Married (%)	39	49
White (%)	80.5	39.6
Black (%)	10.9	31
Hispanic (%)	3.3	17
Asian (%)	2.2	14.6
Native American/American Indian (%)	0.2	4.4
Other race (%)	2.7	22
Fully dual eligible (%)*	14	35
Partially dual eligible (%)*	6	25
Originated from hospital (%)†	94	24
Diagnoses from admission assessment		
Shortness of breath (%)	14	37
Activities of daily living‡	16.7	4.9
Cognitive performance scale§	1.2	1.4
Stroke (%)	9	29
Alzheimer's disease (%)	4	19
Non-Alzheimer's dementia (%)	14	35
Hip fracture (%)	8	26
Multiple sclerosis (%)	0	5
Heart failure (%)	16	36
Diabetes (%)	31	46
Schizophrenia (%)	1	7
Bipolar disease (%)	1	10
Aphasia (%)	1	12
Cancer (%)	8	26
Residential ZIP code MA penetration		
% of Medicare beneficiaries enrolled in patient's MA contract	9.1	7.6
% of Medicare beneficiaries enrolled in other MA contract(s)	24.8	12.4
SNF-level Characteristics		
Distance of SNF from patient's residential ZIP code (km)	13.4	34.4
Total number of beds (mean)	138.2	82.1
Total number of registered nurse (RN)** (mean)	13.2	10.7
Total number of licensed practical nurse (LPN)** (mean)	20.3	14.2

continued

Table 1. *Continued*

<i>Variable</i>	<i>Mean</i>	<i>Std. Dev.</i>
Total number of certified nursing assistants (CNA)** (mean)	57.0	38.4
For profit (%)	71	46
Part of a chain (%)	60	49
% of patients paid by Medicaid	50.4	23.3
Occupancy rate (%)	85	13
Overall star rating ^{††}	3.3	1.3
% of SNF's patients enrolled in MA	29.3	20.4
SNF's ZIP code MA penetration		
% of beneficiaries enrolled in patient's MA contract in SNF's ZIP code	9.5	7.7
% of beneficiaries enrolled in other MA contract(s) in SNF's ZIP code	25.4	12.4

*Fully dual indicates full Medicaid and Medicare eligibility in which Medicaid covers Medicare premiums and provides additional services. Partially dual indicates Medicare and partial Medicaid eligibility in which Medicaid pays Medicare premiums but may not provide additional services.

[†]Originates from hospital indicates that the enrollee was admitted to the SNF directly from a hospital and not from home.

[‡]Calculated on a scale of 0–28 with higher numbers indicative of more limitations in activities of daily living.

[§]Calculated on a scale of 0 to 6 with 6 representing a high level of cognitive impairment.

**We do not include these variables per SNF resident as we include bed count in all of our models.

^{††}Ratings range from 1 to 5 with 5 being the highest rated.

percentage of a SNF's admissions enrolled in patients' MA contracts is associated with an increase in the actual prevalent concentration of 0.15. In models that both include and exclude SNF characteristics, there appears to be a strong correlation between the instrument and the explanatory variable, lending support to the strength of the instrument. The *t*-statistics in the model with SNF characteristics is 21.33 indicating strong statistical significance. The *F*-statistic is greater than 455, far exceeding the minimum recommended number for a valid first stage (Staiger and Stock 1994).

We performed a series of analyses to assess the validity of our exclusion-ary restriction. In Table S1, we compared patient characteristics between patients with high and low values of the IV relative to their contract-level median value. Thus, for each MA contract, we calculated the median value of the IV experienced by its patients and compared patients experiencing IV above and below that median. The two groups of patients look very similar though most differences between groups were statistically significant due to the sample size. Since it is difficult to summarize the difference in acuity from all these patient characteristics, we calculated the predicted likelihood of 180-day survival based on the patient characteristics (using a regression model) to summarize the overall acuity of a patient's during the SNF admission. We compared

