

Differences in Emergency Colorectal Surgery in Medicaid and Uninsured Patients by Hospital Safety Net Status

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Nationwide, hospital emergency department (ED) use has increased due to patients who are Medicaid-insured or uninsured with limited access to primary care.¹ Patients admitted through the ED often present with more severe illness,² and their care is likely to be poorly coordinated following discharge. These emergency presentations are detrimental for patients, costly to society, create a burden for hospitals,³ and occur more often in safety net hospitals.^{4,5}

Safety net hospitals are institutions that, by legal mandate or explicit mission, offer access to services regardless of patients' ability to pay.⁵ Safety net hospitals are often located in underserved communities⁶ and they receive financial compensation from the state and federal government for providing care to underserved populations.⁷ Recent evidence suggests that safety net providers deliver lower quality care,^{8,9} calling into question the adequacy of these providers to deliver healthcare to the populations they serve.

We examined whether safety net hospitals are associated with emergency colorectal cancer (CRC) surgery, which serves as an indicator of poor access to outpatient cancer care. Because safety net institutions have a mission to serve the uninsured and Medicaid-insured, these hospitals may provide better access to timely and appropriate care for medically underserved populations compared with what these patients receive outside the safety net. For example, faculty associated with academic health centers, which are often core safety net providers, give a considerable amount of care to underserved patients in outpatient settings,⁵ possibly alleviating the need for emergency care and the use of the ED as a portal for symptom appraisal. In contrast, the ED may be the only point of access for uninsured and Medicaid patients in non-safety net settings. For these reasons, emergency CRC resection is an informative signal of access to care, making it an ideal condition to investigate the differential effects of safety net hospitals on access to care for complex and costly conditions such as cancer.

ABSTRACT

Objectives

We examined whether safety net hospitals reduce the likelihood of emergency colorectal cancer (CRC) surgery in uninsured and Medicaid-insured patients. If these patients have better access to care through safety net providers, they should be less likely to undergo emergency resection relative to similar patients at non-safety net hospitals.

Study Design

Using population-based data, we estimated the relationship between safety net hospitals, patient insurance status, and emergency CRC surgery. We extracted inpatient admission data from the Virginia Health Information discharge database and matched them to the Virginia Cancer Registry for patients aged 21 to 64 years who underwent a CRC resection between January 1, 1999, and December 31, 2005 (n = 5488).

Methods

We differentiated between medically defined emergencies and those that originated in the emergency department (ED). For each definition of emergency surgery, we estimated the linear probability models of the effects of being treated at a safety net hospital on the probability of having an emergency resection.

Results

Safety net hospitals reduce emergency surgeries among uninsured and Medicaid CRC patients. When defining an emergency resection as those that involved an ED visit, these patients were 15 to 20 percentage points less likely to have an emergency resection when treated in a safety net hospital.

Conclusions

Our results suggest that these hospitals provide a benefit, most likely through the access they afford to timely and appropriate care, to uninsured and Medicaid-insured patients relative to hospitals without a safety net mission.

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CRC is the third most common cancer in the United States,¹⁰ resulting in approximately 142,000 new cases annually,¹¹ and spending on CRC was estimated to be \$14.14 billion in medical care costs in 2010.¹² Surgical resection is standard treatment for all stages of CRC, and is generally conducted on an elective basis, although patients may present acutely and require emergency surgery.¹³ Emergency presentation of CRC is associated with increased morbidity and mortality, including diminished 5-year survival.¹⁴ About 15% to 30% of CRC patients require an emergency resection for several reasons, including bowel perforation, peritonitis, obstruction, or hemorrhage.¹⁴ Uninsured and Medicaid patients aged less than 65 years are 2 to 2.5 times more likely to require an emergency resection than their privately insured counterparts.¹⁵ These emergency resections are associated with longer inpatient stays, higher costs, and higher inpatient mortality.¹⁵ Given the rising demand for care¹⁶ and increasing evidence of poor health outcomes in safety net hospitals,^{8,9,17} our investigation is timely. Although the safety net may underperform on some outcomes, safety net hospitals deliver care that might be otherwise forgone—the lack of which would result in increased morbidity and mortality among low-income uninsured and Medicaid patients.¹⁸

