

Patterns of Hospital Bypass and Inpatient Care-Seeking by Rural Residents

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OVERVIEW

Hospital bypass, the tendency of local rural residents to not seek care at their closest hospital, is thought to be a contributing factor for rural hospital closure. Previous literature indicates that bypass behavior leads to significant losses of potential revenue for rural hospitals,^{1,2} which in turn leads to greater financial distress and risk of closure.³ In fact, from 2012 to 2016, the number of acute inpatient days at rural hospitals fell roughly 15 percent with little change in the national rate.⁴ In addition, from January 2005 to March 2020, 170 rural hospitals closed.⁵ Rural hospital closures typically lead to worse health and economic outcomes due to the loss of local acute care services.³

Furthermore, individuals most impacted by rural hospital closures often belong to vulnerable populations (e.g., the elderly, the poor, individuals dependent on public insurance programs).^{6,7} **The purpose of this brief is to update the knowledge base of determinants of bypass behavior by analyzing state inpatient data from 2014-2016 across 16 diverse states.**

METHODS

The 2014-2016 Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) served as our primary source of data.⁸ We used SIDs, managed by the Agency for Healthcare Research and Quality (AHRQ), to provide discharge data for all payers as well as information on the admitting hospital, the patient's ZIP-based residence, and other important characteristics (e.g., diagnosis, procedure, demographics). Not all SIDs provide information on hospital identifiers and patient residence ZIP codes, and the availability of this information is sometimes subject to yearly change. Thus, our work focused on SIDs that made information on hospital identifiers and patient residence ZIP codes available. Additional data sources for our research included the Centers for Medicaid & Medicare Services Healthcare Cost Report Information System (HCRIS),⁹ the American Hospital Association Annual Survey Database^{TM,10} the Provider of Services data file,¹¹ StreetMap North America,¹² the SAS dataset of zipcodes,¹³ data on core-based statistical areas,¹⁴ data on Rural-Urban Commuting Area (RUCA) codes,¹⁵ and the Inpatient Provider Specific File.¹⁶

We defined rural bypass as any inpatient discharge of a rural resident from a hospital other than the hospital located nearest to the patient's ZIP code-based residence. Furthermore, we defined rural residents as residents of ZIP codes outside metropolitan Core Based Statistical Areas or within metropolitan areas and having a 2010 RUCA code of 4 or greater (following the definition used by the Federal Office of Rural Health Policy).¹⁷ We defined rural hospitals similarly, with the remaining hospitals defined as urban. After determining rural-urban status, we selected for further study all admissions who were both (1) rural residents whose closest hospital was a rural hospital and (2) non-transfer discharges from a short-term acute non-federal rural or urban hospital (includes Critical Access Hospitals). In addition, because of the data, we restricted our analysis to inpatients whose residence, closest hospital, and admitting hospital (if different from the closest hospital) were all located within the same state.

Determinants of interest included hospital characteristics (e.g., size, services offered), patient characteristics (e.g., age, sex, insurer, distance to nearby hospitals), clinical characteristics (e.g., diagnosis, procedure, complexity), and characteristics of the patient's community of residence (e.g., median household income). We compared (1) characteristics of high-bypass, medium-bypass, and low-bypass hospitals and (2) characteristics of patients that bypassed their closest hospital to characteristics of patients that did not bypass their closest hospital. Table 1 divides

KEY FINDINGS

In comparison to other rural hospitals, rural hospitals are more likely to be bypassed by local residents if they are:

- ▲ A Critical Access Hospital (CAH)
- ▲ Smaller (i.e., fewer beds)
- ▲ Less profitable
- ▲ Do not offer obstetric services

In addition, patients that bypassed their local rural hospital were slightly more likely to be seeking:

- ▲ Elective care
- ▲ Obstetric services
- ▲ Services related to the circulatory system or musculoskeletal system.

hospitals into “Low,” “Medium,” and “High” bypass categories. “Low” is defined as hospitals with a bypass rate less than 40% (the 25th percentile), “Medium” is defined as hospitals with a bypass rate greater than or equal to 40% and less than 73% (the 75th percentile), and “High” is defined as hospitals with a bypass rate greater than or equal to 73%. In this Table, we test the characteristics of high bypass hospitals against low bypass hospitals.