Table 2: Estimated Choice Model Coefficients

<i>Variable</i>	<i>Coefficient</i>	<i>Std. Err.</i>	<i>z-Statistics</i>
Distance of SNF from patient's residential ZIP code (km)	−0.103	0.010	−10.56
Total number of beds (count)	0.002	0.001	2.32
Total number of registered nurse (RN) (count)	0.015	0.003	5.52
Total number of licensed practical nurse (LPN) (count)	0.009	0.003	3.12
Total number of certified nursing assistants (CNA) (count)	−0.004	0.001	−3.00
For profit (yes/no)	0.156	0.038	4.08
Part of a chain (yes/no)	0.120	0.024	5.03
Occupancy rate (%)	0.684	0.095	7.19
% of patients paid by Medicaid	−0.012	0.001	−15.79
% of SNF's patients enrolled in MA	0.018	0.003	6.70
Overall star rating (1–5)	0.009	0.008	1.13
% of beneficiaries enrolled in patient's MA contract in SNF's ZIP code	0.049	0.009	5.76
% of beneficiaries enrolled in other MA contract(s) in SNF's ZIP code	0.000	0.002	0.12
Number of observations	2,867,677		
Number of patients	106,907		
Pseudo- R^2	0.1304		

Notes: Choice model is estimated based on a 10% random sample of all patients included in this study due to complexities in the processing of larger samples. Standard errors and test statistics were obtained cluster error by state. The mean number of SNFs in patient's choice set is 27 (median 25). We ran this model on several alternative 10% random samples, and the estimated models from each run were roughly the same. The choice model for creating the instrument only includes nursing home characteristics and does not incorporate beneficiary-level characteristics. The coefficients displayed are changes in the log odds of selecting a SNF based on a change in the corresponding variable.

this predicted 180-day survival (as a proxy for overall acuity) between patients with high and low values of IV (Figure S3 panel B). It reveals no clear difference in overall acuity between patients with different levels of the IV, supporting the idea that the instrument is plausibly exogenous. We also compared the prevalent concentration between patients with high and low values of IV (Figure S3 panel A). Patients who have high levels of the IV also appear to have higher levels of prevalent contract concentration providing evidence of strong first-stage relationship in the 2SLS regression.

In Table 4, we present results from our primary OLS and 2SLS models. In the naïve OLS results, there appears to be a relationship between the SNF contract concentration and patient outcomes, however, when introducing the instrument all significant relationships disappear. The Durbin-Wu-Hausman test statistics imply that that contract concentration is an endogenous variable for most of the outcome variables and OLS estimates are biased. When we

Table 3: First-Stage Regression from the Two-Stage Least-Squares Models

	(1)	(2)	(3)	(4)	(5)
	<i>Entire sample</i>	<i>Nondual</i>	<i>Dual</i>	<i>MA contract Star rating < 4</i>	<i>MA contract Star rating > = 4</i>
Instrumental variable (IV)	0.0149*** [21.36]	0.0150*** [19.10]	0.0141*** [19.78]	0.0153*** [17.75]	0.0145*** [16.15]
Observations	1,069,670	849,800	219,870	568,216	501,454
R-squared	0.115	0.118	0.105	0.102	0.136
Number of MA contracts	456	448	452	352	198
Patient characteristics	Yes	Yes	Yes	Yes	Yes
SNF characteristics	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
MA contract fixed effects	Yes	Yes	Yes	Yes	Yes

Notes: Robust *t*-statistics clustering error by MA contract in brackets; *** $p < .01$. The IV is the predicted % of skilled nursing home admissions enrolled in beneficiary's contract. The outcome in this model is the prevalent % of patients in a beneficiaries' contract residing in a given skilled nursing facility.

used an alternative measure of concentration based on newly admitted patients instead of prevalent patients in SNF (see Table S3), this issue of endogeneity of contract concentration becomes more obvious. For example, with respect to length of nursing home stay, the OLS estimate of prevalence-based contract concentration is positive (Table 4) and OLS estimate of admission-based concentration is negative (Table S3). The 2SLS results are the same regardless of the construction of the concentration variable. We find similar results when we further stratify the results by MA contract star rating, by dual eligibility status, and when we classify concentration in tertiles (Table S2).

DISCUSSION

Using our IV approach, we find no observable relationship between the concentration of patients in a given MA contract in a SNF and patient's outcomes. We find that MA plans do appear to steer patients to specific nursing homes that are presumably in the network. While we cannot determine whether this results in cost savings to the MA plans, we find that efforts to concentrate patients into select nursing homes are not associated with patient outcomes, including length of nursing home stay.

