Quality Peer Group Indicators for Critical Access Hospitals

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Michelle Casey, MS
Ira Moscovice, PhD
Peiyin Hung, PhD

University of Minnesota
Rural Health Research Center

Flex Monitoring Team
University of Minnesota
University of North Carolina at Chapel Hill
University of Southern Maine

HIGHLIGHTS

- The majority of peer-reviewed studies on the relationships between hospital organizational characteristics and quality performance have not specifically examined Critical Access Hospitals.
- Some national and state hospital quality measurement programs allow CAHs to report quality data, but most have a minimum number of cases for hospital-level comparisons.
- Among CAHs, better performance on inpatient and outpatient process of care measures is significantly related to higher inpatient admissions, inpatient surgical volume, and outpatient/emergency room visits, location in the Northeast Census Region, system affiliation and accreditation. No consistent relationships were found between performance on process measures and either nurse staffing or payer mix.
- Lower volumes of inpatient admissions and inpatient surgical volume among CAHs are significantly related to higher scores on ten of the 11 HCAHPS patient experience of care measures. HCAHPS scores also vary significantly by Census Region. Higher nurse staffing tends to be related to higher HCAHPS performance, but differences are small.
- Lower-volume CAHs show higher variation in quality performance, compared to higher-volume CAHs.
- Some studies and hospital quality measurement programs compare quality performance of hospitals by size, or compare CAHs to non-CAHs, but no studies were identified that used quality peer groups to compare quality across groups of CAHs.
- Three factors—adjusted annual admissions (split into three categories), system-affiliation (yes/no), and census region (Northeast, Midwest, South, West)—can be used to develop CAH quality peer groups, given their distributions across CAHs, relationships to range of quality performance, and contributions to the comparability across CAHs.

BACKGROUND

Since 2006, Critical Access Hospital (CAH) financial peer groups have been used as a basis for comparing financial performance of CAHs to similar CAHs.[1] These peer groups are defined by four indicators: whether the CAH provides long term care; whether the CAH operates a provider–based Rural Health Clinic; whether the CAH is owned by a government entity; and the size of net patient revenue. The indicators have been refined over the years by using slightly different definitions and rescaling net patient revenue to recognize CAH revenue growth. A

recent study found that the four indicators remain relevant for comparing similar CAHs with respect to financial performance; it also recommended the addition of surgical charge volume as another financial indicator.[1]

PURPOSE

The purpose of this study was to identify peer groups of CAHs for analyzing quality performance. The study aimed to address the following research question: what is the best way to compare quality performance across CAHs that have different organizational characteristics, such as size, scope of services offered, structure, and location?

DATA AND APPROACH

The sample for this study included 1,334 CAHs that were certified by Medicare as of December 31, 2014. Bed size and an indicator of swing bed service provision came from the FMT CAH longitudinal database. Additional CAH organizational characteristics came from the 2014 American Hospital Association Annual (AHA) Survey database. The quality data came from the Centers for Medicare & Medicaid Services' (CMS) Hospital Compare database and data that CMS suppresses from Hospital Compare due to low volume but provides to the Federal Office of Rural Health Policy for aggregate data analyses. The 39 quality measures included 28 inpatient and outpatient process of care measures for hospital discharges during April 2014–March 2015 and 11 Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey data based on calendar year 2014 discharges.

We first conducted a review of the literature and reviewed information from a variety of national, state, and voluntary hospital quality measurement groups to identify factors to consider in constructing quality peer groups. Based on the literature review and information on hospital quality measurement programs, we identified six categories of hospital characteristics for analysis as potential quality peer group indicators (Table 1).

