Variation in Surgical Outcomes for Adolescents and Young Adults With Inflammatory Bowel Disease

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KEY WORDS

adolescents, care outcomes, inflammatory bowel disease, surgical complications, young adults

ABBREVIATIONS

APR-DRG—All Patient Refined Diagnosis Related Group
CI—confidence interval
IBD—inflammatory bowel disease
ICD-9-CM—*International Classification of Diseases, Ninth Revision, Clinical Modification*
PP—predicted probability

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abstract

OBJECTIVE: To examine whether hospital type (children's hospital or generalist hospital) and surgeon specialty are associated with variations in surgical outcomes for hospitalized adolescents and young adults with inflammatory bowel disease (IBD) requiring surgery.

METHODS: The 2007–2009 Perspective Data Warehouse was used to identify a retrospective cohort study of all inpatients 16 to 25 years old who received surgery for IBD. Multivariate regression, clustered at the hospital level, examined the association of hospital type and surgical specialty with surgical complications and 30-day readmissions.

RESULTS: Surgery was performed in 917 hospitalizations of 598 patients across 20 children's hospitals and 198 general hospitals by 566 general surgeons, 46 pediatric surgeons, and 305 colorectal surgeons. After adjustment, children's hospitals had higher predicted probabilities of surgical complication (predicted probability [PP]: 35% [95% confidence interval (CI): 28–42]) compared with general hospitals (PP: 26% [95% CI: 23–29]). Despite higher complications among children's hospitals, pediatric surgeons had lowest predicated probabilities of surgical complication or 30-day readmission (PP: 24% [95% CI: 10–39]) compared with general surgeons (PP: 39% [95% CI: 35–43]) and colorectal surgeons (PP: 35% [95% CI: 28–42]).

CONCLUSIONS: Disparate outcomes for adolescents and young adults receiving care in children's versus generalist hospitals and from different types of surgeons reveal the need to better understand how practice setting and surgical specialty may modify outcomes for a population that traverses a variety of health care settings. *Pediatrics* 2013;131:S81–S89

The burden of inflammatory bowel disease (IBD) in the United States is high, particularly for adolescent and young adult patients. Between 1 and 1.5 million Americans are estimated to be affected by IBD.[1,2] The peak incidence of IBD, which includes both Crohn's disease and ulcerative colitis, occurs between the ages of 15 and 25 years. IBD causes symptoms of abdominal pain, diarrhea, and weight loss and may be complicated by extra-intestinal manifestations, bowel obstruction, enteric fistulas, abscess formation, toxic megacolon, or massive hemorrhage, complications which often necessitate surgery. Consequently, the lifetime risk of surgery for complications of IBD is significant, ranging from 40% to 70%,[3,4] as is the risk of surgical complications, which ranges from 13% to 55%, depending on IBD diagnosis and type of surgery.[5–7] Surgical complications, such as surgical site infection rate, are surrogate measures of quality in surgery and are increasingly being incorporated into public reporting of hospital performance measures and pay-for-performance reimbursement strategies.

The risk of surgical complication is partly influenced by a patient's comorbidities and disease severity, a surgeon's training and experience, and a hospital's systems and standards of care surrounding surgical care. Variables such as surgeon subspecialty, surgical volume, and hospital setting have been shown to affect surgical outcomes.[8–12] Such an issue is not trivial for adolescents and young adults with IBD, who are at an age at which they may traverse both pediatric and adult hospital settings, where the composition of providers and surgical specialties vary. As the number of adult patients in children's hospitals continues to grow,[13] and children's hospitals are debating whether to transition adult patients to adult hospitals or to develop adult programs within children's hospitals, understanding the effect of hospital setting and provider specialty on outcomes of care will become critical.

Because of significant surgical morbidity for patients with IBD and limited literature documenting the relationship of hospital setting and provider specialty on outcomes of surgical care for adolescents and young adults with IBD, we sought to examine whether hospital type (ie, children's hospital versus general hospital) and surgeon specialty within hospital type might influence the likelihood of surgical complications for this transitioning population of youth. We hypothesized that surgical complications would be different between hospital settings and between different surgical specialties. Finding such differences could suggest the opportunity to improve policies and/or practices to optimally serve this vulnerable population.

