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**Title:** The Five-Star Skilled Nursing Facility Rating System and the Care of Disadvantaged Populations

**Running Head:** SNF Ratings and Disadvantaged Populations

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### **IMPACT Statement**

We certify that this work is confirmatory of recent novel clinical research. Our research confirms that vulnerable Medicare beneficiaries are more likely to be discharged to lower

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quality skilled nursing facilities (SNFs) after a hospital stay. We use a novel measure at the county level to assess SNF post-acute SNF availability and use the most recent measure of SNF quality, the five-star rating system.

Relevant research:

Rahman M, Grabowski DC, Gozalo PL, Thomas KS, Mor V. Are dual eligibles admitted to poorer quality skilled nursing facilities? *Health Serv. Res.* 2014;49(3):798-817.

Werner RM, Norton EC, Konetzka RT, Polsky D. Do consumers respond to publicly reported quality information? Evidence from nursing homes. *J. Health Econ.* 2012;31(1):50-61.

Angelelli J, Grabowski DC, Mor V. Effect of Educational Level and Minority Status on Nursing Home Choice After Hospital Discharge. *Am. J. Public Health.* 2006;96(7):1249-1253.

## Abstract

Background/Objectives: Assuring high quality skilled nursing facility care is particularly important in the Medicare program: after hospitalization, approximately 20% of beneficiaries are discharged to a skilled nursing facility (SNF). We examined characteristics and locations of high- and low-quality facilities and whether certain vulnerable patients were differentially discharged to facilities with lower quality ratings.

Design: We used Medicare claims from October 2013-September 2014 and SNF five-star ratings published on Nursing Home Compare. We describe the characteristics and patient population of facilities by quality and the location of low (one star) and high (five stars) quality facilities. We used logistic regression models to estimate the odds for admission to a low-quality facility after hospital discharge by race/ethnicity, dual enrollment in Medicare and Medicaid, functional status, discharge from a safety-net or low quality hospital, and residence in a county with more low-quality SNFs.

Setting: Medicare certified SNFs providing post-acute care.

Participants: 1,195,166 SNF stays of Medicare beneficiaries age 65 and older admitted to 14,033 SNFs within 2 days of hospital discharge.

Measurements: Hospital discharge to a low-quality (one-star) facility.

Results: 22.2% of the facilities had a rating of 5 stars (high quality), and 15.9% had a one-star (low quality) rating. Low-quality facilities were more likely to be in the South (44%), for-profit (85%), and larger (86% had over 70 beds). Dual enrollment was the strongest predictor of admission to a one-star facility (odds ratio=1.53; 95% confidence interval=[1.51, 1.55]), although racial/ethnic minority status (Black: OR=1.25; CI=[1.22, 1.28]; Hispanic: OR=1.10; CI=[1.06, 1.14]) and geographic prevalence of facilities (for a 10% increase in one-star beds located in the county of patients' residence: OR=1.27; CI=[1.26, 1.27]) were also significant predictors.

Conclusions and Relevance: Vulnerable groups are more likely to be discharged to lower quality facilities for post-acute care. Policymakers should continue to monitor disparities in SNF quality.

**Key words:** Quality measurement, skilled nursing facility, post-acute care, Medicare

## Introduction

Assuring high quality of care in the SNF setting is particularly important: after hospitalization, approximately 20% of Medicare beneficiaries are discharged to a SNF,<sup>1</sup> and Medicare spending on SNFs was \$24 billion in 2016.<sup>2</sup> Post-acute care (PAC) is increasingly recognized as one of the largest drivers of geographic variation in healthcare spending,<sup>3,4</sup> and prior research has demonstrated that quality of post-acute care is often sub-optimal.<sup>5,6</sup>

To direct consumers towards higher-quality providers and incentivize skilled nursing facilities (SNFs) to improve quality, the Centers for Medicare and Medicaid Services (CMS) began publicly reporting SNF ratings on the Nursing Home Compare website in 2008.