DATA LIMITATIONS

Our analysis used SID data from the following states: Arizona, Colorado, Florida, Iowa, Kentucky, Minnesota, North Carolina, Nebraska, New Jersey, New York, Oregon, Rhode Island, Utah, Vermont, Washington, and Wisconsin. Although this collection of states appears to generally represent the major geographic regions of the United States, the possibility remains that results from our data may not fully generalize to hospitals and patients in states outside our study sample.

RESULTS

The final analysis sample had 3,128,839 discharges across 1,518 rural hospital-years. The sample included discharges from all aforementioned states except Rhode Island (no inpatient discharges from Rhode Island for the years studied met our definition for rural hospital bypass). By census region, 34.2% of discharges were from the Midwest, 7.2% of discharges were from the Northeast, 40.5% of discharges were from the South, and 18.1% of discharges were from the West. Among our analysis sample, we identified 1,585,520 (50.7%) discharges associated with hospital bypass and 49.3% of discharges associated with patients that did not bypass their closest hospital.

Table 1 shows differences in region, ownership, size, financial performance, service offerings, and other characteristics between low-bypass, medium-bypass, and high-bypass hospitals. Relative to low-bypass hospitals, hospitals that were classified as high-bypass were significantly more likely to be located in the Midwest (50.1% vs. 47.5%) or the South (33.5% vs. 21.5%) and more likely to be a Critical Access Hospital (89.1% vs. 40.1%). High-bypass hospitals were also generally smaller than low-bypass hospitals (25.4 beds on average vs. 74.1 beds) and demonstrated less profitability. Among hospitals that were members of a hospital system recognized by the American Hospital Association, high-bypass hospitals were generally closer to the largest hospital in the system (304.8 miles on average vs. 440.9 miles).

Table 1. Hospital Characteristics by Rural Bypass Level (Low, Medium, High)

Variable	Bypass Type ^a			p ^b
	Low	Medium	High	
Number of hospital-years	396	737	385	
General Characteristics, %				
Census region				
Midwest	47.5%	54.6%	50.1%	< .001*
Northeast	7.8%	3.4%	4.2%	
South	21.5%	20.1%	33.5%	
West	23.2%	22.0%	12.2%	
Ownership				
Non-profit	69.2%	56.2%	61.8%	.07
Profit	8.3%	7.1%	8.8%	
Government	22.5%	36.8%	29.4%	
Critical Access Hospital	40.1%	66.4%	89.1%	< .001*
Number of beds, mean (SD)	74.1 (68.2)	40.0 (35.5)	25.4 (14.0)	< .001*
Member of AHA-recognized hospital system	54.8%	48.7%	54.3%	.89
Miles to largest hospital in system, mean (SD) ^c	440.9 (553.3)	402.9 (482.5)	304.8 (369.5)	.03*
Financial Performance, mean (SD)				
Percent total margin	6.9 (7.3)	3.5 (9.4)	2.5 (10.3)	< .001*
Net patient revenue (millions) per year	94.6 (76.6)	45.4 (37.1)	28.8 (57.2)	< .001*
Services and Technologies, %				
Emergency department services	100.0%	100.0%	99.0%	.04*
General pediatric medical/surgical services	48.0%	36.9%	26.0%	< .001*
Obstetrical services	93.4%	76.7%	17.1%	< .001*
Surgical services	99.5%	98.2%	91.7%	< .001*

Note: SD = standard deviation; AHA = American Hospital Association.

a “Low” is defined as hospitals with a bypass rate less than 40% (the 25th percentile), “Medium” is defined as hospitals with a bypass rate greater than or equal to 40% and less than 73% (the 75th percentile), and “High” is defined as hospitals with a bypass rate greater than or equal to 73%.

b Significance value for Pearson’s Chi-square test of independence (categorical variables) or Mann-Whitney *U* test (continuous variables). Null hypothesis for either test states that low-bypass hospitals and high-bypass hospitals do not differ significantly based on the given hospital characteristic.

c Among hospitals that are members of a hospital system recognized by the AHA; the largest hospital in a given system was coded as having a distance of 0 miles.

* $p < .05$ (result is statistically significant)

Furthermore, high-bypass hospitals were significantly less likely than low-bypass hospitals to offer obstetric services (17.1% vs. 93.4%) and general pediatric medical/surgical services (26.0% vs. 48.0%). Notably, hospital ownership and whether a hospital was a member of a hospital system were not significantly associated with high- or low-bypass.