METHODS

Inpatient admission and discharge status were extracted from the Virginia Health Information (VHI) discharge database, which contained discharge abstracts on all Virginia civilian hospital admissions that exceeded 23 hours. Since 1993, VHI has collected information on all licensed hospital discharges (more than 870,000 per year) under contract with the Virginia Department of Health. Discharge abstracts included patient information, *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* diagnosis and procedure codes, payer information, dates of admission and discharge, source and type of admission, and discharge status. CRC resections were identified by one of these *ICD-9-CM* diagnosis codes—153.0-154.3, 154.8, V10.05, and V10.06—in conjunction with at least 1 of the following *ICD-9-CM* procedure codes—45.4X, 45.5X, 45.6X, 45.7X, 45.8X, 46.10, 46.43, 46.52, 46.81, 46.82, 48.3X, 48.4X, 48.5X, and 48.6X.¹⁹

The VHI and the American Hospital Association (AHA) survey supplied hospital tax status, teaching status, staffed beds, ownership, charity care, and Medicaid charges that were used to classify hospitals according to

safety net status. The AHA Annual Survey of Hospitals profiles a universe of more than 6500 hospitals. Data are available at the hospital and system level for research, and the AHA survey is a primary reference for government agencies and industry reports. Using the proportion of charges for charity care, Medicaid, and for receipt of Disproportionate Share Hospital funds, 2 out of 61 hospitals were designated as safety net providers.²⁰ In a sensitivity analysis, we expanded the definition to the top 10 hospitals in proportion of charges for charity care and Medicaid. These estimations were qualitatively unchanged, although the evidence that safety net hospitals reduced emergency resections for Medicaid patients became stronger ([eAppendix](#), available at www.ajmc.com).

The Virginia Cancer Registry (VCR) is a statewide registry of data on individuals diagnosed or treated in Virginia and on Virginia residents who received cancer care out of state. The North American Association of Central Cancer Registries certifies the VCR to be a provider of complete, accurate, and timely cancer incidence data. Using the VCR from January 1, 1999, to December 31, 2005, we identified 8666 CRC patients. The following exclusions were made: unknown gender (n = 1), unknown race (n = 93), insurance other than Medicaid or private, or uninsured (n = 1119). Among the 7453 remaining patients, 5488 (74%) had a claim for inpatient resection while 1965 (26%) did not. Of those 1965, we tried to distinguish between patients without a claim due to missing data and patients who legitimately did not have an inpatient surgery. Our assessment suggests that most of those without a claim did not have an inpatient surgery. In sum, the VCR also indicated an absence of surgery on 464 patients: 409 patients had stage IV cancer or unstaged cancer for which surgery is often not indicated, 324 had stage 0 disease for which outpatient surgery is indicated, and 90 had military insurance and likely had surgery in a military facility, leaving 678 (9%) patients who may have had outpatient surgery or no surgery, or were missing claims.

In addition to the 5488 patients identified in the VCR, we identified another 981 patients from the VHI discharge data set with inpatient surgical claim for CRC, but since they were not reported in the VCR, we could not be certain they had cancer. Therefore, in a separate analysis, we included these patients in the sample; the findings were unchanged (results not shown). The **Figure** traces the steps taken to select the study sample.

We considered 4 definitions of emergency resection. The first 3 are: 1) all admissions through the ED that

also had an emergency ICD-9-CM procedure code for bowel perforation (569.83),²¹ peritonitis (567.2, 567.8, 567.9),²¹ obstruction (560.X)²¹ or hemorrhage (578.X)¹⁶; 2) all ED admissions; 3) ED admissions, but without an ICD-9-CM emergency code. By considering ED admissions without an emergency diagnosis code, we identified admissions related to access, but without a condition that required immediate medical attention. The fourth definition restricts the definition of emergency resection to patients with an emergency ICD-9-CM code, reflecting an immediate medical emergency, regardless of source of admission. **Table 1** reports the number of emergency resections using each definition.

Statistical Analysis

We estimated the probability of an emergency resection using linear probability models to avoid challenges associated with the interpretation of interaction terms in nonlinear models,²² such as those between health insurance and safety net status. We account for clustering of patients within hospitals using multiple variance covariance structures. Bayesian Information Criterion was used to select the best fit, allowing for different correlations among patients in safety net hospitals and non-safety net hospitals. The models included random intercepts and accounted for compound symmetric correlations within hospitals.