A substantial number of studies have evaluated variation in quality for long-term nursing home patients.<sup>7-14</sup> Far fewer focus on the quality of post-acute care in SNFs; we know of only three that evaluated publicly reported quality measures.<sup>15-17</sup> Recent studies have examined post-acute SNF choice, including the role of preferred SNFs, hospital-SNF affiliations, and discharge planning.<sup>18-21</sup> Although long-term and post-acute patients may use the same facilities, the factors considered in choosing a facility may be quite different. First, hospital staff may provide information and help beneficiaries choose a post-acute care facility before they are discharged, while those entering long-term care may come directly from home without this additional decision support. Moreover, post-acute care is paid by Medicare, while long-term care is not, and payment rates could affect a facility's decision to accept a patient.

Despite these differences, little is known about either the characteristics of low-performing SNFs or the types of patients they serve in the post-acute setting. The quality of care that vulnerable populations receive, such as beneficiaries dually enrolled in Medicaid and Medicare, racial and ethnic minorities, those with poor functional status, those discharged from low-quality or safety-net hospitals, and those living in areas where there are few high-quality SNFs, is of particular concern. Therefore, in this paper we addressed three key questions. First, what are the structural characteristics of high- and low-quality SNFs? Second, where are they located? Third, are certain vulnerable patients more likely to be discharged to low-quality SNFs?

## **Methods**

### *Data*

We used fiscal year (FY) 2014 data (October 1, 2013 to September 30, 2014) including the Medicare Beneficiary Summary File (MBSF), which includes beneficiary enrollment information and demographics; Medicare hospital, SNF, and home health claims, which include records of inpatient care in acute care hospitals, SNFs and home health agencies for all fee-for-service (FFS) Medicare beneficiaries; and the Nursing Home Minimum Data Set (MDS), which includes detailed clinical data on all patients in Medicare-certified SNFs. We also used 2015 Nursing Home Compare data published on the CMS website, which includes characteristics of

Medicare and Medicaid certified skilled nursing facilities, and FY 2014 Hospital Value-Based Purchasing (HVBP) data published on the CMS website for hospital performance measures.

Our sample included all discharges of Medicare FFS beneficiaries age 65 and older from nonfederal acute care hospitals in FY 2014 to a Medicare covered SNF, as indicated by discharge destination from the admitting hospital. We excluded beneficiaries who did not have an associated claim for a SNF stay within two days of hospital discharge and those without continuous Medicare FFS enrollment for one year prior to discharge. We also focused on post-acute SNF stays by excluding beneficiaries with a long SNF stay (>100 days) in the 30 days prior to hospital admission.

### *Measures*

We defined SNF quality using the publicly available five-star quality ratings on Nursing Home Compare. Stars range from one star (worst) to five stars (best), and are based on three performance domains: health inspection, staffing, and quality measures. These three domains are combined to calculate an overall rating. The overall rating is primarily based on health inspection scores and then adjusted up or down based on performance in the other two domains.<sup>22</sup>

To better understand this quality measure, we examined the correlation between the three domains and the overall star rating. Although most SNFs had scores for all three domains,

15 were missing quality scores due to a small number of beneficiaries and 237 were missing staffing scores because the SNF did not submit data. Because the overall star rating relies heavily on health inspection ratings, no facilities with a one-star overall rating received more than three stars on health inspection. The correlations between individual domain scores were low (0.11 to 0.18) but statistically significant ( $p < 0.001$ ). The overall score was most highly correlated with the health inspection component score (0.84), while quality and staffing correlations were lower (0.45 and 0.47, respectively).

Using the MDS, we constructed a modified Barthel Index (BI) for each patient as a measure of functional status at the time of SNF admission.<sup>23</sup> The BI contains nine items: feeding, bathing, grooming, dressing, bowels, bladder, toilet use, transfers, and mobility. The sum of itemized scores produces a total from 0 to 90, with lower scores indicating higher levels of dependence. Items not assessed were coded as 0 or “total dependence”.<sup>24</sup> A total of 31,165 cases missing all nine BI items were excluded.

We measured hospital quality at the discharging hospital by whether it received a penalty under the HVBP in 2014. In 2014, the HVBP assessed hospitals on 15 process and outcome measures and patient experience to provide an overall hospital quality score. We measured hospital safety-net status by whether a hospital was in the top 20% of hospitals by disproportionate share hospital (DSH) index. The DSH index is a measure of the proportion of

poor patients a hospital serves, based on Medicare beneficiaries receiving Supplemental Security Income and Medicaid beneficiaries.