Next, we used data from the AHA Annual Survey and the FMT CAH database to examine the distribution of CAHs across these hospital characteristics, using descriptive statistics. We

Table 1. Potential Indicators for the Development of Quality Peer Groups

Category	Hospital Characteristics
Size/Volume	Inpatient Admissions, Emergency & Outpatient Visits
Scope or Scale of Services	Inpatient Surgery, Outpatient Surgery, Obstetrics, Swing Beds
Staffing	Full Time Equivalent (FTE) Registered Nurses & Licensed Practical Nurses, Physicians with Privileges
Payer Mix	Medicare & Medicaid Share of Inpatient Days
Geographic Location	Census Regions
Other Characteristics	System membership, Accreditation

eliminated the number of physicians with privileges from further consideration due to missing data, and created a limited number (2– 4) of categories for each remaining indicator so that there would be a reasonable distributions of CAHs across categories (Table 2). Since the vast majority of CAHs provide outpatient surgeries (86%) and swing beds (88%), these two factors were eliminated as potential peer group indicators. Obstetric services, which are provided by about 38% of CAHs, were also dropped from further consideration since the indicator would not be applicable to a broad range of quality measures.

Table 2. Distribution of CAHs by Hospital Characteristics

Hospital Characteristics		Number (%) of CAHs
Volume of Annual Inpatient Admissions	Missing	6 (0.4%)
	≤300	424 (31.8%)
	301– 700	470 (35.2%)
	701+	434 (32.5%)
Volume of Annual Emergency & Outpatient Visits	≤17,000	436 (32.5%)
	17,001– 35,000	434 (32.4%)
	35,001+	464 (34.6%)
Scope of Services	Outpatient Surgery	1,148 (86.1%)
	Inpatient Surgery	1,004 (75.3%)
	Obstetrics	500 (37.5%)
	Swing Beds	1,175 (88.1%)
FTE Registered Nurses & Licensed Practical Nurses /1000 Patient Days	Missing	6 (0.4%)
	≤2	418 (31.3%)
	2.1– 4	461 (34.6%)
	4.1+	449 (33.7%)
Medicare + Medicaid Share of Patient Days	Missing	35 (2.6%)
	<70%	417 (31.3%)
	70.1%– 80%	450 (33.7%)
	>80%	432 (32.4%)
Census Region	Northeast	70 (5.2%)
	South	350 (26.2%)
	Midwest	629 (47.2%)
	West	285 (21.4%)
System Affiliation		587 (44.0%)
Accreditation		408 (30.6%)

Next, we examined the correlations between the remaining potential indicators, using Fisher's exact tests for categorical factors and Pearson's correlation coefficients for numerical factors, to choose indicators that were not highly correlated. We then analyzed the bivariate relationships between CAH performance on the 39 Hospital Compare quality measures and each of the remaining potential indicators, using Mantel– Haenszel tests for ordinal factors and Fisher's exact tests for other categorical factors, in order to identify indicators that were significantly and consistently associated with CAH quality performance. To display the variations of quality performance across hospitals by numeric factors such as patient volume, we used scatterplots to visualize hospital quality performance scores by each factor.

We shared the results of these analyses and our preliminary list of potential quality peer group indicators with rural hospital quality experts, and sought their input to help inform the final selection of quality peer group indicators.

RESULTS

Review of Literature

We reviewed literature that examined the relationship between hospital characteristics and performance on quality measures. Key results from this review include:

- A substantial portion of the literature assessed the hospital volume/outcome relationship across a range of diagnoses frequently associated with hospital admissions. The majority of these studies found statistically significant associations between higher volume and better outcomes.[2-7]
- Hospitals with better financial resources and improved operating margins generally had improved results for outcome and process measures.[2,6,8,9]
- Urban/rural hospital comparisons often found better performance by urban hospitals on many processes and outcome measures. The strong correlation between urbanity and size/volume accounts for a substantial portion of the geographic location results. Of note, smaller rural hospitals tend to have better performance on patient experience of care/satisfaction measures.[2,7-10]
- Increased nurse staffing in hospitals was associated with improved patient outcomes. The strength of this relationship depended on the specific staffing measures used.[2,11]
- Other comparisons (e.g. based on teaching status, specialty designation) are not relevant for CAHs. Also, many volume/outcome relationships are for conditions and procedures that are not relevant for small rural hospitals.[7,12,13]

Review of Hospital Quality Measurement Programs

We reviewed the websites of national and state organizations that publish hospital quality data. Each website and published data set was analyzed to determine what comparisons and

benchmarks are used to compare different quality measures (Table 3).

