Original Investigation

Utilization and Outcomes of Inpatient Surgical Care at Critical Access Hospitals in the United States

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IMPORTANCE There is a growing interest in the quality and cost of care provided at Critical Access Hospitals (CAHs), a predominant source of care for many rural populations in the United States.

OBJECTIVE To evaluate utilization, outcomes, and costs of inpatient surgery performed at CAHs.

DESIGN, SETTING, AND PATIENTS A retrospective cohort study of patients undergoing inpatient surgery from 2005 through 2009 at CAHs or non-CAHs was performed using data from the Nationwide Inpatient Sample and American Hospital Association.

EXPOSURE The CAH status of the admitting hospital.

MAIN OUTCOMES AND MEASURES In-hospital mortality, prolonged length of stay, and total hospital costs.

RESULTS Among the 1283 CAHs and 3612 non-CAHs reporting to the American Hospital Association, 34.8% and 36.4%, respectively, had at least 1 year of data in the Nationwide Inpatient Sample. General surgical, gynecologic, and orthopedic procedures composed 95.8% of inpatient cases at CAHs vs 77.3% at non-CAHs ($P < .001$). For 8 common procedures examined (appendectomy, cholecystectomy, colorectal cancer resection, cesarean delivery, hysterectomy, knee replacement, hip replacement, and hip fracture repair), mortality was equivalent between CAHs and non-CAHs ($P > .05$ for all), with the exception that Medicare beneficiaries undergoing hip fracture repair in CAHs had a higher risk of in-hospital death (adjusted odds ratio = 1.37; 95% CI, 1.01-1.87). However, despite shorter hospital stays ($P \leq .001$ for 4 procedures), costs at CAHs were 9.9% to 30.1% higher ($P < .001$ for all 8 procedures).

CONCLUSIONS AND RELEVANCE In-hospital mortality for common low-risk procedures is indistinguishable between CAHs and non-CAHs. Although our findings suggest the potential for cost savings, changes in payment policy for CAHs could diminish access to essential surgical care for rural populations.

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Aiming to bolster small rural hospitals in danger of closing, the Medicare Rural Hospital Flexibility Program in the Balanced Budget Act of 1997 established the special designation of Critical Access Hospitals (CAHs).[1] To secure CAH status, a hospital must have no more than 25 acute care beds and must be located at least 35 miles from another hospital by primary road (or 15 miles by secondary road).[2] Hospitals meeting these criteria receive reimbursement at cost for services provided to Medicare beneficiaries.[2,3] Perhaps reflecting this favorable payment structure, the number of facilities with CAH designation has proliferated during the last 15 years; as of 2011, CAHs composed more than one-fourth of all acute care hospitals in the United States.

Not surprisingly, there is growing interest in the actual quality and costs of care provided at these facilities. Section 3127 of the Patient Protection and Affordable Care Act requires the Medicare Payment Advisory Commission to evaluate quality of care and payment policies for rural health care providers, including nearly all CAHs.[4,5] Moreover, both the Congressional Budget Office and the US Executive Branch recently proposed reducing payments to CAHs as a cost-saving measure for the Medicare program.[6,7]

Although a recent analysis suggested that patients admitted to CAHs for medical conditions have inferior clinical outcomes,[8] whether such differences exist for surgical patients remains unknown. Because inpatient surgery represents a major source of morbidity, mortality, and health care expenditures for the Medicare program, a better understanding of this question would prove invaluable to policy makers as they deliberate both the health and economic implications of CAH designation.

In this context, we used the Nationwide Inpatient Sample (NIS) to examine characteristics of CAHs in the United States and to compare the utilization, outcomes, and costs of common inpatient procedures performed at CAHs vs non-CAHs.

Methods

Data Sources

We used 2 data sources for this analysis. First, we used data from the American Hospital Association (AHA) annual survey (2005-2009) to ascertain hospital-level characteristics, including CAH designation. We then used the NIS (2005-2009) from the Healthcare Cost and Utilization Project to evaluate patient-level utilization, outcomes, and costs of inpatient surgical care. The NIS includes all discharge abstracts from a 20% stratified sample of US nonfederal hospitals in 44 states.[9] The abstracts contain patient demographic variables, admission and discharge information (eg, length of stay [LOS], type of admission), hospital charges around the inpatient stay, and *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) diagnostic and procedure codes related to the inpatient stay. This study was deemed exempt by the University of Michigan institutional review board.