Table 4: Effect of Change in % of Skilled Nursing Facility’s Patients Enrolled in Patient’s Medicare Advantage Contract (by 10%) on Outcome

		Discharged to an acute setting within 30 days (percentage point)	Discharged to a nonsnucle setting within 30 days (percentage point)	Nursing home length of stay (days)	180-day survival (percentage point)
Entire sample	OLS	−0.0232 [−0.404]	−0.711*** [−4.300]	0.656*** [4.552]	0.200*** [2.896]
IV		0.282 [1.242] (4.42)**	−0.794 [−1.058] (0.194)	1.010 [1.384] (3.54)*	−0.0882 [−0.398] (3.63)*
IV results for patients with different Dual	Nondual	0.272 [1.021]	−0.951 [−1.224]	1.403** [2.038]	0.0160 [0.0685]
eligibility	Dual	0.378 [1.095]	−0.377 [−0.408]	−0.251 [−0.183]	−0.499 [−1.208]
IV results for patients in different MA contract	Star rating <4	0.303 [0.934]	−0.734 [−0.937]	0.323 [0.362]	0.0780 [0.279]
	Star rating ≥4	0.206 [0.742]	−0.902 [−0.857]	1.854* [1.768]	−0.166 [−0.480]

Notes: All models include patient and SNF characteristics (described in control variables section) but not the contract-specific MA penetration by ZIP code variable which were used to calculate the IV. Robust *t*-statistics clustering at MA contract level are reported in square brackets. Durbin-Wu-Hausman (test of endogeneity) chi-square test statistics are presented in parentheses. ****p* < .01, ***p* < .05, **p* < .1.

While the economies of scale argument imply that increased coordination and the advantage of more physician and nurse practitioner visits might improve patient outcomes, we do not observe any return to concentration. This may be because the outcome differential between MA and fee for service is already so great that MA plans do not need to invest in more coordination and medical services embedded in their SNF partners since they are already achieving superior outcomes. Kumar's recent finding that new MA patients posthospitalization for hip fracture remain in SNF 5 fewer days than do FFS in the same facility would be consistent with this interpretation (Kumar et al. 2018). It is also possible that any positive effects of concentration are nullified by the lower prices MA plans pay for SNF care than FFS reimburses. SNFs may accept this lower payment since it exceeds Medicaid rates, but the care requirements of treating a postacute care patient may be greater than what it costs although SNFs may not have a sufficiently sophisticated cost accounting approach to realize that they are losing money on these admissions. Long-term care is predominantly paid by Medicaid (paying for 59 percent of all nursing home residents in 2015). As such, the influence of Medicaid may override any potential steering effect since both FFS Medicare and MA subsidize the level of Medicaid payment.

Another potential explanation for our null findings is that quality provided within a SNF is a public good (Grabowski, Gruber, and Angelelli 2008). SNF patients from a given MA contract may receive the same quality medical services regardless of concentration. It is also possible that a SNF provides the same quality of care to all patients regardless of enrollment status. Additionally, concentration of one MA contract may have positive spillover effects on patients enrolled in other MA contract or traditional Medicare. The public good and positive spillover effect arguments suggest that the overall MA concentration may have a positive effect on all patients even in the absence of the effect of contract-specific MA concentration. However, because MA enrollees are, in general, healthier than FFS patient, any analysis of the effect of overall MA patient concentration would be highly endogenous (Rahman et al. 2015).

Our study is subject to several limitations. We are unable to measure cost outcomes for patients and plans due to concentration. Additionally, while we demonstrate a strong first-stage relationship for our IV, and it is unlikely that our IV fails the exclusion restriction assumption, this assumption is not formally testable. While the choice model we use to calculate the IV has been used previously in the literature, using a conditional logit model is but one of several options for modeling enrollee choice. Conditional logit models come

with an assumption of the independence of irrelevant alternatives (IIA), which we cannot formally test; however, we do not believe it to be relevant in this instance as it is unlikely that the removal of a SNF from the choice set would substantially change the drivers that influence which SNF the enrollee actually selected. Additionally, we do not have data on physician or nurse practitioner provider visits MA enrollees may receive, which we suppose is why MA plans engage in concentration in the first place. Finally, it is important to note that failure to reject the null does not in fact confirm that there are no effects; however, given our sample size, we are likely powered to detect small changes in patient outcomes in our models.

