Title

Predicting COVID-19 at skilled nursing facilities in California: do the stars align?

Journal

BMJ Open Quality, 10(1)

ISSN

2050-1315

Authors

Poltavskiy, Eduard

Tabriz, Amir Alishahi

Romano, Patrick S

et al.

Publication Date

2021-03-01

DOI

10.1136/bmjoq-2020-001099

Peer reviewed

BMJ Open Quality

Predicting COVID-19 at skilled nursing facilities in California: do the stars align?

Eduard Poltavskiy,[1] Amir Alishahi Tabriz ,[2] Patrick S Romano,[3] Heejung Bang,[4] Abhijit V Kshirsagar[5]

To cite: Poltavskiy E, Alishahi Tabriz A, Romano PS, *et al*. Predicting COVID-19 at skilled nursing facilities in California: do the stars align? *BMJ Open Quality* 2021;**10**:e001099. doi:10.1136/bmjoq-2020-001099

► Additional material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/bmjoq-2020-001099).

Received 1 July 2020
Revised 21 January 2021
Accepted 16 February 2021

[1]California Association of Health Facilities, Sacramento, California, USA
[2]Department of Health Outcomes and Behavior, Moffitt Cancer Center, Tampa, Florida, USA
[3]Department of Internal Medicine, University of California Davis School of Medicine, Sacramento, CA, USA
[4]Division of Biostatistics, Department of Public Health Sciences, University of California, Davis, CA, USA
[5]University of North Carolina Kidney Center and Division of Nephrology & Hypertension, Department of Medicine, Chapel Hill, NC, USA

Correspondence to
Dr Abhijit V Kshirsagar; sagar@med.unc.edu

INTRODUCTION

A notable proportion of cases of COVID-19 have occurred among older adults living in congregant settings.[1 2] Once an outbreak occurs in such settings, few mitigation strategies exist. Identifying predictors of COVID-19 would facilitate enhanced surveillance to prevent future outbreaks. The Centers for Medicare and Medicaid Services have long required that all skilled nursing facilities (SNFs) report quality metrics, including the Five-Star Quality Rating System for comparing SNFs: 1 star (lowest score) to 5 star (highest score).[3] This metric is predicated on patient and stakeholder perceptions. We examined the relationship of star ratings and other facility-related metrics to COVID-19 occurrence among nursing home residents using a newly established reporting mechanism by the state of California.

METHODS

Beginning 17 April 2020, the California Department of Public Health (CDPH) started reporting the daily and cumulative numbers of positive cases of COVID-19 among the residents and staff of SNFs.[4] For this study, we used the category 'Cumulative Positive Residents', and compiled data available through 31 May 2020.

SNF characteristics were obtained from the Facilities Compare Website[3] as follows: Overall Star Rating, its three domains—Health Inspections, Staffing and Quality Measures, plus Provider and Ownership Types, Number of Certified Beds and Medicare Claims Quality Measures, and linked using the Federal Provider Number. Descriptive statistics were used for SNF characteristics with and without COVID-19 among the residents, and univariate-adjusted and multivariable-adjusted logistic regression models explored an association between the SNF characteristics with COVID-19 presence in SNF, while handling multicollinearity. The proportion of infected residents was calculated as the ratio of the maximum cumulative number of cases reported to the number of certified beds and visualised as bar plots for all levels of Five-Star ratings—SNFs with '<11' infected residents were treated as having one infected resident per CDPH reporting requirements.[4]

RESULTS

A total of 1184 of 1224 facilities that reported data are included in analyses. The cumulative number of residents with COVID-19 is 9650.[4] Approximately 24% of facilities reported COVID-19 as of 31 May 2020. Figure 1 displays the proportions of facilities with residents with COVID-19 by star ratings. There appears to be an inverse relationship with COVID-19 with the Health Inspection and Overall Star ratings. Univariate regression shows that Health Inspection ratings and Overall ratings are significantly associated with facilities reporting COVID-19, and with multivariable adjustment, health inspections, emergency room visits and short-stay hospitalisations remain significant. Particularly, Health Inspection (among the three domains of the Overall rating) showed a consistent monotonic relationship between the star value and the presence of COVID-19, OR 2.6–6.5 (table 1 and online supplemental table S1).