Table 3. Summary of Hospital Quality Measurement Program Characteristics

	Comparison Group					Volume (Minimum Cases for Reporting)				Benchmark Percentages			
	National	State/ Regional	Individual	Hospitals	Trends	10	20	25	30	1%	5%	10%	25%
Arizona	X	X										X	
California		X											
Colorado	X	X			X				X				
Illinois	X	X						X					
Kentucky	X			X			X						
Maine	X	X											
Massachusetts		X	X										
Michigan	X	X											
Minnesota		X						X					
Nevada	X	X		X								X	
New Hampshire	X							X				X	
New York	X	X						X					
North Carolina		X				X						X	X
Ohio								X					
Oklahoma	X	X						X					
Oregon	X	X						X				X	
Pennsylvania		X						X					
South Carolina	X	X						X					
South Dakota	X	X						X				X	
Tennessee				X									
Texas		X											
Utah		X							X				
Vermont	X				X								
Washington	X	X						X				X	
West Virginia	X		X					X					
Wisconsin	X							X					
CMS	X	X				X							
Commonwealth				X					X	X	X	X	X
Joint Commission			X						X				
Leapfrog	X		X		X								

We also identified whether or not CAHs were included in the data set and what the minimum volume is for reporting hospital performance. A summary of the results from this review include:

- Many hospital quality measurement programs group CAHs separately from other hospitals.
- Many programs have minimum volume requirements for reporting performance on hospital quality measures. The large majority of states use a minimum number of cases of 25 for hospital-level comparisons. However, the minimum number of cases ranges from 10 cases to 30 cases in a handful of states as well as CMS and the Joint Commission.
- Hospital quality measurement programs do not use peer groups for CAH comparisons. Many states and CMS and Leapfrog use national and/or state/regional comparisons for hospital quality performance measurement while some states do comparisons across hospitals with similar location (e.g. rural) and/or size (e.g. number of beds, admissions, minimum number of cases).

Correlations between Potential Quality Peer Group Indicators

Table 4 (next page) shows the direction (positive or negative) and strength of correlations for each pair of potential peer group indicators. The correlations between volume indicators are strong; these indicators include the share of Medicare & Medicaid inpatient days, number of hospital inpatient admissions, total outpatient visits (including ER visits), and surgical inpatient operations.

System-affiliated CAHs are more likely to be accredited and vice versa. Both system-affiliated and accredited CAHs tend to be large with over 700 annual admissions. Accreditation is also positively correlated with being in the highest volume group of hospitals for total outpatient visits and surgical inpatient visits. Census region is weakly correlated with hospital volume indicators and nurse staffing levels. CAHs in the Northeast region are also those with largest inpatient and outpatient volume, while CAHs in the South region are those with lowest volume and no inpatient surgeries. CAHs in the South were more likely to be accredited than those in the other regions.

Because of the strong correlations between hospital inpatient admissions and total outpatient/ER visits, we replaced these indicators with an adjusted annual admissions indicator that takes into account both inpatient admissions and outpatient visits. This indicator is defined as follows:

$$\text{Adjusted Annual Admissions} = \text{\# Inpatient Admissions} + \left(\text{\# Inpatient Admissions} \times \frac{\text{Total Outpatient Revenue}}{\text{Total Inpatient Revenue}} \right)$$

Relationships between Potential Indicators and Quality Performance

Inpatient and Outpatient Process of Care Measures

Better performance on inpatient and outpatient process measures is significantly related to higher volumes of adjusted annual admissions (16 measures) and inpatient surgery (19 measures) (Table 5 and Table 6, pages 9 and 10). Better performance is also significantly related to location in the Northeast census region (worst in South), system affiliation (9 measures), and accreditation (12 measures). No consistent relationships were found between either the Medicare & Medicaid share of inpatient days or nurse staffing and performance on process measures.