We calculated the predicted percent of patients who underwent emergency resection using the expected values for patients in safety net and non-safety net hospitals and health insurance type under the same multivariate distribution of the other covariates in the sample. We used the bootstrap method to construct the nonparametric percentile and 95% CIs. One thousand random samples of the same size as the original analytical data set were drawn with replacement. Statistical significance was estimated between hospital types and insurance groups.

We were mindful of the possibility that unobservable characteristics that lead one to seek care in a safety net facility may also be the same characteristics that are associated with emergency surgery. These characteristics include delay in seeking care, poor preventive care, poor health status, etc. Observable patient characteristics included in the estimation were public insurance, no insurance, and racial/ethnic minority, which are also strongly associated with receiving care in a safety net hospital. If endogeneity were a problem, we might observe an effect attributable to the safety net hospital when in fact, the effect is attributable to the unobserv-

able patient characteristics that led them to the safety net hospital.

We address the possibility of endogeneity using 3 approaches. First, we estimated an instrumental variables equation. We tested 2 specifications for distance as an instrument for hospital choice. The first specification used distance to the closest safety net hospital and the second used the difference between the distance to the closest safety net hospital and the distance to the closest non-safety net hospital. In both models, statistical tests for endogeneity were rejected (results not shown). Second, we added controls associated with the use of safety net hospitals to the linear probability models. In addition to insurance status, race, and socioeconomic status, we control for age, sex, distance traveled to the hospital where surgery was performed, comorbid conditions, cancer stage, and a summary measure of socioeconomic status for the zip code in which patients resided. Third, we used multiple definitions of “emergency surgery” to test the robustness of the findings under different definitions.

Race was categorized as white, African American, or other. Age at the time of surgery was entered into the model as a continuous variable. To estimate patient comorbidity, we used the Deyo, Cherkin, and Ciol²³ adaptation of the Charlson Comorbidity Index,²⁴ which has been used to predict the extent of cancer treatment.²⁵ Comorbidities were grouped into 0, 1, and ≥ 2 . Cancer stage was defined as 0, I, II, III, or IV based on American Joint Commission on Cancer criteria. We grouped stages 0, I, and II into a single category relative to stages III and IV. We also included an additional category to indicate that stage was unknown.

We used zip codes to calculate driving distances incurred by patients. Last, we used a summary measure of socioeconomic status for each census zip code in Virginia using data from the 2000 US Census.^{26,27} The summary measure was the summation of the 6 z scores of the variables used in the study by Diez et al (ie, log of the median household income; log of the median value of housing units; the percentage of households receiving interest, dividend, or net rental income; the percentage of adults 25 years or older who had completed high school; the percentage of adults 25 years or older who had completed college; and the percentage of employed persons 16 years or older in executive, managerial, or professional specialty occupations)²⁶ and ranged from -12.2 to 17.5; it was rescaled to be between 0 and 1. We entered the score as quartiles in all models. Hospital characteristics included in the models were ownership (private for-profit, private nonprofit, and government-owned), teaching status, and

number of beds (≤ 100 , 101-500, and > 500).

RESULTS

Table 2 reports descriptive statistics for the sample. The first 3 columns are organized by patients' insurance source and the last 2 columns are by hospital safety net status. Uninsured and Medicaid patients were more likely to be African American (38% and 41%, respectively) relative to those who were privately insured. There were a higher percentage of later-stage cancers among the uninsured and Medicaid-insured. Uninsured and Medicaid patients had more comorbid conditions, and a higher percentage resided in lower socioeconomic zip codes. A fifth of the resections performed on uninsured patients were done at a safety net hospital. Fourteen percent of the resections performed on Medicaid patients were performed at safety net hospitals, and only 5% of privately insured patients had a resection in a safety net hospital.

Using the definition that includes all patients with either ED admission or an *ICD-9-CM* emergency code, about half of uninsured and Medicaid patients had an emergency resection. In sharp contrast, only 31% of privately insured patients had an emergency resection. When we narrow the definition of emergency resection to include only those admitted through the ED, about one-third (35%) of uninsured and Medicaid patients were admitted for resection, but only 11% of privately insured patients were admitted through the ED. Last, approximately 37% of uninsured patients and Medicaid patients had a diagnosis for an emergency condition, whereas 25% of privately insured patients had an emergency code.

Safety net hospitals (column 4) treated a greater proportion of African Americans, later-stage cancers, and patients with 2 or more comorbid conditions. The majority of patients treated in safety net hospitals also lived in census tracts in the lower half of socioeconomic status. The average driving distance was longer to safety net hospitals compared with non-safety net facilities. Safety net hospitals also performed a greater proportion of emergency resections with an emergency *ICD-9-CM* diagnosis.

