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Original Study

Is There a Link between Nursing Home Reported Quality and COVID-19 Cases? Evidence from California Skilled Nursing Facilities

Mengying He PhD^{a,*}, Yumeng Li PhD^b, Fang Fang PhD^a^a Department of Management, College of Business and Economics, California State University, Los Angeles, CA^b Biogen, Inc, Cambridge, MA

A B S T R A C T

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Objectives: During the Coronavirus disease 2019 (COVID-19) outbreak in the United States, nursing homes became the hotbed for the spread of COVID-19. States developed different policies to mitigate the COVID-19 risks at nursing homes, including limiting nursing home visitation and mandating staff screening. The purpose of this study is to examine whether COVID-19 cases and deaths are related to the nursing home reported quality.

Design: We combined the COVID-19 data reported by the California Department of Public Health, quality ratings provided by Nursing Home Compare, and patient racial information from Long-Term Care Focus to examine the association between nursing home reported quality and COVID-19 cases and deaths.

Settings and Participants: Cross-sectional data from 1223 California skilled nursing facilities with reported quality and longitudinal data of COVID-19 cases were used.

Methods: The dependent variable is COVID-19 residents' cases and deaths. The main independent variable is nursing home reported quality. Nursing home ownership, size, years of operation, and patient race composition are also included.

Results: Nursing home star ratings and greater percentage of residents from different racial and ethnicity groups were significantly ($P < .01$) related to increased probability of having a COVID-19 residents' case or death.

Conclusions and Implications: Nursing homes with 5-star ratings were less likely to have COVID-19 cases and deaths after adjusting for nursing home size and patient race proportion.

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As the first outbreak of Coronavirus disease 2019 (COVID-19) appeared at LifeCare Center of Kirkland, nursing homes became the hotbed for COVID-19.¹ As of April 23, 2020, there have been over 50,000 COVID-19 cases and 10,000 reported deaths at nursing homes, representing 11% of all COVID-19 cases and 27% of the total number of deaths in the United States, respectively.² In some states, more than one-half of COVID-19 deaths happened at nursing homes.³ The aging population is the most vulnerable group under the COVID-19 pandemic,⁴ and nursing homes are the major resident place for older adults in the United States. To mitigate the risk at nursing homes, the Centers for Medicare and Medicaid Services

(CMS) published a comprehensive guide on infection control procedures, personal protection equipment, symptom screening, and facility staffing.⁵ States also come up with their own policies in terms of nursing home visitation, staff screening, and personal protection equipment use.⁶

Quality is an essential issue in nursing homes. In 2008, CMS adopted a 5-star quality rating system to measure the nursing home quality of care, and the quality information was publicly available on the Nursing Home Compare (NHC) website.^{7,8} The website reported the overall star ratings of nursing homes together with specific ratings on health inspection, staffing, and quality measures. The study has testified the reliability of the star quality ratings by examining the association between nursing home published quality information and outcome for heart failure patients.⁹ Based on structured interviews from nursing home residents and caregivers, the study also confirmed the value of star ratings in helping residents in making choices about nursing homes.¹⁰

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* Address correspondence to Mengying He, PhD, Assistant Professor, Department of Management, College of Business and Economics, California State University, Los Angeles, CA 90032.

E-mail address: mhe15@calstatela.edu (M. He).

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As the number of COVID-19 cases continues to increase in the United States, we were curious about the relationship between nursing home reported quality and COVID-19 cases and deaths. The purpose of this study is to explore the impact of the nursing home reported quality on COVID-19 cases and deaths, and to track the COVID-19 cases development rates at California skilled nursing facilities (SNFs) based on their quality ratings.

