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from three acute care hospitals in rural Appalachia**

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Follow-up analysis of federal process of care data reported from three acute care hospitals in rural Appalachia

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Background: This investigation evaluated standardized process of care data collected on selected hospitals serving a remote rural section of westernmost North Carolina.

Methods: Centers for Medicare and Medicaid Services data were analyzed retrospectively for multiple clinical parameters at Fannin Regional Hospital, Murphy Medical Center, and Union General Hospital. Data were analyzed by paired *t*-test for individual comparisons among the three study hospitals to compare the three facilities with each other, as well as with state and national average for each parameter.

Results: Centers for Medicare and Medicaid Services “Hospital Compare” data from 2011 showed Fannin Regional Hospital to have significantly higher composite scores on standardized clinical process of care measures relative to the national average, compared with Murphy Medical Center ($P = 0.01$) and Union General Hospital ($P = 0.01$). This difference was noted to persist when Fannin Regional Hospital was compared with Union General Hospital using common state reference data ($P = 0.02$). When compared with national averages, mean process of care scores reported from Murphy Medical Center and Union General Hospital were both lower but not significantly different (-3.44 versus -6.07 , respectively, $P = 0.54$).

Conclusion: The range of process of care scores submitted by acute care hospitals in western North Carolina is considerable. Centers for Medicare and Medicaid Services “Hospital Compare” information suggests that process of care measurements at Fannin Regional Hospital are significantly higher than at either Murphy Medical Center or Union General Hospital, relative to state and national benchmarks. Further investigation is needed to determine what impact these differences in process of care may have on hospital volume and/or market share in this region. Additional research is planned to identify process of care trends in this demographic and geographically rural area.

Keywords: process of care, hospital quality, North Carolina, rural

Introduction

In the setting of a competitive health care marketplace, factors influencing patient decisions concerning where to obtain medical services have been the focus of considerable study. Some health care consumers may base their choice mainly on convenience rather than characteristics of care delivery,¹ although hospital quality and proximity may interact together to influence this decision. Less is known about hospital selection when geographic, economic, and other factors reduce the number of available hospitals from which to choose. Indeed, when the range of hospital options is very limited and consists entirely of isolated facilities offering similar services, patients are essentially “captive consumers”. Using a standardized assessment tool measuring process of care information among remote hospitals can provide useful data on process of care

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indicators, which in turn may be one element in how patients select a hospital for themselves or their family. The present investigation extends the analysis of standardized process of care data provided by three small hospitals in rural western North Carolina, originally reported in 2009.² This updated study captures data reported in 2011 by the same hospitals, but also includes a cross-institutional comparison which was not performed in the original research.

Materials and methods

This analysis utilized standardized federal data on adult hospital care tabulated by the Centers for Medicare and Medicaid Services, an agency of the US Department of Health and Human Services, along with the Hospital Quality Alliance. The Hospital Quality Alliance initiative was launched in December 2002 and resulted from coordinated efforts by the American Hospital Association, Federation of American Hospitals, and Association of American Medical Colleges. The Hospital Quality Alliance promotes reporting on hospital quality of care and consists of organizations representing consumers, hospitals, doctors and nurses, employers, accrediting organizations, and US federal agencies.

Data were collected retrospectively on process of care measures originating from information extracted from the medical records maintained at each study hospital, in accordance with federal law. The source data are indicative of how often hospitals provide selected care recommended for patients being treated for myocardial infarction, heart failure, or pneumonia, or care provided immediately following surgery. Such process of care measures have evolved to include nine measures related to myocardial infarction care, four measures related to heart failure care, six measures related to pneumonia care, and 11 measures related to prevention of surgical infection. Process of care information regarding children's medical services, psychiatric hospitals, rehabilitation facilities, and long-term care hospitals was excluded. Updated versions of these data are published periodically and are publicly accessible via the US Department of Health and Human Services website ("Hospital Compare"). Data used for this study were reported current to March 2011.

Sampling protocol and facility performance rate calculations

As required under Sections 1152–1154 of the US Social Security Act, one organization in each state (and the District of Columbia, Puerto Rico, and the US Virgin Islands) is contracted by Centers for Medicare and Medicaid Services to serve as that state/jurisdiction's quality

improvement organization. Quality improvement organizations are private, mostly not-for-profit, staffed by health care professionals who are trained to review medical care and help beneficiaries with complaints about the quality of care and to implement improvements in the quality of care available throughout the spectrum of care. For this study, denominators were the sum of all eligible cases (as defined in measure specifications) submitted to the quality improvement organization clinical data warehouse for the reporting period, while numerators were the sum of all eligible cases submitted for the same reporting period where the recommended care was provided. Performance rates were then calculated by dividing the numerator by the denominator. Data were submitted by hospitals to the quality improvement organization clinical data warehouse via the Centers for Medicare and Medicaid Services Abstraction and Reporting Tool, an application for collection and analysis of health quality improvement data, which is available at no charge to hospitals or other organizations seeking to improve the quality of care.

