General Surgical Resident Operative Autonomy vs Patient Outcomes: Are we Compromising Training without Net Benefit to Hospitals or Patients?

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OBJECTIVE: Resident operative autonomy has been steadily declining. The reasons are multifactorial and include concerns related to patient safety and operating room efficiency. Simultaneously, faculty have expressed that residents are less prepared for independent practice. We sought to understand the effect of decreasing resident autonomy on patient outcomes and operative duration.

DESIGN: Retrospective study utilizing the Veterans Affairs Surgical Quality Improvement Program (VASQIP) database.

SETTING: Operative cases within the VASQIP database from July 1, 2004-September 30, 2019 were analyzed.

PARTICIPANTS: All adult patients who underwent a surgical procedure from July 1, 2004 to September 30, 2019 were analyzed. The subpopulation of patients that underwent a surgical procedure in General Surgery or Peripheral Vascular Surgery were identified based on the code of the specialty surgeon. Within these subgroups, the most frequent cases by current procedural terminology (CPT) code were selected for study inclusion. The principle CPT code of all cases was further coded by level of supervision: attending primary surgeon (AP); attending and resident (AR), or resident primary with the attending supervising but not scrubbed (RP). Baseline demographics, operative variables, and outcomes were compared between groups.

RESULTS: The VASQIP database included 698,391 total general/vascular surgery cases. 38,483 (6%) of them were RP cases. Analysis revealed that the top 5 RP cases account for 73% of total RP volume—these include: 1) Hernias (55% total; 33% open inguinal, 13% umbilical, 5% open ventral/incisional, and 4% laparoscopic) 2) cholecystectomy (18%), 3) Amputations (17% total; 10% above knee, 7% below knee), 4) Appendectomy (7%) and 5) Open colectomy (3%). The percentage of cases at teaching hospitals that were RP cases significantly decreased from 15% in 2004 to 5% in 2019 ($p < 0.001$). RP cases were generally sicker as demonstrated by higher ASA classifications and more likely to be emergent cases. Operative times were also increased with resident involvement, but RP cases were faster than AR cases on average. After adjusting for baseline demographics, case type, and year of procedure, mortality was no different between groups. Complications were higher in the AR group but not in the RP group.

CONCLUSIONS: The rate of resident autonomy in routine general surgery cases has decreased by two-thirds over the 15-year study period. Cases performed by residents without an attending surgeon scrubbed were performed faster than cases performed by a resident and attending together and there was no increase in patient morbidity or mortality when residents performed cases independently. The erosion of resident autonomy is not justified based upon operative time or patient outcomes. Efforts to increase surgical resident operative autonomy are needed. (J Surg Ed 78:e174—e182. Published by Elsevier Inc. on behalf of Association of Program Directors in Surgery.)

KEY WORDS: Graduate medical education, operative autonomy, VASQIP, efficiency, outcomes, patient safety

COMPETENCIES: Patient Care, Medical Knowledge, Practice-Based Learning and Improvement

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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1931-7204/$30.00
https://doi.org/10.1016/j.jsurg.2021.09.017

INTRODUCTION

Graduated independence in the operating room is a hallmark of surgical training. The Accreditation Council on Graduate Medical Education's (AGGME) Surgery 2.0 Milestones make it clear that residency training programs have increased responsibility to allow residents to teach common surgical procedures to more junior trainees. The graduation target for patient care as it relates to operative skills indicate chief residents are expected to perform complex operations with the guidance of faculty and expected to teach common operations such as hernia, appendectomy, and cholecystectomy to more junior trainees.[1] Yet resident confidence in operating autonomously, even for common surgical procedures, has been reported to be low.[2,3] Resident case numbers have been used to predict procedural competence, but have been shown to correlate poorly with the achievement of meaningful operative autonomy in the most common general surgery cases.[4] Simultaneously, teaching faculty have expressed concern that surgical residency graduates are ill-prepared for independent practice at the conclusion of their training.[5,6,7,8]