Methods

We merged California SNFs COVID-19 data (June 2, 2020) together with 2019 NHC data and 2017 nursing home data from Long-Term Care Focus. NHC data provided us with the overall and domain-specific quality ratings on each nursing home along with information about nursing home ownership, bed occupancy, and facility operation date.⁸ We also retrieved data from California SNFs COVID-19 cases and deaths, which was collected and reported by the California Department of Public Health. This data described how SNFs in California were impacted by COVID-19 based on the confirmed COVID-19 cases from residents and the cumulative number of COVID-19 related deaths.¹¹ Patient racial and ethnicity information came from nursing home Long-Term Care Focus data.¹²

Our dependent variables were 2 critical factors of COVID-19: resident confirmed cases and deaths. We used the nursing homes' star ratings from NHC as our primary independent variable. There are 5 levels with 1 to 5 stars in increasing order of quality. Univariate analyses of the independent variables (analysis of variance for the continuous variables and χ^2 test for the categorical variables) were conducted to calculate the number of nursing homes and the average number in each category: no COVID-19 cases, less than 11 COVID-19 cases, and more than 11 cases (including 11). Except for the primary independent variable of quality ratings, the independent variables also include ownership type [for profit (FP), not-for-profit (NFP), and government], bed occupancy, percentage of white residents, and facility age. Based on the California state average of white population (59.5%), we categorized the white resident percentage into 2 groups: above state average and below state average. Next, we fit a multivariate logistic regression model with whether or not there are any confirmed cases by June 2, 2020, as the binary dependent variable. Our key independent variable is nursing home quality ratings. Three-star nursing homes were used as the reference group to compare with other groups. We combined NFP and government-owned nursing homes as the reference group and compared them with FP nursing homes. We also included bed occupancy and facility history as

measured by years of operation and the proportion of white residents in each nursing home. To see the development rates of COVID-19 cases from April 23 to June 2, 2020, we did a trend analysis to see how the rate of confirmed cases adjusted by facility size changed over time. Analyses were performed using R v 3.6.2.

Results

We analyzed data on 1223 California nursing homes, which included both skilled nursing facilities and nursing homes that reported COVID-19 cases and deaths in California. The descriptive analyses showed that nursing homes with higher star ratings generally had a lower number of confirmed COVID-19 cases and deaths (Table 1). Nursing homes with lower white residents' percentage had higher COVID-19 cases and deaths. Compared with NFP and government-owned SNFs, FP nursing homes had more COVID-19 cases. Nursing home bed occupancy was positively associated with COVID-19 cases and deaths.

Further, we checked the relationship between COVID-19 confirmed cases and deaths with quality ratings and other factors. To examine the effect of these factors, we used a multivariate logistic regression model and summarized the results in Table 2. Our model showed that overall quality rating, white resident percentage, ownership, and bed occupancy had a significant impact on COVID-19 cases and deaths. Specifically, the odds ratio (OR) of COVID-19 cases between the 5-star group and the 3-star group was 0.41, with 95% confidence interval (CI) ranging from 0.27 to 0.62. For residents' deaths, the OR was 0.3 and 95% CI is between 0.18 and 0.48. A similar pattern was observed for the 4-star ratings group (Cases: OR 0.66, 95% CI 0.44–0.98; Deaths: OR 0.65, 95% CI 0.42–1.01). Compared with nursing homes with higher percentage of white residents, nursing homes with below state average white residents had a higher odds in having COVID-19 cases (OR 1.95, 95% CI 1.49–2.55) and deaths (OR 1.64, 95% CI 1.21–2.23). Compared with NP and government-owned nursing homes, FP nursing homes were more likely to have COVID-19 infection (OR 1.49, 95% CI 0.97–2.34) and COVID-19 related deaths (OR 1.69, 95% CI 1.01–3.00). In addition, we found a positive relationship between nursing home size (measured by bed occupancy) and COVID-19 cases (OR 1.009, 95% CI 1.006–1.012) and deaths (OR 1.006, 95% CI 1.003–1.009).