Table 3 reports the probability of an emergency admission for surgical resection and the interaction terms estimating the effects of treatment in a safety net hospital for uninsured or Medicaid patients relative to privately insured patients. Estimates of the association between uninsurance status and Medicaid insurance and emergency resection were positive and statistically significant.

Uninsured patients were 10 to 26 percentage points more likely to have an emergency resection than privately insured patients, depending on the definition. A similar percentage point difference is observed for Medicaid patients across all definitions.

In 3 of the definitions of emergency resection, uninsured patients were less likely to have an emergency resection when treated in a safety net hospital. These patients were 15 percentage points less likely to have an emergency resection than uninsured patients in a non-safety net hospital (column 1). Similar findings are reported for the alternative definitions except when we use an *ICD-9-CM* emergency diagnosis to identify emergency surgeries (column 4).

Safety net hospitals also reduced the likelihood of an emergency resection by 20 percentage points for Medicaid patients (column 1) and reduced the likelihood of an ED admission by 15 percentage points (column 2). When we restrict ED admissions to those without an *ICD-9-CM* emergency code (column 3), the effect is similar (16 percentage points less).

Table 4 reports predictions derived from the regression-based coefficients in Table 3. Uninsured and Medicaid patients treated in a safety net hospital have a statistically significant lower proportion of emergency resections than the uninsured in non-safety net hospitals. For 3 of the definitions, safety net hospitals appear to reduce the rate of emergency resections among uninsured and Medicaid patients to be below the rate observed for privately insured patients treated in non-safety net hospitals. Estimates in the third column suggest that there are substantial reductions in the percentage of emergency resections for uninsured and Medicaid patients treated in safety net hospitals relative to non-safety net hospitals.

DISCUSSION

Safety net hospitals reduce uninsured and Medicaid patients' likelihood of an emergency CRC resection, suggesting that they play an important role in avoiding emergency surgeries for the patients they serve. If endogeneity were a plausible explanation for the findings, we would expect safety net hospitals to be associated with a higher likelihood of emergency surgery. But, in fact, safety net hospitals reduce the likelihood of emergency surgery for the publicly insured and uninsured patients who non-randomly select safety net hospitals for their care.

The definitions chosen for emergency resection are intended to reflect lack of access or regular care that may lead patients to use the ED as an access point for

emergent and nonemergent care. Safety net hospitals had the lowest percentage of resections that followed an ED visit, perhaps due to their outpatient referral networks that may provide specialty care or because they are more willing to electively schedule uninsured and Medicaid patients for resection whereas non-safety net hospitals may only admit uninsured and Medicaid patients when they have an emergency condition.

Limitations

There are 4 main limitations. First, only 2 hospitals in this statewide analysis were considered safety net hospitals. In a sensitivity analysis, we expanded the definition of a safety net hospital to include up to the 10 highest ranked hospitals (eAppendix). Most results were unchanged. Second, we do not have patient-reported levels of pain or discomfort that could have led to emergency admission; these perceptions and the actions taken to remedy them may differ between hospitals and patients. Third, we report findings from a single state, although focusing on a single state is appropriate for studies of Medicaid outcomes and avoids issues encountered when comparing widely different state programs. Last, while we used several methods to rule out endogeneity based on unobservable characteristics that nonrandomly pair patients and hospitals, we acknowledge that selection could still play a role, albeit a minor one, in our analysis.

CONCLUSIONS

Our results suggest that safety net institutions reduce rates of emergency surgery—particularly those stemming from ED admissions—among uninsured and Medicaid patients with CRC. Additional research is needed to determine if the findings from this paper are replicated in other conditions. The Affordable Care Act will cut support for safety net hospitals in anticipation of expanded insurance coverage.²⁸ Yet, a recent study from Massachusetts indicates that safety net hospitals faced increased demand after reform because they continued to be heavily utilized by low-income populations.^{29,30} Further, many states do not currently have plans to expand their Medicaid programs, which may leave many low-income individuals without coverage. Combined with evidence that safety net hospitals reduce emergency resections for CRC patients, our analysis suggests that continued support for these institutions might be warranted. Further research to understand the precise mechanisms through which safety net hospitals reduce the need for emergency surgery among this patient

population is needed.