Identification of CAHs

Using AHA data, we first identified all nonfederal acute care hospitals with and without CAH designation in the 50 United States and Washington, DC. We classified each hospital as rural or urban using the established Rural-Urban Commuting Area Codes.[10] We then linked data from the NIS and AHA survey by year to identify hospitals reporting to the NIS. We were unable to link AHA and NIS data for hospitals in 17 states where privacy laws prohibit release of identifying hospital information to the NIS. With this approach, we successfully linked AHA and NIS data in at least 1 year for 34.8% of CAHs and 36.4% of non-CAHs in the United States.

Identification of Patients, Procedures, and Surgical Specialties

For this group of hospitals (ie, those with a successful linkage between NIS and AHA data), we identified all patient admissions that included a principal *ICD-9-CM* procedure code meeting NIS criteria for a major procedure performed in an operating room.[11] We defined admissions in which a major procedure was performed to be surgical admissions. For all surgical admissions, we used Clinical Classifications Software[12] available in the NIS to assign the major procedures to 1 of 10 mutually exclusive categories of operations performed by surgeons from distinct specialties (eg, general surgery, orthopedics, urology).

Outcome Measures

Using Clinical Classifications Software codes, we identified the 8 most common major surgical procedures performed in CAHs: cesarean delivery, abdominal hysterectomy (for benign indications), appendectomy, cholecystectomy, colorectal cancer resection, knee replacement, hip replacement, and hip fracture repair. We then examined and compared in-hospital mortality (ie, during the index surgical admission), prolonged LOS, and costs around the surgical admission for patients undergoing this set of operations at CAHs vs non-CAHs. We classified a patient's LOS as prolonged if it was greater than the 90th percentile for all patients undergoing that procedure. We calculated costs associated with the surgical admission, exclusive of physician fees, using an established method[13,14] based on total admission charges and hospital-specific cost-to-charge ratios developed by the Healthcare Cost and Utilization Project.[15] To further enhance the accuracy of our cost estimates, we applied an additional Healthcare Cost and Utilization Project adjustment factor based on the patient's primary admitting diagnosis.[16] This approach allowed estimation of the costs of hospital services provided but not payments received.

Statistical Analysis

We first compared structural characteristics of hospitals with and without CAH designation using χ^2 and Wilcoxon rank sum tests as appropriate. To assess the generalizability of CAHs in our analytic sample, we also compared the same characteristics between CAHs that could or could not be linked to the NIS.

Next, we again used χ^2 and Wilcoxon rank sum tests to compare characteristics of patients undergoing major inpatient surgery in CAHs vs non-CAHs. We also examined the relative prevalence of procedures performed by each surgical specialty at CAH vs non-CAH facilities, including the proportion of CAHs and non-CAHs that performed 5 or more operations from each specialty within a given year.

Table 1. Hospital Characteristics[a]

Characteristic	CAHs	Non-CAHs	*P* Value
Hospitals, No.	1283	3612	
Bed capacity, median, No.[b]	18	82	<.001
Operating rooms, median, No.[c]	2	8	<.001
Hospitals, %			
With ICU capabilities[b]	33.1	86.9	<.001
Performing any surgery	88.3	96.8	<.001
Performing inpatient surgery	78.4	96.4	<.001
Ownership, %			
Public	42.4	15.9	<.001
Nonprofit	52.5	60.5	
For profit	5.1	23.6	
Hospital system member, %	38.7	61.2	<.001
Teaching hospital, %[d]	4.5	28.6	<.001
Accreditation, %[e]	30.6	88.8	<.001
Rural location, %	92.7	31.2	<.001
United States region, %			
Northeast	5.1	15.5	<.001
Midwest	48.8	21.9	
South	26.2	43.7	
West	19.9	18.9	

Abbreviations: CAH, Critical Access Hospital; ICU, intensive care unit.

[a] Values for each hospital's most recent year of American Hospital Association survey data are presented.

[b] Missing data in 18% of hospitals.

[c] Missing data in 21% of hospitals.

[d] Medical school affiliation, residency program, or Council of Teaching Hospitals membership.

