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## Associations Between Published Quality Ratings of Skilled Nursing Facilities and Outcomes of Medicare Beneficiaries with Heart Failure

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### Abstract

**Introduction**—Nursing Home Compare quality ratings are designed to allow patients, families, and clinicians to compare facilities based on quality, but associations of the current measures with important clinical outcomes are not known. Our study examined associations between ratings and readmission and mortality among Medicare beneficiaries admitted to a skilled nursing facility with a primary diagnosis of heart failure.

**Methods**—We conducted a retrospective cohort study of 164,672 Medicare beneficiaries discharged to skilled nursing facilities after hospitalization for heart failure in 2006–2007. The main outcome measures were readmission and mortality within 90 days.

**Results**—One-fifth of the 13,619 skilled nursing facilities received a 1-star rating and 11% received a 5-star rating. Nearly half of the patients discharged to a skilled nursing facility were readmitted to a hospital within 90 days after discharge, and 30% died within 90 days. Compared with patients in 5-star skilled nursing facilities, patients in 1-star facilities had higher risks of 90-day readmission (hazard ratio, 1.08) and mortality (1.15). After adjustment for facility size and ownership type, the associations between the quality rating and readmission were not statistically significant, but the associations with mortality were significant.

**Conclusion**—Publicly reported Nursing Home Compare quality ratings of Medicare-certified skilled nursing facilities were modestly associated with 90-day readmission and mortality among Medicare beneficiaries discharged to these facilities after hospitalization for heart failure.

### Keywords

Skilled nursing facilities; Nursing Home Compare; Medicare; patient readmission; mortality; heart failure

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The US Centers for Medicare & Medicaid Services (CMS) launched the Nursing Home Compare Web site in 2002 to publicly report quality measures of Medicare-certified skilled nursing facilities.<sup>1</sup> The Web site reports information about health inspections, staffing levels, and clinical quality, such as the percentage of residents who received influenza

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### Supplementary Data

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vaccinations. In 2008, CMS began using a 5-star rating system to score skilled nursing facilities based on those measures. The rating system is designed to help patients, families, and clinicians choose nursing facilities based on quality. Moreover, CMS is considering strategies to reimburse providers on the basis of these and other quality measures. However, the value of the Nursing Home Compare Web site for patients and their families, clinicians, and policy makers remains a subject of debate.<sup>2,3</sup>

Readmission and mortality are commonly used markers of quality of care, and they have implications for reimbursement to hospitals.<sup>4-7</sup> Among Medicare beneficiaries discharged to skilled nursing facilities, the potentially preventable readmission rate was 18.5% in 2007.<sup>6</sup> Other studies have found similarly high rates of potentially avoidable hospitalizations of patients in nursing facilities.<sup>8,9</sup> Rehospitalizations of nursing facility residents occur in the context of many patient-level factors, such as disease stage, comorbid conditions, and preferences for care. Characteristics and care practices of nursing facilities also influence hospitalization rates, and higher-quality care should result in fewer potentially avoidable hospitalizations.

Ambulatory care-sensitive diagnoses have been used by previous researchers to identify avoidable hospitalizations of nursing home residents.<sup>10-13</sup> Heart failure is both an ambulatory care-sensitive diagnosis and the most common medical diagnosis for hospitalizations that precede nursing facility admissions.<sup>6</sup> Nearly 20% of Medicare beneficiaries hospitalized for heart failure were discharged to a nursing facility in 2006.<sup>14</sup> Furthermore, heart failure is a disease that requires close collaboration among staff and providers to ensure appropriate monitoring, which may include adjustment of medication, checking laboratory test results, and frequently recording vital signs. Hospital readmission among patients with heart failure is sensitive to the quality of transitional care in outpatient settings.<sup>15,16</sup> Thus, heart failure is an appropriate indicator condition for use in exploring possible associations between quality of nursing home care and hospital readmission and mortality.

Although a major goal of the Nursing Home Compare Web site is to provide reliable information to patients, families, and clinicians about the quality of nursing homes in the United States, it is unclear whether the quality ratings are associated with patient outcomes. We examined associations between the Nursing Home Compare quality ratings and readmission and mortality among Medicare beneficiaries with heart failure.