While there is a reasonable body of literature on preparedness for independent surgical practice, the true rates of surgical resident operative autonomy for common general surgical procedures are not well described in recent literature. Further, the reasons cited for the presumed erosion of resident autonomy in the operating room are multifactorial and include: perception of increased patient safety in the setting of external scrutiny and "pay for performance" metrics, and concerns about operative duration and OR efficiency.[5,9] While these are cited as rationales for limiting resident autonomy in the operating room, little data is published to substantiate these claims. The data on outcomes of resident involvement is conflicting, with some data suggesting that resident involvement leads to worse outcomes,[10,11,12] and other multi-institutional studies that suggest resident involvement has no effect on patient outcomes.[13,14,15] In short, without definitive data to the contrary, the perception and fears on patient outcomes are driving down resident autonomy and negatively impacting resident education.

We had two objectives of this study. First, we investigated whether there has truly been a change in operative autonomy on "bread and butter" general and vascular surgery cases within Veteran's Affairs teaching hospitals nationwide over a 15-year period. Second, we investigated whether patient morbidity or mortality has been impacted by residents either performing or assisting in these same cases.

METHODS

Patient Population and Case selection

This is a retrospective study of 15 years of surgical data utilizing the Veterans Affairs Quality Improvement Program (VASQIP) database from patients undergoing surgery at Veterans Affairs Medical Centers from July 1st, 2004 through September 30th, 2019. This data is kept secure on the VA Informatics and Computing Infrastructure (VINCI). This study was approved as exempt by the VA New Jersey institutional review board (#01513) and approved by VINCI (DART 2020-05-042-D).

The initial population included all veterans above the age of 18 who underwent surgery by either general surgery or vascular surgery. To form the cohort of core surgical procedures that residents were performing independently, we analyzed the principle current procedural terminology (CPT)[16] code for all cases coded as attending not scrubbed and selected the most frequent cases for analysis. We organized related codes that would represent similar procedures. These included 1) Hernias (Inguinal Hernias (CPT 49505, 49507, 49520, 49521, and 49525), Umbilical Hernias (CPT 49585 and 49587), Ventral Hernias (CPT 49560, 49561, 49562, 49565, 49568, 49570, and 49572), Laparoscopic Hernias (CPT 49650, 49651, 49652, 49653, 49654, 49655, 49656, and 49659)), 2) Cholecystectomy (CPT 47562, 47563, and 47600), 3) Appendectomy (44970 and 44950), 4) Amputations (Above Knee Amputations (27590, 27592, 27594, 27596 and 27598), Below Knee Amputations (27880, 27881, 27882, 27884, 27886, 27888, and 27889)) and 5) Open Colectomy (44140, 44141, 44143, 44144, 44145, 44146, or 44160). We identified Veterans Affairs Medical Centers which had a General Surgery Residency affiliated with them to classify those centers as a teaching hospital and those without a residency as a non-teaching hospital.

Variables and Outcomes

Patients were separated into one of three groups based on the level of attending surgeon involvement and supervision in the case as recorded in the database. Figure 1 maps an inclusion/exclusion flow diagram to reach the final study cohort. Cases were excluded if they did not include a supervision code. The reference group, attending primary (AP), was coded as attending surgeon performing the case, but may be assisted by a resident. The primary comparison group, resident primary (RP), was attending surgeon either not scrubbed, but physically present in the operating room (OR) and providing direction to the resident, or attending in the OR suite and immediately available for supervision or consultation as needed. Attending in the OR supervising vs in the OR