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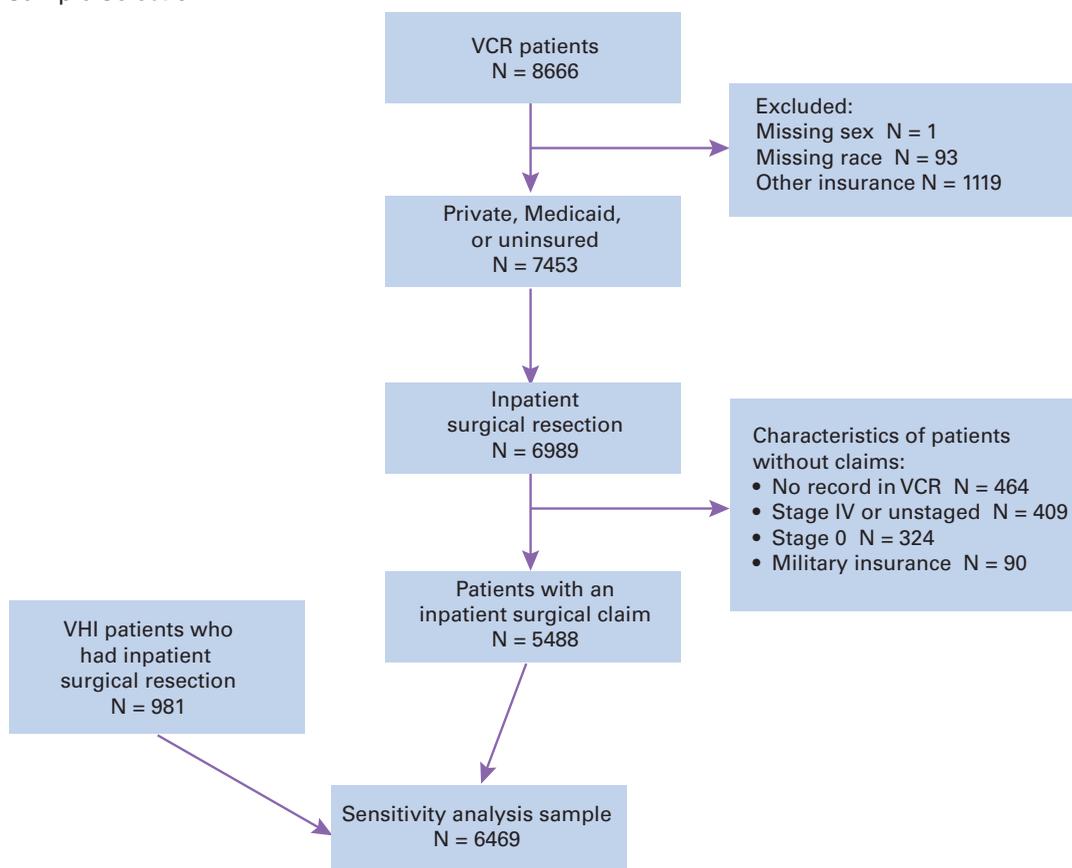
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Take-Away Points

Safety net institutions reduce emergency colorectal cancer surgery among uninsured and Medicaid insured patients:

- There is a lower percentage of resections following an emergency department (ED) visit.
- Findings may be due to improved access to outpatient care for these patients who can only access care through the ED outside of the safety net.
- Suggests an ongoing and vital role for safety net providers following the implementation of Medicaid expansions.

■ **Figure. Sample Selection**

VCR indicates Virginia Cancer Registry; VHI, Virginia Health Information.

■ **Table 1. Sample Sizes Using Different Definitions of Emergency Resections**

Definition	Sample Size	Safety Net Hospital	Non-Safety Net Hospital
Total	5488	363	5125
Either an ED admission or an emergency <i>ICD-9-CM</i> code	1850	124	1726
All ED admissions	780	37	743
ED admissions without emergency <i>ICD-9-CM</i> code	398	10	388
All admissions with emergency <i>ICD-9-CM</i> code	1452	114	1338

ED indicates emergency department; *ICD-9-CM*, *International Classification of Disease, Ninth Revision, Clinical Modification*. *ICD-9-CM* codes used to identify emergencies: bowel perforation (569.83), peritonitis (567.2, 567.8, 567.9), obstruction (560.X), or hemorrhage (578.X).