## Methods

### Data Sources

We obtained Medicare Provider and Analysis Review claims from CMS for all Medicare beneficiaries discharged from a hospital or skilled nursing facility between January 1, 2005, and December 31, 2007; inpatient files for all Medicare beneficiaries discharged between January 1, 2008, and December 31, 2008; and the corresponding denominator files. The Medicare Provider and Analysis Review files contain inpatient records and summary skilled nursing facility stay records, and the inpatient files contain all claims for facility costs covered under Medicare Part A. The institutional review board of the Duke University Health System approved this study.

### Study Population

We included all Medicare beneficiaries with a primary diagnosis of heart failure (International Classification of Diseases, Ninth Revision, Clinical Modification codes 428.xx, 402.x1, 404.x1, or 404.x3) on a single inpatient claim between January 1, 2006, and December 31, 2007, who were admitted to a skilled nursing facility within 2 days after

hospital discharge. For beneficiaries with multiple hospitalizations and discharges to skilled nursing facilities, we considered the earliest hospital discharge in each calendar year to be the index hospitalization. We limited the analysis to beneficiaries residing in the United States who had at least 12 months of continuous fee-for-service Medicare eligibility before the index hospitalization discharge date. We excluded beneficiaries for whom the provider number for the index skilled nursing facility stay was not found in the 2007 Nursing Home Compare data files.<sup>1</sup>

## Outcomes

We followed patients for up to 90 days after the index hospitalization discharge date. We calculated time to first readmission as the number of days between the index hospitalization discharge date and the subsequent hospital readmission date, excluding hospital transfers and admissions for rehabilitation. We obtained mortality information from the Medicare denominator files.

## Facility and Patient Characteristics

We obtained data on Medicare-certified nursing facilities in 2007 from the Nursing Home Compare Web site, including Medicare provider number; overall quality rating; individual ratings for health inspections, clinical quality, and registered nurse hours per resident per day; type of ownership; certified number of beds; number of residents; and percentage of occupied beds. Quality measures reflect all care provided in the nursing facility for both long-term residents and postacute care residents. Individual measures of clinical quality in the Nursing Home Compare data are derived from information in the Minimum Data Set, and most include some risk adjustment using resident-level covariates. Similarly, the staffing level measure is adjusted for nursing facility case mix. The overall 5-star quality rating is calculated using an additive algorithm that incorporates health inspections, staffing, and clinical quality measures. The rating is weighted toward health inspections because these are assessed independently, unlike the other domains, which are self-reported by the facility.<sup>17</sup>

The patient demographic characteristics available for the analysis included age, sex, and race. We used the reported category “black” and combined all others as “other” for this analysis.<sup>18</sup> We defined comorbid conditions using previously validated coding algorithms<sup>19,20</sup> based on inpatient claims in the 365 days before the index hospitalization discharge date (Appendix 1). We used enrollment codes listed for the month of the index hospitalization to ascertain eligibility for Medicaid, a marker of socioeconomic status.

## Statistical Analysis

For baseline facility and patient characteristics, we present categorical variables as frequencies with percentages and continuous variables as medians with interquartile ranges. We stratified facilities and patients by the Nursing Home Compare overall 5-star quality rating and used Cochran-Mantel-Haenszel tests for nonzero correlation to test for trends. For 90-day outcomes, we compared the groups using Gray tests for readmission and log-rank tests for mortality. To account for the competing risk of death, we used the cumulative incidence function to calculate unadjusted 90-day readmission. We used the Kaplan-Meier method to calculate unadjusted 90-day mortality.

We used Cox proportional hazards models to examine unadjusted and adjusted relationships between the overall 5-star quality rating and 90-day readmission and mortality, including robust standard errors to account for the clustering of patients within facility.<sup>21</sup> In the primary multivariable analysis (ie, “model 1”), we modeled readmission as a function of the overall 5-star quality rating, age, sex, race, comorbid conditions, Medicaid eligibility, a

variable indicating whether the length of stay for the index hospitalization was greater than 7 days,<sup>22</sup> hospitalization in the previous year, rural location, US geographic region, and the year of the index hospitalization. We were also interested in examining the Nursing Home Compare quality rating in the context of other facility characteristics that have been linked to outcomes in previous studies.<sup>23-25</sup> Therefore, in a secondary analysis (ie, “model 2”), we examined associations between the Nursing Home Compare overall quality rating and readmission with adjustment for the quartile of certified number of beds, type of ownership, whether the facility was located within a hospital, and whether the facility was part of a multifacility chain.