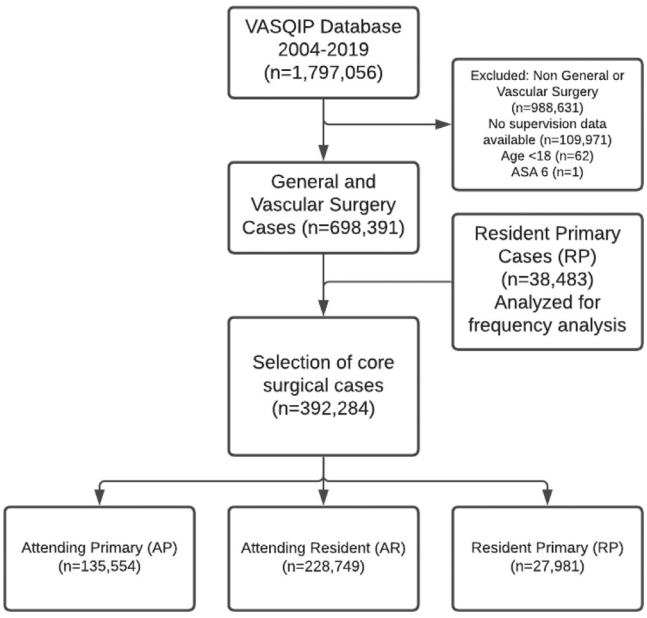

FIGURE 1. Inclusion/exclusion flow diagram.

suite and immediately available are coded separately in the VASQIP database, however due to a small proportion of attending in the OR suite but not in the room they have been combined into the RP group. The secondary comparison group, attending with resident (AR) were cases where the attending in OR, scrubbed, directly involved in the procedure but the resident performs major portions of the procedure. We had two primary outcomes, one for each objective. The primary outcome for resident autonomy was proportion of cases performed by RP at teaching hospitals at the start of the study compared to at the end of the study. The primary outcome for case outcomes was adjusted 30-day all-cause mortality between the 3 groups in the core procedures. We included cases from teaching and nonteaching VA Medical Centers to capture the full scope of cases. Secondary outcomes included adjusted composite complication rate of all VASQIP collected complications, each individual complication rate, and operative time. Baseline characteristics including patient demographics and medical comorbidities, ASA classification and functional status, were collected and compared. Due to a small proportion of ASA class 5 patients, ASA 4 and 5 were combined into 1 grouping.

Statistics

Categorical variables were compared with chi-squared methods and continuous variables were compared with ANOVA or Kruskal Wallis as appropriate. Adjusted analysis comprised of logistic regression with the outcome variables of 30-day mortality, all cause and specific morbidities as the dependent variables, and AP was the reference group to which AR and RP were compared. Models were created in a stepwise fashion with an alpha of 0.3 for entry into the model and 0.2 to stay in the model. Adjusted odds are reported as odds ratios with 95% confidence intervals. All statistics were performed using SAS version 9.4 for windows.

RESULTS

The VASQIP database included 698,391 total general/vascular surgery cases. Of the total cases performed during the study period, 38,483 (5.5%) of them were RP cases. The percentage of the top 5 RP cases at VA teaching facilities steadily decreased over time—15% of total cases in 2004 to only 5% of total cases in 2019 (Fig. 2). There was a less profound decrease in the number of AR cases during the same study period: 68% to 63%. The number of AP cases in VA teaching hospitals increased substantially from 17% to 32%. All the changes in RP, AP and AR were significant ($p < 0.001$).

The top 5 RP cases account for 73% of total RP volume (n = 27,981). These include 55% hernias (n = 15,377), 18% laparoscopic or open cholecystectomy (n = 4,928), 17% above-knee or below-knee amputations (n = 4,789; 2,002 AKA and 2,787 BKA), 7% laparoscopic or open appendectomy (n = 1,929), and 3% open colectomies (n = 958). Within the hernia group, 33% were open inguinal (n = 9,259), 13% umbilical (3,658), 5% open ventral/incisional (n = 1,325), and 4% laparoscopic (n = 1,135). Comparative case numbers for the AP and AR groups are presented in Table 1. Demographic data for all patients in all 3 groups undergoing these common operative procedures during the 15-year study period is presented in Table 2. There were statistically significant differences in gender, age, and BMI, but the clinical relevance of the small differences is unclear. There was a significant difference with regards to race and ethnicity in the proportions of each group, with more white patients in the AP (68.8% vs 63.2% and 61.0%), more black patients in the RP group (18.6% vs 15.1% vs 10.4%), and more Hispanic patients in the AR group (6.0% vs 3.5% vs 4.3%, $p < 0.001$).