■ **Table 2.** Distribution of Colorectal Cancer Patient Characteristics by Health Insurance Source, 1999-2005 (N = 5488)

Characteristics	(1) Private N = 4769	(2) Uninsured N = 502	(3) Medicaid N = 217	(4) Safety Net Hospital N = 363	(5) Non-Safety Net Hospital N = 5125
Male	55.32	51.59	41.47 ^a	52.89	54.54
Race		a	a	a	
White	77.02	56.18	54.84	69.15	74.60
African American	19.44	38.05	41.01	30.03	21.42
Other	3.54	5.78	4.15	0.83	3.98
AJCC stage		a	a	a	
0/I/II	72.82	68.53	57.14	41.60	46.95
III/IV	40.11	46.41	42.86	45.73	40.45
Unknown	12.12	12.35	23.96	12.67	12.60
Comorbidities		a	a	b	
0	66.28	55.58	46.54	60.88	64.78
1	19.69	23.11	26.73	19.83	20.31
2 or more	14.03	21.31	26.73	19.28	14.91
Mean driving distance, miles (SD)	17.66 (21.87)	24.39 (42.47) ^a	20.16 (38.13)	59.86 (63.33) ^a	15.44 (16.52)
Socioeconomic quartiles		a	a	a	
1st quartile (lowest)	0.78	3.39	5.53	1.10	1.21
2nd quartile	70.27	85.66	83.41	88.15	71.06
3rd quartile	26.86	10.56	10.60	10.47	25.74
4th quartile (highest)	2.10	0.40	0.46	0.28	1.99
Mean age, years (SD)	53.87 (7.65)	52.27 (8.82) ^a	52.17 (9.27) ^a	52.09 (8.31) ^a	53.77 (7.80)
Resection in a safety net hospital	4.76	21.12 ^a	13.82 ^a	N/A	N/A
Either ED admission or emergency ICD-9-CM diagnosis	30.74	52.59 ^a	55.30 ^a	34.16	33.68
ED admission	11.16	34.46 ^a	34.56 ^a	10.19 ^c	14.50
ED admission, no ICD-9-CM diagnosis	7.79	25.39 ^a	28.15 ^a	4.02	10.25
Emergency ICD-9-CM diagnosis	24.89	36.45 ^a	37.79 ^a	31.40 ^c	26.11

AJCC indicates American Joint Commission on Cancer; ED, emergency department; ICD-9-CM, *International Classification of Diseases, Ninth Revision, Clinical Modification*; SES, socioeconomic status.

^aP < .01.

^bP < .10.

^cP < .05.

Values in Table 2 are percentages unless otherwise specified as mean of continuous variable.

ICD-9-CM diagnoses include: bowel perforation (569.83), peritonitis (567.2, 567.8, 567.9), obstruction (560.8, 560.9), or hemorrhage (578.X). Statistically significant differences from privately insured patients or non-safety net hospitals are determined using the χ^2 test for categorical variables and *t* test for continuous variables.

■ **Table 3.** Linear Probability Models Predicting Emergency Admissions for Colorectal Cancer Resection

