BEYOND STAFFING RATIOS: DAILY VARIATION IN STAFFING AS A DRIVER OF NURSING HOME QUALITY

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Background

- Nurse staffing is fundamental to nursing home quality.
- Policymakers have generally focused on measuring and reporting only average staffing levels during a quarter or a year.
- Average staffing measures mask daily variation, which:
  - may also influence outcomes
  - could offer additional information about nursing home quality and relative ranking
  - Is not just driven by weekday versus weekend staffing
  - Is different from staff turnover

Objectives

To examine several measures of *daily variation in staffing* and

- their association with quality
- whether daily variation provides information regarding quality ranking of nursing homes over and above the information provided by average staffing levels.

Data / Sample

- 2017-2018 Payroll-Based Journal (PBJ), Medicare Cost Reports, and Nursing Home Care Compare data
  - PBJ data capture daily staffing level
  - Cost reports and Care Compare data capture facility-level characteristics including quality ratings
- 13 339 certified nursing homes nationally

Three Measures of Daily Variation

1. *Coefficient of Variation (COV):* Standard deviation of hours per resident-day / average hours per resident-day
2. *Total Outlier Days (TOD):* Number of days with staffing hours per resident-day more than 20% lower or higher than facility mean staffing
3. *Low Outlier Days (LOD):* Number of days with staffing hours per resident-day more than 20% lower than facility mean staffing

- Calculated across all days in a year, resulting in annual measures
- Calculated separately for registered nurses (RNs) and certified nurse assistants (CNAs)