Because one of the drivers of admission to a low-quality SNF could be a paucity of high-quality facilities in the patients' residential area, we evaluated county-level access to high- and low-quality facilities. Geographic access included total SNF beds and the percentage of beds in one-star SNFs in a beneficiary's county of residence.

### *Statistical Analysis*

We first assessed differences in structural characteristics of SNFs by star rating. Facility characteristics included certification, nursing home size ( $\leq 70$ , 71-120, or  $\geq 121$  beds), hospital-based, profit status (not-for-profit, for-profit, or government owned), urban (located in a core based statistical area), and Census region (Northeast, Midwest, South, or West). We then examined and mapped the proportion of low- and high-quality SNF beds in each county.

We evaluated the association between SNF star rating and patient and hospital stay characteristics. Patient characteristics included demographics (age, sex, race/ethnicity), dual enrollment, location (urban and Census region), original reason for Medicare entitlement (aged, disabled, or end-stage renal disease (ESRD)), functional status, number of comorbid conditions, type of hospital admission (medical, surgical, cardiovascular, cardiorespiratory, or neurological), whether patients spent time in the intensive care unit (ICU) during the admission, had a

hospitalization in the year prior to admission, patients' county-level access to SNFs (total beds and proportion of beds in low-quality SNFs), availability of other post-acute care (PAC) services (number of long-term care hospitals, inpatient rehabilitation facilities, and home health agencies serving beneficiaries in the county), and state fixed effects to account for state-level SNF policies. Hospital stay characteristics were based on the acute care discharge and included safety-net status, HVBP penalties, system membership, urban location, profit status, and number of beds.

For the patient and hospital characteristics of interest (race/ethnicity, dual enrollment, functional status, access to SNFs, and discharge from a safety-net or low-quality hospital) we estimated the odds for admission to a low-quality (one star) SNF after hospital discharge. We first evaluated bivariate relationships between each of these characteristics and admission to a low-quality SNF with a multilevel logistic model with random intercepts for the discharging hospital. Then, we included all of the characteristics of interest in the same multivariable model controlling for additional patient (demographics, original reason for Medicare entitlement, prior hospitalization, prior ICU stay, number of comorbidities, type of index admission, other PAC service availability) and hospital (system membership, urban location, bed size, and profit status) measures. As a sensitivity analysis, we evaluated the odds of discharge to a SNF with each star rating using a multinomial logit model.

All analyses were conducted in Stata, version 14.1, and SAS, version 9.4. Two-sided p-values less than 0.05 were considered statistically significant. As determined by the Common Rule, policy research at the U.S. Department of Health and Human Services that uses secondary, administrative, and deidentified data for program analysis does not require approval by an institutional review board or informed consent.<sup>25</sup>

## Results

### *SNF Characteristics by Overall Star Rating*

Our sample included 1,195,166 stays at 14,033 SNFs, described in Table 1. Nearly half (45.5%) had an overall rating of 4 or 5 stars, and 2,230 (15.9%) had an overall rating of only 1 star. Of one-star facilities, 44% were located in the South compared to 28% of five-star facilities. Compared to five-star SNFs, one-star SNFs were more likely to be for-profit and larger. They were also less likely to be hospital-based facilities.

When we mapped SNF availability, we saw significant geographic variation in the availability of high- and low-quality SNFs (Figure 1). Overall, 156 out of 2,909 counties (5%) have only one-star facilities available, with an average of 571 (SD=1466) beds in 1.2 (SD=0.46) facilities per county. Two-thirds of these counties are located in the South, compared to 20% in the Midwest, 10% in the West, and 3% in the Northeast. 427 (15%) counties have only 1- or 2-star facilities available. 63% of these counties are located in the South, compared to 21% in the

Midwest, 12% in the West, and 4% in the Northeast. Most striking, Western and Midwestern counties tended to have more high quality facilities, while counties in southern Texas had a disproportionate share of one-star facilities. In the Northeast, upstate New York and Pennsylvania have more counties with one-star facilities than other states in the region. Other regions exhibit greater variation in SNF quality.

#### *Patient Characteristics by Overall Star Rating*

Low-quality SNFs admitted a greater proportion of disadvantaged patients than high-quality SNFs (Table 2). Low-quality facilities were more likely to take care of Black patients (12% vs. 6%), dually-enrolled patients (38% vs. 22%), and patients with lower functional status, than high-quality facilities. Low-quality facilities were also more likely to admit patients from hospitals that received a HVBP penalty.