In assessing pre-operative risk, RP cases were generally higher risk and sicker patients (Table 3). Attending Primary cases were more likely to be ASA Class 1 or 2 (3.5% and 36.9% vs 2.4% and 29.5% and 3.0% and 31.0%) and Clean cases (67.4% vs 58.4% vs 58.3%). Resident Primary cases were more likely to be smokers, more likely to have a partially or total dependent functional status, and more likely to suffer from preoperative sepsis and/or preoperative open wound infections. Further, RP

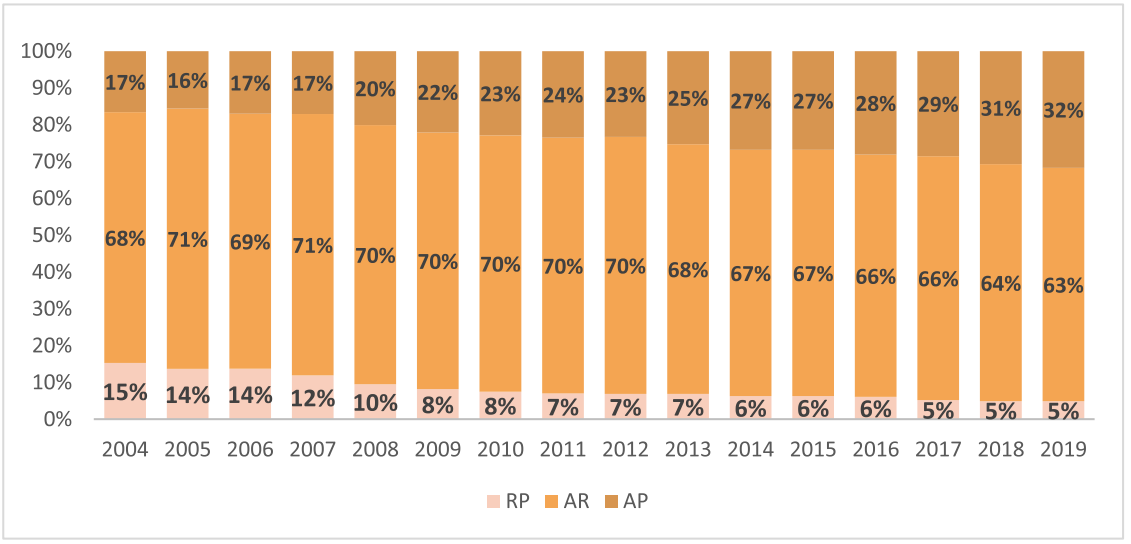

FIGURE 2. Resident operative autonomy over time.

TABLE 1. Most Common Resident Primary Operative Cases

Case Description	Attending Primary	Attending & Resident	Resident Primary
Hernia:			
Open inguinal hernia	38% (51,556)	32% (72,322)	33% (9,259)
Open umbilical hernia	13% (17,192)	9% (21,566)	13% (3,658)
Open ventral/incisional hernia	7% (9,062)	6% (13,275)	5% (1,325)
Laparoscopic hernia	9% (12,469)	11% (24,121)	4% (1,135)
Laparoscopic or open cholecystectomy	17% (23,483)	19% (43,294)	18% (4,928)
Amputation			
Below knee amputation	3% (4,167)	5% (10,533)	10% (2,787)
Above knee amputation	2% (2,865)	3% (7,587)	7% (2,002)
Laparoscopic or open appendectomy	4% (5,364)	5% (10,703)	7% (1,929)
Open colectomy	7% (9,396)	11% (25,348)	3% (958)