METHODS

Data Source and Study Population

We used the Perspective Data Warehouse, maintained by Premier, Inc. (Charlotte, NC), as our primary data source. This is the largest clinical and operational data warehouse in the nation and contains longitudinal inpatient and ambulatory data from >500 US hospitals representing 22% of all hospital admissions throughout the United States.[14] Because data were de-identified and administrative, the study was exempted from institutional board review.

The study sample included all inpatients 16 to 25 years old with an IBD diagnosis who underwent bowel surgery and were discharged between January 1, 2007, and December 31, 2009. IBD diagnosis was identified by using the following *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnostic codes: 555.x (regional enteritis) or 556.x (ulcerative enterocolitis). Bowel surgery was identified by using the following ICD-9-CM procedure codes: 45.6x (small bowel resection), 45.7x (colectomy), 45.8x (total colectomy), 45.9x (ileal pouch-anal anastomosis), 46.0 to 46.2 (ileostomy/colostomy), 46.5 (stoma closure), 46.93 to 46.94 (anastomotic revisions), or 48.4 to 48.6 (proctectomy).[15,16] Excluded were patients: (1) in whom the primary exposure (hospital type) could not be identified; (2) whose attending physician was not a surgeon; or (3) who had undergone bowel surgery in the previous 90 days.

Outcomes

The primary outcome, surgical complications, was defined as the following ICD-9-CM codes (Appendix): dehiscence or fistula (998.83, 998.12-3, 998.31-2, 998.6), infectious complications (998.5, 998.51, 998.59, 790.7, 038.0–038.9), urinary retention or infection (997.5), ileus or bowel obstruction (997.4, 560.1), cardiovascular complications (453.40–453.42, 453.8, 453.9, 415.11, 997.02, 997.1, 998.0, 427.5), pulmonary complications (997.3, 518.4, 518.5, 518.81, 518.82, 512.2, 518.4), or requirement for reoperation within the hospitalization (54.12, 54.61) during the primary admission[17] or readmission within a 30-day interval.

Exposures

The primary exposures were hospital type and surgeon specialty. Hospital type was categorized as children's hospital or general hospital. A hospital was identified as a children's hospital if it: (1) was a member of the National Association of Children's Hospitals and Related Institutions; (2) was identified as a children's hospital by the American Hospital Association; or (3) had a patient age distribution comparable to children's hospitals within the national Kids' Inpatient Database and had

attending physicians from ≥10 different pediatric subspecialties. All other hospitals were designated general hospitals. Surgeon specialty for each hospital admission was obtained from attending specialty designated by Perspective Data Warehouse and then categorized as general surgeon, pediatric surgeon, or colorectal surgeon.

Covariates

Hospital-level variables included size, categorized as <250 beds or ≥250 beds; region of the country, categorized as north, south, Midwest, and west; teaching status; location in an urban or rural area; and IBD volume, calculated as annual admissions of patients aged 16 to 25 years with IBD.

Patient-level variables included age; gender; race, classified as white or nonwhite; and insurance payer, categorized as public, private, or charity care/self-pay. Two standardized case-mix measures derived from the All Patient Refined Diagnosis Related Group (APR-DRG), APR-DRG severity of illness and APR-DRG risk of mortality, were included in the analysis. Each measure assigns the patient to a subclass, ranging from 1 to 4, for use in nonelderly populations.[18] Ninety-seven percent of the sample belonged to the APR-DRG small and large bowel procedures. For disease severity adjustment, we included the following variables available from the claims data: IBD diagnosis, categorized as Crohn's disease, ulcerative colitis, or both; number of complex chronic conditions beyond IBD[19–21]; number of hospital admissions and ICU admissions in the 90 days before the index admission; transfer from another hospital; admission type, elective or nonelective; inpatient steroid use duration, categorized as <7 days or ≥7 days[22]; and resource utilization on admission. Resource utilization on admission was used as a measure of illness severity on admission and was calculated by totaling hospital charges on hospital day 0 and 1 for each patient and standardizing the charges to those of all patients in the same age group admitted to the same hospital.[23]

