



Does Perceived Resident Operative Autonomy Impact Patient Outcomes?

Jennifer H. Fieber, MD,^{*,1} Elizabeth A. Bailey, MD, MEd,^{*,1} Chris Wirtalla, BA,^{*} Adam P. Johnson, MD, MPH,[†] Ira L. Leeds, MD, MBA, ScM,[‡] Rachel L. Medbery, MD,[§] Vanita Ahuja, MD, MPH, MBA,^{||} Thomas VanderMeer, MD,[¶] Elizabeth C. Wick, MD,^{‡,2} Busayo Irojah, MD,[#] and Rachel R. Kelz, MD, MSCE, MBA^{*}

^{*}Hospital of the University of Pennsylvania, Department of Surgery, Philadelphia, Pennsylvania; [†]Thomas Jefferson University Hospital, Department of Surgery, Philadelphia, Pennsylvania; [‡]Johns Hopkins Hospital, Department of Surgery, Baltimore, Maryland; [§]Emory University Hospital, Department of Surgery, Atlanta, Georgia; ^{||}Sinai Hospital, Department of Surgery, Baltimore, Maryland; [¶]Guthrie Robert Packer Hospital, Department of Surgery, Sayre, Pennsylvania; and [#]Wellspring York Hospital, Department of Surgery, York, Pennsylvania

OBJECTIVE: We investigated the association of perceived trainee autonomy with patient clinical outcomes following colorectal surgery.

DESIGN: This was a prospective multi-institutional study that consisted of surgery trainees completing a survey tool immediately after participating in colorectal resections to rate their self-perceived autonomy and case characteristics. Self-perception of autonomy was classified as observer, assistant, surgeon, or teacher. The completed trainee surveys were linked with patient information available through each hospital's internal NSQIP directory. The primary outcome was death and serious morbidity (DSM) and secondary outcome was 30-day readmissions. Separate mixed effects regression models were used to examine the association between perceived trainee autonomy and DSM or 30-day readmissions. Fixed effects were used to control for the effects of the training environment. The models were constructed to adjust for patient and trainee characteristics associated with each outcome independently.

SETTING: This study was conducted at 7 general surgery training programs (5 academic medical centers and 2 independent training programs) with general surgery or colorectal surgery services.

PARTICIPANTS: This study included a total of 63 residents and fellows rotating on surgery services that performed colorectal resections at the included 7 general surgery training programs from January until March 2016.

RESULTS: The 63 trainees that participated in this study completed 417 surveys with over a 95% response rate. National Surgical Quality Improvement Program (NSQIP) patient records were available for 67% ($n = 273$) of completed surveys. The clinical year of the trainees were 6.1% PGY 1/2, 36% Post graduate year (PGY) 3, 40.9% PGY 4/5, and 17% fellows. Residents perceived their participation in the case to be that of an observer in 9.2% of surveys, an assistant in 51.6% of surveys, and the surgeon/teacher in 39.3% of surveys. About 50% of patients were male, 80% were White, the majority had an American Society of Anesthesiologists classification of 3, almost half had prior abdominal surgery, and over 80% of surgeries were elective. The primary operation types performed were laparoscopic (40.3%) and open (35.9%) partial colectomies.

The rate of DSM in patients was approximately 24% when trainees perceived their role as observers, 23% when trainees perceived their role as assistants, and 18% when trainees perceived their role as surgeons/teachers. After adjustment for patient, trainee, and training environment, we found that the perceived level of trainee autonomy of a surgeon/teacher was associated with a 4-fold lower rate of DSM (odds ratio: 0.23, confidence of interval: 0.05-0.97, $p = 0.045$) compared to observers. The rate of readmissions was approximately 20% when trainees perceived their role as observers, 14% when trainees perceived their role as assistants and 9% when trainees perceived their role as surgeons/teachers. After adjustment for patient, trainee, and training environment, we found that the

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Correspondence: Inquiries to Jennifer H Fieber MD, Hospital of the University of Pennsylvania: Department of Surgery, 3400 Spruce Street, 4 Maloney, Philadelphia, PA 19104; fax: (215)662-7983; e-mail: Jennifer.Fieber@uphs.upenn.edu

¹These authors contributed equally to the manuscript.