[e] Accredited by the Joint Commission or the American Osteopathic Association.

Table 2. Patient Characteristics[a]

Characteristic	CAHs	Non-CAHs	*P* Value
Admissions, No.	84 302	6 503 411	
Age, y			
Median	50	54	<.001
Category, %			
<50	49.6	42.9	<.001
50-59	12.1	14.9	
60-69	13.0	16.2	
70-79	13.3	15.4	
≥80	11.9	10.8	
Female, %	71.2	62.2	<.001
Race, %[b]			
White	86.7	71.2	<.001
Black	3.3	10.1	
Other	9.9	18.7	
Household income quartile, $, %			
1-38 999	30.3	21.5	<.001
39 000-47 999	43.5	24.5	
48 000-62 999	20.8	25.8	
≥63 000	5.5	28.3	
Elixhauser comorbidity, %			
0	48.3	34.1	<.001
1	22.2	23.2	
≥2	29.5	42.7	
Admission type, %[c]			
Emergency or trauma	15.9	28.7	<.001
Urgent	28.9	17.0	
Elective[d]	55.1	54.4	
Primary payer, %			
Medicare	33.4	35.3	<.001
Medicaid	17.3	13.3	
Private, self-pay, or other	49.3	51.4	

Abbreviation: CAH, Critical Access Hospital.

[a] Percentages may not total exactly 100% owing to rounding.

[b] Missing data in 22%.

[c] Missing data in 17%.

[d] Also includes newborn and other admissions, which combined for less than 0.2% of all admissions.

We subsequently fit multivariable regression models to compare procedure-specific outcomes at CAHs vs non-CAHs. We classified in-hospital mortality and prolonged LOS as binary variables (ie, yes or no), and we log-transformed total admission costs. We implemented generalized estimating equations to account for clustering of patients within hospitals, and we adjusted for patient variables that may influence outcomes including age, sex, race, comorbidity, median household income of patient's home zip code, admission type (emergent/trauma, urgent, or elective), and the primary payer for admission. We additionally adjusted the cost models for LOS. We measured comorbidity for each patient using *ICD-9-CM* diagnosis codes based on established methods described by Elixhauser et al.[17] We also adjusted for the rural or urban status of the admitting hospital. Finally, we performed additional analyses evaluating the same outcomes for the following patient subgroups: (1) patients treated at rural hospitals, (2) patients with elective admissions, and (3) patients with Medicare as the primary payer.

All statistical analyses were completed with SAS version 9.2 statistical software (SAS Institute, Inc). Tests were performed at the 5% significance level.

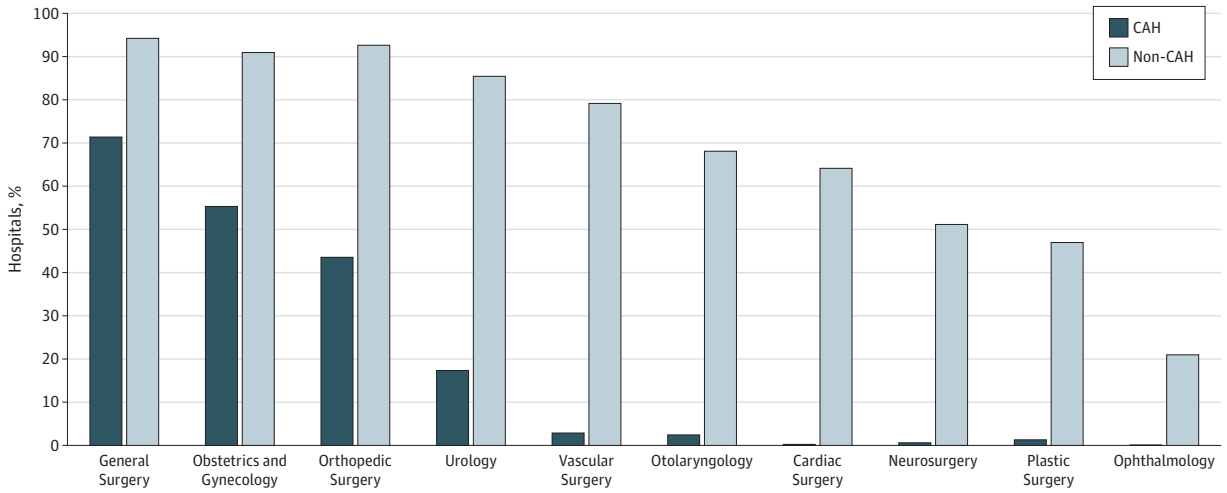
Results

Among 4895 acute care hospitals reporting data to the AHA from 2005 through 2009, we identified 1283 (26.2%) with CAH designation. During the study period, 148 and 9 hospitals obtained or lost CAH status, respectively.