Analysis

Baseline characteristics of patients in the children's hospital and general hospital groups were compared for each covariate and outcome variable by using χ^2 or t tests. Multivariate regression, clustered at the hospital level, examined the association of hospital type and surgical specialty with the outcomes of interest. Variables known or theorized to affect risk of surgical complication were included in the model a priori. These included age, gender, IBD diagnosis, APR-DRG severity of illness, number of complex chronic conditions, prolonged inpatient steroid use, resource utilization on admission, and hospital IBD volume. All other covariates were included in the model if they were significantly associated with hospital type, provider specialty, and outcome measures at $P < .05$. Because there were a small number of patients who had multiple admissions at a given hospital, we developed regression models clustered at both the hospital level and the patient level. Because hospital-level effects on parameter estimation overwhelmed patient-level effects, the final models were simplified by accounting only for hospital-level effects. APR-DRG case-mix measures were dropped from the final model because of both collinearity with other patient-level clinical variables and concern that APR-DRG measures may mask effects of complications related to the hospitalization because they are assigned after discharge. The final model included age, gender, IBD diagnosis, number of complex chronic conditions, admission type, prolonged steroid use, resource utilization on admission, and hospital IBD volume. After determining an interaction effect between hospital type and surgeon specialty, within-group analysis was conducted of the association of postoperative complications with each surgeon specialty group practicing in pediatric versus general hospitals. Results for all logit models (complications and readmission) were standardized as predictive probabilities across hospital type and surgical specialty.

RESULTS

During the 3-year study period, there were 11 924 hospitalizations of patients aged 16 to 25 years with IBD. Of these, 1298 patients underwent bowel surgery. We excluded 42 hospitalizations (3.2%) in which the primary exposure, children's hospital or general hospital, could not be identified. We then excluded 289 hospitalizations (23%) of patients who had undergone bowel surgery in the previous 90 days and 50 hospitalizations (4%) whose attending physician was not a surgeon. The final study therefore consisted of 917 hospitalizations of 598 unique patients to 20 children's hospitals and 198 general hospitals (Fig 1).

Compared with general hospitals, children's hospitals tended to be larger (≥250 beds) teaching institutions with larger volumes of IBD-related admissions in the 16- to 25-year age group (Table 1). Ninety-seven percent of patients admitted to a general hospital compared with 85% of those in children's hospitals were operated on by general surgeons or colorectal surgeons.

The mean age of patients in the cohort was 21.1 years. Fifty-six percent of the cohort was male, and most patients were privately insured (Table 2). The IBD diagnosis and disease severity measures were similar between patients admitted to children's hospitals and general hospitals. Seventy-one percent of the cohort had Crohn's