²Present address: Department of Surgery, University of California San Francisco, 1825 Fourth St, 4th Floor, San Francisco, CA 94158.

perceived level of trainee autonomy of a surgeon/teacher was significantly associated with a 10-fold lower rate of 30-day readmissions (odds ratio: 0.09, confidence of interval: 0.01-0.70, $p = 0.022$) compared to observers.

CONCLUSIONS: There was an association between increased perceived trainee autonomy and improved patient outcomes, suggesting that when trainees identify with an increased role in the operation, patients may have improved care. Further research is needed to understand this association further. (J Surg Ed 76: e182–e188. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Surgery education, Autonomy, Surgery outcomes, Surgery residency

COMPETENCIES: Patient Care, Interpersonal and Communication Skills, Practice-Based Learning and Improvement

INTRODUCTION

Surgical autonomy is valued as a major stepping stone to advancing from a surgical trainee to independent surgeon.¹ Resident education relies on graduated responsibility in all realms of patient care, including in the operating room. Previous studies suggest that there is a consistent discrepancy between how much autonomy granted during operations based on resident and attending perceptions.¹⁻³ Although, multiple modalities including entrustable professional activities and the Zwisch scale have been developed to improve the evaluation of resident autonomy, it remains challenging to accurately assess the resident operative role.^{2,4-6}

The literature suggests that patients undergoing operations with surgical trainees involved have comparable post-operative outcomes to patients undergoing operations without surgical trainees present.⁷⁻¹⁰ Trainees have varying degrees of autonomy during operations because of multiple factors including the experience level of the resident, case difficulty, and attending preferences. Earlier studies do not address the impact of the degree of resident autonomy during operations on patient outcomes. We conducted a prospective multi-institutional study to begin to quantify the impact of perceived trainee autonomy on patient outcomes following colorectal surgery.

METHODS

Study Design

We performed a prospective multi-institutional study at 7 general surgery residency programs to evaluate the role

of perceived trainee autonomy with patient outcomes after colorectal surgery. The University of Pennsylvania was the principle site and was responsible for circulation of the survey tool and analysis of data. The sites consisted of 5 academic medical centers and 2 independent training programs. Each site had a research team that included an attending surgeon-resident and program director support. This study received exemption from full review by the University of Pennsylvania Institutional Review Board as well as all participating sites.

Survey

As described in Bailey et al., a 2-minute survey tool was developed through resident and faculty focus groups and subsequently piloted at 3 of the participating institutions.¹¹ The survey included trainee demographic data, clinical data, and self-interpreted role. The trainee demographic data collected included clinical year to account for varying research years and participating site. Several patient factors known to be associated with the difficulty of the operation were collected via the survey to supplement the information collected by the internal National Surgical Quality Improvement Program (NSQIP) directory including prior abdominal surgery, presence of adhesive disease, history of preoperative abdominopelvic radiation, and multivisceral resection. The trainee intraoperative role included self-perceived autonomy, based on the 4-level Zwisch scale and classified as observer, assistant, surgeon, or teacher.^{5,11}

Data Collection

Residents and fellows rotating on the colorectal surgery service or on a general surgery service performing colorectal procedures between January and March 2016 were eligible to participate in the study. Trainees were asked to complete the survey immediately after each colorectal operation performed during the study period. Eligible cases included elective and emergent operations; open and laparoscopic operations; and rectal and colon operations including partial and total resections. Trainees were able to access the survey through the Research Electronic Data Capture tool either through an email link or smartphone shortcut. The survey responses were collected at the University of Pennsylvania using the Research Electronic Data Capture tool. The survey results were not used for trainee evaluation and remained anonymous.