In terms of geographic region, 77% of SNF stays were in the same county as the beneficiary's county of residence. Patients admitted to low-quality facilities had an average of 3,643 SNF beds in their counties. In contrast, patients admitted to high-quality facilities averaged 5,385 SNF beds in their counties (Table 2). Patients who went to one-star SNFs resided in counties where 31% of SNF beds were of low-quality, while those who went to five-star SNFs lived in counties with only 13%.

### *Predictors of Discharge to Low-Quality SNFs*

Table 3 presents the odds ratios (ORs) from raw and adjusted models for admission to a low-quality SNF (full multivariable model is in Supplementary Table S2).<sup>26</sup> In the bivariate models, Black patients (OR=1.61), Hispanic patients (OR=1.40), dually-enrolled patients (OR=1.72), and those discharged from a safety-net hospital (OR=1.25) were significantly more likely ( $p<0.05$ ) to be admitted to a low-quality SNF. In contrast, discharge from a low-quality hospital was not a significant predictor. In the full model, all of the patient characteristics continued to be significant predictors of being admitted to a low-quality SNF (OR for Black patients = 1.25; for Hispanic patients, OR=1.10; for dual patients, OR=1.53; all  $p<0.05$ ), but discharge from a safety-net hospital was no longer significant. We also found that geographic access played an important role; in the full model, a 10% increase in the proportion of one-star beds in a county was associated with 1.27 higher odds of being admitted to a low-quality SNF. Results from the multinomial logit model were similar and can be found in Supplementary Table S3.

### **Discussion**

We found substantial variation in the quality of SNFs, with low-quality SNFs more likely to be located in the South, under for-profit ownership, and larger in size. Dual enrollment status was the most powerful predictor of admission to a one-star SNF, although racial and ethnic minority status and geographic availability of SNFs were also significant predictors.

Our findings about vulnerable patients—those with lower income and racial/ethnic minorities—are troubling. Understanding the reasons these patterns exist will be critical to finding ways to reduce disparities in discharge to low-quality facilities. Dually-enrolled beneficiaries may be less likely to “shop” for high-quality SNFs in general, and this may be exacerbated when beneficiaries need to choose a SNF quickly at hospital discharge. Despite the fact that from the beneficiary perspective, cost sharing is the same no matter the quality of the SNF chosen, a beneficiary’s educational level, knowledge of quality rating programs, or being discharged from hospitals with fewer resources to assist with these choices may play into this disparity. Alternatively, high-quality SNFs may be less likely to accept dually-enrolled beneficiaries, particularly if they are expected to stay longer than the Medicare benefit period and the SNF would receive lower Medicaid reimbursement rates. Prior research has shown that simply providing quality information does not necessarily drive patients to higher quality providers,<sup>27,28</sup> and that hospitals are not actively encouraging beneficiaries to choose higher quality SNFs at discharge.<sup>18,20,21</sup> Assisting with patient choice at hospital discharge may represent an important mechanism for reducing disparities in care.

Beyond patient characteristics, we found that geographic access, as measured by the proportion of one-star SNFs in the same county as the patient’s residence, was also a significant predictor of being admitted to a low-quality SNF, and that this observed relationship persisted after adjusting for patient and discharging hospital characteristics. Although patient, area, and

hospital characteristics are all associated with post-acute SNF quality, we did not assess the relative influence of these. Future research could shed more light on which factors are the most influential on SNF choice.

Prior studies have shown that distance as a measure of geographic availability is associated with choice of post-acute care setting.<sup>15,29</sup> There have been many studies of disparities in quality in the acute care hospital setting, and a substantial number focusing on long-term nursing home residents and showing that vulnerable populations are more likely to use lower quality facilities,<sup>8,10,12,13</sup> but we know of only a few studies focusing on post-acute care in SNFs. Our findings are consistent with work by Rahman et al. who showed that duals are more likely to be cared for in lower quality SNFs<sup>15</sup> and Werner et al. and Angelelli et al. who found that those with lower education and racial minorities are more likely to be cared for in lower quality SNFs.<sup>16,17</sup> Other studies have focused on readmissions.<sup>30,31</sup> Our study provides rationale for programs to encourage active patient choice and other efforts to reduce disparities in access to high-quality SNFs.