Table 2 shows differences in demographic characteristics between patients that bypassed their closest hospital and patients that did not bypass their closest hospital. Rural residents bypassing their local rural hospital were younger (48.6 years of age on average vs. 53.3 years), more likely to be male (44.0% vs. 40.4%), and less likely to be a racial or ethnic minority (13.3% vs. 15.6%). Furthermore, rural residents that chose to bypass were farther from the local rural hospital (7.7 miles on average vs. 5.6 miles) and closer to the first urban hospital (37.2 miles on average vs. 41.6 miles). Rural residents in both groups were similarly close to the first 100-bed hospital (28.9 miles on average for the bypass group vs. 28.2 for the non-bypass group), although the difference between groups was significantly different from a statistical

Table 2. Patient Demographic Characteristics by Rural Bypass Status

Variable	Non-Bypass	Bypass	p ^a
	n = 1,543,319	n = 1,585,520	
Age, mean years (SD)	53.3 (28.5)	48.6 (27.0)	< .001*
Age category, %			
Newborns	10.8%	11.5%	
0 years, non-newborns	0.7%	0.9%	
1-4 years	0.6%	0.8%	
5-9 years	0.3%	0.6%	
10-14 years	0.3%	0.7%	
15-24 years	6.2%	6.7%	< .001*
25-34 years	9.3%	10.6%	
35-44 years	5.9%	7.2%	
45-54 years	8.6%	10.3%	
55-64 years	13.1%	15.7%	
65-74 years	15.9%	17.3%	
75+ years	28.3%	17.7%	
Female, %	59.6%	56.0%	< .001*
Race/Ethnicity, %			
White	84.4%	86.7%	
Black	7.1%	5.6%	
Hispanic	4.9%	4.5%	< .001*
Asian or Pacific Islander	0.5%	0.4%	
Native American	2.2%	1.6%	
Other	1.0%	1.1%	
Median household income, %			
State Quartile 1 (i.e., least wealthy)	43.1%	39.9%	
State Quartile 2	36.7%	35.2%	
State Quartile 3	17.2%	20.3%	< .001*
State Quartile 4 (i.e., most wealthy)	3.1%	4.6%	
Distance to hospital, miles (SD)			
Nearest rural hospital	5.6 (5.9)	7.7 (7.1)	< .001*
Nearest urban hospital	41.6 (22.6)	37.2 (21.0)	< .001*
Nearest 100-bed hospital	28.2 (25.1)	28.9 (21.2)	< .001*
FAR area code, ^b %			
Level 1	29.2%	21.8%	< .001*
Level 2	16.9%	14.2%	< .001*
Level 3	10.1%	10.2%	< .001*
Level 4	3.3%	5.5%	< .001*

Note: SD = standard deviation; FAR = Frontier and Remote area codes.

a Significance value for Pearson's Chi-square test of independence (categorical variables) or Mann-Whitney *U* test (continuous variables).

Null hypothesis for either test states that patients treated at their local hospital and patients that bypassed their local hospital do not differ significantly based on the given patient characteristic.

b FAR levels are not mutually exclusive.

* $p < .05$ (result is statistically significant)

perspective. Moreover, rural residents bypassing their local rural hospital were less likely to live in a Frontier and Remote (FAR) area (51.7% vs. 59.5%), as defined by the United States Department of Agriculture Economic Research Service.¹⁸

Table 3 shows differences in medical characteristics between bypass patients and non-bypass patients. Medical characteristics generally differed between rural residents that chose to bypass their local rural hospital and those that did not bypass. For instance, rural residents bypassing their local rural hospital were more likely to be admitted for an elective condition (36.6% vs. 22.2%) and were less likely to be admitted for an emergency condition (34.1% vs. 48.5%). Rural residents in both groups (bypass vs. non-bypass) had similar average number of chronic conditions and average number of diagnoses (although the latter was significantly different between groups from a statistical perspective). However, patients bypassing their local rural hospital had almost twice as many procedures performed during their inpatient stay (1.9 procedures on average vs. 1.1), were approximately twice as likely to have a major operating room procedure (38.8% vs. 19.1%), and generally had greater DRG (diagnosis-related group)¹⁹ weights (1.6 DRG weight on average vs. 1.1). Furthermore, rural residents bypassing their local rural hospital were more likely to be commercially insured (32.5% vs. 23.5%).