In an exploratory analysis, we examined associations between individual components of the overall quality rating and readmission. We omitted the overall rating from model 2 and added the individual ratings for health inspections, clinical quality, and registered nurse staffing. In sensitivity analyses, we examined adjusted readmission and mortality outcomes at 30 days and 60 days. We used SAS version 9.2 for all analyses (SAS Institute Inc, Cary, NC).

## Results

The study population included 164,672 Medicare beneficiaries hospitalized for heart failure and discharged to 13,619 skilled nursing facilities between January 1, 2006, and December 31, 2007. As shown in Table 1, we stratified the skilled nursing facilities according to their overall 5-star quality rating. Twenty percent of the facilities received 1 star and 11% received 5 stars. Compared with 5-star facilities, 1-star facilities were larger, more likely to be for-profit, and more likely to be part of multifacility chains.

Table 2 shows patient characteristics stratified by the overall quality ratings of the skilled nursing facilities. Patients with heart failure in 5-star facilities were slightly older and were less likely to be black than patients at 1-star facilities. Although rates of comorbid conditions were generally high, renal disease, diabetes mellitus, and dementia were more prevalent in 1-star facilities compared with 5-star facilities. One-star facilities had a higher percentage of patients eligible for Medicaid compared with 5-star facilities (31.5% vs 22.8%;  $P < .001$ ).

Nearly half of the cohort was readmitted to a hospital within 90 days after admission to a skilled nursing facility, and almost 30% died within 90 days (Table 3). Unadjusted rates of 90-day readmission and mortality were lower among nursing facilities with higher overall quality ratings ( $P < .001$ ).

Table 4 shows the unadjusted and adjusted associations between facility characteristics and patient outcomes (see Appendix 2 and 3 for the full results of the models). In the primary multivariable analysis of readmission (ie, model 1), the hazard of readmission was 8% higher for patients in 1-star facilities than for patients in 5-star facilities. After adjustment for facility characteristics (ie, model 2), these associations were weaker. Compared with patients in for-profit facilities, the hazard of readmission was significantly lower for patients in government-owned facilities and for patients in nonprofit facilities. In the primary multivariable analysis of mortality, the hazard of mortality was significantly higher for 1-star facilities than for 5-star facilities. After adjustment for additional facility characteristics, the hazard of mortality among patients in 1-star facilities was 1.10 (95% confidence interval [CI], 1.06–1.15;  $P < .001$ ) compared with patients in 5-star facilities.

The hazard of readmission was 7% higher among patients in facilities with a 1-star rating of clinical quality (95% CI, 1.03–1.11;  $P = .001$ ) and 3% higher among patients in facilities with a 2-star rating of clinical quality (95% CI, 1.00–1.07;  $P = .04$ ) compared with patients in facilities with a 5-star rating of clinical quality. Neither health inspection ratings nor

registered nurse staffing ratings were significantly associated with readmission. In contrast, the hazard of mortality was 9% higher for patients in facilities with a 1-star health inspection rating (95% CI, 1.04–1.13;  $P < .001$ ) compared with patients in facilities with a 5-star health inspection rating. The hazard of mortality was also higher for patients in facilities with a 1-star rating of registered nurse staffing, compared with 5-star facilities (hazard ratio, 1.06; 95% CI, 1.02–1.11,  $P < .01$ ).

Results of the sensitivity analyses of 30-day and 60-day models were generally consistent with the 90-day models, although individual ratings of clinical quality, health inspections, or registered nurse staffing were not significantly associated with 30-day mortality.

## Discussion

Reflecting an interest in improving transparency in health care, recent health care reform legislation mandates additions to the Nursing Home Compare Web site to include information on staffing ratios, staff turnover, and complaints substantiated by state inspectors.<sup>26</sup> The legislation also requires the US Government Accountability Office to study the Nursing Home Compare 5-star rating system and recommend improvements.<sup>26</sup> Research on associations between this composite quality rating and patient outcomes has been limited. In this study of 164,672 patients with heart failure in 13,619 skilled nursing facilities in the United States, we found significant but modest associations between the overall quality rating and 90-day hospital readmission and mortality.