	(1) ED Admission or ICD-9-CM Diagnosis N = 5488	(2) All ED Admissions N = 5488	(3) ED Admission, No ICD-9-CM Code N = 4036	(4) ICD-9-CM Diagnosis N = 5488
Insurance status				
Uninsured	0.22 (0.02) ^a	0.26 (0.02) ^a	0.21 (0.02) ^a	0.10 (0.02) ^a
Medicaid	0.24 (0.04) ^a	0.24 (0.03) ^a	0.21 (0.03) ^a	0.12 (0.03) ^a
Private	Referent	Referent	Referent	Referent
Safety net status				
Safety net	-0.08 (0.11)	-0.07 (0.07)	-0.04 (0.06)	-0.10 (0.12)
Non-safety net	Referent	Referent	Referent	Referent
Safety net x uninsured	-0.15 (0.06) ^b	-0.16 (0.04) ^a	-0.19 (0.05) ^a	-0.04 (0.06)
Safety net x Medicaid	-0.20 (0.10) ^b	-0.15 (0.07) ^b	-0.16 (0.07) ^b	-0.13 (0.09)
Race				
White	Referent	Referent	Referent	Referent
African American	0.08 (0.02) ^a	0.05 (0.01) ^a	0.05 (0.01) ^a	0.06 (0.02) ^a
Other	0.02 (0.03)	-0.02 (0.03)	0.01 (0.03)	0.01 (0.03)
Gender				
Female	-0.06 (0.01) ^a	-0.0002 (0.01)	-0.01 (0.01)	-0.06 (0.01) ^a
Age	-0.002 (0.001) ^b	-0.001 (0.001) ^b	-0.002 (0.001) ^a	-0.001 (0.001)
Distance traveled	-0.001 (0.0003) ^a	-0.001 (0.0002) ^a	-0.0001 (0.0002)	-0.001 (0.0003) ^b
Comorbidities				
0	-0.03 (0.02) ^c	-0.03 (0.01) ^b	-0.05 (0.01) ^a	0.01 (0.02)
1	-0.01 (0.02)	-0.01 (0.02)	-0.03 (0.02) ^c	0.02 (0.02)
2 or more	Referent	Referent	Referent	Referent
AJCC stage				
0/I/II	-0.07 (0.01) ^a	-0.06 (0.01) ^a	-0.05 (0.01) ^a	-0.04 (0.01) ^a
Unknown	-0.02 (0.02)	-0.04 (0.02) ^b	-0.02 (0.02)	-0.001 (0.03)
III/IV	Referent	Referent	Referent	Referent
Socioeconomic quartile				
1st quartile (lowest SES)	-0.09 (0.08)	-0.06 (0.06)	-0.11 (0.06) ^c	-0.04 (0.08)
2nd quartile	-0.07 (0.05)	-0.03 (0.04)	-0.05 (0.04)	-0.04 (0.05)
3rd quartile	-0.08 (0.05)	-0.01 (0.04)	-0.02 (0.04)	-0.07 (0.05)
4th quartile (highest SES)	Referent	Referent	Referent	Referent

AJCC indicates American Joint Commission on Cancer; ED, emergency department; ICD-9-CM, *International Classification of Diseases, Ninth Revision, Clinical Modification*.

^a*P* < .01.

^b*P* < .05.

^c*P* < .10.

Included in the regressions, but not reported, are hospital teaching status (yes/no), ownership (private not-for-profit, for-profit, or government-owned), hospital size (small, medium, large), and year of diagnosis.

Excluded 1452 observations who had emergency ICD-9-CM code from column 3.

■ **Table 4.** Rates of Emergency Resections

	(1) Safety Net Hospital	(2) Non-Safety Net Hospital	(3) Difference between SN and NSN
ED admission or ICD-9-CM emergency diagnosis			
Uninsured	0.35 (0.15-0.56)	0.58 (0.50-0.67) ^a	-0.23 (-0.47 to 0.01) ^b
Medicaid	0.32 (0.07-0.56)	0.60 (0.50-0.69) ^a	-0.28 (-0.56 to -0.001) ^c
Private	0.28 (0.09-0.48)	0.36 (0.29-0.43)	-0.08 (-0.30 to 0.15)
ED admission			
Uninsured	0.18 (0.05-0.31) ^a	0.41 (0.35-0.46) ^a	-0.23 (-0.38 to -0.08) ^b
Medicaid	0.17 (0.01-0.34)	0.38 (0.31-0.45) ^a	-0.21 (-0.39 to -0.03) ^c
Private	0.08 (-0.04 to 0.20)	0.14 (0.10-0.19)	-0.06 (-0.2 to 0.07)
ED admission, no ICD-9-CM emergency code			
Uninsured	0.09 (-0.03 to 0.21)	0.32 (0.26-0.38) ^a	-0.23(-0.37 to -0.09) ^b
Medicaid	0.12 (-0.04 to 0.28)	0.32 (0.25-0.39) ^a	-0.20 (-0.37 to -0.02) ^c
Private	0.07 (-0.04 to 0.19)	0.11 (0.06-0.16)	-0.04 (-0.16 to 0.09)
ICD-9-CM emergency code			
Uninsured	0.25 (0.03-0.47)	0.39 (0.30-0.47) ^a	-0.14 (-0.39 to 0.12)
Medicaid	0.18 (-0.07 to 0.44)	0.41 (0.31-0.50) ^a	-0.22 (-0.51 to 0.07)
Private	0.19 (-0.03 to 0.40)	0.28 (0.21-0.36)	-0.10 (-0.34 to 0.14)

ED indicates emergency department; ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification; SN, safety net; NSN, non-safety net.

^aSignificantly different from privately insured patients; $P < .05$.

^bThe difference between SN and NSN among uninsured is statistically significantly different from privately insured patients; $P < .05$.