We conducted a trend analysis of confirmed COVID-19 cases adjusted by bed occupancy at each nursing facility among different quality ratings (Figure 1). First, we observed that 5-star quality nursing homes had the lowest increasing rate of COVID-19 cases, followed by nursing homes with 4-star quality ratings. Moreover, we checked the

Table 1
Descriptive Analyses of Nursing Home COVID-19 Cases and Deaths

	COVID-19 Cases				COVID-19 Deaths			
	0	<11	≥11	P Value	0	< 11	≥11	P Value
As reported by June 2, 2020	795	205	223		944	217	62	
Overall ratings				<.0001				.0001
1	70 (9.6%)	24 (12.4%)	34 (16.4%)		85 (9.7%)	36 (17.6%)	7 (12.3%)	
2	112 (15.3%)	40 (20.6%)	59 (28.5%)		137 (15.7%)	54 (26.5%)	20 (35.1%)	
3	111 (15.2%)	40 (20.6%)	54 (26.1%)		142 (16.3%)	45 (22.1%)	18 (31.6%)	
4	159 (21.7%)	41 (21.1%)	38 (18.4%)		188 (21.6%)	40 (19.6%)	10 (17.5%)	
5	280 (38.3%)	49 (25.3%)	22 (10.6%)		320 (36.7%)	29 (14.2%)	2 (3.5%)	
Ownership				<.0001				.0002
NFP	118 (16.0%)	27 (13.8%)	8 (3.8%)		133 (15.1%)	19 (9.2%)	1 (1.7%)	
FP	587 (79.6%)	167 (85.2%)	202 (95.7%)		712 (81%)	186 (90.3%)	58 (98.3%)	
Government	32 (4.3%)	2 (1.0%)	1 (0.5%)		34 (3.9%)	1 (0.5%)	0	
White resident percentage (≥59.5%)	403 (56.2%)	79 (41.4%)	64 (31.2%)	<.0001	453 (53%)	75 (37.3%)	18 (31.0%)	<.0001
Bed occupancy	77.54 (41.56)	93.68 (46.54)	113.18 (70.59)	<.0001	81.34 (50.08)	100.60 (46.24)	121.40 (56.30)	<.0001
Facility age	37.79 (13.58)	37.85 (13.61)	41.39 (11.43)	.0019	38.00 (13.52)	39.73 (12.56)	40.96 (11.51)	.0812

Count (percentage) and P value from χ^2 test are presented for overall rating, facility ownership, and white resident percentage. Mean (standard deviation) and P value from analysis of variance are presented for continuous variables.

Table 2
Multivariate Logistic Regression Results

Covariates	COVID-19 Cases		COVID-19 Deaths	
	OR	95% CI of OR	OR	95% CI of OR
Ownership				
NFP	Reference			
FP	1.49*	0.97, 2.34	1.69*	1.01, 3.00
Quality ratings				
3	Reference			
1	0.83	0.52, 1.33	1.04	0.64, 1.69
2	1.02	0.68, 1.53	1.23	0.80, 1.87
4	0.66**	0.44, 0.98	0.65*	0.42, 1.01
5	0.41***	0.27, 0.62	0.30***	0.18, 0.48
Bed occupancy	1.009***	1.006, 1.012	1.006***	1.003, 1.009
White resident percentage				
≥59.5%	reference			
<59.5%	1.95***	1.49, 2.55	1.64***	1.21, 2.23
Facility age (y)	1.006	0.995, 1.017	1.006	0.993, 1.019

*** $P < .01$; ** $P < .05$; * $P < .10$

1107 complete cases contribute this logistic model.

development of COVID-19 cases between FP and NFP nursing homes (Figure 2). Compared with NFP nursing homes, the development rate of COVID-19 cases is higher in FP nursing homes.