DISCUSSION

Publicly reported SNF metrics are associated with COVID-19 presence in facilities. While not directly compared with each other, the findings suggest that facility star ratings directly driven by *recent* patient and stakeholder complaints are more potent predictors of COVID-19 than staffing or

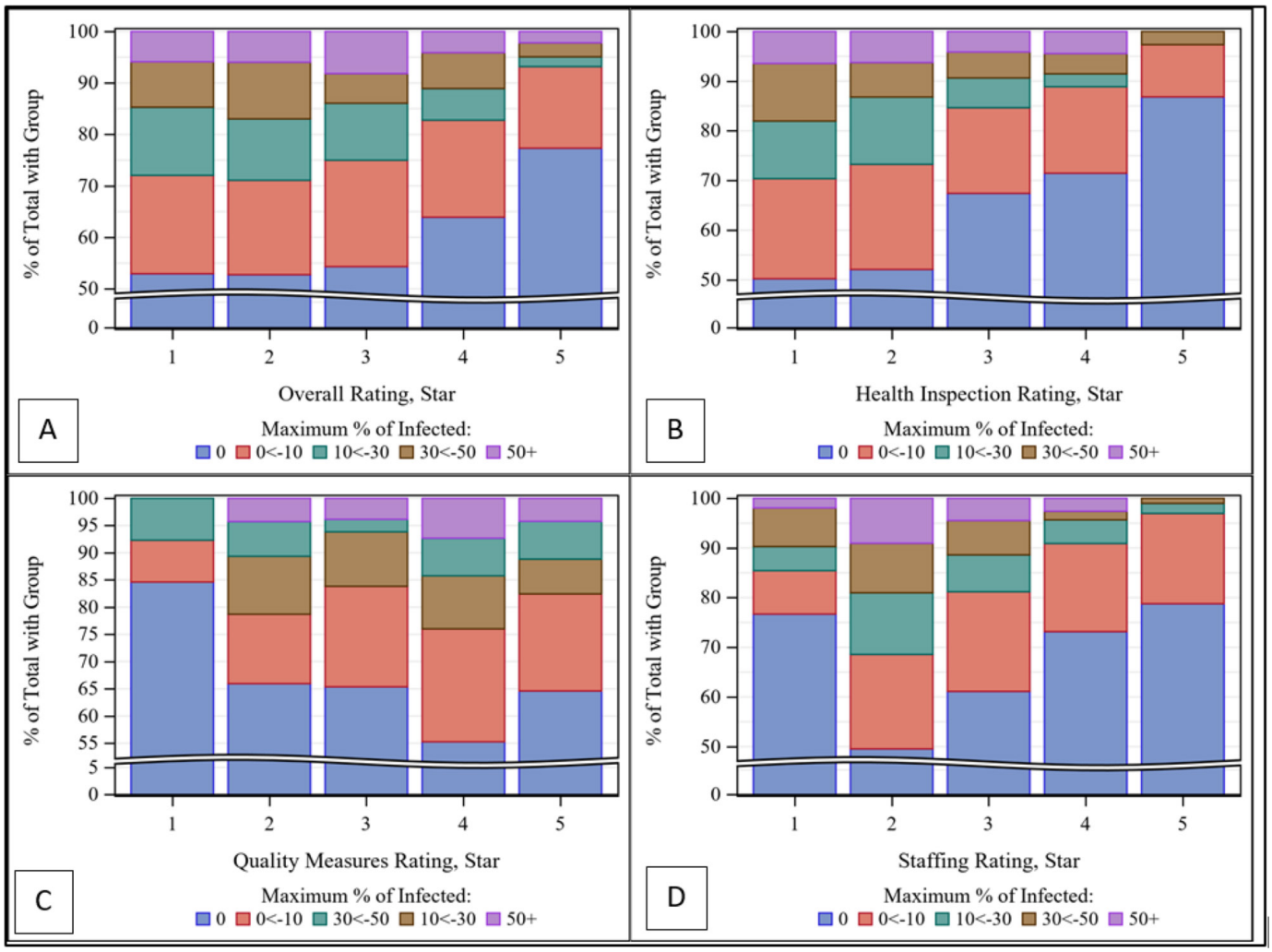

Figure 1 Star ratings (overall and its three domains) and percentage of having COVID-19 case among residents. (A) Overall Star Rating*; (B) Health Inspection star rating**; (C) Quality Measures star rating*** and (D) Staffing star rating****. Within each panel, the percentage of total COVID-19 cases by numeric value of the star rating, 1 (minimum) to 5 (maximum). *Overall Five-Star Rating includes components of the three domains of star ratings. **The Health Inspection rating contains the three most recent health inspections and investigations due to complaints, with the most recent survey findings are weighted more than the prior year. ***The Staffing rating has information about the number of hours of care provided on average to each resident each day by nursing staff, and considers differences in the levels of residents' care need in nursing home. ****The Quality Measures rating has information on 15 different physical and clinical measures for nursing home residents to assess care delivery for their residents' physical and clinical needs (see https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandComplianc/downloads/usersguide.pdf for more details).

quality ratings. Hospital and emergency utilisation are also predictive but less directly patient focused than the star ratings. While the relationship with the Quality Measures star ratings, a subset of the Overall Quality Ratings with COVID-19 seems counterintuitive, it may be the result of hospital practice driving referrals of residents with high comorbidities to facilities with presumably high-quality ratings (≥3 stars) and away from facilities with low-quality ratings.[5]

As local governments attempt to mitigate multiple future outbreaks of COVID-19, these readily available metrics may help public health officials triage resources to select facilities, including the use of patient-focused surveys. Preventing outbreaks in congregate groups with heightened morbidity has obvious benefit.[6] Yet, the gain may extend beyond as a substantial proportion of its residents have high contact rates with other healthcare venues. For example, nearly 32% of maintenance dialysis patients use SNFs during a calendar year.[7]