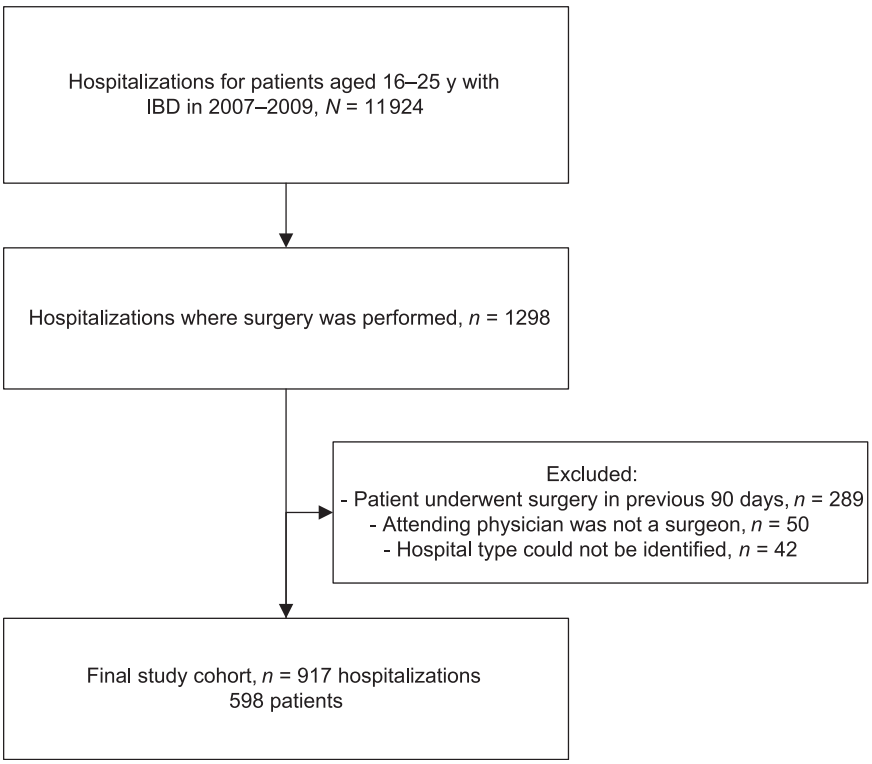

FIGURE 1
Inclusion and exclusion criteria for the study cohort.

TABLE 1 Characteristics of Hospitals Where Patients Aged 16 to 25 Years With IBD Received Surgery in 2007–2009

Characteristic	Children's Hospitals (*n* = 20 hospitals; (*n* = 163 inpatients)	General Hospitals (*n* = 198 hospitals; (*n* = 754 inpatients)	*P*
Hospital size			.067
<250 beds	2 (10)	53 (27)	
≥250 beds	16 (88)	140 (71)	
Hospital teaching status			.002
Teaching	13 (65)	66 (33)	
Nonteaching	5 (25)	127 (64)	
Location			.101
Urban	17 (85)	162 (81.8)	
Rural	1 (5)	31 (15.7)	
Volume of IBD-related admissions per year, mean ± SD[a]	31.6 ± 19.2	12.8 ± 11.4	<.001
Admissions			
<20	7 (35)	160 (81)	
20–49	9 (45)	33 (17)	
≥50	4 (20)	5 (3)	
Geographic region			.475
South	11 (61)	89 (46)	
Midwest/west	5 (28)	73 (38)	
Northeast	2 (11)	31 (16)	

All values are relative to the number of hospitals. Hospital characteristics were missing from 2 children's hospitals and 5 general hospitals. Data are presented as *n* (%) unless otherwise noted.
[a] For patients aged 16 to 25 years.

disease, 28% had ulcerative colitis, and 9% had both diagnoses. Eighteen percent of patients had a complex chronic condition beyond IBD, and 17% had at least 1 hospitalization or ICU admission in the previous 90 days. Compared with general hospitals, there were more elective admissions in children's hospitals. A larger proportion of patients in children's hospitals were receiving prolonged steroids (≥7 days) compared with general hospitals. The mean ± SD length of stay for the cohort was 9.0 ± 7.7 days. Patients admitted to children's hospitals had a longer mean length of stay compared with patients admitted to general hospitals (9.7 vs 8.8 days).

A total of 252 inpatients (27.5%) had ≥1 surgical complication during the primary surgical admission: 32 (3.5%) had dehiscence or fistula, 74 had (8.1%) infectious complications, 2 (0.2%) had urinary retention or infection, 161 (17.6%) had ileus or bowel obstruction, 31 (3.4%) had cardiovascular complications, 24 (2.6%) had pulmonary complications, and 8 (0.9%) required reoperation within the hospitalization. Thirty-one percent of patients admitted to children's hospitals had ≥1 surgical complication in the primary surgical admission compared with 27% of patients admitted to general hospitals.

A total of 129 inpatients (14.0%) were readmitted within 30 days. Twelve percent of patients admitted to children's hospitals and 15% of those admitted to general hospitals were readmitted within 30 days. When surgical complications during the primary admission and readmission within 30 days were combined, the overall combined complication rate was 36.7%; the combined complication rate in children's hospitals was 39% compared with 36% in general hospitals.

The complication rates of patients operated on by general surgeons, pediatric surgeons, and colorectal surgeons were 29%, 11%, and 27%, respectively. Fourteen percent of patients operated on by general surgeons were readmitted within 30 days, compared with 11% by pediatric

TABLE 2 Surgeon Specialty and Characteristics of Patients Aged 16 to 25 Years With IBD Undergoing Surgery From 2007 to 2009