In summary, our IV analysis of the role of MA contract concentration on patient nursing home outcomes finds no relationship between the concentration of patients in a given contract in a given nursing home and the outcomes that MA patients experience. It is of policy interest that there does not appear to be any impact on patient health outcomes. Previous work has found that beneficiaries enrolled in MA contracts tend to enter lower quality nursing homes than those in FFS (Meyers, Mor, and Rahman 2018) as measured by both readmissions rates, and nursing home compare star ratings. Other work has also found that these star ratings and readmissions rates are related to patient health outcomes. Thus, if patient steering by MA contracts does not improve patient outcomes and may actually lead patients entering poorer quality nursing homes, should steering patients be encouraged? More research is needed into any cost savings that steering by MA contracts may result in; however, these steering practices do not seem related to patient health outcomes.

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Disclosures: None.

Disclaimer: None.

NOTES

1. In MA, private companies submit bids to CMS. Each bid takes the form of a contract, which can subsequently include many different plans that beneficiaries can choose from. While in our data it is possible to include information on both plans and contracts, CMS evaluates the performance of the MA program at the contract level, which we will use as our main MA unit of analysis in this study.
2. While travel time to a SNF may be a more precise driver of SNF selection, our analysis is limited in that we do not have patient-level coordinates, so we cannot accurately use a road network to calculate travel time. While travel time could be calculated from the zip centroid to the SNF, it may not necessarily be more accurate than Haversine distance as patients can live in different parts of a zip code, and travel time calculation with the scale of this study data can be computationally intensive. We believe that Haversine distance is an adequate proxy as it would still capture the role distance plays in SNF selection, if perhaps slightly less precise than travel time.

REFERENCES

- Baker, L. C. 1999. "Association of Managed Care Market Share and Health Expenditures for Fee-for-Service Medicare Patients." *Journal of the American Medical Association* 281 (5): 432–7.
- Bundorf, K. E., J. A. Stafford, D. Gaskin, J. G. Jollis, K. A. Schulman, and J. J. Escarce. 2004. "Impact of Managed Care on the Treatment, Costs, and Outcomes of Fee for Service Medicare Patients with Acute Myocardial Infarction." *Health Services Research* 39 (1): 131–52.
- Cohen, R., J. Lemieux, J. Schoenborn, and T. Mulligan. 2012. "Medicare Advantage Chronic Special Needs Plan Boosted Primary Care, Reduced Hospital Use among Diabetes Patients." *Health Affairs* 31 (1): 110–9.
- Froebe, D., A. Balitsis, S. Beckman, N. Dolphin, V. Hayes, and S. Morrissey. 1982. "Variables Influencing the Consumer's Choice of Nursing Homes." *Journal of Health Care Marketing* 2 (2): 25–33.
- Goldberg, E. M., A. N. Trivedi, V. Mor, H.-Y. Jung, and M. Rahman. 2017. "Favorable Risk Selection in Medicare Advantage: Trends in Mortality and Plan Exits among Nursing Home Beneficiaries." *Medical Care Research and Review* 74 (6): 736–49.
- Grabowski, D. C., J. Gruber, and J. J. Angelelli. 2008. "Nursing Home Quality as a Common Good." *The Review of Economics and Statistics* 90 (4): 754–64.
- Heidenreich, P. A., M. McClellan, C. Frances, and L. C. Baker. 2002. "The Relation between Managed Care Market Share and the Treatment of Elderly Fee-for-Service Patients with Myocardial Infarction." *American Journal of Medicine* 112 (3): 176–82.
- Huckfeldt, P. J., J. J. Escarce, B. Rabideau, P. Karaca-Mandic, and N. Sood. 2017. "Less Intense Postacute Care, Better Outcomes For Enrollees In Medicare Advantage Than Those In Fee-For-Service." *Health Affairs* 36 (1): 91–100.