The Nursing Home Compare overall quality rating is a composite of ratings for health inspections, staffing levels, and clinical quality. Composite measures of provider performance can be useful, because they summarize many pieces of information for ease of interpretation.<sup>27</sup> In addition to reporting the overall quality rating, Nursing Home Compare reports ratings in the individual categories, allowing users to consider the domains that are most important to them. However, the Nursing Home Compare measure has been criticized for focusing more on structural and clinical parameters than on nursing facility residents' quality of life.<sup>3</sup> The associations we observed between the overall quality rating and readmission and mortality highlight the importance of discussions about the validity of the measures currently reported. Further research may identify the specific components that best reflect high-quality care and those that do not, thereby improving the rating system and providing insight into quality-improvement targets.

Hospital readmission is an important indicator of nursing facility quality,<sup>6,28</sup> as reflected by its inclusion as an outcome in the CMS Value-Based Purchasing pilot program for nursing facilities, a test of pay-for-performance approaches in this setting.<sup>29</sup> In 2006, one-quarter of the 1.79 million Medicare nursing facility admissions were followed by hospital readmissions within 30 days. The average Medicare payment per readmission was \$10,352, and total Medicare reimbursements were more than \$4.34 billion.<sup>30</sup> Readmission represents a considerable burden to patients and a substantial cost to the health care system. Traditional Medicare fee-for-service reimbursement does not offer incentives to providers to reduce hospitalizations or to coordinate care across settings. As readmission becomes an increasingly recognized marker of quality for hospitals and nursing facilities, new payment models will continue to receive attention.

In our patient-level analysis, the association between lower quality and greater hazard of readmission was attenuated when we adjusted for the number of beds and the type of ownership. In contrast, lower quality was associated with a greater hazard of mortality, even after adjustment for additional facility characteristics. Consistent with a recent analysis,<sup>6</sup> we found nonprofit status to be significantly associated with lower hazards of readmission and

mortality after controlling for other covariates. For-profit facilities have higher rates of deficiency citations,<sup>31,32</sup> which has been attributed to negative effects of for-profit status, such as motivation to reduce staffing and cut costs. In addition, for-profit facilities tend to depend more heavily on Medicaid reimbursement and to operate in states with lower Medicaid reimbursement, which has been associated with lower quality.<sup>24</sup> In our analysis, lower-rated facilities had more Medicaid-eligible residents than did higher-rated facilities.

The value of the Nursing Home Compare Web site to patients and their families, clinicians, and policy makers is a subject of debate. A survey of families of nursing facility residents found that only 13% used the Web site, more commonly to compare facility locations than facility quality.<sup>33</sup> However, some studies have found that facilities have improved on some outcomes since Nursing Home Compare was launched, suggesting that providers have responded to the public reporting of these measures.<sup>34,35</sup>

Our study has some limitations. Because we relied on Medicare claims data alone, we did not capture data on nursing facilities not covered by Medicare and also could not distinguish between short-stay and long-stay nursing facility residents. The patients with heart failure we studied may be different from patients with other diagnoses, but heart failure is the most common medical diagnosis in this population. We used International Classification of Diseases, Ninth Revision, Clinical Modification codes for diagnoses but did not have access to medical records with more detailed information about medical conditions, functional status, or patient and family goals and preferences for medical care, including advance directives, all of which play a role in whether and when a patient transfers to another level of care. Moreover, Medicare claims data are not available for beneficiaries enrolled in Medicare managed care. Nursing Home Compare reports risk-adjusted measures of clinical quality and staffing ratios, and we included measures of comorbidity and severity in these multivariable models, but these measures may not fully account for differences in illness severity.

## Conclusion

In a large cohort of Medicare beneficiaries with heart failure who were discharged from the hospital to a skilled nursing facility, Nursing Home Compare quality ratings were modestly associated with 90-day hospital readmission and mortality. Further research should explore whether these associations exist for patients with conditions other than heart failure. As the Nursing Home Compare reporting system is revised, direct reporting of outcomes such as readmission should be considered.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**Table 1**  
 Characteristics of Skilled Nursing Facilities by Nursing Home Compare Overall Quality Rating\*