Compared with their non-CAH counterparts, CAHs have fewer beds and operating rooms, are more frequently located in rural communities, and are less likely to provide inpatient surgical services (**Table 1**). In general, structural characteristics of CAHs that could be linked to NIS data were similar to those for CAHs where linkage was not feasible (eTable in Supplement).

From the NIS, we identified 6 587 713 surgical admissions from 2005 through 2009, including 84 302 (1.3%) that occurred at CAHs. Patients admitted for surgery at CAHs were generally younger and had fewer measured comorbidities than their counterparts at non-CAH facilities (**Table 2**). Patients treated at CAHs were also more likely to be white, to have lower

Figure 1. Hospitals Performing at Least 5 Inpatient Surgical Specialty Procedures in 1 Year



Proportion of hospitals performing at least 5 inpatient surgical specialty procedures in 1 year according to Critical Access Hospital (CAH) designation. $P < .001$ for all specialty comparisons.

Table 3. In-Hospital Mortality

	All Patients			Medicare Beneficiaries[a]		
	Raw Rate, %			Raw Rate, %		
Surgical Procedure	CAHs	Non-CAHs	AOR (95% CI)[b]	CAHs	Non-CAHs	AOR (95% CI)[b]
CRC resection	1.54	2.36	0.64 (0.42-1.00)	1.93	3.21	0.64 (0.40-1.02)
Hip replacement	0.93	0.85	1.09 (0.79-1.50)	1.25	1.19	1.14 (0.82-1.58)
Knee replacement	<0.10[c]	0.09	0.58 (0.21-1.60)	<0.10[c]	0.12	0.66 (0.21-2.06)
Hip fracture repair	2.30	1.86	1.32 (0.99-1.78)	2.73	2.22	1.37 (1.01-1.87)
Cholecystectomy	0.47	0.62	0.90 (0.60-1.35)	1.19	1.50	1.04 (0.68-1.57)
Hysterectomy	<0.10[c]	0.04	0.99 (0.11-9.20)	<0.40[c]	0.20	NA[d]
Appendectomy	0.11	0.12	1.26 (0.50-3.20)	0.85	0.99	1.45 (0.51-4.14)
Cesarean delivery	<0.10[c]	0.02	1.46 (0.33-6.42)	0[e]	0.04	NA[d]

Abbreviations: AOR, adjusted odds ratio; CAH, Critical Access Hospital; CRC, colorectal cancer; NA, not applicable.

[a] Patients with Medicare as primary payer.

[b] Risks were adjusted for patient variables and rural or urban location of admitting hospital; reference is non-CAHs.

[c] Given the few number of events, the exact rate was censored per the Nationwide Inpatient Sample data use agreement for patient confidentiality.

[d] Too few events for model convergence.

[e] No events.

incomes, and to have Medicaid as the primary payer (Table 2). The proportion of patients undergoing emergent operations was also lower at CAHs (Table 2).

General surgery, obstetrics and gynecology, and orthopedics composed 33.8%, 32.6%, and 29.4%, respectively, of all inpatient operations performed at CAHs compared with 23.4%, 25.6%, and 28.3%, respectively, of all inpatient operations performed at non-CAHs ($P < .001$). Compared with non-CAH facilities, CAHs are less likely to provide inpatient surgical care in specialty fields such as urology, cardiac surgery, and vascular surgery (**Figure 1**). More complex operations (pancreatectomy, esophagectomy, lung resection, pelvic exenteration, coronary artery bypass graft, and open abdominal aortic aneurysm repair) represented less than 0.1% of operations at CAHs vs 3.3% at non-CAHs ($P < .001$).