Characteristic	Children's Hospitals (n = 163 inpatients)	General Hospitals (n = 754 inpatients)	P
Surgeon specialty			<.001
General surgeon	76 (46.6)	490 (65.0)	
Pediatric surgeon	24 (14.7)	22 (2.9)	
Colorectal surgeon	63 (38.7)	242 (32.1)	
Patient demographic characteristics			
Age, mean ± SD, y	20.5 ± 3.0	21.2 ± 2.6	<.001
16–17 y	32 (19.6)	71 (9.4)	
18–20 y	52 (31.9)	226 (30.0)	
21–25 y	79 (48.5)	457 (60.6)	
Male gender	92 (56.4)	423 (56.1)	
Race			.905
White	119 (73.0)	547 (72.6)	
Non-white	44 (27.0)	207 (27.5)	
Insurance payer			.05
Public	44 (27.0)	136 (18.0)	
Private	106 (65.0)	552 (73.2)	
Charity or self-pay	12 (7.4)	53 (7.0)	
Patient clinical characteristics			
No. of complex chronic conditions beyond IBD			.502
0	137 (84.0)	617 (81.8)	
≥1	26 (16.0)	137 (18.2)	
IBD diagnosis			.859
Crohn's disease	117 (71.8)	534 (70.8)	
Ulcerative colitis	45 (27.6)	212 (28.1)	
Both Crohn's disease and ulcerative colitis	1 (0.6)	8 (1.1)	
Any hospital or ICU admission in previous 90 days	31 (19.0)	127 (16.8)	.505
Transfer from another hospital	11 (6.8)	26 (3.5)	.052
Nonelective admission	45 (27.6)	329 (43.6)	
Standardized resource utilization on admission, z score (SD)[a]	1.2 (0.8)	1.2 (0.9)	.9604
Number of days on steroids			.008
<7 d	145 (89.0)	713 (94.6)	
≥7 d	18 (11.0)	41 (5.4)	
APR-DRG severity of illness			.533
Minor	39 (23.9)	150 (19.9)	
Moderate	76 (46.6)	356 (47.3)	
Major	41 (25.2)	198 (26.3)	
Extreme	7 (4.3)	49 (6.5)	
APR-DRG risk of mortality			.352
Minor	122 (74.9)	511 (67.8)	
Moderate	26 (15.6)	130 (17.2)	
Major	12 (7.4)	91 (12.1)	
Extreme	3 (1.8)	21 (2.8)	

Data are presented as n (%) unless otherwise noted.
[a] For all patients aged 16 to 25 years.

surgeons and 14% by colorectal surgeons, for a total combined complication rate of 38% by general surgeons, 22% by pediatric surgeons, and 36% by colorectal surgeons.

After multivariate adjustment, both hospital type and specialty remained independently associated with surgical complications during the primary admission. Only surgeon type remained independently associated with the combined complications of surgical complication and 30-day readmission. Children's hospitals continued to have higher complication rates, in which the predicted probability of surgical complication was 35% (95% confidence interval [CI]: 28–42) for children's hospitals compared with 26% (95% CI: 23–29; P = .012) for general hospitals (Table 3). Pediatric surgeons continued to have the lowest complication rates; the predicted probabilities of postoperative complication for general surgeons, pediatric surgeons, and colorectal surgeons were 30% (95% CI: 26–34), 7% (95% CI: 0.01–15), and 26% (95% CI: 19–32), respectively. The predicted probabilities of combined complications for general surgeons, pediatric surgeons, and colorectal surgeons were 39% (93% CI: 35–43), 24% (95% CI: 10–39), and 35% (93% CI: 28–42).

Tests for interaction did not reveal any nesting effects of surgical specialty within hospital type. Ultimately, the predicted probabilities of the combined complications among children's hospitals versus general hospitals were 44% versus 36%. The predicted probabilities of the combined complications among general surgeons, pediatric surgeons, and colorectal surgeons practicing in children's hospitals were 47% (95% CI: 37–57), 29% (95% CI: 14–44), and 42% (95% CI: 29–54), respectively (Table 4).

DISCUSSION

For a national population of adolescents and young adults receiving surgery for IBD, this study found that both hospital type and surgeon specialty within hospital type influence the likelihood of surgical complications. Surgeries performed within children's hospitals had higher complication rates compared with surgeries performed within general hospitals: 35% of patients admitted to children's hospitals had at least 1 or more surgical complications compared with 26% of patients admitted to general hospitals. Although surgeries in children's hospitals had higher complication rates, we also found, conversely, that surgeries performed by pediatric surgeons, whether in a general or children's hospital, had lower complications than surgeries performed by either general surgeons or colorectal surgeons.