Study region and vicinity hospitals

Extreme western North Carolina is a difficult to access geographic region in rural Appalachia where the state boundaries of Georgia, North Carolina, and Tennessee intersect (see Figure 1). This is a remote area of Appalachia where three



Figure 1 Location of three acute-care study hospitals in a remote area of westernmost North Carolina and northeast Georgia (inset).

Notes: The relative locations of Fannin Regional Hospital (F), Murphy Medical Center (M), and Union General Hospital (U) are shown within their common service region (red circle).

facilities offer coverage for several thousand patients within a shared 30 mile radius. The case-mix, ethnicity, health insurance coverage, veteran status, and other demographic features provide a common patient profile for these three hospitals. Because the largest population center over 50,000 is approximately 90 minutes away by car, health care for these residents is available in the three contiguous counties of Union (Georgia), Fannin (Georgia), and Cherokee (North Carolina). Each of these counties has at least one accredited hospital with a 24-hour emergency department.

Fannin Regional Hospital is a nonprofit community hospital located in Blue Ridge, Georgia. It opened in 1979 and is licensed for 50 beds. The total population of Fannin County, Georgia, was 23,682 in 2010. Murphy Medical Center is a nonprofit community hospital located in Murphy, North Carolina. It opened in 1979 and is licensed for 57 beds. Murphy Medical Center also operates a long-term care/nursing home facility with an additional 106 inpatient beds. The total population of Cherokee County, North Carolina, was 27,444 in 2010. Union General Hospital is a nonprofit community hospital located in Blairsville, Georgia. It opened in 1959 and is licensed for 45 beds. The total population of Union County, Georgia, was 21,356 in 2010.

Residents of westernmost North Carolina also have access to another facility, the Copper Basin Medical Center, located immediately west of the study area in Polk County, Tennessee (population 16,825 in 2010). However, this small 25-bed hospital did not report any data to the Centers for Medicare and Medicaid Services in either 2007 or 2011, so was excluded from the study.

Because these were small rural hospitals where the full range of services evaluated by the national Centers for Medicare and Medicaid Services template was not routinely available, some data cells were left empty intentionally. Specifically, Fannin Regional Hospital reported no data on frequency of administration of fibrinolytics to patients with myocardial infarction within 30 minutes of arrival, or on the number of patients given percutaneous coronary intervention within 90 minutes of arrival due to insufficient patient volume. This hospital also did not report any data on smoking cessation counseling for myocardial infarction patients, or on heart surgery patients whose blood sugar was kept under good control in the days immediately following surgery.

Statistical analysis

Process of care measurements were reported from the three sample areas in aggregate form and compared with national and state averages by paired *t*-test. This test was also used for

pair-wise comparisons among the three hospitals. Because not all institutions were located in the same state, cross-hospital state comparisons were not performed except for Georgia. A process of care measurement was considered significantly better than average at a 95% confidence level. Due to the large number of potential comparisons, and because not all study hospitals generated data for each parameter, the number of reported responses was not the same for each facility. For each comparison, a *P* value < 0.05 indicated a significant difference between the two means, with the higher value corresponding to the hospital with better process of care scores. Because patient-level data were not available, multiple regression analysis could not be performed.

Results

Several process of care categories demonstrated a significant difference when the three study hospitals were compared in a pairwise fashion. Fannin Regional Hospital reported higher overall scores than either of the other two area hospitals. When compared with its same-state study hospital in Georgia (Union General Hospital), process of care measurements at Fannin Regional Hospital were significantly higher (*P* = 0.02). For care of patients with pneumonia, Murphy Medical Center reported no score that was above either the state or national average. Relative to national process of care measurements, mean scores reported from Murphy Medical Center and Union General Hospital were both lower, but not significantly so (−3.44 versus −6.07, respectively; *P* = 0.54). Data reported by each facility are shown in Table 1, with pairwise summary comparisons for the three study hospitals provided in Table 2.

No data were reported from these three hospitals on heart patients given percutaneous coronary interventions or on the number of patients administered fibrinolytic medication within 30 minutes of arrival. Moreover, there were no data on heart surgery patients whose blood sugar was satisfactorily controlled in the perioperative period. Because the three study hospitals are of comparable size and offer similar services, in most cases a process of care parameter with missing data was seen for all three facilities. The very low number (or absence) of heart attack patients given angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers for left ventricular dysfunction, and smoking cessation counseling were exceptions, as shown in Table 1.