- Intrator, O., J. Hiris, K. Berg, S. C. Miller, and V. Mor. 2011. "The Residential History File: Studying Nursing Home Residents' Long-Term Care Histories." *Health Services Research* 46 (1 Pt 1): 120–37.
- Jung, H.-Y., Q. Li, M. Rahman, and V. Mor. 2018. "Medicare Advantage Enrollees' Use of Nursing Homes: Trends and Nursing Home Characteristics." *American Journal of Managed Care* 24 (8): e249–56.
- Kaiser Family Foundation. 2016. "Medicare Advantage Hospital Networks: How Much Do They Vary?" [accessed on October 15, 2018]. Available at <http://insurance.maryland.gov/Consumer/Documents/agencyhearings/KaiserReport-Medicare-Advantage-Hospital-Networks-How-Much-Do-They-Vary.pdf>
- Kane, R. L., and S. Huck. 2000. "The Implementation of the EverCare Demonstration Project." *Journal of the American Geriatrics Society* 48 (2): 218–23.
- Kumar, A., M. Rahman, A. N. Trivedi, L. Resnik, P. Gozalo, and V. Mor. 2018. "Comparing Post-Acute Rehabilitation Use, Length of Stay, and Outcomes Experienced by Medicare Fee-for-Service and Medicare Advantage Beneficiaries with Hip Fracture in the United States: A Secondary Analysis of Administrative Data." *PLOS Medicine* 15 (6): e1002592.
- LTCFocus. 2018. "Long-Term Care: Facts on Care in the US - LTCFocus.Org" [accessed on May 3, 2017]. Available at <http://ltcfocus.org/>.
- Meyers, D. J., V. Mor, and M. Rahman. 2018. "Medicare Advantage Enrollees More Likely To Enter Lower-Quality Nursing Homes Compared To Fee-For-Service Enrollees." *Health Affairs* 37 (1): 78–85.
- Mor, V. 2004. "A Comprehensive Clinical Assessment Tool to Inform Policy and Practice: Applications of the Minimum Data Set." *Medical Care* 42 (4 Suppl): III50–9.
- Pope, G. C., and R. T. Burge. 1996. "Economies of Scale in Physician Practice." *Medical Care Research and Review* 53 (4): 417–40.
- Rahman, M., and A. D. Foster. 2015. "Racial Segregation and Quality of Care Disparity in US Nursing Homes." *Journal of Health Economics* 39: 1–16.
- Rahman, M., A. D. Foster, D. C. Grabowski, J. S. Zinn, and V. Mor. 2013. "Effect of Hospital-SNF Referral Linkages on Re-Hospitalization." *Health Services Research* 48 (6 Pt 1): 1898–919.
- Rahman, M., D. Tyler, J. K. Acquah, J. Lima, and V. Mor. 2014. "Sensitivity and Specificity of the Minimum Data Set 3.0 Discharge Data Relative to Medicare Claims." *Journal of the American Medical Directors Association* 15 (11): 819–24.
- Rahman, M., L. Keohane, A. N. Trivedi, and V. Mor. 2015. "High-Cost Patients had Substantial Rates of Leaving Medicare Advantage and Joining Traditional Medicare." *Health Affairs* 34 (10): 1675–81.
- Robusto, C. C. 1957. "The Cosine-Haversine Formula." *American Mathematical Monthly* 64 (1): 38–40.
- Staiger, D., and J. H. Stock. 1994. "Instrumental Variables Regression with Weak Instruments." Working Paper 151, National Bureau of Economic Research [accessed on December 21, 2016]. Available at <http://www.nber.org/papers/t0151>.
- Zwanziger, J., D. B. Mukamel, and I. Indridason. 2002. "Use of Resident-Origin Data to Define Nursing Home Market Boundaries." *INQUIRY: The Journal of Health Care Organization, Provision, and Financing* 39 (1): 56–66.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix SA1: Author Matrix.

Figure S1: Mean Level of Concentration Faced by Patients Enrolled in Medicare Advantage Contracts with Different Star Rating.

Figure S2: Marginal Effects of Proximity to a Skilled Nursing Facility and Penetration of Patient's Medicare Advantage Contract in Skilled Nursing Facility's Zip Code.

Figure S3: Panel A: Proportion of Skilled Nursing Facility's Patients Enrolled in Patient's Medicare Advantage Contract for Patients with Lower and Higher Value of Instrumental Variable. Panel B: Predicted Probability of 180 day Survival Following Skilled Nursing Facility Admission among Patients with Lower and Higher Value of Instrumental Variable.

Table S1: Balance of Patients with Low and High Values of the Instrumental Variable.

Table S2: Effect on Categorical Change in % of Skilled Nursing Facility's Patients Enrolled in Patient's Medicare Advantage Contract on Outcome.

Table S3: Effect on Change in % of Skilled Nursing Facility's Newly Admitted Patients Enrolled in Patient's Medicare Advantage Contract (by 10 percent) on Outcome.