Figure 1. Example Calculation of Total Outlier Days and Low Outlier Days

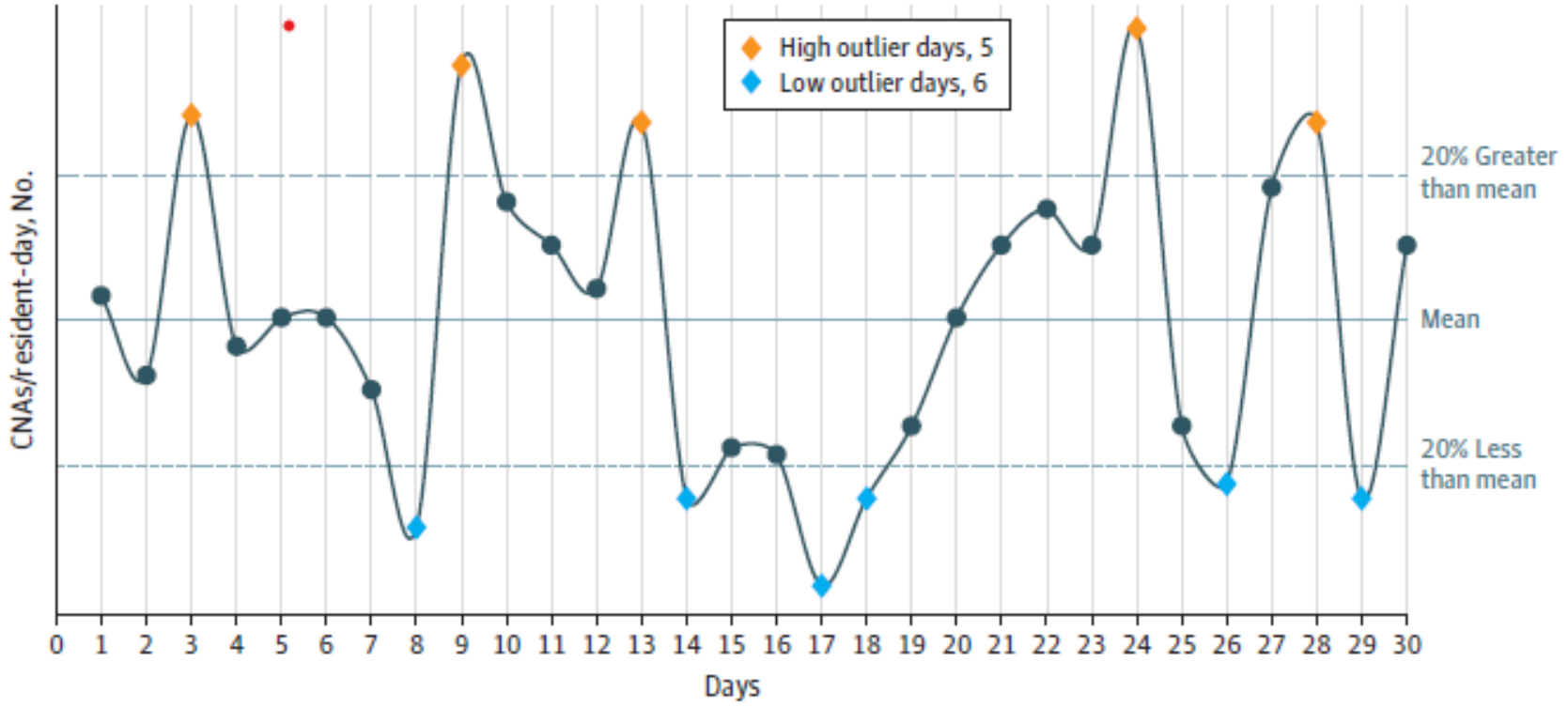


Table 1. Descriptive Statistics

Characteristic	Sample Analysis
Daily variation in staffing measures	
Coefficient of variation	
RNs	
Nursing homes, No.	13 295
Mean (SD)	0.50 (0.58)
CNAs	
Nursing homes, No.	13 339
Mean (SD)	0.13 (0.11)
Total outlier days	
RNs	
Nursing homes, No.	13 295
Mean (SD)	219.83 (68.58)
CNAs	
Nursing homes, No.	13 339
Mean (SD)	44.26 (45.20)
Low outlier days	
RNs	
Nursing homes, No.	13 295
Mean (SD)	115.93 (45.39)
CNAs	
Nursing homes, No.	13 339
Mean (SD)	22.37 (23.71)

Analysis

- Association between the variation measures and other quality measures estimated with GEE regression + facility-clustered errors.
  - *Quality measures*: 5-star survey rating and 5-star quality measures rating.
  - *Controls*: state, size (average annual resident census), case-mix-index (average resource utilization group–IV score), payer mix, ownership, and chain affiliation
- Agreement about ranking nursing homes into quality deciles by the average and the variation measures assessed by weighted Kappa statistics.

Table 2. Characteristics of Nursing Homes Associated With Daily Variation Measures[a]

	COV				TOD				LOD			
	For RNs		For CNAs		For RNs		For CNAs		For RNs		For CNAs	
Variable	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value
CMS 5-Star ranking												
Quality Measures	−0.014 (−0.021 to −0.007)	<.001	−0.004 (−0.006 to −0.003)	<.001	−3.79 (−4.59 to −2.99)	<.001	−2.52 (−3.08 to −1.96)	<.001	−2.46 (−3.03 to −1.88)	<.001	−1.29 (−1.58 to −0.99)	<.001
Survey	−0.026 (−0.033 to −0.019)	<.001	−0.006 (−0.007 to −0.004)	<.001	−5.10 (−5.97 to −4.23)	<.001	−4.16 (−4.77 to −3.55)	<.001	−3.04 (−3.65 to −2.44)	<.001	−1.97 (−2.29 to −1.65)	<.001
Case mix	−0.023 (−0.034 to 0.012)	<.001	−0.002 (−0.005 to −0.002)	.01	−3.67 (−4.67 to −2.68)	<.001	−0.61 (−1.28 to 0.06)	.07	−2.27 (−2.97 to −1.57)	<.001	−0.37 (−0.74 to 0.00)	.05
Payers												
Medicaid	[Reference]	NA	[Reference]	NA	[Reference]	NA	[Reference]	NA	[Reference]	NA	[Reference]	NA
Medicare	−0.027 (−0.033 to −0.020)	<.001	0.004 (0.001 to 0.006)	.002	−4.90 (−5.95 − 3.84)	<.001	1.41 (0.84 to 1.97)	<.001	−2.91 (−3.64 to −2.18)	<.001	0.62 (0.31 to 0.94)	<.001
Other payers	−0.013 (−0.021 to −0.005)	.002	0.002 (−0.000 to 0.003)	.05	−2.77 (−3.72 to −1.82)	<.001	0.71 (0.08 to 1.35)	.03	−1.67 (−2.35 to −1.00)	<.001	0.22 (−0.13 to 0.57)	.22
Part of a chain	−0.016 (−0.033 to 0.001)	.06	−0.008 (−0.011 to −0.005)	<.001	−5.48 (−7.44 to −3.53)	<.001	−5.16 (−6.49 to −3.83)	<.001	−3.02 (−4.36 to −1.69)	<.001	−2.45 (−3.14 to −1.76)	<.001
Ownership												
For profit	[Reference]	NA	[Reference]	NA	[Reference]	NA	[Reference]	NA	[Reference]	NA	[Reference]	NA
Nonprofit	−0.015 (−0.042 to 0.012)	.28	−0.003 (−0.007 to 0.001)	.16	−10.35 (−12.93 to −7.77)	<.001	−5.08 (−6.72 to −3.44)	<.001	−5.80 (−7.54 to −4.06)	<.001	−2.62 (−3.50 to −1.74)	<.001
Government	−0.043 (−0.066 to −0.020)	<.001	−0.001 (−0.008 to 0.007)	.89	−9.57 (−13.98 to −5.15)	<.001	−4.51 (−7.09 to −1.93)	<.001	−7.17 (−10.01 to −4.32)	<.001	−2.36 (−3.72 to −1.00)	<.001
Other	−0.020 (−0.042 to 0.001)	.61	−0.003 (−0.007 to 0.001)	.17	−5.43 (−9.00 to −1.86)	.003	−1.89 (−4.21 to 0.43)	.11	−2.78 (−5.24 to −0.32)	.03	−1.02 (−2.21 to 0.17)	.09
Hospital based	−0.051 (−0.097 to −0.004)	.03	0.002 (−0.012 to 0.016)	.80	−2.11 (−13.34 to 9.11)	.71	0.980 ((−6.67 to 6.84))	.09	−2.78 (−9.68 to 4.12)	.43	1.26 (−2.86 to 5.39)	.55
Resident annual mean census	−0.127 (−0.140 to −0.114)	<.001	−0.025 (−0.027 to −0.023)	<.001	−27.28 (−28.94 to −25.61)	<.001	−21.73 (−23.01 to −20.45)	<.001	−16.92 (−18.01 to −15.82)	<.001	−10.15 (−10.82 to −9.47)	<.001