TABLE 3 Probability of Postoperative Complication From IBD-Related Surgery by Hospital Type and Surgeon Specialty

Variable	Total	Surgical Complication		Surgical Complication or Readmission Within 30 Days	
		Unadjusted Probability	Predicted Probability (95% CI)[a]	Unadjusted Probability	Predicted Probability (95% CI)[a]
Hospital type					
General hospital	754	0.27	0.26 (0.23–0.29)	0.36	0.36 (0.32–0.40)
Children's hospital	163	0.31	0.35 (0.28–0.42)*	0.39	0.44 (0.37–0.51)
Surgeon specialty					
General surgeon	566	0.29	0.30 (0.26–0.34)	0.38	0.39 (0.35–0.43)
Pediatric surgeon	46	0.11	0.07 (0.00–0.15)*,[b]	0.22	0.24 (0.10–0.39)*
Colorectal surgeon	305	0.27	0.26 (0.19–0.32)	0.36	0.35 (0.28–0.42)

* $P < .05$.

[a] Adjusted for interaction between hospital type and surgeon specialty, age, gender, IBD diagnosis, presence of complex chronic conditions other than IBD, admission type, duration of inpatient steroid use, resource utilization on admission, volume of IBD-related admissions, and hospital region of the country.

[b] Compared with general surgeons, $P < .05$; compared with colorectal surgeons, $P < .05$.

TABLE 4 Probability of Postoperative Complications According to Surgical Specialty and Surgeon's Hospital Practice Site

Variable	Total	Surgical Complication or Readmission Within 30 Days	
		Unadjusted Probability	Predicted Probability (95% CI)[a]
General hospitals			
General surgeons	490	0.37	0.38 (0.33–0.42)
Pediatric surgeons	22	0.23	0.23 (0.06–0.40)
Colorectal surgeons	242	0.35	0.34 (0.26–0.41)
Children's hospitals			
General surgeons	76	0.43	0.47 (0.37–0.57)
Pediatric surgeons	24	0.21	0.29 (0.14–0.44)
Colorectal surgeons	63	0.41	0.42 (0.29–0.54)

[a] Adjusted for interaction between hospital type and surgeon specialty, age, gender, IBD diagnosis, presence of complex chronic conditions other than IBD, admission type, duration of inpatient steroid use, resource utilization on admission, volume of IBD-related admissions, and hospital region of the country.

Although this study cannot illuminate why such differences in complications were observed, the results suggest that children's hospitals and general hospitals differ in their experience, systems, or standards of care not captured by hospital IBD volume, case-mix, or teaching status. We were surprised that children's hospitals were associated with higher complication rates, given their increased experience with younger patients and availability of pediatric anesthesiologists, radiologists, and other clinical staff. Our study suggests that the availability of these pediatric subspecialists and pediatric nursing may not necessarily benefit patients who are adolescents and young adults. It is possible, for example, that lower complication rates in general hospitals are a function of higher overall surgical volume in these hospitals. Compared with children's hospitals, general hospitals may benefit from greater institutional experience with similar abdominal surgeries given the high prevalence of conditions necessitating abdominal surgeries in adult populations, such as cholecystitis, colon and other abdominal cancers, and trauma. Studies looking at adult populations have shown that complications are lower not only in hospitals performing a higher number of a specific procedure but also in hospitals performing a higher number of similar procedures.[24] General hospitals may benefit from better nursing surveillance, surgical ancillary services, or a spectrum of clinical services, which have been shown to improve surgical outcomes.[25] Differences in outcomes across hospital type may also be due partly to differences in coding between children's and general hospitals.