Analysis

The completed trainee surveys were linked with patient information available through each hospital's internal NSQIP directory. Additional patient information collected from the internal NSQIP directory included patient demographics (gender and race), American Society of Anesthesiologists (ASA) classification, operative

urgency (elective or emergent), and operation type (open or laparoscopic approach and total colectomy, partial colectomy, or rectal operation). ASA classification was used as a proxy for severity of patient illness as it was readily available and has been shown to be a valid and reliable marker of preoperative health status and predictive of perioperative postoperative complications.^{12,13} Patient age was not available through the internal NSQIP directory at all of the sites so was not included in our analysis.

Our primary outcome factor, death and serious morbidity (DSM) during the initial admission, and secondary outcome factor, 30-day readmission, were collected from internal NSQIP data. DSM is a composite metric that includes inpatient mortality or the presence of at least one complication including: deep surgical site infection, organ space infection, sepsis, septic shock, pneumonia, urinary tract infection, wound disruption, thromboembolic event (deep vein thrombosis and pulmonary embolism), unplanned intubation, acute myocardial infarction, cardiac arrest, renal insufficiency, and reoperation within 30 days.^{14,15} These DSM criteria were adapted to the available internal NSQIP outcomes data from the International Statistical Classification of Diseases 9 codes as defined in the *Annals of Surgical Oncology* article by Bartlett et al. and have previously been used in colorectal surgery.^{14,16-20} Thirty-day readmission statistics were not available for one of the surveyed institutions, and therefore, only 6 institutions were included for that analysis.

Trainee autonomy for analysis purposes was reclassified as observer, assistant, and surgeon/teacher because of low numbers of trainees who defined themselves as teachers and because both surgeon and teacher categories presume a high level of autonomy. Observers were selected as the reference group for analysis as this category conveyed the lowest level of perceived autonomy. Univariate analyses were performed using the chi square test or Fisher's exact test for categorical variables to examine the association between trainee perceived autonomy and patient characteristics and outcomes. Separate mixed effects regression

models were used to examine the association between perceived trainee autonomy and DSM or 30-day readmissions. Fixed effects were used to control for the effects of the training environment. The models were constructed to adjust for patient and trainee characteristics associated with each outcome independently. Patient demographics, ASA classification, level of operative urgency, operation type, and factors known to be associated with the difficulty of the operation were included in the models. The trainee year of clinical training was included in each model. Stata/MP 15.1 statistical software (StataCorp, College Station, TX) was used for all analyses.

RESULTS

A total of 63 trainees participated in this study, completing 417 surveys with over a 95% response rate. Patient records were available for 67% ($n = 273$) of completed surveys. The clinical year of the trainees were 6.1% Post graduate year (PGY) 1/2, 36% PGY 3, 40.9% PGY 4/5, and 17% fellows. Trainees perceived their participation in the case to be that of an observer in 9.2% of surveys, an assistant in 51.6% of surveys, and a surgeon/teacher in 39.3% of surveys. Further data based on perceived autonomy and level of training is stated in [Table 1](#).

Of the 273 patients with available information, approximately 50% of patients were male and 80% of patients were White. The majority of patients had an ASA classification of 3, characteristic of severe systemic disease but not incapacitating.¹² Approximately half of patients had prior abdominal surgery and a third of patients had adhesive disease. Over 80% of the operations were performed electively. The primary operation types performed were laparoscopic (40.3%) and open (35.9%) partial colectomies. Operation type was significantly associated with perceived trainee autonomy. Further data based on trainee perceived autonomy and patient characteristics is available in [Table 2](#).

Overall, the rate of DSM was 21.2% (Standard Deviation [STD]: 41%) with unplanned reoperation (29 patients, 12.4% overall patients) and organ space infection (12

TABLE 1. Trainee Demographics

	Perception of Trainee Autonomy, n (%)				p Value
	Observer	Assistant	Surgeon/Teacher	Total, n (%)	
Total n	25 (9.2)	141 (51.6)	107 (39.2)	273 (100.0)	
Clinical year (CY)					<0.001
CY 1/2	4 (16.0)	12 (8.9)	0 (0.0)	16 (6.1)	
CY 3	15 (60.0)	67 (49.6)	13 (12.5)	95 (36.0)	
CY 4/5	6 (24.0)	47 (34.8)	55 (52.9)	108 (40.9)	
Fellow	0 (0.0)	9 (6.7)	36 (34.6)	45 (17.0)	