Our research has some limitations. Because we used FFS claims, we were unable to include beneficiaries enrolled in Medicare Advantage. Additionally, the Medicare enrollment files have limited demographic and socioeconomic status measures. We also relied on health status obtained through claims, and better measures of health status and disability may explain some of the differences in SNF use. In this analysis, we used county-level measures of SNF

availability; measures at a different geographic level or using a different method (such as distance) may show a different relationship. To the extent that beneficiaries are willing to go to SNFs outside of their county of residence, this measure of availability is limited. However, we found that over three-quarters of SNF patients enrolled in a SNF in their county of residence. We focused on post-discharge SNF stays for this study, and as such our results may not generalize to longer-term nursing home care. We also used the five-star rating system to determine SNF quality, which aggregates health inspections, staffing, and quality measure performance. This system includes measures applicable to both post-acute and long-term nursing home residents, and the quality measures in 2014 were mostly based on long-stay patients' experiences.<sup>22</sup> Since that time, additional measures pertaining to short-stay patients have been added to the quality score.<sup>32</sup> However, some components of post-acute quality may still not be captured in this summary measure.

Finally, we assessed the relationship between vulnerable groups and SNF quality, but cannot comment on the directionality of this relationship. It may be that some SNFs appear to be lower quality because it is harder to achieve high performance with these groups. It may also be that vulnerable patients are discharged to SNFs that have lower quality across all their patients. We also do not know whether vulnerable beneficiaries choose lower quality SNFs, or if lower-quality SNFs are more likely to accept these patients than other facilities.

The five-star rating system prioritizes simplicity over transparency. Although consumers may not be aware of exactly what the stars are measuring, they are made up of important components: health inspections, staffing, and quality measures. And the simplicity may be working; recent studies have found that the proportion of beneficiaries admitted to higher rated facilities has increased, while the proportion admitted to low-quality facilities decreased, since reporting began in 2008.<sup>6,14</sup> Overall star ratings have also increased,<sup>9</sup> although there is the potential for SNFs to improve on self-reported staffing measures without changes to the actual quality of care being delivered. It will be important to continue to monitor changes in both disparities and overall quality as the SNF value-based purchasing program is implemented.

In summary, we found that compared to other Medicare beneficiaries, vulnerable populations, particularly dually enrolled beneficiaries and racial/ethnic minorities, are more likely to be discharged to low-quality SNFs. They are also more likely to reside in areas that have fewer high-quality SNFs. We also found wide variation in SNF quality as measured by the five-star rating system used on Nursing Home Compare. Quality improvement efforts aimed at low-quality SNFs, as well as interventions that address the reasons for differential discharge of vulnerable populations to low-quality facilities may be necessary to reduce disparities in nursing home care.

## **Acknowledgments**

*Conflicts of Interest*

The authors have no conflicts of interest.

*Author Contributions*

All authors contributed to the study concept and design, analysis and interpretation of data, and preparation of manuscript. RBZ, LMC, KEJM, and SHS contributed to the acquisition of data.

*Sponsor's Role*

None.

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## Supplemental Material

Supplementary Table S1. Additional Characteristics of Patients Admitted to SNFs in 2014, by Star Rating

Supplementary Table S2. Odds Ratio for Admission to Low-Quality (one-star) SNFs in 2014 (full multivariable model)

Supplementary Table S3. Odds Ratio (95% CI) for Admission to 1-4 star SNFs as compared to 5 star SNFs

**Table 1. Characteristics of Skilled Nursing Facilities in 2014, by Star Rating**

	Overall Star Rating				
	1	2	3	4	5
n=14,033	2230 15.9%	2733 19.5%	2679 19.1%	3273 23.3%	3118 22.2%
Urban	89%	90%	88%	90%	89%
Geography region					
Northeast	16%	18%	19%	18%	20%
Midwest	32%	30%	31%	33%	33%
South	44%	36%	38%	32%	28%
West	8%	16%	13%	16%	19%
Number of beds					
≤70	14%	17%	20%	27%	39%
71-120	45%	45%	46%	43%	39%
≥121	41%	38%	34%	31%	22%
Certification					
Medicare Only	0%	2%	2%	6%	12%
Medicare and Medicaid	100%	98%	98%	94%	88%
Hospital-based facility	2%	2%	3%	5%	7%
Profit Status					
For-profit	85%	80%	72%	66%	60%
Government	4%	4%	5%	6%	6%
Non-profit	10%	16%	22%	28%	35%

Notes: All differences between overall star ratings are statistically significant at  $p < .0001$  based on a chi-square test, except urban with  $p = 0.01$ . Urban is defined as located in a Core-Based Statistical Area (CBSA).