Facility Characteristic	Nursing Home Compare Overall Quality Rating					P Value
	One Star (n = 2772)	Two Stars (n = 2841)	Three Stars (n = 2953)	Four Stars (n = 3468)	Five Stars (n = 1585)	
Patients with heart failure, median (IQR)	9.0 (5.0–16.0)	9.0 (4.0–16.0)	9.0 (4.0–16.0)	8.0 (4.0–17.0)	7.0 (3.0–15.0)	<.001
Certified number of beds, median (IQR)	120.0 (96.0–150.0)	115.0 (84.0–145.0)	104.0 (72.0–132.0)	94.0 (60.0–120.0)	75.0 (51.0–113.0)	<.001
Residents, median (IQR)	98.0 (73.0–126.0)	92.0 (64.0–121.0)	88.0 (58.0–116.0)	78.0 (50.0–110.0)	64.0 (43.0–96.0)	<.001
Occupancy rate, median (IQR), %	86.0 (75.0–93.0)	88.0 (77.0–93.0)	88.0 (79.0–94.0)	89.0 (79.0–95.0)	90.0 (79.0–96.0)	<.001
Ownership type, no. (%)						
For-profit	2329 (84.0)	2185 (76.9)	2072 (70.2)	2067 (59.6)	863 (54.4)	<.001
Government	64 (2.3)	95 (3.3)	120 (4.1)	200 (5.8)	88 (5.6)	<.001
Nonprofit	379 (13.7)	561 (19.7)	761 (25.8)	1201 (34.6)	634 (40.0)	<.001
Located in a hospital, no. (%)	65 (2.3)	107 (3.8)	147 (5.0)	311 (9.0)	162 (10.2)	<.001
Multifacility ownership, no. (%)	1799 (64.9)	1701 (59.9)	1706 (57.8)	1771 (51.1)	726 (45.8)	<.001
Rural location, no. (%)	814 (29.4)	929 (32.7)	1044 (35.4)	1267 (36.5)	542 (34.2)	<.001
US geographic region, no. (%)						
Midwest	873 (31.5)	891 (31.4)	992 (33.6)	1140 (32.9)	494 (31.2)	.44
Northeast	426 (15.4)	521 (18.3)	533 (18.0)	681 (19.6)	373 (23.5)	<.001
South	1085 (39.1)	1017 (35.8)	983 (33.3)	1122 (32.4)	518 (32.7)	<.001
West	388 (14.0)	412 (14.5)	445 (15.1)	525 (15.1)	200 (12.6)	.89

IQR, interquartile range.

\* Percentages were calculated among facilities with nonmissing ratings in each category.

**Table 2**  
Baseline Patient Characteristics by Nursing Home Compare Overall Quality Rating

Patient Characteristic	Nursing Home Compare Overall Quality Rating					P Value
	One Star (n = 32,506)	Two Stars (n = 33,836)	Three Stars (n = 36,585)	Four Stars (n = 43,281)	Five Stars (n = 18,464)	
Age at index, median (IQR), y	83.0 (76.0–88.0)	84.0 (77.0–89.0)	84.0 (78.0–89.0)	84.0 (79.0–89.0)	85.0 (79.0–89.0)	<.001
Female, no. (%)	20,829 (64.1)	21,945 (64.9)	23,921 (65.4)	28,501 (65.9)	12,271 (66.5)	<.001
Black race, no. (%)	4713 (14.5)	3864 (11.4)	3421 (9.4)	3175 (7.3)	1365 (7.4)	<.001
Comorbid conditions, no. (%)						
Cancer	1925 (5.9)	2104 (6.2)	2300 (6.3)	2770 (6.4)	1231 (6.7)	<.001
Cerebrovascular disease	4931 (15.2)	4925 (14.6)	5317 (14.5)	5682 (13.1)	2440 (13.2)	<.001
COPD	17,332 (53.3)	17,882 (52.8)	18,821 (51.4)	22,160 (51.2)	9320 (50.5)	<.001
Dementia	3556 (10.9)	3530 (10.4)	3542 (9.7)	3945 (9.1)	1598 (8.7)	<.001
Diabetes Mellitus	13,991 (43.0)	14,259 (42.1)	14,676 (40.1)	16,676 (38.5)	7069 (38.3)	<.001
Hypertension	25,897 (79.7)	26,516 (78.4)	28,653 (78.3)	33,580 (77.6)	14,407 (78.0)	<.001
Ischemic heart disease	19,639 (60.4)	20,123 (59.5)	22,217 (60.7)	25,977 (60.0)	11,257 (61.0)	.24
Peripheral vascular disease	5147 (15.8)	5033 (14.9)	5600 (15.3)	6234 (14.4)	2610 (14.1)	<.001
Renal disease	15,065 (46.3)	15,214 (45.0)	16,011 (43.8)	18,371 (42.4)	7673 (41.6)	<.001
Eligible for Medicaid, no. (%)	10,255 (31.5)	9499 (28.1)	9516 (26.0)	10,374 (24.0)	4210 (22.8)	<.001
Index hospitalization length of stay, median (IQR), d	6.0 (4.0–9.0)	6.0 (4.0–9.0)	6.0 (4.0–9.0)	6.0 (4.0–9.0)	6.0 (4.0–9.0)	<.001
Length of stay > 7 days, no. (%)	11,729 (36.1)	12,190 (36.0)	12,895 (35.2)	14,735 (34.0)	6305 (34.1)	<.001
Previous hospitalization, no. (%)						
Discharge to skilled nursing facility	15,116 (46.5)	15,375 (45.4)	16,694 (45.6)	18,884 (43.6)	7895 (42.8)	<.001
Other discharge disposition	8977 (27.6)	9482 (28.0)	10,182 (27.8)	12,303 (28.4)	5315 (28.8)	.002
No previous hospitalization	8413 (25.9)	8979 (26.5)	9709 (26.5)	12,094 (27.9)	5254 (28.5)	<.001
Rural location, no. (%)	7587 (23.3)	7993 (23.6)	8815 (24.1)	11,082 (25.6)	4431 (24.0)	<.001
US geographic region, no. (%)						
Midwest	9700 (29.8)	9760 (28.8)	10,848 (29.7)	12,085 (27.9)	5152 (27.9)	<.001
Northeast	7459 (22.9)	8953 (26.5)	9756 (26.7)	11,898 (27.5)	5478 (29.7)	<.001
South	11,610 (35.7)	11,725 (34.7)	11,749 (32.1)	14,171 (32.7)	6016 (32.6)	<.001
West	3737 (11.5)	3398 (10.0)	4232 (11.6)	5127 (11.8)	1818 (9.8)	.95