Despite higher complication rates in children's hospitals, pediatric surgeons were associated with fewer complications than general or colorectal surgeons. It is possible that pediatric surgeons or their affiliated surgical team may have different skill sets and resources that are more suited for this age group compared with their general or colorectal surgical colleagues. Our study is consistent with others that show variability in surgical outcomes according to surgeon subspecialty.[26]

The large variation in complication rates differing by hospital setting and surgeon specialty imply that there may be areas for surgical quality improvement. The study findings support the importance of further research comparing outcomes of adolescents and young adult patients who may be hospitalized in either children's hospital or general hospital settings. Further research is needed to uncover the true reasons for surgical complications and identify those that are potentially avoidable, particularly the factors surrounding pediatric surgeons or surgical technique that contribute to decreased surgical complications in this age group. Concurrently, further research is needed to elucidate the differences in resources and systems of care between children's hospitals and general hospitals that contribute to quality of surgical care,

particularly for patients who are adolescents and young adult patients who are seen in these 2 different hospital settings.

Our study has several limitations related to the use of inpatient billing data. Our observations study design could be subject to unobserved confounding, such as differences in hospital operating procedures, nursing surveillance, or patient clinical factors not captured by billing data or inpatient data. Patients excluded from the study may have affected the results of our study. More patients who had undergone surgery in the 90 days before the index hospitalization were treated in children's hospitals. By excluding these patients from our study, we may have excluded patients who were undergoing a repeat surgery secondary to a complication and underestimated our results. We also excluded patients whose attending physician was not a surgeon. Potentially, these patients were those with more complex disease or surgical complications who were eventually transferred to a nonsurgical provider for medical management, thereby also underestimating our results. Finally, by limiting our sample to inpatients requiring surgery, our study population was likely sicker and at higher risk for poorer outcomes than the general population of patients with IBD.[27]

CONCLUSIONS

This study found that hospital type and surgeon specialty within hospital type influenced the likelihood of surgical complications among adolescents and young adults with IBD requiring surgical intervention. Complication rates were higher in children's hospitals compared with general hospitals, although complications were lower among pediatric surgeons compared with general or colorectal surgeons. These findings support the need for better understanding of quality of care variations across different hospitals settings, particularly for youth of transitional age who are traversing both pediatric and adult systems of care.

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APPENDIX ICD-9-CM Codes Used to Define Surgical Complication in Patients Aged 16 to 25 Years With IBD Requiring Surgery

ICD-9	Description
Dehiscence or fistula	
998.83	Nonhealing surgical wound
998.12	Hematoma complicating a procedure
998.13	Seroma complicating a procedure
998.31	Disruption of internal operation (surgical) wound
998.32	Disruption of external operation (surgical) wound
998.60	Persistent postoperative fistula
Infectious complications	
998.50	Postoperative infection not elsewhere classified
998.51	Infected postoperative seroma
998.59	Other postoperative infection
790.70	Bacteremia
38.00	Streptococcal septicemia
38.10	Staphylococcal septicemia
38.20	Pneumococcal septicemia
38.30	Septicemia due to anaerobes
38.40	Septicemia due to other gram-negative organisms
38.80	Other specified septicemias
38.90	Unspecified septicemia
Urinary retention or infection	
997.50	Urinary complications, not elsewhere classified
Ileus or bowel obstruction	
997.40	Digestive system complications, not elsewhere classified
560.10	Paralytic ileus
Cardiovascular complications	
453.40	Acute venous embolism and thrombosis of deep vessels of lower extremity
453.41	Acute venous embolism and thrombosis of deep vessels of proximal lower extremity
453.42	Acute venous embolism and thrombosis of deep vessels of distal lower extremity
453.80	Acute venous embolism and thrombosis of other specified veins
453.90	Iatrogenic cerebrovascular infarction or hemorrhage
415.11	Cardiac complications, not elsewhere classified
997.02	Iatrogenic cerebrovascular infarction or hemorrhage
997.10	Cardiac complication, not elsewhere classified
998.00	Other complications of procedures not elsewhere classified
427.50	Respiratory complications not elsewhere classified
Pulmonary complications	
997.30	Respiratory complications not elsewhere classified
518.40	Acute edema of lung, unspecified
518.50	Pulmonary insufficiency after trauma or surgery
518.81	Acute respiratory failure
518.82	Other pulmonary insufficiency, not elsewhere classified
512.20	Postoperative air leak
518.40	Acute edema of lung, unspecified
Requirement for re-operation within the hospitalization	
54.12	Reopening of recent laparotomy site
54.61	Reclosure of postoperative disruption of abdominal wall

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