Table 3. Patient Medical Characteristics by Rural Bypass Status

Variable	Non-Bypass	Bypass	p ^a
	n = 1,543,319	n = 1,585,520	
Primary source of health insurance, %			
Medicare	48.5%	39.4%	< .001*
Medicaid	22.8%	22.5%	
Private	23.5%	32.5%	
Self-pay	3.0%	2.7%	
No charge	0.1%	0.1%	
Other	2.2%	2.9%	
Admission type, %			
Emergency	48.5%	34.1%	< .001*
Urgent	18.3%	16.8%	
Elective	22.2%	36.6%	
Newborn	10.8%	11.4%	
Trauma Center	0.2%	1.1%	
Other	0.0%	0.0%	
Major Diagnosis Category (MDC), %			
Respiratory system	15.3%	7.7%	< .001*
Circulatory system	10.9%	12.0%	< .001*
Digestive system	9.4%	7.8%	< .001*
Musculoskeletal system and connective tissue	7.7%	14.8%	< .001*
Pregnancy, childbirth, puerperium	11.6%	11.8%	< .001*
Newborns and other neonates with conditions originating in perinatal period	11.1%	11.6%	< .001*
Infectious and parasitic disease	5.9%	4.2%	< .001*
Other MDCs	28.0%	30.1%	< .001*
Number of chronic conditions, ^b mean (SD)	4.5 (3.8)	4.6 (3.8)	.47
Number of diagnoses, mean (SD)	10.1 (6.5)	10.0 (6.7)	< .001*
Number of procedures, mean (SD)	1.1 (2.0)	1.9 (2.5)	< .001*
DRG weight, mean (SD)	1.1 (0.8)	1.6 (1.5)	< .001*
Major operating room procedure, ^c %	19.1%	38.8%	< .001*

Note: SD = standard deviation; MDC = major diagnostic category; DRG = diagnosis-related group.

a Significance value for Pearson's Chi-square test of independence (categorical variables) or Mann-Whitney *U* test (continuous variables).

Null hypothesis for either test states that patients treated at their local hospital and patients that bypassed their local hospital do not differ significantly based on the given patient characteristic.

b Only recorded in SID up through the third quarter of 2015 (n = 2,255,383).

c Only recorded in SID up through the third quarter of 2015 (n = 2,255,390).

* p < .05 (result is statistically significant)

DISCUSSION

Our results suggest that inpatient bypass behavior is driven by both hospital-level and patient-level characteristics. Important hospital-level determinants included CAH status, size, financial performance, and service offerings. It is possible that some hospital characteristics, such as CAH status, are not always understood by patients and instead reflect associations between hospital size (a potential signal of hospital quality) and patient decisions to bypass. Given the

recent decline in access to rural obstetric care,^{20,21} the provision of obstetric services by rural hospitals is particularly noteworthy. We found that hospitals providing obstetric services were less likely to be bypassed in general. This result suggests that the provision of obstetric services may serve as a signal of greater hospital quality for patients seeking obstetric care or other services. However, provision of obstetric services does not guarantee a rural patient will visit his or her local rural hospital, even if they are seeking obstetric care. Additional analysis showed that even among local hospitals that offered obstetric services, patients seeking obstetric care had a bypass rate of approximately 38%.

In addition to hospital-level characteristics, important patient-level determinants included age, sex, race and ethnicity, median household income of the patient's community of residence, distance (both distance to the local rural hospital and distance to the closest urban hospital), insurance status, admission type, MDC (major diagnostic category), number of procedures, DRG weight, and whether or not the patient's inpatient stay included a major operating room procedure. Individuals that did not bypass their local rural hospital were more likely to belong to vulnerable populations (e.g., adults age 65 and over, racial and ethnic minorities, individuals with public insurance, individuals living in frontier and remote areas). Individuals from vulnerable populations may not always possess the resources to bypass their local hospital and seek care elsewhere. Thus, these results continue to highlight the importance of local rural hospitals as a source of care for vulnerable populations and the potential effect of inpatient bypass behavior on rural hospital closures. Future research can build on this study by considering the determinants of outpatient bypass behavior and its possible effects on rural hospitals.