TABLE 2. Demographic Data

	AP (n = 135,554)	AR (n = 228,749)	RP (n = 27,981)
Males	95% (n = 128,766)	95% (n = 217,868)	95% (n = 26,736)
Age	61 (±13)	62 (±13)	61 (±13)
BMI	29 (±6)	28 (±6)	28 (±6)
Race:			
White	69% (n = 93,297)*	63% (n = 14,4460)	61% (n = 17,054)
Black	10% (n = 14,075)	15% (34,612)	19% (5,201)*
Hispanic	4% (n = 4,687)	6% (n = 13,652)*	4% (n = 1,199)
Other	17% (n = 23,495)	16% (n = 36,025)	16% (n = 4,527)

RP, resident primary; AR, attending and resident; AP, attending primary.
*statistically significant difference with $p < 0.001$

cases were more likely to be classified as ASA 3, or ASA 4 or 5. Resident Primary cases were also more likely to be emergent surgeries and more likely to be on inpatients.

Despite the higher risk patient population identified in RP cases, outcomes were not worse. Operative times for each group are reflected in Table 4. Operative times were significantly increased with resident involvement, but RP was faster than AR.

Post-operative complications are summarized in Table 5. After adjusting for baseline demographics, case

TABLE 3. Pre-Operative Surgical Risk Factors

	AP % (n)	AR % (n)	RP % (n)	p value
Current Smoker	30.7% (41,658)	31.4% (71,706)	35.1% (9,822)	<0.001
Functional Status:				
Partially dependent	4.2% (5,736)	6.0% (13,686)	9.2% (2,574)	<0.001
Totally Dependent	0.9% (1,239)	1.7% (3,792)	2.4% (674)	
Preoperative sepsis	1.7% (2,311)	2.7% (6,083)	3.7% (1,031)	<0.001
Open wound infection pre-op	4.8% (6,519)	7.7% (17,540)	14.7% (4,110)	<0.001
Emergency Surgery	6.1% (8,282)	8.4% (19,213)	9.5% (2,644)	<0.001
Inpatient surgery	27.4% (37,104)	37.9% (86,619)	38.2% (10,673)	<0.001
ASA Class:				
1	3.5% (4,704)	2.4% (5,534)	3.0% (838)	<0.001
2	36.9% (50,049)	29.5% (67,514)	31.0% (8,658)	
3	52.5% (71,194)	58.6% (13,4115)	54.8% (15,331)	
4 or 5	7.1% (9,598)	9.4% (21,574)	11.3% (3,151)	
Wound Class:				
Clean	67.4% (91,400)	58.4% (13,3510)	58.3% (16,314)	<0.001
Clean/Contaminated	23.9% (32,421)	29.0% (66,373)	25.6% (7,173)	
Contaminated	4.7% (6,366)	6.9% (15,700)	8.2% (2,285)	
Infected/Dirty	4.0% (5,367)	5.8% (13,165)	7.9% (2,209)	

RP, resident primary; AR, attending and resident; AP, attending primary

type, and year of procedure, mortality was no different between groups. In addition, the composite 30-day complication rate was not different in the RP group compared to the AP group and accounted for one or more of the defined VASQIP complications listed in Table 5. Complications were higher in the AR group compared to both AP and RP. Thirty-day return to OR for any reason was higher in RP compared to AR. Higher rates of amputations may account for this difference as they are often planned, staged procedures. Interestingly, RP cases had lower rates of wound dehiscence and lower rates of post-operative hemorrhage requiring greater than 4 units packed red blood cell transfusion than AP cases, and higher rates of urinary tract infections, pulmonary embolisms, and superficial wound infections than AP cases.