TABLE 2. Patient Demographics

	Trainee Perception of Autonomy, n (%)				p Value
	Observer	Assistant	Surgeon/Teacher	Total, n (%)	
n (%)	25 (9.2)	141 (51.6)	107 (39.2)	273 (100.0)	
Gender:					0.69
Male	14 (56.0)	73 (51.8)	51 (47.7)	138 (50.5)	
Female	11 (44.0)	68 (48.2)	56 (52.3)	135 (49.5)	
Race:					0.32
White	24 (96.0)	111 (78.7)	89 (83.2)	224 (82.1)	
Black	0 (0.0)	21 (14.9)	14 (13.1)	35 (12.8)	
Asian	1 (4.0)	3 (2.1)	1 (0.9)	5 (1.8)	
Unknown/not reported	0 (0.0)	6 (4.3)	3 (2.8)	9 (3.3)	
ASA classification: *					0.66
ASA 1/2	6 (24.0)	55 (39.0)	42 (39.3)	103 (37.7)	
ASA 3	18 (72.0)	81 (57.4)	59 (55.1)	158 (57.9)	
ASA 4	1 (4.0)	5 (3.5)	5 (4.7)	11 (4.0)	
None assigned	0 (0.0)	0 (0.0)	1 (0.9)	1 (0.4)	
Operative urgency:					0.84
Elective	21 (84.0)	121 (85.8)	94 (87.9)	236 (86.4)	
Emergency	1 (4.0)	6 (4.3)	5 (4.7)	12 (4.4)	0.98
Operation type:					0.04
Partial colectomy					
Open	7 (28.0)	64 (45.4)	27 (25.2)	98 (35.9)	
Laparoscopic	13 (52.0)	49 (34.8)	48 (44.9)	110 (40.3)	
Total colectomy					
Open	1 (4.0)	5 (3.5)	6 (5.6)	12 (4.4)	
Laparoscopic	0 (0.0)	13 (9.2)	13 (12.1)	26 (9.5)	
Rectal operation	4 (16.0)	10 (7.1)	13 (12.1)	27 (9.9)	
Additional factors					
Prior abdominal surgery	17 (68.0)	66 (46.8)	46 (43.0)	129 (47.3)	0.08
Adhesive disease	10 (40.0)	42 (29.8)	28 (26.2)	80 (29.3)	0.39
Abdominopelvic radiation	1 (4.0)	19 (13.5)	7 (6.5)	27 (9.9)	0.11
No prior history	5 (20.0)	60 (42.6)	50 (46.7)	115 (42.1)	0.05
Multivisceral resection	0 (0.0)	13 (9.4)	9 (8.4)	22 (8.1)	0.28

*ASA: American Society of Anesthesiologists Classification.

patients, 4.4% overall patients) being the most common complications. There were a total of 5 patients (1.8% overall) who died within 30 days of their initial operation. The DSM ranged from 43.6% when the trainee perceived themselves as an observer to 17.8% when the trainees perceived their role as a surgeon/teacher, although this difference was not statistically significant. After adjustment for patient, trainee, and training environment, we found that the perceived level of trainee autonomy of a surgeon/teacher was associated with a 4-fold lower rate of DSM (odds ratio: 0.23, confidence of interval: 0.05-0.97, $p = 0.045$) compared to observers.

The overall rates of 30-day readmissions were 12.4%, ranging from 20% when the trainee perceived themselves as an observer to 8.5% when the trainees perceived their role as a surgeon/teacher, although not statistically significant. After adjustment for patient, trainee, and training environment, we found that the perceived level of trainee autonomy of a surgeon/teacher was significantly associated with a 10-fold lower

rate of 30-day readmissions (odds ratio: 0.09, confidence of interval: 0.01-0.70, $p = 0.022$) compared to observers.