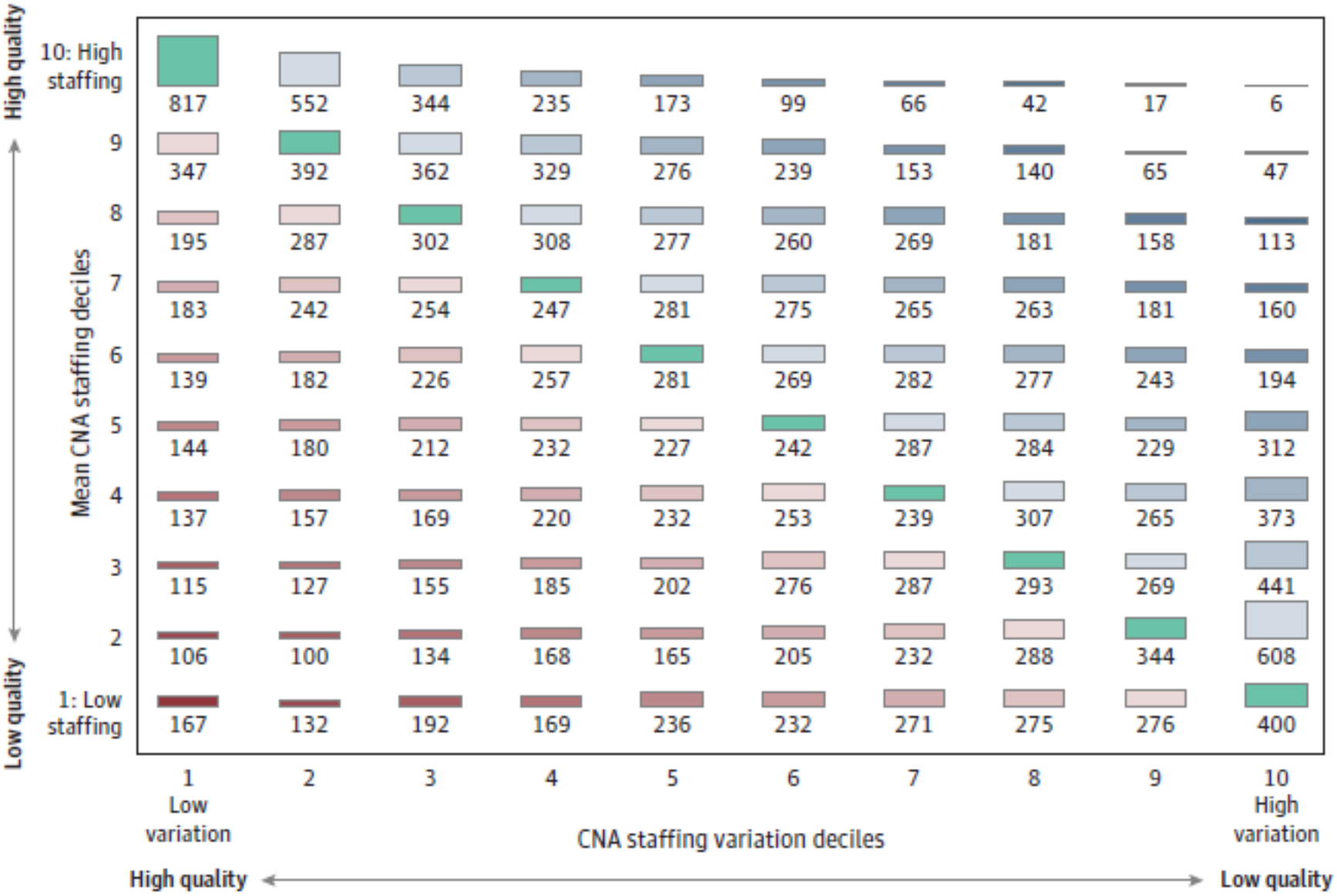
Abbreviations: CMS, Centers for Medicare & Medicaid Services; CNAs, certified nurse aide; COV, coefficient of variation; LOD, low outlier days; RNs, registered nurses; TOD, total outlier days.