Table 4. Correlations between Hospital Characteristics for Potential CAH Quality Peer Group Indicators

		Share of Medicare & Medicaid IP Days			Number of Annual Admissions			System Affiliation	Accreditation	Census Region			
		Low-70%	70.1%-80%	>80%	Low-300	301-700	701+			NE	MW	S	W
Share of Medicare & Medicaid Inpatient Days	Low-70%		– – –	– –	+			–	–				
	70.1%-80%	– – –		– – –	–		+		+				
	>80%	– –	– – –					+					–
Hospital Unit Inpatient Annual Admissions	Low-300	+	–			– – –	– –		–	–			
	301-700				– – –		– – –						
	701+		+		– –	– – –		+	++	+			
Total Outpatient Visits (including ER visits)	1-17,000	+			++		– –	–	–	–		+	
	17,001-35,000					+	–						
	35,001+	–	+		– –	–	++		+	+		–	
Surgical Inpatient Operations	No IP Surgery		–	+	++	–	–		–			+	
	1-60		–	+		+	–				+		
	61-180		+		–	+						–	
	181+		+	+	– –	–	+++		+	+	–		+
FTE Nurses per Patient Day	Low-2 per 1000 PD	+	–				–						
	2.1-4 per 1000 PD			+	–							+	–
	>4 per 1000 PD		+										+
System Affiliation		–		+			+		+				–
Accreditation		–	+		–		++	+				+	
Census Region	Northeast				–		+				–	–	–
	Midwest									–		– – –	– –
	South								+	–	– – –		– –
	West			–				–		–	– –	– –	

Notes: Symbols reflect positive (+) or negative (–) associations between categories. The level of significant associations denotes as high with correlation coefficients greater than 0.5 (+++/– – –), moderate with 0.3-0.5 (++/– –) and low with 0.1-0.3 (+/–).

Table 5. Significant Relationships between Performance on Inpatient Process of Care Measures and Potential CAH Quality Peer Group Indicators

	Share of Medicare & Medicaid IP Days	Adjusted Annual Admissions[a]	FTE Nurses per Patient Day	Surgical Inpatient Operations	System Affiliation	Accreditation	Census Region			
							NE	MW	S	W
Heart Failure: Assessment of LVS	++	+++	+	+++	+++	+++	+++			---
Pneumonia: Most appropriate initial antibiotic(s)		+++		+++	+++	+++	+++		---	
Inpatient Surgery: Preventative antibiotic(s) 1 hour before incision		++		+++		+				
Inpatient Surgery: Received Appropriate Preventative Antibiotic(s)	--	+		+++						
Inpatient Surgery Preventative Antibiotic(s) Stopped Within 24 Hours After Surgery				+++						
Inpatient Surgery: Received Blood Clot Prevention Treatments 24 Hours Pre/Post-Surgery				+++		+				
Inpatient Surgery: Beta Blockers Before/After Surgery		++		+++		+				
Inpatient Surgery: Urinary catheter removed 1st/2nd day after surgery	--	+++	+	+++			+++		---	
Stroke: Venous Thromboembolism (VTE) Prophylaxis		++		++	+++					
Stroke: Discharged on Antithrombotic Therapy		+++	+++	+++			++			
Stroke: Thrombolytic Therapy				+			+		-	
Stroke: Antithrombotic therapy by end of hospital day 2		+		++	++	++	+		-	
Stroke: Discharged on Statin Medication		+++		+	++	+++				
Stroke: Stroke Education				+		+				
Stroke: Assessed for Rehabilitation		++		+++	+++	+	+		-	
VTE: VTE Prophylaxis		+++		+++	+++	++	++			
VTE: Intensive Care Unit VTE Prophylaxis		++		+++						
VTE: Patients with Anticoagulation Overlap Therapy		+		+			+			
VTE: Warfarin Therapy Discharge Instructions		+			+	++				
Patients Assessed and Given Influenza Vaccination		+++		++	+++	+++	++		--	
Perinatal Care: Early Elective delivery			-							

[a]Adjusted annual admissions = hospital inpatient admissions + (inpatient admissions x outpatient revenue / inpatient revenue)

Note: Symbols denote significant positive (+) or negative (-) associations at +++/--- p<.001, ++/-- p<.01, and +/- p<.05

Table 6. Significant Relationships between Performance on Outpatient/Emergency Department Process of Care Measures and Potential CAH Quality Peer Group Indicators