DISCUSSION

This prospective, multi-institutional study used an innovative methodology to link trainee perceived intraoperative autonomy with patient outcomes following colorectal surgery. The DSM rate of 21% in our study is similar to previous studies measuring rates of at 10% to 55% depending on approach and operation-type.^{21,22,23} Our results were also consistent with previously published rates of 30-day readmissions.^{24,25} In this context, we found that when surgical trainees perceive a more autonomous, active role in the operating room, patients are more likely to have lower rates of complications and readmissions. To the best of our knowledge, this is the first study to quantify the association of perceived trainee autonomy with patient outcomes.

The impact of the presence of surgical trainees on patient outcomes is controversial with limited data but of paramount importance to ensuring patient safety at academic centers.^{7,9} Advani et al. studied the impact of resident involvement on laparoscopic appendectomy outcomes through NSQIP and found that resident involvement increases operative times by a median of 14 minutes with similar perioperative outcomes.⁷ Castleberry et al. similarly studied the impact of resident presence in the operating room during colectomy cases and showed a small increase in some complications but improved failure to rescue.⁹ Multiple studies have suggested that residents involvement in the operating room leads to a slight increase in operative times with minimal clinical significance and impact on patient postoperative morbidity.^{7,8,10,26,27} These previous studies do not address the actual or perceived role that the trainee had during the case, but merely, the presence of a resident during the operation. In contrast, our results suggest that when evaluating the impact of trainees in the operating room, trainees should not be grouped based on attendance alone, but instead based on differing degrees of involvement and perceived autonomy during the operation.

Our study takes a unique approach to the role of the trainee in patient outcomes through measuring perceived trainee autonomy. The effect of perceived autonomy has been studied extensively in education, business, psychology, and health-care settings through self-determination theory.^{3,28,29} Self-determination theory relies on the close relationship of autonomy with competence and relatedness.²⁸ Increased perceived autonomy not only leads to improved learner well-being and motivation but also may improve outcomes and competence.²⁸⁻³⁰ Biondi et al. addressed the differences in the perception of autonomy between surgical residents and faculty but did not evaluate the association with patient outcomes.³ Although the relationship of surgery trainee perceived autonomy with actual autonomy and competence is beyond the scope of this manuscript, our results do suggest that the patients of trainees with increased perceived autonomy have better outcomes.

Our finding is potentially important when broaching the topic of trainee involvement in the operating room with patients. In general, patients desire to be cared for by the most experienced physician available and may be resistant to a team approach to their care.^{9,31} Cowles et al. found that 86% of patients were comfortable having residents involved in their care especially if it led to increased attention, but 32% of patients did not want residents to be involved with their operation.³² Previous studies have shown minimal transparency of attending surgeons when discussing trainee involvement in the operating room despite patient expectations to be informed.^{31,33} One potential explanation of these

findings is that having surgical trainees perceive an active role intraoperatively may lead to better patient care. This potentially would encourage an increased emphasis on the importance of the surgical team and transparency about the trainee role both intraoperatively and postoperatively when the attending surgeon discusses the presence of trainees with patients.

An alternative explanation for our findings is that trainees perceived a higher level of autonomy in less difficult cases. Anecdotally, trainee autonomy may be inversely associated with case complexity. That is, trainees may actually have less autonomy in the complex cases that are more prone to postoperative complications and readmissions. Although we did include many factors related to case complexity in our multivariable analysis, there still may be unmeasured factors related to case complexity that may further confound this association.

Future studies are needed to determine if the improved patient outcomes are because trainees with higher levels of perceived autonomy are actually more competent or committed to patient care, or if our findings are in fact confounded and trainees perceive a higher level of autonomy in more straight-forward cases that are less likely to have complications independent of trainee involvement. A future project could include surveying the attendings to further define case difficulty and to characterize autonomy from the attending perspective. Such a study could also examine the conditional effects of attending experience and volume on the relationship between autonomy and patient outcomes.