The 8 procedures selected for outcomes analysis (cesarean delivery, hysterectomy, appendectomy, cholecystectomy, colorectal cancer resection, knee replacement, hip replacement, and hip fracture repair) composed 57.1% and 36.6% of all inpatient surgical operations performed at CAHs and non-CAHs, respectively. For each of these procedures, we observed no differences in adjusted mortality for patients treated at CAHs (**Table 3**). In planned subgroup analyses, we noted higher inpatient mortality with hip fracture repair performed at CAHs both for patients with Medicare as the primary payer (adjusted odds ratio [AOR] = 1.37; 95% CI, 1.01-1.87) (Table 3) and for patients with elective admissions (AOR = 2.65; 95% CI, 1.20-5.82).

Patients treated at CAHs were less likely to have a prolonged LOS following colorectal cancer resection, hip frac-

Table 4. Prolonged Length of Stay[a]

	All Patients			Medicare Beneficiaries[b]		
	Raw Rate, %			Raw Rate, %		
Surgical Procedure	CAHs	Non-CAHs	AOR (95% CI)[c]	CAHs	Non-CAHs	AOR (95% CI)[c]
CRC resection	4.02	9.76	0.56 (0.41-0.77)	2.90	8.93	0.49 (0.32-0.76)
Hip replacement	7.63	9.49	0.88 (0.70-1.10)	5.93	8.98	0.88 (0.66-1.17)
Knee replacement	6.89	7.23	0.86 (0.70-1.06)	7.67	8.10	0.86 (0.68-1.08)
Hip fracture repair	3.03	8.88	0.56 (0.39-0.80)	3.51	8.05	0.65 (0.45-0.95)
Cholecystectomy	3.73	9.01	0.63 (0.53-0.75)	2.97	10.19	0.53 (0.39-0.71)
Hysterectomy	3.72	5.92	1.24 (0.93-1.64)	3.30	7.83	0.97 (0.44-2.13)
Appendectomy	8.39	9.86	0.89 (0.78-1.02)	5.13	8.88	0.84 (0.53-1.32)
Cesarean delivery	1.22	5.14	0.64 (0.49-0.84)	0[d]	10.09	NA[e]

Abbreviations: AOR, adjusted odds ratio; CAH, Critical Access Hospital; CRC, colorectal cancer; NA, not applicable.

[a] Prolonged length of stay if the procedure-specific length of stay was greater than the 90th percentile of the compared population.

[b] Patients with Medicare as primary payer.

[c] Risks were adjusted for patient variables and rural or urban location of admitting hospital; reference is non-CAHs.

[d] No events.

[e] Too few events for model convergence.

ture repair, cholecystectomy, and cesarean delivery (**Table 4**). In subgroup analyses, this relationship changed such that patients undergoing hysterectomy at CAHs were more likely to experience a prolonged LOS when comparing elective admissions (AOR = 1.39; 95% CI, 1.10-1.76) and patients treated in rural hospitals (AOR = 1.35; 95% CI, 1.09-1.67).

Finally, treatment at CAHs was associated with higher adjusted costs around the surgical admission for each of the operations and subgroups examined ($P < .001$ for all comparisons). Illustrating this point specifically, excess costs associated with surgical admissions to CAHs ranged from $679 for patients undergoing cesarean delivery to $5170 for those undergoing colorectal cancer resection (**Figure 2**A). This finding was consistent in subgroup analyses limited to patients with Medicare (Figure 2B), patients with elective admissions (Figure 2C), and patients treated at rural hospitals (data not shown).

Discussion

In this analysis, we found that surgical care at CAHs revolves mainly around general surgical, obstetric and gynecologic, and orthopedic procedures. Inpatient operations performed by surgical specialists are relatively uncommon.

Notably, inpatient mortality for the most commonly performed operations was largely indistinguishable for patients treated at CAHs vs non-CAHs. The one exception was hip fracture repair, where the subgroup of patients with Medicare as the primary payer and those admitted electively had higher mortality at CAHs. Despite being less likely to have a prolonged LOS, costs associated with both elective and nonelective surgical admissions were 9.9% to 30.1% higher for patients treated in CAHs, depending on the procedure.