Discussion

Beginning in 2004, acute care hospitals in the US could voluntarily elect to report quality data in order to receive incentive

Table 1 Federal process of care data reported from three rural hospitals in Appalachia, 2010–2011

Process of care measure	FRH	MMC	UGH
HF patients given discharge instructions	93 (56)	89 (28)	88 (33)
HF patients given an evaluation of LVS fxn	100 (72)	95 (41)	100 (39)
HF patients given ACE inhibitor or ARB for LVSD	100 (13)	67 (6)	90 (10)
HF patients given smoking cessation advice/counseling	100 (14)	100 (6)	100 (5)
Interval between arrival with CP and transfer to another hospital ^a	78 (7)	94 (6)	77 (5)
Interval between arrival with CP and ECG ^a	11 (51)	5 (143)	14 (106)
CP patients who received fibrinolytics within 30 minutes of arrival	100 (1)	92 (12)	50 (2)
CP patients who received aspirin within 24 hours of arrival	96 (49)	92 (135)	96 (100)
MI patients who received aspirin at arrival	100 (3)	95 (19)	100 (8)
MI patients who were given aspirin at discharge	100 (3)	91 (11)	100 (4)
MI patients who were given ACE inhibitor or ARB for LVSD	100 (2)	100 (1)	N/A
MI patients given smoking cessation counseling	N/A	100 (1)	N/A
MI patients given beta-blocker at discharge	100 (3)	91 (11)	100 (5)
MI patients given fibrinolytics within 30 minutes of arrival	N/A	N/A	N/A
MI patients given PCI within 90 minutes of arrival	N/A	N/A	N/A
MI patients given Rx for statin at discharge	100 (1)	100 (4)	0 (1)
PNEU patients given pneumococcal vaccine	100 (87)	89 (88)	95 (102)
PNEU patients whose initial ED blood culture preceded first ABX dose	99 (78)	94 (109)	99 (75)
PNEU patients given smoking cessation counseling	100 (32)	98 (45)	100 (28)
PNEU patients given initial ABX within 6 hours of arrival	98 (87)	94 (95)	97 (103)
PNEU patients given most appropriate initial ABX	97 (29)	85 (59)	92 (75)
PNEU patients given influenza vaccination	100 (74)	92 (60)	91 (64)
Outpatient SURG patients who received ABX within one hour of surgery	98 (43)	88 (26)	87 (62)
Outpatient SURG patients who got the right type of ABX	100 (42)	83 (24)	95 (57)
SURG patients who were taking beta-blockers with minimal interruption by surgery	100 (51)	82 (34)	59 (17)
SURG inpatients who received ABX within one hour of surgery	99 (143)	98 (121)	96 (54)
SURG inpatients who got the right kind of ABX	99 (144)	88 (121)	91 (54)
SURG inpatients who had ABX prophylaxis discontinued within 24 hours of surgery	100 (136)	95 (121)	98 (53)
Heart SURG patients with satisfactory postoperative serum glucose control	N/A	N/A	N/A
SURG patients needing hair removal from surgical site, using nonrazor method	100 (174)	99 (161)	100 (84)
SURG patients with urinary catheters removed on post-surgery day 1 or 2	100 (68)	82 (40)	95 (19)
SURG patients receiving active warming (intraoperative), or with near normal postoperative body temperature	100 (174)	100 (160)	100 (85)
SURG patients with postoperative orders to reduce thrombus risk	98 (52)	92 (53)	87 (23)
SURG patients receiving thrombus risk reducing treatment within \pm 24 hours of surgery	98 (52)	92 (53)	86 (22)

Notes: ^aData presented as % (n), except interval between arrival with CP and transfer to another hospital, and interval between arrival with CP and ECG [given in (average) minutes (n)].

Abbreviations: ABX, antibiotics; ACE, angiotensin converting enzyme; ARB, angiotensin II receptor blocker; CP, chest pain; ECG, electrocardiogram; ED, emergency department; FRH, Fannin Regional Hospital (Georgia); HF, heart failure; LVS fxn, left ventricular systolic function; LVSD, left ventricular systolic dysfunction; MMC, Murphy Medical Center (North Carolina); MI, myocardial infarction; N/A, not applicable or no data; PCI, percutaneous coronary intervention; PNEU, pneumonia; Rx, prescription; SURG, surgery; UGH, Union General Hospital (Georgia).

payments established by Section 501(b) of the Medicare Prescription Drug, Improvement and Modernization Act of 2003. To obtain enhanced disbursements, eligible hospitals were required to report on an initial set of ten quality performance measures and agree to have their data publicly displayed. Initially, almost all hospitals eligible for the payment incentive provided these data, reflecting care delivered during 2004. Under Section 5001(a) of the Deficit Reduction Act of 2005, the set of measures included in the incentive was expanded, the magnitude of the incentive was increased, and the time limit for the provision removed.