DISCUSSION

The data presented here clearly demonstrate that rate of resident autonomy has decreased by two thirds over the 15-year study period despite most cases being routine general surgery. Further, and most importantly, resident autonomy resulted in no increase in morbidity or mortality despite these patients being sicker and cases being more frequently emergent. Autonomous resident performed surgery did not increase operative times when compared to cases performed by attendings and residents together. This study represents a large retrospective review—nearly 700,000 operative general surgical and vascular cases performed over 15 years within the VA healthcare system. The VA system is the largest educator of medical professionals in the country, and we

TABLE 4. Operative Case Duration for Common Attending Primary (AP), Attending and Resident (AR), and Resident Primary (RP) Cases

Case Type	AP Time in minutes (±SD)	AR Time in minutes (±SD)	RP Time in minutes (±SD)
AKA	74 (±34)	76 (±36)	79 (±34)
Appy	62 (±30)	72 (±32)	73 (±29)
BKA	77 (±42)	77 (±43)	72 (±45)
Chole	85 (±46)	104 (±48)	103 (±39)
Col	165 (±88)	182 (±90)	173 (±80)
IHR	66 (±33)	85 (±35)	94 (±32)
LHR	96 (±53)	101 (±51)	106 (±50)
UHR	45 (±29)	58 (±32)	59 (±29)
VHR	78 (±61)	110 (±73)	97 (±60)
Average Case Time	77 (±53)	99 (±60)	90 (±45)

AKA, above knee amputation; Appy, appendectomy; BKA, below knee amputation; Chole, cholecystectomy; Col, colectomy; IHR, open inguinal hernia repair; LHR, any laparoscopic hernia repair; UHR, open umbilical hernia repair; VHR, open ventral hernia repair

TABLE 5. Comparative Post-Operative Outcomes

	AR vs AP (OR)	RP vs AP (OR)	AR vs RP (OR)
30-D all-cause mortality	1.00 (0.91-1.09)	0.97 (0.83-1.12)	1.04 (0.90-1.20)
30-D composite complication	1.14 (1.10-1.18)	1.04 (0.98-1.11)	1.10 (1.03-1.16)
30 D Return to OR	1.03 (0.99-1.08)	1.23 (1.15-1.33)	0.84 (0.78-0.90)
Cardiac Complications			
Cardiac arrest	1.27 (1.10-1.47)	1.07 (0.83-1.37)	1.19 (0.95-1.50)
Myocardial infarction	0.95 (0.80-1.13)	0.68 (0.47-0.98)	1.40 (0.98-2.01)
Pulmonary Complications			
Reintubation	1.38 (1.26-1.51)	1.17 (0.98-1.38)	1.18 (1.01-1.38)
Failure to wean from ventilator >48 h	1.39 (1.26-1.52)	1.10 (0.91-1.33)	1.26 (1.06-1.50)
Genitourinary Complications			
Post op dialysis	1.07 (0.89-1.27)	1.16 (0.85-1.58)	0.92 (0.69-1.22)
Post op acute renal failure without dialysis	1.15 (0.99-1.33)	1.15 (0.87-1.51)	1.00 (0.77-1.29)
Venous Thromboembolic Events			
Post op deep vein thrombosis	1.05 (0.89-1.24)	1.17 (0.84-1.63)	0.90 (0.65-1.23)
Post op pulmonary embolus	1.23 (1.03-1.48)	1.66 (1.20-2.30)	0.74 (0.55-1.01)
Hemorrhage			
Post op bleed >4units	0.98 (0.77-1.25)	0.57 (0.32-0.99)	1.74 (1.00-3.01)
Infection			
Post op *C. diff* infection	1.07 (0.94-1.21)	1.02 (0.81-1.29)	1.04 (0.84-1.29)
Post op urinary tract infection	1.09 (1.01-1.18)	1.18 (1.02-1.36)	0.92 (0.81-1.06)
Post op pneumonia	0.97 (0.89-1.06)	0.92 (0.78-1.09)	1.05 (0.90-1.23)
Post op sepsis	1.22 (1.13-1.32)	0.93 (0.79-1.09)	1.32 (1.14-1.54)
Wound Complication/Surgical Site Infection			
Wound dehiscence	1.00 (0.90-1.11)	0.74 (0.58-0.95)	1.35 (1.05-1.72)
Organ space surgical site infection	1.28 (1.15-1.41)	0.83 (0.64-1.07)	1.54 (1.20-1.97)
Superficial surgical site infection	1.24 (1.16-1.32)	1.26 (1.11-1.43)	0.98 (0.88-1.10)
Deep surgical site infection	1.16 (1.03-1.31)	1.20 (0.97-1.47)	0.97 (0.80-1.18)