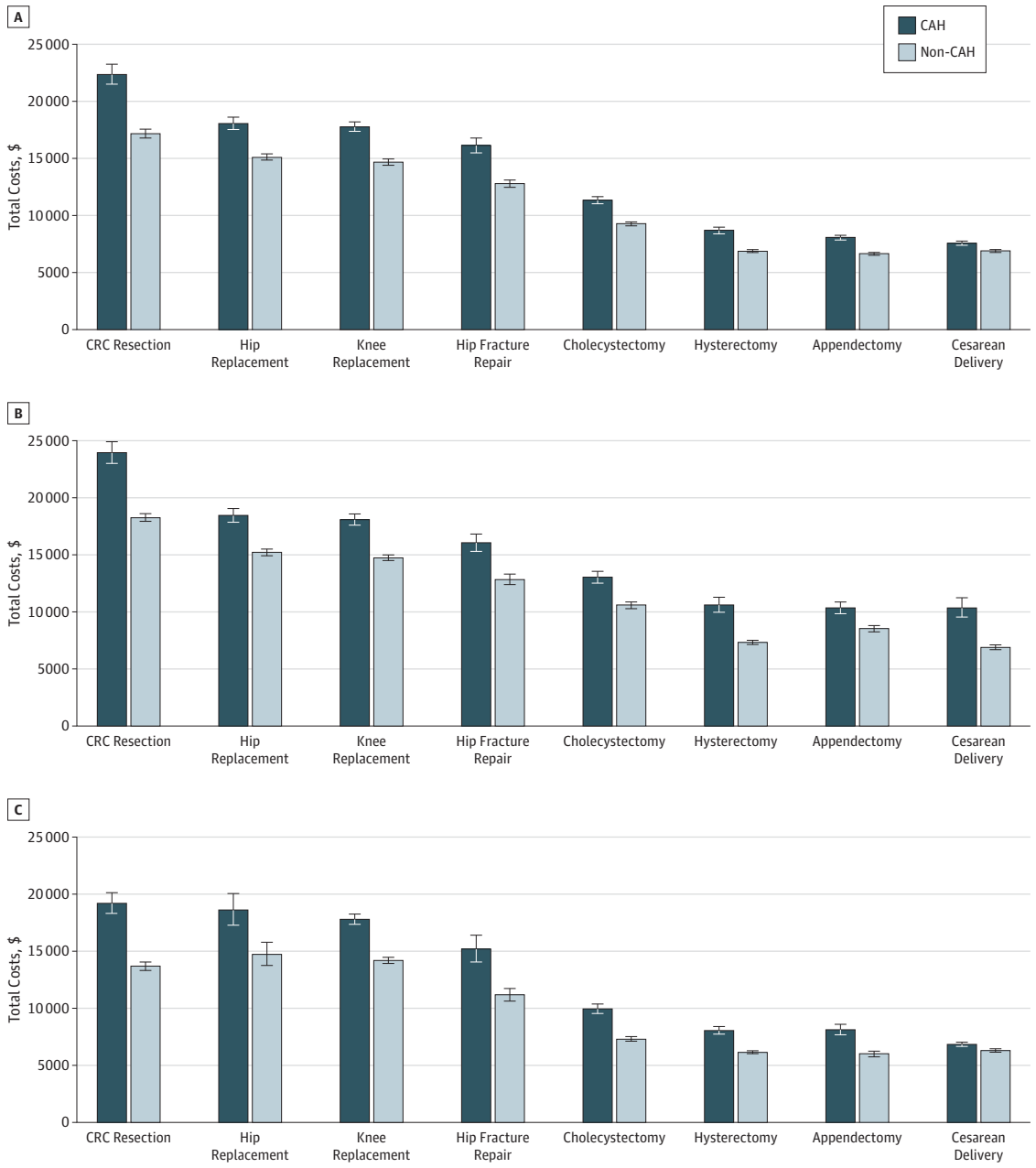
While to our knowledge there have been no other large studies that explicitly evaluated inpatient surgical care in CAHs, our findings are consistent with previous national studies describing both the structural characteristics of these facilities[8] and differences in patient case mix for inpatient operations at rural vs urban hospitals.[18]

However, our results for inpatient mortality differ from those reported for patients with common medical conditions, where treatment at a CAH was associated with higher 30-day mortality.[8] This divergence may be explained by the elective (and therefore potentially less acute) nature of many of the procedures studied, as evidenced by mortality rates less than 4% for surgical admissions compared with rates ranging from 10% to 25% for medical admissions.[8] Alternatively, the discrepancy could reflect the lack of postdischarge follow-up in our study or perhaps even differences in the technical quality of medical and surgical care provided at CAHs.