**Table 2. Characteristics of Patients Admitted to SNFs in 2014, by Star Rating**

	Overall Star rating				
	1	2	3	4	5
n=1,195,166	132,311 11.1%	207,418 17.4%	216,540 18.1%	309,917 25.9%	328,980 27.5%
Race/ethnicity					
White	79%	80%	83%	84%	85%
Black	12%	10%	9%	7%	6%
Hispanic	4%	4%	4%	4%	4%
Other	5%	5%	5%	5%	5%
Dual enrollment	38%	33%	30%	25%	22%
Geographic region of beneficiary's home					
Northeast	24%	25%	27%	25%	27%
Midwest	25%	26%	26%	29%	26%
South	42%	32%	36%	32%	27%
West	10%	17%	12%	15%	20%
Functional Status: Modified Barthel Index, mean (SD)	30 (19.0)	30 (18.4)	31 (18.3)	33 (18.1)	33 (17.5)
Discharging hospital characteristics					
Safety-net hospital (top 20% by DSH index)	15%	16%	14%	15%	16%
2014 HVBP penalty	55%	52%	50%	49%	48%
Quality of SNFs in county					
Total SNF beds, mean (SD)	3,643 (6710)	4,799 (8216)	4,366 (7358)	4,959 (8108)	5,385 (8116)
% of beds at 1 star SNFs, mean (SD)	31% (0.23)	16% (0.16)	15% (0.16)	15% (0.15)	13% (0.13)

Notes: Additional characteristics are in Supplementary Table S1. SNF=skilled nursing facility;

DSH=disproportionate share hospital; HVBP=hospital value based purchasing. All differences

between star ratings are statistically significant at  $p < .0001$ . Lower functional status scores indicate a higher level of dependence.

**Table 3. Estimated Odds of Admission to Low-Quality (one-star) Skilled Nursing Facility in 2014**

OR (95% CI)	Raw	Full Model
Patient Characteristics		
Race/Ethnicity		
Black	1.61 (1.58, 1.65)	1.25 (1.22, 1.28)
Hispanic	1.40 (1.35, 1.45)	1.10 (1.06, 1.14)
Other	1.26 (1.22, 1.29)	1.19 (1.15, 1.22)
White	REF	REF
Dual enrollment	1.72 (1.70, 1.75)	1.53 (1.51, 1.55)
Functional Status: Modified Barthel Index	0.99 (0.99, 0.99)	0.99 (0.99, 0.99)
Discharging Hospital		
Safety-net hospital (top 20% by DSH index)	1.25 (1.04, 1.50)	1.00 (0.85, 1.17)
2014 HVBP penalty	1.15 (0.99, 1.33)	1.11 (0.98, 1.26)
SNF Availability		
% of beds in 1 star SNFs in beneficiary's county (10% change)	1.26 (1.26, 1.27)	1.27 (1.26, 1.27)

Notes: OR: Odds ratio; CI: Confidence interval; DSH: Disproportionate Share Hospital; HVBP:

Hospital Value-Based Purchasing; SNF: Skilled nursing facility. Lower functional status scores

indicate a higher level of dependence. All models include discharging hospital random effects.

The raw models include only the variable of interest and are separate models for each

vulnerable group. The full model adjusts for patient age, sex, urban residence, number of comorbidities, disability, ESRD, number of SNF beds in the beneficiary's county, county post-acute care availability (long term care hospitals, inpatient rehabilitation facilities, and home health agencies), state of residence, prior hospitalization, and hospital stay characteristics (type of index admission, ICU stay, hospital system membership, urban location, bed count, and profit status). Additional ORs from the full model are in Supplementary Table S2.

**Figure 1. Distribution of High- and Low-Quality SNF beds in 2014 by County**

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