Additional limitations for our study include the standard limitations for survey and database studies. Our surveys had a >95% response rate yet still 5% of the data were missed. There was also the potential of recall and reporting bias although we tried to limit bias by having surveys completed in <48 hours after the case, emphasizing that there is no potential impact on evaluations, and encouraging participants not to change practice patterns. We do not have data on the potential number of trainees present in each case, which may have impacted perceived autonomy or patient outcomes. We only have NSQIP data for 67% of the patient cases. As NSQIP is a random convenience sample collected prospectively through a systemic-sampling process to identify patients undergoing major surgical procedures at each institution, we do not have a reason to suspect that the patients that were missing data were different than the other patients in this cohort.³⁴ Our study included 7-institutions which may limit generalizability, although these institutions did include both academic and independent training programs, and we controlled for residency site in our analysis.

In conclusion, our prospective, multi-institutional study that links trainee perceived intraoperative

autonomy with patient outcomes following colorectal surgery suggests that a higher degree of perceived trainee autonomy is associated with improved patient outcomes. Follow-up studies focused on the attending perception of the extent of trainee participation will further enlighten our understanding of the relationship between trainee autonomy and patient outcomes.

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REFERENCES

1. Chen XP, Williams RG, Smink DS. Do residents receive the same OR guidance as surgeons report? Difference between residents' and surgeons' perceptions of OR guidance. *J Surg Educ.* 2014;71:e79-e82.
2. Fryer JP, Teitelbaum EN, George BC, et al. Effect of ongoing assessment of resident operative autonomy on the operating room environment. *J Surg Educ.* 2018;75:333-343.
3. Biondi EA, Varade WS, Garfunkel LC, et al. Discordance between resident and faculty perceptions of resident autonomy: can self-determination theory help interpret differences and guide strategies for bridging the divide? *Acad Med.* 2015;90:462-471.
4. Chen XP, Sullivan AM, Smink DS, et al. Resident autonomy in the operating room: how faculty assess real-time entrustability. *Ann Surg.* 2018;269:1080-1086.
5. George BC, Teitelbaum EN, Meyerson SL, et al. Reliability, validity, and feasibility of the Zwisch scale for the assessment of intraoperative performance. *J Surg Educ.* 2014;71:e90-e96.
6. DaRosa DA, Zwischenberger JB, Meyerson SL, et al. A theory-based model for teaching and assessing residents in the operating room. *J Surg Educ.* 2013;70:24-30.
7. Advani V, Ahad S, Gonczy C, Markwell S, Hassan I. Does resident involvement effect surgical times and complication rates during laparoscopic appendectomy for uncomplicated appendicitis? An analysis of 16,849 cases from the ACS-NSQIP. *Am J Surg.* 2012;203:347-351. discussion 51-2.
8. Babineau TJ, Becker J, Gibbons G, et al. The "cost" of operative training for surgical residents. *Arch Surg.* 2004;139:366-369. discussion 9-70.
9. Castleberry AW, Clary BM, Migaly J, et al. Resident education in the era of patient safety: a nationwide analysis of outcomes and complications in resident-assisted oncologic surgery. *Ann Surg Oncol.* 2013;20:3715-3724.
10. Gorgun E, Benlice C, Corrao E, et al. Outcomes associated with resident involvement in laparoscopic colorectal surgery suggest a need for earlier and more intensive resident training. *Surgery.* 2014;156:825-832.
11. Bailey EA, Johnson AP, Leeds IL, et al. Quantification of resident work in colorectal surgery. *J Surg Educ.* 2018;75:564-572.
12. Wolters U, Wolf T, Stutzer H, Schroder T. ASA classification and perioperative variables as predictors of postoperative outcome. *Br J Anaesth.* 1996;77:217-222.
13. Sankar A, Johnson SR, Beattie WS, Tait G, Wijeyesundera DN. Reliability of the American Society of Anesthesiologists physical status scale in clinical practice. *Br J Anaesth.* 2014;113:424-432.
14. Bartlett EK, Meise C, Roses RE, Fraker DL, Kelz RR, Karakousis GC. Morbidity and mortality of cytoreduction with intraperitoneal chemotherapy: outcomes from the ACS NSQIP database. *Ann Surg Oncol.* 2014;21:1494-1500.
15. Fieber J, Sharoky C, Wirtalla C, Williams N, Dempsey D, Kelz R. The malnourished patient with obesity: a unique paradox in bariatric surgery. *J Surg Res.* 2018;232:456-463.
16. Neuwirth MG, Bartlett EK, Newton AD, et al. Morbidity and mortality after total splenectomy for lymphoid neoplasms. *J Surg Res.* 2016;205:155-162.
17. Neuwirth MG, Bartlett EK, Roses RE, Fraker DL, Kelz RR, Karakousis GC. Obesity is not associated with increased morbidity in patients undergoing cytoreductive surgery with intraperitoneal chemotherapy. *J Surg Oncol.* 2016;114:619-624.
18. Peters MG, Bartlett EK, Roses RE, Kelz RR, Fraker DL, Karakousis GC. Age-related morbidity and mortality with cytoreductive surgery. *Ann Surg Oncol.* 2015;22(Suppl 3):S898-S904.
19. Montgomery SR Jr., Butler PD, Wirtalla CJ, et al. Racial disparities in surgical outcomes of patients with inflammatory bowel disease. *Am J Surg.* 2018;215:1046-1050.
20. Liu JB, Berian JR, Ban KA, et al. Outcomes of concurrent operations: results from the American College