^cThe difference between SN and NSN among Medicaid patients is statistically significantly different from privately insured patients; $P < .05$.

Expected values in the table were computed by applying model coefficients to each combination of insurance status and safety net hospital status. The 95% bootstrap confidence intervals shown in parentheses were generated using the percentile method on the regression predicted outcomes of 1000 random samples from the original data.

eAppendix Table. Sensitivity Analysis Using the Highest 10 Ranked Hospitals as Safety Net; Linear Probability Models Predicting Emergency Admissions for Colorectal Cancer Resection

	(1) ED Admission or <i>ICD-9-CM</i> Diagnosis N = 5488	(2) All ED Admissions N = 5488	(3) ED Admission, No <i>ICD-9-CM</i> Code N = 4036	(4) <i>ICD-9-CM</i> Diagnosis N = 5488
Insurance status				
<i>Uninsured</i>	0.27 (0.02) ^a	0.27 (0.02) ^a	0.22 (0.02) ^a	0.10 (0.03) ^a
<i>Medicaid</i>	0.24 (0.03) ^a	0.24 (0.03) ^a	0.21 (0.03) ^a	0.17 (0.04) ^a
<i>Private</i>	Referent	Referent	Referent	Referent
Safety-net status				
<i>Safety-net</i>	0.02 (0.03)	0.02 (0.03)	0.04 (0.03)	0.07 (0.05)
<i>Non-safety-net</i>	Referent	Referent	Referent	Referent
Safety net × uninsured	-0.14 (0.04) ^a	-0.14 (0.04) ^a	-0.17 (0.04) ^a	-0.06 (0.05)
Safety net × Medicaid	-0.08 (0.05)	-0.08 (0.06)	-0.09 (0.06)	-0.26 (0.07) ^a
Race				
<i>White</i>	Referent	Referent	Referent	Referent
<i>African American</i>	0.05 (0.02) ^a	0.05 (0.02) ^a	0.05 (0.01) ^a	0.06 (0.02) ^a
<i>Other</i>	-0.02 (0.03)	-0.02 (0.03)	0.01 (0.03)	0.01 (0.03)
Gender				
<i>Female</i>	-0.001 (0.01)	-0.001 (0.01)	-0.01 (0.01)	-0.06 (0.01) ^a
Age	-0.001 (0.01) ^b	-0.001 (0.001) ^b	-0.002 (0.001) ^a	-0.001 (0.001)
Distance traveled	-0.001 (0.0002) ^a	-0.001 (0.0002) ^a	-0.0001 (0.0002)	-0.001 (0.0003) ^a
Comorbidities				
0	-0.03 (0.01) ^b	-0.03 (0.01) ^b	-0.05 (0.01) ^a	0.01 (0.02)
1	-0.01 (0.02)	-0.01 (0.02)	-0.03 (0.02) ^c	0.02 (0.02)
2 or more	Referent	Referent	Referent	Referent
AJCC Stage				
<i>Stage 0/I/II</i>	-0.06 (0.01) ^a	-0.06 (0.01) ^a	-0.05 (0.01) ^a	-0.03 (0.01) ^a
<i>Stage Unknown</i>	-0.04 (0.02) ^b	-0.04 (0.02) ^b	-0.02 (0.02)	-0.002 (0.02)
<i>Stage III/IV</i>	Referent	Referent	Referent	Referent
Socioeconomic quartile				
<i>1st quartile (lowest SES)</i>	-0.04 (0.06)	-0.04 (0.06)	-0.09 (0.06)	-0.01 (0.07)
<i>2nd quartile</i>	-0.04 (0.04)	-0.04 (0.04)	-0.05 (0.04)	-0.04 (0.05)
<i>3rd quartile</i>	-0.01 (0.04)	-0.01 (0.04)	-0.02 (0.04)	-0.07 (0.05)
<i>4th quartile (highest SES)</i>	Referent	Referent	Referent	Referent

AJCC indicates American Joint Commission on Cancer; ED, emergency department; *ICD-9-CM*, *International Classification of Diseases, Ninth Revision, Clinical Modification*; SES, socioeconomic status.

^a*P* < .01.

^b $P < .05$.

^c $P < .10$.

Included in the regressions, but not reported, are hospital teaching status (yes/no), ownership (private not-for-profit, for-profit, or government owned), hospital size (small, medium, large), and year of diagnosis.