OR, Odds Ratio; RP, resident primary; AR, attending and resident; AP, attending primary.

can only postulate that this erosion of resident autonomy is likely higher in the "private sector."

The significant decrement in resident operative autonomy over the last 15 years has been cited by others.[9,17] In particular, this decline has been for cases that the ACGME defines as "common" such as appendectomies and cholecystectomies.[1] The decline in operative autonomy has had profound effects on the operative skill of graduating surgical residents. Surveys of senior surgeons show that only 59% of "older" surgeons think that graduating residents are ready for independent surgical practice.[7] Surveys of fellowship directors reported 66% of trainees were deemed unable to operate for 30 minutes unsupervised for a major procedure.[6] We must next seek to understand what qualities in our teaching faculty and trainees—faculty years in practice, resident PGY level, age, sex, etc.– may contribute to faculty willingness to allow residents independence in the operating room so that we may design our training programs and faculty development endeavors to optimize opportunities for resident operative learning. Others have worked to understand the factors that contribute to diminished resident operative autonomy and in an effort to enhance surgical resident "entrustability."[18] Based on an understanding of the factors that have contributed to the erosion of trainee autonomy, Sandhu et al. have proposed a validated tool known as OpTrust that, along with faculty development, may assist progressive entrustment of residents in operative procedures and advancement from direct supervision to indirect supervision in the operating room.[19,20] A very recent study demonstrated that the use of OpTrust in a single tertiary academic medical center facilitated increased resident autonomy without negatively impacting clinical outcomes.[21] Perhaps the next best step for training programs is adoption of a validated tool for entrusting procedures or procedural elements to surgical residents. Members of the teaching faculty at hospitals that host trainees must recognize that limiting resident autonomy is not justified based upon the data presented here and should advocate for surgical resident operative autonomy for common "bread and butter" surgical cases to preserve the integrity of surgical practice in the future.

When analyzing our demographic data, we found that a larger percentage of white patients had surgery with an attending primary surgeon, a larger percentage of black patients had a resident primary surgeon, and a larger percentage of Hispanic patients had residents involved in their operation (AR). This potential systemic bias requires further investigation. This is particularly

concerning given public perception captured in a recent survey study by Dickinson et al. that when asked, Black and Latinx patients hold to the belief that "If a resident is involved in my operation I am more likely to have a complication," and the further sentiment "I would never allow a resident to perform an operation on me"[22] While the data presented here may help to correct the misconception that resident involvement leads to a higher complication rate, the higher percentage of black patients in the RP group must be explored in detail. Because AP cases from both teaching and non-teaching hospitals were examined and AR and RP cases were from teaching hospitals only, this difference may be due to the geography of the VA Medical Centers that are teaching vs non-teaching. Detailed analysis of this finding is outside the scope of this study, but future exploration of this finding is both warranted and intended.