Discussion

Nursing homes with 5-star quality ratings showed significantly less COVID-19 cases compared with nursing homes with 1 to 4 star ratings. Larger nursing homes with higher bed occupancy rates were positively associated with COVID-19 cases and deaths. After controlling for the bed occupancy rate at each nursing home, the trend analysis from April 23 to June 2 showed that the increasing rate of COVID-19 related cases was much lower in 5-star nursing homes compared with other nursing homes. Previous studies also confirmed the association between nursing home quality ratings and performance as measured by the improved patient outcome⁹ and reduced nursing home costs.¹³ However, the quality information provided by NHC was not widely adopted by hospitals as part of the discharge plan and used by patients and caregivers in choosing facilities.^{10,14} The NHC website provides salient quality-related information about nursing homes in the United States; public awareness, including healthcare organizations and consumers about the NHC quality together with the COVID-19 information, should be increased.

We also found that nursing homes with a lower proportion of white residents were more likely to have COVID-19 cases. This finding was consistent with a recent study and report that examined the characteristics of US nursing homes with COVID-19 cases.^{15,16} This study found that nursing homes with a higher proportion of black patients were more likely to be influenced by COVID-19, which is similar to the trend observed in general that black communities were the hardest hit by COVID-19.¹⁷ Our study confirmed the findings published by New York Times that claimed nursing homes with more black and Latino residents were twice as likely to be hit by the coronavirus.¹⁸

Compared with NFP and government-owned nursing homes, FP nursing homes have relatively more COVID-19 cases and related deaths. Our study is consistent with previous findings that FP nursing homes provided worse care to patients and offered less nursing care compared with NFP and public nursing homes.¹⁹ A more recent study also found that nursing homes associated with large- and medium-for-profit chains had lower family ratings in terms of care experience and satisfaction.²⁰ When facing the COVID-19 pandemic, the development rate of COVID-19 cases was faster in FP nursing homes compared with NFP and government-owned nursing homes.

For nursing homes that did not report quality to CMS, we observed considerable variability in COVID-19 cases and deaths among these 8 nursing homes. Some of these nursing facilities fell into the category of “too new to rate,” and some of them had a special quality cautious mark being applied to indicate significant quality problems.⁸ Particular attention should be paid to the nursing facilities with quality problems, including the COVID-19 cases and deaths. Future studies can be done to examine the quality difference between nursing homes COVID-19 reporters and nonreporters.

There were several limitations of this study. First, we only used California SNFs COVID-19 data because of the data availability and standardization issue. We will further examine the relationship between nursing home quality and COVID-19 cases when the national level COVID-19 data required by CMS come out. Second, SNFs with less than 11 COVID-19 cases were marked as “<11” for the de-identification purpose. Therefore, we did not have the actual number of cases and deaths for SNFs with less than 11 cases. Last but not the least, nursing home COVID-19 cases were strongly correlated with testing capability, but without the testing data, we were unable to link the testing capacity to COVID-19 cases at each nursing facility. We also did not include nursing home staffing