	Share of Medicare & Medicaid IP Days	Adjusted Annual Admissions[a]	FTE Nurses per Patient Day	Surgical Inpatient Operations	System Affiliation	Accreditation	Census Region			
							NE	MW	S	W
Outpatient: Aspirin at arrival			+		+		+++		---	
Median minutes to ECG for outpatient with chest pain/AMI					--	---				
Median time from Emergency Department (ED) arrival to admission to the hospital as an inpatient		---		---	--	--				
Admit decision time to ED departure time for admitted patient		-		-						
Average time patients spent in ED before being sent home					-					
Median time to pain medication for long bone fractures					--					
Patients who left the ED before being seen		--					--		+++	

[a]Adjusted annual admissions = hospital inpatient admissions + (inpatient admissions x outpatient revenue / inpatient revenue)

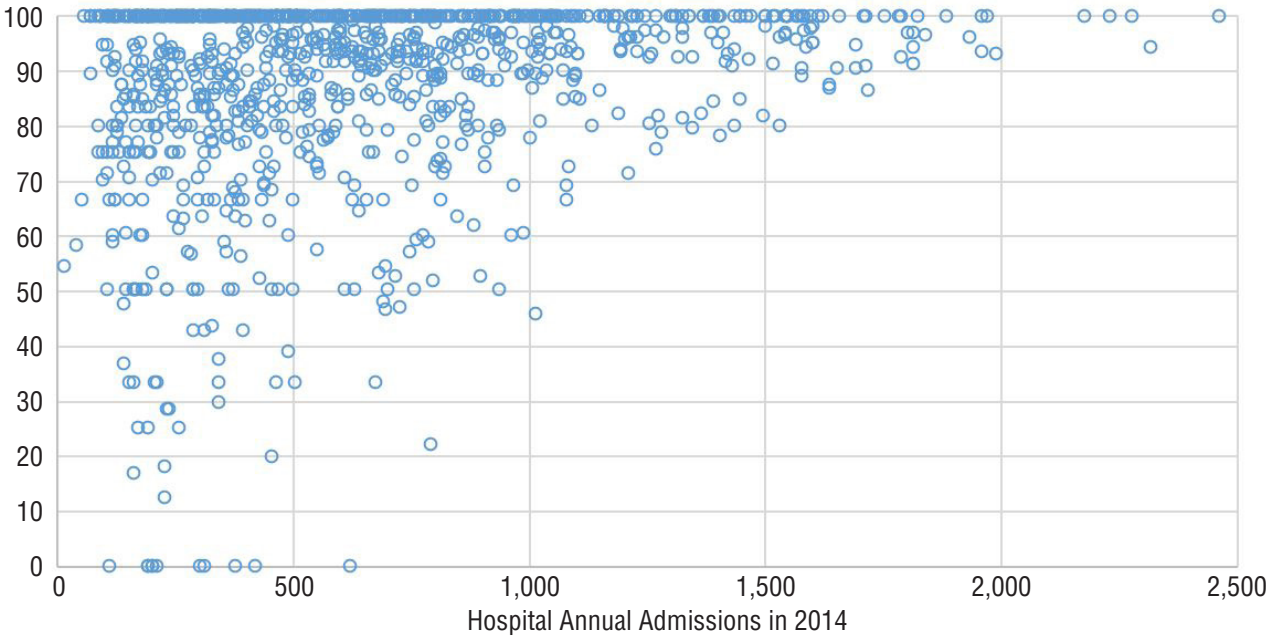
Note: Symbols denote significant positive (+) or negative (-) associations at +++/--- p<.001, ++/-- p<.01, and +/- p<.05

Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Measures
CAHs with lower volumes of inpatient admissions and inpatient surgeries had significantly higher scores on all HCAHPS measures except the discharge information measure (Table 7, next page). Significant differences by Census Region were found for nine of the 11 HCAHPS measures. CAHs in the West region had significantly lower performance on seven HCAHPS measures. System affiliation was significantly associated with performance on five HCAHPS measures, but no consistent associations were found between accreditation and HCAHPS performance. Higher nurse staffing were associated with higher HCAHPS performance, but the differences were small across CAHs with different levels of nurse staffing.