of Surgeons' National Surgical Quality Improvement Program. *Ann Surg*. 2017;266:411-420.

21. Wilson MZ, Dillon PW, Hollenbeak CS, Stewart DB. How do risk factors for mortality and overall complication rates following laparoscopic and open colectomy differ between inpatient and post-discharge phases of care? A retrospective cohort study from NSQIP. *Surg Endosc*. 2014;28:3392-3400.
22. Silva-Velazco J, Dietz DW, Stocchi L, et al. Considering value in rectal cancer surgery: an analysis of costs and outcomes based on the open, laparoscopic, and robotic approach for proctectomy. *Ann Surg*. 2017;265:960-968.
23. Shih T, Cole AI, Al-Attar PM, et al. Reliability of surgeon-specific reporting of complications after colectomy. *Ann Surg*. 2015;261:920-925.
24. Al-Mazrou AM, Suradkar K, Mauro CM, Kiran RP. Characterization of readmission by day of rehospitalization after colorectal surgery. *Dis Colon Rectum*. 2017;60:202-212.
25. Andersen J, Hjort-Jakobsen D, Christiansen PS, Kehlet H. Readmission rates after a planned hospital stay of 2 versus 3 days in fast-track colonic surgery. *Br J Surg*. 2007;94:890-893.
26. Hwang CS, Pagano CR, Wichterman KA, Dunnington GL, Alfrey EJ. Resident versus no resident: a single institutional study on operative complications, mortality, and cost. *Surgery*. 2008;144:339-344.
27. Hernandez-Irizarry R, Zendejas B, Ali SM, Lohse CM, Farley DR. Impact of resident participation on laparoscopic inguinal hernia repairs: are residents slowing us down? *J Surg Educ*. 2012;69:746-752.
28. Miserandino M. Children who do well in school: individual differences in perceived competence and autonomy in above-average children. *Journal of Educational Psychology* 1996;88:203-14.
29. Williams GC, McGregor HA, Sharp D, et al. Testing a self-determination theory intervention for motivating tobacco cessation: supporting autonomy and competence in a clinical trial. *Health Psychol*. 2006;25:91-101.
30. Williams GC, Freedman ZR, Deci EL. Supporting autonomy to motivate patients with diabetes for glucose control. *Diabetes Care*. 1998;21:1644-1651.
31. Counihan TC, Nye D, Wu JJ. Surgeons' experiences with patients' concerns regarding trainees. *J Surg Educ*. 2015;72:974-978.
32. Cowles RA, Moyer CA, Sonnad SS, et al. Doctor-patient communication in surgery: attitudes and expectations of general surgery patients about the involvement and education of surgical residents. *J Am Coll Surg*. 2001;193:73-80.
33. Kempenich JW, Willis RE, Blue RJ, et al. The effect of patient education on the perceptions of resident participation in surgical care. *J Surg Educ*. 2016;73:e111-e1e7.
34. ACo S. User Guide for the 2014 ACS NSQIP Participant Use Data File (PUF). 2015.

SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jsurg.2019.06.006.