Patient Characteristic	Nursing Home Compare Overall Quality Rating					P Value
	One Star (n = 32,506)	Two Stars (n = 33,836)	Three Stars (n = 36,585)	Four Stars (n = 43,281)	Five Stars (n = 18,464)	
Year of the index hospitalization						
2006	16,609 (51.1)	17,316 (51.2)	18,306 (50.0)	22,016 (50.9)	9376 (50.8)	.28
2007	15,897 (48.9)	16,520 (48.8)	18,279 (50.0)	21,265 (49.1)	9088 (49.2)	.28

COPD, chronic obstructive pulmonary disease; IQR, interquartile range.

**Table 3**  
Unadjusted Mortality and Readmission Rates by Nursing Home Compare Overall Quality Rating

Outcome	Nursing Home Compare Overall Quality Rating					P Value*	
	Overall (n = 164,672)	One Star (n = 32,506)	Two Stars (n = 33,836)	Three Stars (n = 36,585)	Four Stars (n = 43,281)		Five Stars (n = 18,464)
Length of index stay, median (IQR)	19.0 (9.0–35.0)	20.0 (10.0–38.0)	20.0 (10.0–36.0)	19.0 (10.0–35.0)	18.0 (9.0–32.0)	17.0 (8.0–31.0)	<.001
90-day mortality	46,950 (28.5)	9717 (29.9)	9719 (28.7)	10,318 (28.2)	12,154 (28.1)	5042 (27.3)	<.001
90-day readmission <sup>†</sup>	79,307 (48.1)	16,375 (50.4)	16,571 (48.9)	17,602 (48.1)	20,113 (46.5)	8646 (46.8)	<.001

IQR, interquartile range.

\* Comparing the Nursing Home Compare quality rating groups.

<sup>†</sup> From the cumulative incidence function, which accounts for the competing risk of death.