We identified that operative procedures performed by attendings with residents or with a resident primary surgeon were "sicker" and more frequently emergent. This is consistent with data published by Kasotakis and colleagues after analyzing nearly a million cases from the nationwide American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database.[11] While the ACS-NSQIP data demonstrated significantly worse outcomes with resident involvement in operative cases, this study did not reproduce those results. This may be in part because the ACS-NSQIP database does not capture the degree of resident involvement and may instead delineate between teaching and non-teaching facilities. A 20-year-old study by Khuri and colleagues of the VASQIP database reveals that teaching hospitals compared to non-teaching perform higher rates of complex and high-risk surgical procedures.[14] Khuri demonstrated that pre-operative patient risk factors at teaching vs non-teaching VA medical centers was evaluated and teaching hospitals were found to have substantially sicker patients as measured by functional status, pre-operative weight loss, malnutrition, and a higher number of emergent procedures. This approximates our findings now 20 years later.

Khuri et al. also found that the risk-adjusted morbidity and mortality indices were similar whether or not residents were involved. [14] This is commensurate with what we have shown here. Khuri's group later examined patient outcomes relative to level of resident supervision at VA Medical Centers from 1998 to 2004 and again found similar outcomes between groups.[13] We have demonstrated that these findings are durable even now in the age of the 80-hour work week which was instituted in 2003. Common faculty rationale for not entrusting residents with increased autonomy in the operating room included: duty-hour and time restrictions, decreased resident autonomy overall, and an increased shift-work mentality among residents, with concomitant decreased sense of responsibility.[5] While the results of our study do not allow us to comment on resident attitudes, we have demonstrated that operative times are longest when both a resident and attending are scrubbed together in a surgical case. This contradicts sentiments expressed by surgeons in the earlier study and argues in favor of allowing a resident to truly act as a teacher in the OR. The resident independently performing an operative procedure is unlikely to negatively impact OR utilization when case duration is the primary concern.

Resident involvement in operative procedures has previously been shown to be an independent risk factor for venous thromboembolic events and surgical site infections.[10,12] While our data also reinforces these findings, the underlying reason is unclear. Perhaps the higher likelihood of pre-existing infection/sepsis contributes to the increased rate of wound infection. This pro-inflammatory state may also contribute to increased rates of VTE, but there is insufficient data to make this association. Interestingly, rates of post-operative hemorrhage and post-operative wound dehiscence are highest in cases where the attending served as primary surgeon. Resident primary operations had the best outcomes in these two subcategories. While this is also not well understood, one may surmise that a resident given an opportunity to operate independently may be extremely meticulous and diligent about hemostasis and each suture placed. This is a potential area for further study.

This study has several limitations. First, due to the retrospective nature of the work, it is difficult to discern why there is such a substantial erosion of resident primary cases. There is certainly pressure from media to mandate direct supervision of trainees at all times. While the Veteran's Affairs teaching hospitals still allow cases to proceed with indirect supervision, many other teaching hospitals/hospital systems have changed supervision policies to mandate faculty presence. Secondary to these pressures, perhaps supervising surgical faculty are scrubbed more frequently but still allowing the trainee to perform a significant portion of the procedure? If this is the case it may facilitate the acquisition of enhanced surgical skills, but still impact the confidence of residency graduates to operate independently. These potential changes in the culture of surgical training are not captured in this retrospective review. In addition, it is impossible to understand factors that contribute to an attending's decision to scrub into a case versus supervise from a distance. Most surgeons can appreciate that not all cholecystectomies or appendectomies are identical and perhaps AR cases were more complicated than AP cases due to factors that are not captured in the database thus contributing to longer operative times. Perhaps more senior surgical faculty were more likely to turn

over a case to a resident than junior faculty? This is also not captured in the VASQIP data set. Finally, regarding differences in pre-operative risk factors and post-operative outcomes between groups, we can only suppose that the former begets the latter. Ultimately, further prospective investigative work is necessary to truly understand the differences between the study groups and decisions that contribute to allowing a resident to operate independently.

In summary, the data presented here demonstrate that decreasing resident autonomy is overwhelming and not justified in the desire to improve patient outcomes. Given the significant detriment to readiness for independent practice that has been documented by numerous studies, a concerted effort must be made by surgical faculty to increase resident autonomy.

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