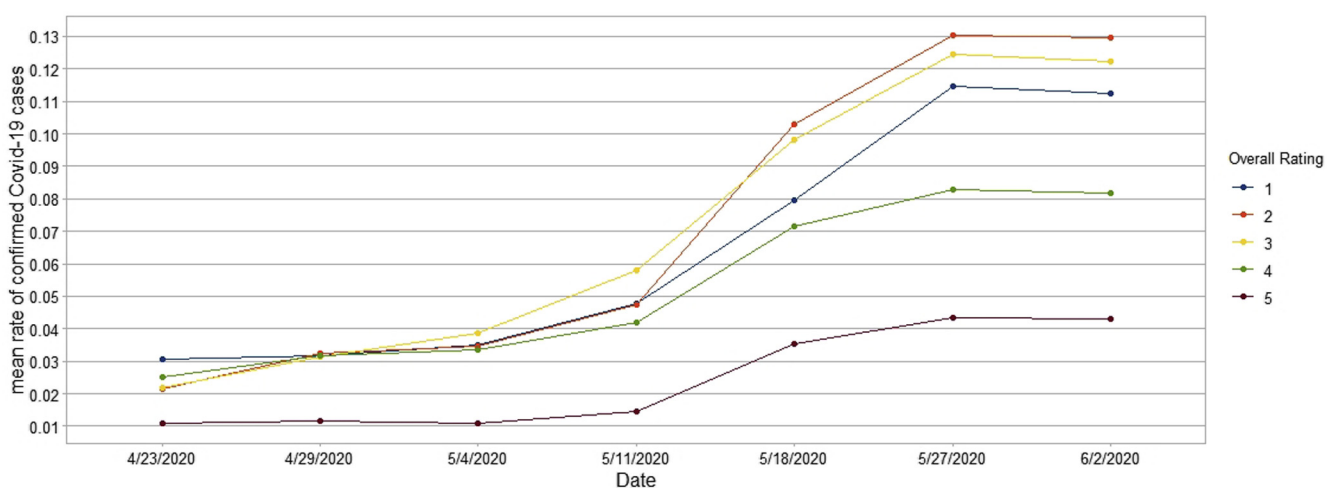


Fig. 1. Change of COVID-19 confirmed cases adjusted by bed occupancy with time by overall quality ratings.

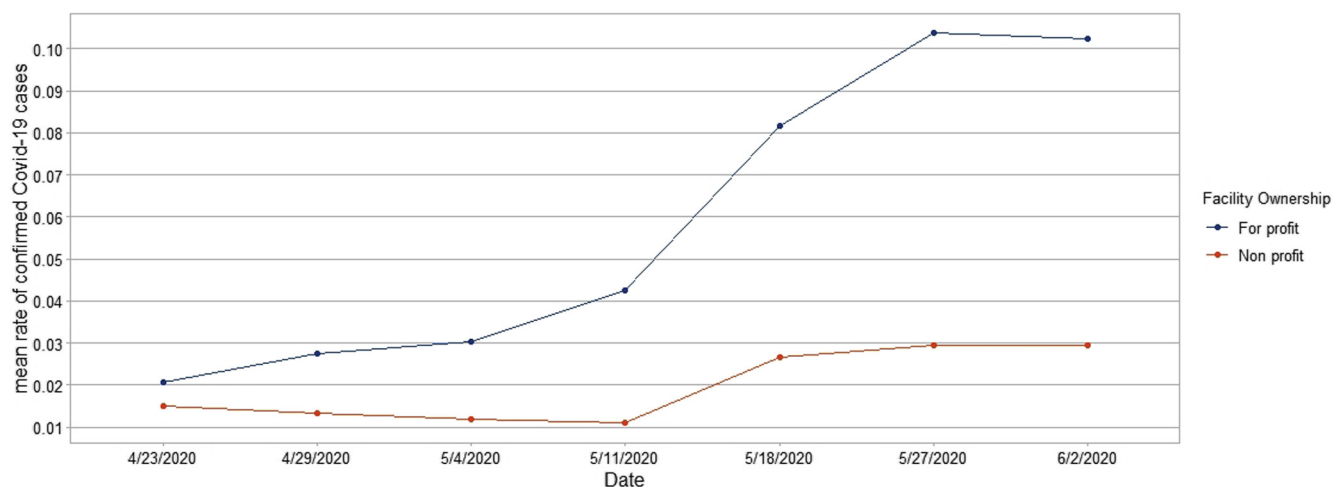


Fig. 2. Change of COVID-19 confirmed cases adjusted by bed occupancy with time by ownership.

patterns, location, and patient comorbidities, which could potentially contribute to the relationship between nursing home quality and COVID-19 cases.

Conclusions and Implications

Nursing homes with 5-star ratings and higher percentage of white residents were less likely to have COVID-19 cases and deaths after adjusting for nursing home size, ownership, and years of operation. Updated information about COVID-19 related cases and quality information at the national level would be valuable to consumers.

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