**Table 4**  
Univariate and Multivariable Predictors of 90-Day Readmission and Mortality

Facility Characteristic	Univariate Model		Multivariable Model 1*		Multivariable Model 2*	
	Unadjusted HR (95% CI)	P Value	Adjusted HR (95% CI)	P Value	Adjusted HR (95% CI)	P Value
90-Day All-Cause Readmission						
Nursing Home Compare overall quality rating						
1 star	1.12 (1.08–1.15)	<.001	1.08 (1.04–1.11)	<.001	1.04 (1.00–1.07)	.02
2 stars	1.07 (1.04–1.11)	<.001	1.04 (1.01–1.07)	.009	1.01 (0.98–1.04)	.53
3 stars	1.05 (1.01–1.08)	.005	1.03 (1.00–1.06)	.06	1.01 (0.98–1.04)	.69
4 stars	0.99 (0.96–1.02)	.61	0.99 (0.96–1.02)	.56	0.98 (0.95–1.01)	.22
5 stars	1.00 [Reference]		1.00 [Reference]		1.00 [Reference]	
Certified number of beds						
Quartile 1 (3–70 beds)	1.00 [Reference]		—		1.00 [Reference]	
Quartile 2 (71–102 beds)	1.04 (1.01–1.06)	.01	—		1.02 (0.99–1.05)	.27
Quartile 3 (103–132 beds)	1.10 (1.08–1.13)	<.001	—		1.04 (1.01–1.07)	.009
Quartile 4 (133–1389 beds)	1.16 (1.14–1.19)	<.001	—		1.07 (1.04–1.10)	<.001
Ownership type						
For-profit	1.00 [Reference]		—		1.00 [Reference]	
Government	0.83 (0.78–0.87)	<.001	—		0.85 (0.81–0.90)	<.001
Nonprofit	0.89 (0.88–0.91)	<.001	—		0.92 (0.90–0.94)	<.001
Located in a hospital	0.93 (0.90–0.95)	<.001	—		1.03 (0.99–1.06)	.13
Multifacility ownership	1.01 (0.99–1.03)	.24	—		0.98 (0.97–1.00)	.05
90-Day All-Cause Mortality						
Nursing Home Compare overall quality rating						
1 star	1.11 (1.07–1.16)	<.001	1.15 (1.11–1.20)	<.001	1.10 (1.06–1.15)	<.001
2 stars	1.06 (1.02–1.11)	.003	1.09 (1.04–1.13)	<.001	1.05 (1.01–1.09)	.02
3 stars	1.04 (1.00–1.08)	.06	1.05 (1.01–1.09)	.02	1.02 (0.98–1.05)	.44
4 stars	1.03 (0.99–1.08)	.10	1.04 (1.00–1.08)	.07	1.02 (0.98–1.06)	.25
5 stars	1.00 [Reference]		1.00 [Reference]		1.00 [Reference]	
Certified number of beds						
Quartile 1 (3–70 beds)	1.00 [Reference]		—		1.00 [Reference]	

Facility Characteristic	Univariate Model			Multivariable Model 1*			Multivariable Model 2*		
	Unadjusted HR (95% CI)	P Value	Adjusted HR (95% CI)	P Value	Adjusted HR (95% CI)	P Value	Adjusted HR (95% CI)	P Value	
Quartile 2 (71–102 beds)	1.07 (1.04–1.11)	<.001	—	—	1.05 (1.01–1.09)	.006	—	—	
Quartile 3 (103–132 beds)	1.06 (1.03–1.09)	<.001	—	—	1.05 (1.02–1.09)	.004	—	—	
Quartile 4 (133–1389 beds)	1.06 (1.03–1.09)	<.001	—	—	1.07 (1.03–1.10)	<.001	—	—	
Ownership type									
For-profit	1.00 [Reference]	—	—	—	1.00 [Reference]	—	—	—	
Government	1.08 (1.02–1.14)	.005	—	—	1.08 (1.03–1.15)	.006	—	—	
Nonprofit	0.93 (0.91–0.96)	<.001	—	—	0.94 (0.92–0.97)	<.001	—	—	
Located in a hospital	0.90 (0.86–0.94)	<.001	—	—	0.97 (0.92–1.01)	.17	—	—	
Multifacility ownership	1.03 (1.01–1.05)	.001	—	—	1.03 (1.01–1.05)	.009	—	—	

CI, confidence interval; HR, hazard ratio.

\* Models 1 and 2 include age, sex, race, ischemic heart disease, hypertension, cerebrovascular disease, dementia, chronic pulmonary disease, diabetes mellitus, peripheral vascular disease, renal disease, cancer, Medicaid eligibility, index hospital stay > 7 days, prior hospitalization history, rural location, US geographic region, and index year, as well as the variables shown. See Appendices 2 and 3 for the full results of the models. Dashes indicate variables that were not included in multivariable model 1.