Indeed, a better understanding of the causes and consequences of our findings will require future work that clarifies the postdischarge experience of patients treated at CAH vs non-CAH facilities. For instance, the observation that surgical patients are less likely to have a prolonged LOS at CAHs may simply reflect the statutory requirement that these facilities maintain an average LOS less than 96 hours for acute admissions.[3] Alternatively, this finding may reflect the fact that patients treated at CAHs had fewer comorbidities (ie, were apparently healthier) than those treated at non-CAHs. Other potential explanations for the LOS disparities include the occurrence of fewer complications, a greater propensity by CAHs to transfer patients to another facility, or even differences in the availability and utilization of postdischarge nursing and/or rehabilitative care in markets served by CAHs. Likewise, additional studies that evaluate longer-term mortality (eg, 30-day or 1-year mortality) would provide important insight regarding comparative outcomes of surgical care in CAHs.

Our findings should be considered in the context of several limitations. Owing to privacy laws that preclude data linkage for facilities in several states, our analysis was limited to a subset of hospitals in the NIS. Nonetheless, more than one-third of all CAHs and non-CAHs were represented in our final sample, and the characteristics of included and excluded CAH facilities were very similar. Because our study used administrative data, we also cannot exclude the possibility that unmeasured differences in patient characteristics and disease severity contributed to differences in the out-

Figure 2. Adjusted Hospital Costs Associated With Surgical Admissions According to Critical Access Hospital (CAH) Designation



A, All patients. B, Patients with Medicare as primary payer. C, Elective admissions. Total costs were calculated from total charges, hospital-specific cost-to-charge ratios, and principal diagnosis adjuster. Costs were adjusted for patient variables, length of stay, and rural or urban location of admitting hospital. Error bars indicate 95% CIs. $P < .001$ for all procedure comparisons. CRC indicates colorectal cancer.

comes and costs of inpatient surgery. In an effort to minimize this risk, we did use specific admitting diagnoses to create more homogeneous patient cohorts (eg, colorectal resections only for patients with colorectal cancer).

Another concern is whether regional differences in payments for surgical care may affect our findings for the cost analyses. Namely, intentional variations in hospital payments based on local differences in wages and cost of living, among other factors, could explain some of the observed discrepancies in episode costs at CAHs vs non-CAHs. Because the geographic distribution of CAHs in our sample was asymmetric, we did not include a measure of geographic region in our multivariable analyses. However, we did adjust for both the rural vs urban location of each hospital as well as the primary payer for each patient. Taken together, these steps are likely to account for some of the regional payment differences that exist for Medicare and other payers. Nonetheless, there may still be some unmeasured differences in

actual charges and costs according to individual payers and distinct geographic regions.

Our cost analyses were also limited by the fact that we used charges rather than actual payments. Nonetheless, our methods are similar to those used by others,[13,14] and they represent an established approach to obtaining accurate cost estimates from the NIS.[16] Moreover, given the differences in payment policy, it might be expected that costs will be higher for CAHs; however, the fact that the disparities in costs were large in magnitude and consistent across multiple procedures suggests clinically relevant and policy-relevant differences in the costs of surgical care provided at CAHs. Ultimately, future work that compares actual payments would clarify further the cost differential between surgical care at CAH and non-CAH facilities.

These limitations notwithstanding, our findings have important implications for both policy makers and CAH leadership. President Obama's 2013 budget proposes a reduction in Medicare payments to CAHs from 101% to 100% of costs[6]; moreover, the Congressional Budget Office recently suggested eliminating the CAH designation altogether.[7] The cost differentials reported herein suggest that such policy shifts could yield meaningful savings for the Centers for Medicare and Medicaid Services with respect to payments for inpatient surgery. At the same time, however, rural hospitals often struggle to recruit and retain surgeons,[19,20] and global reductions in reimbursement may exacerbate this access concern even further. Because we observed similar cost disparities for both elective and nonelective procedures, a potential middle ground might be for policy makers to limit proposed changes in payment levels to elective inpatient operations, where access-related implications for communities served by CAHs may be less acute. Even with this approach, however, it would be important to monitor the effects of such changes, particularly because elective procedures likely represent a pivotal revenue stream for both CAHs and rural surgeons working in these communities.