[a] Coefficients are reported as average marginal effects, and all continuous variables are standardized. All models include state fixed effects. The sample size for RNs was 29 398, with 13 295 facilities. The sample size for CNAs was 23 503, with 13 339 facilities.

Results 1 (Adjusted Associations)

- High variation in RN and CNA staffing associated with lower quality (survey and quality measures star ratings)
- For-profit facilities tend to have less stable staffing than other ownership types based on outlier measures
- Chain facilities tend to have more stable staffing than non-chain facilities
- High-Medicare facilities tend to have more stable RN staffing but less stable CNA staffing
- Higher case mix associated with more stable staffing
- Larger facilities tend to have more stable staffing

Figure 2. Mean Certified Nurse Aide (CNA) Staffing vs CNA Staffing Daily Variation



Results 2: Comparison of Quality Rankings

- Weighted Kappa statistics generally low (ranging from 0.23 to 0.63), indicating little agreement between the classification by average staffing measures and the 3 variation measures
- Disagreement is much larger for the CNA measures than for the RN measures

Head to head comparison: Effects of average staffing and variation on quality outcomes

	RNs			LPNs			CNAs	
	Below Average Staffing Days	**Average HPRD**		**Below Average Staffing Days**	**Average HPRD**		**Below Average Staffing Days**	**Average HPRD**
	Percent of mean	**Percent of mean**		**Percent of mean**	**Percent of mean**		**Percent of mean**	**Percent of mean**
Deficiencies score within the last 6 month (180 days) - Z score	0.2	-0.9*		-0.6*	0.0		-0.5*	-0.1
Long-Stay Quality Measures								
% Residents receiving antipsychotic drugs for 1st time	-0.3	-2.3*		-0.5	-1.4*		-0.7*	0.1
Pressure ulcers (1st Quarter 2017-3rd Quarter 2018)	-0.8	-1.2		-1.8	3.7		-2.1*	-1.2*
Pressure ulcers (4th quarter2018 – 3rd Quarter 2019)	0.3	-1.5		-4.0*	5.7		-1.4*	-2.1*
ADL decline	-0.7	-2.6*		-2.4*	1.5		-1.1*	-1.6*
% Residents whose ability to move independently worsened	-0.4	0.1		-2.8*	2.8		-1.1*	-1.6*
ED visits per 1000 residents	-2.4*	-6.7*		-3.4*	-0.6		-3.0*	0.7
Hospitalizations per 1000 residents	-0.0	-0.2*		-0.0	0.0		-0.1*	0.1
Short-Stay Quality Measures								
% Residents receiving antipsychotic drugs for 1st time	-2.4	-6.4*		-4.6*	0.7		-4.8*	-1.9*
Functioning failed to improve by discharge	-37.4*	57.2		-3.9	70.2		-27.5*	-97.0*
Rehospitalizations	0.1	-1.3*		-0.2	1.7		-0.0	-0.5*
ED visits	-1.8*	-5.0*		-4.5*	1.0		-0.4	0.0

Conclusions

- Does stability of daily staffing matter?
  - Yes: Higher daily variation in RN and CNA staffing is significantly associated with worse quality
- Does stability of daily staffing tell us something we don't already know?
  - Yes: The addition of daily variation measures would change the quality ranking of nursing homes relative to using average staffing alone.
    - Especially important for CNA staffing

Discussion

- Our findings highlight the potential importance of measuring and reporting daily variation in staffing to improve understanding of the relationship between staffing and quality.
- Measures of daily staffing may enhance the value of Nursing Home Care Compare for nursing homes and others engaged in quality improvement and consumers searching for high quality nursing homes.