REFERENCES AND NOTES

1. Radcliff TA, Brasure M, Moscovice IS, Stensland JT. Understanding rural hospital bypass behavior. *The Journal of Rural Health*, 2003;19(3):252-259.
2. Weigel PA, Ullrich F, Finegan CN, Ward MM. Rural bypass for elective surgeries. *The Journal of Rural Health*, 2017;33(2):135-145.
3. Kaufman BG, Thomas SR, Randolph RK, Perry JR, Thompson KW, Holmes GM, Pink GH. (2016). The rising rate of rural hospital closures. *The Journal of Rural Health*, 2016;32(1):35-43.
4. Preliminary analyses of CMS's HCRIS data by the North Carolina Rural Health Research Program (Summer 2019).
5. North Carolina Rural Health Research Program. (2020). 170 Rural Hospital Closures: January 2005 - Present (128 since 2010). Available at: <https://www.shepscenter.unc.edu/programs-projects/rural-health/rural-hospital-closures/>.
6. Newkirk V, Damico A. (2014). The Affordable Care Act and insurance coverage in rural areas. The Kaiser Commission on Medicaid and the Uninsured, May 29, 2014. Available at: <https://www.kff.org/uninsured/issue-brief/the-affordable-care-act-and-insurance-coverage-in-rural-areas/>.
7. Meit M, Knudson A, Gilbert T, Yu ATC, Tanenbaum E, Ormson E, Popat MS. (2014). The 2014 update of the rural-urban chartbook. Bethesda, MD: Rural Health Reform Policy Research Center, October. Available at: <https://ruralhealth.und.edu/projects/health-reform-policy-research-center/pdf/2014-rural-urban-chartbook-update.pdf>.
8. Arizona, Colorado, Florida, Iowa, Kentucky, Minnesota, North Carolina, Nebraska, New Jersey, New York, Oregon, Rhode Island, Utah, Vermont, Washington, Wisconsin, State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality.
9. Healthcare Cost Report Information System (HCRIS) data file for Hospitals for the 1st, 2nd, 3rd, and 4th Quarters of Years 2014-2016; U.S. Department of Health and Human Services, Centers for Medicare & Medicaid Services; 2014-2017.
10. AHA Annual Survey DatabaseTM Fiscal Years 2014-2015; Health Forum LLC, an American Hospital Association Company; 2014-2016.
11. Provider of Services (POS) data file for the 4th Quarters of 2014-2016; U.S. Department of Health and Human Services, Centers for Medicare & Medicaid Services, Office of Information Services; 2014-2017.
12. StreetMap North America; Esri, DeLorme, AND, Tele Atlas, First American, UNEP-WCMC, USGS; May 2013.
13. SAS dataset of zipcodes, Fourth Quarter update 2014-2016; SAS Maps Online; SAS Institute Inc.; 2014-2016.
14. Core based statistical areas for 2015; U.S. Office of Management and Budget (OMB) and U.S. Census Bureau; 2018.
15. Rural-Urban Commuting Area (RUCA) Codes for 2013; U.S. Department of Agriculture, Economic Research Service; 2013.
16. Inpatient Provider Specific File (PSF) data file (2019); U.S. Department of Health and Human Services, Centers for Medicare & Medicaid Services.
17. Health Resources and Services Administration (2018). Defining Rural Population. Accessed at: <https://www.hrsa.gov/rural-health/about-us/definition/index.html>.
18. United States Department of Agriculture Economic Research Service (2019). Frontier and Remote Area Codes. Accessed at: <https://www.ers.usda.gov/data-products/frontier-and-remote-area-codes/>.
19. DRG weights, or diagnosis-related group weights, represent the average resources required to care for cases in that particular diagnosis-related group, relative to the average resources used to treat cases in all DRGs (from cms.gov) Higher weights denote more complex (expensive) cases.
20. Hung P, Henning-Smith CE, Casey MM, Kozhimannil KB. Access to obstetric services in rural counties still declining, with 9 percent losing services, 2004-14. *Health Affairs*, 2017;36(9):1663-1671.
21. Kozhimannil KB, Hung P, Henning-Smith C, Casey MM, Prasad S. Association between loss of hospital-based obstetric services and birth outcomes in rural counties in the United States. *JAMA*, 2018;319(12):1239-1247.

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