Variations across Critical Access Hospitals

Figure 1 shows each CAH's score on the pneumonia quality measure – the percentage of patients that received most appropriate initial antibiotic(s) – by hospital annual admissions in 2014. The range of quality scores across CAHs with fewer than 500 annual admissions was from 0% to 100%. This range decreases across CAHs that had higher admissions, as the performance score was at least 86% among CAHs with at least 1,600 annual admissions. Similar results for variations across CAHs were found for other Hospital Compare care measures with sufficient volume.

Figure 1. Percent of Patients that Received Most Appropriate Initial Antibiotic(s) by Hospital Admissions (N=1,042 CAHs)



CONCLUSIONS

This study identified three factors – adjusted annual admissions (split into three categories), system-affiliation (yes/no), and census region (Northeast, Midwest, South, West) – that could be used to develop CAH quality peer groups, given their distributions across CAHs, relationships

Table 7. Significant Relationships between Performance on HCAHPS Measures and Potential CAH Quality Peer Group Indicators

	Share of Medicare & Medicaid IP Days	Adjusted Annual Admissions[a]	FTE Nurses per Patient Day	Surgical Inpatient Operations	System Affiliation	Accreditation	Census Region			
							NE	MW	S	W
Room and bathroom were "Always" clean	+	---		---		---	+++			---
Communication with nurses	++	---	++	---	+				+++	---
Communication with doctors	+	-		--	+				+++	---
Responsiveness of hospital staff		---	+	---						
Pain management	+						+++			--
Communication about medicines				-						
Discharge information		+++	++	+++	++	++	+++		--	
Care Transition		---	+					+++	--	
Overall rating of hospital 9-10	+		+		+			+++		--
Quietness of hospital environment	+	---		---	+				+++	---
Definitely recommend the hospital		-					+++			---

[a]Adjusted annual admissions = hospital inpatient admissions + (inpatient admissions x outpatient revenue / inpatient revenue)

Note: Symbols denote significant positive (+) or negative (-) associations at +++/--- p<.001, ++/-- p<.01, and +/- p<.05

to a range of quality performance, and contributions to the comparability across CAHs. Table 8 shows the # CAHs in each of the 24 distinct peer group categories based on the above three factors. Given the limited # CAHs in the Northeast, we recommend collapsing CAHs in this region into 2 categories based on whether or not they are part of a system. This results in 20 distinct CAH quality peer group categories. It should be noted that the variations of quality performance within groups of CAHs, especially for those with lower volume, warrant further examination. ■

Table 8. Distribution of CAHs by Peer Group Categories

Region	Peer Group	# CAHs
Northeast	Not part of system, Adjusted admission: Up to 1500	3
	Not part of a system, Adjusted admission: 1501-3000	10
	Not part of a system, Adjusted admission: > 3000	31
	Part of a system, Adjusted admission: Up to 1500	3
	Part of a system, Adjusted admission: 1501-3000	7
	Part of a system, adjusted admission: > 3000	19
Midwest	Not part of system, Adjusted admission: Up to 1500	108
	Not part of a system, Adjusted admission: 1501-3000	99
	Not part of a system, Adjusted admission: > 3000	109
	Part of a system, Adjusted admission: Up to 1500	91
	Part of a system, Adjusted admission: 1501-3000	89
	Part of a system, Adjusted admission: >3000	134
South	Not part of system, Adjusted admission: Up to 1500	76
	Not part of a system, Adjusted admission: 1501-3000	65
	Not part of a system, Adjusted admission: > 3000	48
	Part of a system, Adjusted admission: Up to 1500	41
	Part of a system, Adjusted admission: 1501-3000	51
	Part of a system, adjusted admission: > 3000	67
West	Not part of system, Adjusted admission: Up to 1500	92
	Not part of a system, Adjusted admission: 1501-3000	52
	Not part of a system, Adjusted admission: > 3000	46
	Part of a system, Adjusted admission: Up to 1500	27
	Part of a system, Adjusted admission: 1501-3000	25
	Part of a system, adjusted admission: > 3000	47

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For more information on this study,
please contact Ira Moscovice at
mosco001@umn.edu

Flex Monitoring Team
University of Minnesota
University of North Carolina at Chapel Hill
University of Southern Maine

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