We acknowledge the data are limited to a single state in the early stage of the COVID-19 pandemic. Yet, California has a large population and sample size with standardised reporting and high participation by facilities[4] (near 95%) compared with other states. As national governments begin reporting national data on COVID-19 morbidity in SNF, an opportunity to better align prediction with COVID-19 outcomes may soon arise.

Table 1 Univariate and multivariable logistic regression models of facility characteristics with no reported cases or at least one reported COVID-19 case among residents as the outcome

	Univariate (n=1184 facilities)		Multivariate* (n=894 facilities)	
	Unadjusted OR (95% CI)	**P value**	**Adjusted OR (95% CI)**	**P value**
Provider type				
Medicaid only	0.52 (0.23 to 1.15)	0.106	Not included	
Medicare only	0.37 (0.19 to 0.75)	**0.006**		
Medicare and Medicaid	Ref			
Ownership type				
Government	0.19 (0.07 to 0.05)	**0.002**	0.26 (0.03 to 2.89)	0.23
Non-profit	0.59 (0.41 to 0.86)	**0.006**	1.00 (0.55 to 1.84)	0.99
Profit	Ref		Ref	
Number of certified beds	1.01 (1.007 to 1.012)	**<0.0001**	1.01 (1.00 to 1.01)	**<0.0001**
Overall Star Rating†	n=1172			
★☆☆☆☆	3.03 (2.00 to 4.60)	**<0.0001**		
★★☆☆☆	3.05 (2.13 to 4.38)	**<0.0001**		
★★★☆☆	2.87 (1.99 to 4.14)	**<0.0001**	Not included†	
★★★★☆	1.92 (1.35 to 2.75)	**0.0003**		
★★★★★	Ref			
Health Inspection	n=1172			
★☆☆☆☆	6.54 (3.59 to 11.93)	**<0.0001**	5.62 (2.03 to 15.59)	**0.001**
★★☆☆☆	6.07 (3.36 to 10.95)	**<0.0001**	4.86 (1.79 to 13.16)	**0.002**
★★★☆☆	3.19 (1.75 to 5.81)	**0.0002**	3.20 (1.18 to 8.66)	**0.020**
★★★★☆	2.63 (1.44 to 4.81)	**0.002**	2.78 (1.01 to 7.61)	**0.047**
★★★★★	Ref		Ref	
Staffing	n=1168			
★☆☆☆☆	1.13 (0.58 to 2.19)	0.72	1.04 (0.35 to 3.07)	0.95
★★☆☆☆	3.78 (2.23 to 6.41)	**<0.0001**	1.67 (0.68 to 4.11)	0.27
★★★☆☆	2.36 (1.40 to 3.98)	**0.001**	1.22 (0.50 to 2.96)	0.66
★★★★☆	1.36 (0.78 to 2.39)	0.28	1.09 (0.44 to 2.70)	0.86
★★★★★	Ref		Ref	
Quality Measures	n=1171			
★☆☆☆☆	0.33 (0.07 to 1.51)	0.15	0.64 (0.11 to 3.72)	0.62
★★☆☆☆	0.94 (0.51 to 1.76)	0.85	0.69 (0.29 to 1.63)	0.40
★★★☆☆	0.97 (0.65 to 1.43)	0.87	0.62 (0.36 to 1.09)	0.10
★★★★☆	1.48 (1.10 to 1.98)	**0.009**	1.31 (0.87 to 1.98)	0.20
★★★★★	Ref		Ref	
Percentage of short-stay residents who were rehospitalised after a nursing home admission	n=1012			
	1.04 (1.02 to 1.07)	**0.0005**	1.05 (1.01 to 1.08)	**0.006**
Percentage of short-stay residents with outpatient emergency department visit	n=1012			
	0.91 (0.88 to 0.93)	**<0.0001**	0.92 (0.88 to 0.96)	**0.0002**
Number of hospitalisations per 1000 long-stay resident days	n=966			
	2.29 (1.93 to 2.71)	**<0.0001**	2.09 (1.67 to 2.60)	**<0.0001**
Number of outpatient emergency department visits per 1000 long-stay resident days	n=966			
	0.66 (0.51 to 0.86)	**0.002**	0.77 (0.53 to 1.13)	0.18