This is a follow-up investigation presenting data on three acute care hospitals available to medical consumers in the

mountainous area of extreme westernmost North Carolina. The hospital “report card” used in this analysis is one source of information attracting significant consumer interest,³ particularly when the data are considered reliable and collected in a highly standardized format. The present study focused on westernmost North Carolina because this region is remote and represents an essentially captive rural health care market where outside influences are unlikely to play a major role. Moreover, given the severe recessionary effects of a relatively contracted national economy since the initial survey was conducted, a follow-up analysis was considered useful.

It is reassuring that patients in westernmost North Carolina continue to have access to these key medical

Table 2

	FRH	MMC
Summary of federal process of care measurements at FRH and MMC, compared with national (US) averages		
Mean	4.77	-1.97
Variance	63.5	135.9
Process of care elements analyzed	30	
P^a	0.01	
	FRH	UGH
Summary of federal process of care measurements at FRH and UGH, compared with national (US) averages		
Mean	4.41	-6.07
Variance	63.7	387.5
Process of care elements analyzed	27	
P^a	0.01	
Summary of federal process of care measurements at FRH and UGH, compared with state (Georgia) averages		
Mean	4.03	-6.44
Variance	40.0	391.0
Process of care elements analyzed	27	
P^a	0.02	

Notes: Process of care data as reported by each study hospital and tabulated at "Hospital Compare" for public information; ^aby two sample paired t-test.

Abbreviations: FRH, Fannin Regional Hospital; MMC, Murphy Medical Center; UGH, Union General Hospital.

services at multiple locations; the Centers for Medicare and Medicaid Services data do not suggest that any of the study hospitals performed significantly below state or national average for any of the categories. However, data reported from Fannin Regional Hospital show a significantly higher process of care score compared with the other two study hospitals. Of note, this finding aligns with a 2007 process of care report that evaluated the same three facilities,² in which Fannin Regional Hospital emerged as the institution where process of care measures were significantly better than the state and national average. Moreover, the current study identified one study hospital (Murphy Medical Center) where no score was above the state or national average for care of patients with pneumonia. This was the same hospital that failed to achieve a significantly higher score on any process of care measure when compared with state averages in 2007.² Many factors may influence a particular hospital's process of care performance, but it was outside the scope of our research to identify specific reasons for institutional scores.

This descriptive follow-up investigation was limited in several ways. Because Centers for Medicare and Medicaid Services information is not provided as patient-level data, it was impossible to undertake a regression analysis for a more detailed assessment of clinical factors. Whether these aggregate data depicted a series of independent observations should also be questioned, because it cannot be confirmed

that each patient was only counted once and the treatments assessed were themselves independent. However, given that the primary analysis for this investigation was process of care rather than individual patients, even if multiple treatments were provided to one individual, this would not entirely invalidate these comparisons. Our analysis depended on hospital self-reported data collected retrospectively by manual tabulation from medical records, although the accuracy and consistency of this methodology have not been rigorously validated. Accordingly, confusion exists in "ranking" hospitals on the basis of Centers for Medicare and Medicaid Services data⁴ because information available via the "Hospital Compare" website does not always agree with other publicly available evaluation instruments.⁵ This can present a conflicting picture on hospital performance to health care consumers. Indeed, because hospital charges submitted to Centers for Medicare and Medicaid Services are typically reimbursed at a lower rate than requested irrespective of facility location, relatively isolated hospitals are particularly vulnerable to shortfalls which can compromise essential services, including obstetrics and urgent care. It is reasonable to expect such fiscal challenges can adversely impact process of care measurements, although longer range studies will be required to confirm this.

Conclusion

Centers for Medicare and Medicaid Services data available on the "Hospital Compare" website represents a highly accessible tool to empower patients with current and standardized information about hospitals. In other settings, hospital market share has been influenced by other factors, including population density, number of nearby hospitals, medical school affiliation, percentage of Medicaid admissions, and medical/surgical service offerings.^{6,7} To determine if the Centers for Medicare and Medicaid Services Hospital Compare dataset plays a similar role for medical consumers in westernmost North Carolina, and if this information influences patient choice or contributes in other ways to this market dynamic, represents the aim of ongoing research. This most recent analysis of small acute care hospitals in westernmost North Carolina supplies additional data underscoring the importance of process of care markers for the local population. It will be instructive to assess these facilities further on a longitudinal basis to identify changes in process of care measures.

Disclosure

The authors report no conflicts of interest in this work.

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