Our results will also prove useful to Medicare Payment Advisory Commission and Centers for Medicare and Medicaid Services policy makers as they respond to the Patient Protection and Affordable Care Act mandate to evaluate access, quality of care, special payments, and adequacy of Medicare payments to rural health care providers.[4,5] Our data suggest that—at least from a surgical perspective—CAHs are fulfilling their intended role by providing rural populations with basic inpatient surgical care and mortality outcomes that are largely indistinguishable from those at non-CAHs. However, the challenge for policy makers will be how to weigh the benefits of easier access to surgical care for rural residents against the apparently higher costs associated with CAHs, especially for elective operations. Also, given the increasingly limited resources in the Medicare program, policy makers may ultimately have to compare the population-level health impact of the CAH program with other distinct reimbursement policies aimed at supporting hospitals that serve complex or underserved populations (eg, Prospective Payment System–exempt cancer centers and Disproportionate Share Hospitals[21]).

In addition, our findings inform some of the opportunities and challenges associated with CAH participation in value-based purchasing programs and accountable care organizations established by the Patient Protection and Affordable Care Act. The higher costs associated with CAHs suggest the potential for savings to Medicare (and other payers evaluating this option[22]) with implementation of value-based purchasing programs around inpatient surgery. With respect to accountable care organizations, involvement by eligible CAHs may require new partnerships between these hospitals and other facilities or networks[23] to meet the population requirement for participation (ie, ≥5000 Medicare beneficiaries[24]). However, the higher costs at CAHs may represent a barrier to such ventures given the emphasis on controlling expenditures within accountable care organizations. As a result, these emerging organizations may have a much smaller footprint among rural communities in the United States.

In conclusion, inpatient surgical care in CAHs revolves mainly around lower-risk general surgical, gynecologic, and orthopedic procedures. In-hospital mortality for these procedures is largely indistinguishable from that at non-CAHs. The higher costs associated with surgical care at CAHs identify potential opportunities for cost savings; however, payment reforms aimed at this issue will have to consider the implications for timely access to surgical care among rural populations.

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Study concept and design: Gadzinski, Dimick, and Miller.
Acquisition of data: Gadzinski, Ye, and Miller.
Analysis and interpretation of data: All authors.
Drafting of the manuscript: All authors.
Critical revision of the manuscript for important intellectual content: Dimick.
Statistical analysis: Gadzinski and Ye.
Obtained funding: Gadzinski and Miller.
Administrative, technical, and material support: Dimick and Miller.
Study supervision: Dimick and Miller.

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Invited Commentary

Cost of and Access to Surgical Care

Philip P. Goodney, MD, MS

Gadzinski et al[1] found that that while mortality rates are similar between CAHs and non-CAHs, costs are higher in critical access settings, even when patients leave the hospital sooner.

Several aspects of this study deserve comment. First, this study found no differences in perioperative mortality between CAHs and non-CAHs. While perioperative mortality is a convenient end point, many have suggested that it is of limited use in detecting quality differences, especially at the sample sizes that occur in most CAHs.[2,3] While this study represents a good starting point, future work will certainly use more granular markers of surgical quality.

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Second, the authors simply and elegantly demonstrate that the higher payments allotted to CAHs result in higher costs. Is this really a problem? Proponents of policies enacted to ensure that CAHs remain fiscally viable will argue that the system is achieving exactly the results for which it was designed. However, those interested in limiting Medicare spending will argue that the higher payments to CAHs are "low-hanging fruit" in terms of opportunities for more efficient spending.

Overall, this study nicely demonstrates that it is difficult to determine what rate is right in terms of how much excess payment is necessary to ensure that emergent surgical care is available at CAHs. Pay too little, and surgeons will migrate away from low-volume, low-revenue rural practices. But pay too much, and Medicare will be unnecessarily subsidizing surgery in these locales.

Where this threshold lies is an empirical question, and policy makers will have to decide. One wonders if their answer might depend on whether they or one of their loved ones has ever needed emergent surgical care late some evening, on a dark and stormy night, in a hospital far, far away.

ARTICLE INFORMATION

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