The sample sizes differ for univariate and multivariable regression model because of the availability of reported data.
*Limited to SNFs with Medicare claims.
†Overall Star Rating is not included in the multivariable regression model because of collinearity as Overall rating is a composite score of three domains: Health Inspections ratings, Quality Metrics ratings and Staffing ratings (see https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandComplianc/downloads/usersguide.pdf https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandComplianc/downloads/usersguide.pdf and https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandComplianc/downloads/usersguide.pdf).
SNFs, skilled nursing facilities.

Contributors AVK, EP and HB conceptualised the study. EP acquired the data. EP and HB analysed the data. AVK and EP drafted the manuscript. HB, AAT and PSR made critical changes to the original and revised manuscript.

Funding HB was partly supported by the National Institutes of Health through grant UL1 TR001860.

Disclaimer The opinions expressed in the paper are solely of the authors and do not represent the views of their affiliations.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iD

Amir Alishahi Tabriz http://orcid.org/0000-0002-6273-9105

REFERENCES

1 McMichael TM, Clark S, Pogosjans S, *et al*. COVID-19 in a Long-Term Care Facility - King County, Washington, February 27-March 9, 2020. *MMWR Morb Mortal Wkly Rep* 2020;69:339–42.
2 Bagchi S, Mak J, Li Q, *et al*. Rates of COVID-19 Among Residents and Staff Members in Nursing Homes - United States, May 25-November 22, 2020. *MMWR Morb Mortal Wkly Rep* 2021;70:1–5.
3 Star Ratings. Data.Medicare.gov. Overall, health inspection, staffing and quality measure ratings for all active providers. Available: https://data.medicare.gov/Nursing-Home-Compare/Star-Ratings/ax9d-vq6k [Accessed 27 May 2020].
4 California department of public health skilled nursing facilities: COVID-19. Available: https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/SNFsCOVID_19.aspx [Accessed 2 Jun 2020].
5 Medicare and Medicaid programs; revisions to requirements for discharge planning for hospitals, critical access hospitals, and home health agencies, and hospital and critical access Hospital changes to promote innovation, flexibility, and improvement in patient care. Available: https://www.federalregister.gov/documents/2019/09/30/2019-20732/medicare-and-medicaid-programs-revisions-to-requirements-for-discharge-planning-for-hospitals [Accessed 18 Jun 2020].
6 Kaiser Family Foundation. State reports of long-term care facility cases and deaths related to COVID-19 (as of May 28, 2020). Available: https://www.kff.org/health-costs/issue-brief/state-data-and-policy-actions-to-address-coronavirus/ [Accessed 3 Jun 2020].
7 United States Renal Data System. *Skilled nursing facility utilization among Medicare beneficiaries with ESRD by year, overall*, 2017.