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Resident perceptions and evaluations of fellow-led and resident-led surgical services

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ABSTRACT

Background: The impact of fellowship training on general surgery residency has remained challenging to assess. Surgical resident perceptions of fellow-led and resident-led surgical services have not been well described.

Methods: Retrospective cross-sectional data were collected from residents' service evaluations from 7/2014 through 7/2017. Surgical services were categorized as resident-led or fellow-led. 31 variables were evaluated and collapsed into 7 factors including clinical experience, educational experiences, clinical staff, workload, feedback, treatment of residents, and overall rotation.

Results: Among all PGY levels, fellow-led surgical services were rated significantly higher ($p < 0.05$) regarding clinical experience, clinical staff, treatment of residents, and overall rotation. PGY1-2 residents rated resident-led services significantly higher in the area of educational experiences, while PGY 3 residents rated resident-led services higher in the area of workload. However, PGY4-5 residents rated fellow-led services significantly higher in all 7 categories. Individual fellow-led services were rated significantly higher for various categories at different PGY levels.

Conclusions: Surgical residents appear to value the educational experiences of fellow-led services. Each fellow-led service may ultimately provide unique educational opportunities and resources for different PGY levels.

Introduction

Graduate surgical education has highly evolved within the last decade. With new work hour restrictions, a wider range of operative cases and surgical approaches to master, and increasing technologies, surgery residency training has been strained.[1] As standard practices shift toward nonoperative management for issues previously treated by surgery, surgery residency programs have experienced additional pressures to train residents.[2] An assessment of the current state of the general surgery training model reveals that United States (U.S.) residents are not universally ready to perform core general surgery procedures by the completion of residency training.[3,4] The American Board of Surgery (ABS), now more than ever, has been focused on optimizing and enhancing surgical education to provide the best training for surgical resident graduates.[5] As surgical practice has become more specialized, the training of surgery residents has evolved similarly.

Within the last few decades, there has been an increasing number of fellowship training programs which have increased in response to the changing surgical training landscape.[6,7] The proportion of surgery residents obtaining additional fellowship training has increased from 67% in 1993 to over 80% in 2010.[6,7] Although these fellowship programs seek to train competent and proficient surgical subspecialists, the impact of fellowship training on surgical resident training has remained a matter of investigation. Within recent years, the relationship between subspecialty fellowship training and general surgery residency has been compared to relationships such as "symbiosis vs. parasitism" or even "friend vs. foe."[1,8]

The impact of fellowship training on general surgery residency has remained challenging to assess. Prior evaluation has focused

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predominantly on resident case volume and index cases using Accreditation Council for Graduate Medical Education (ACGME) case data operative logs or individual resident case data logs over time.[8–12] Within recent years, the impact of case volume on procedural autonomy has failed to demonstrate readiness for independent practice.[3] Other studies have focused on surveys of general surgery program directors or surveys of fellows' and residents' opinions for specific fellowship programs,[13,14] such as minimally invasive surgery (MIS).[15] With these approaches, the overall impact of surgical fellowships on resident education and training remains unclear. However, resident perceptions and evaluations of fellow-led surgical services have not been well evaluated.

This study sought to investigate resident perceptions and evaluations of fellow-led and resident-led surgical services within the realm of general surgery and general surgery subspecialty training at a university hospital, and to determine if there are opportunities to further enhance the training that surgical residents receive at a large academic institution.

Materials and methods

Hospital setting

The University of Michigan is a 1000-bed tertiary care university hospital located in Ann Arbor, Michigan that provides inpatient and outpatient surgical care for patients in Michigan and several neighboring states. It is a high-volume surgical center with a total of 66 operating rooms.

General surgery and subspecialty residencies

The University of Michigan general surgery residency program comprises six residents per class, with the addition of a seventh for the intern class in 2017. The integrated cardiothoracic program consists of two residents per class, and the integrated vascular program consists of one resident per class. During surgical residency, residents rotate on over 12 surgical services, including fellow-led and resident-led surgical services, and participate in over 7000 operative cases annually working with over 100 full time surgical faculty. Surgical residents spend 4-week blocks rotating on surgical services determined for each PGY-level. At the completion of the 4-week service rotation, surgical residents evaluate the service rotations regarding 31 different variables highlighting clinical experiences, autonomy and independence, resident education, formal and informal feedback, peer-to-peer teaching, clinical staff interactions, appropriate supervision, and overall rotation experience. Surgical service evaluations are internally reviewed monthly by the Program Evaluation Committee (PEC).

Surgical service evaluations

To investigate resident perceptions and evaluations of fellow-led and resident-led services, retrospective cross-sectional data were collected from the University of Michigan's resident evaluation software, MedHub (Minneapolis, MN). Service evaluations from categorical general surgery and integrated cardiothoracic and vascular surgery residents' service evaluations from 7/2014 through 7/2017 were retrieved. Resident evaluations were obtained for core general surgery services, including trauma and acute care surgery (ACS), endocrine, MIS, surgical oncology, colorectal, hepatobiliary and pancreatic (HPB), and the Veteran's Affairs (VA) general and vascular services, and general surgery subspecialties, including transplant, thoracic, and pediatric surgery. Surgical services were categorized as resident-led (trauma/ACS, endocrine, MIS, surgical oncology, colorectal, HPB, and VA general & vascular) and fellow-led (transplant, thoracic, pediatric).

Surgical service evaluations were completed by residents each month at the conclusion of the rotation. Service evaluations contained a total of 31 variables which were assessed using a 9-point, Likert-type scale. Scores of 1–3 were designated as “unsatisfactory,” 4–6 as “satisfactory,” and 7–9 as “superior.” If a resident had insufficient contact to assess a variable, “N/A” was selected. Given the extensive list of variables, the 31 variables were collapsed into 7 categories including *clinical experience*, *educational experiences*, *clinical staff*, *workload*, *feedback*, *treatment of residents*, and *overall rotation* (Fig. 1).

Surgical service evaluations were assessed as an overall cohort, using cumulative post-graduate year (PGY) 1–5 residents, for fellow-led and resident-led services. Service evaluations were also evaluated according to similar PGY level, including junior (PGY1-2), mid-level (PGY3), and senior (PGY4-5) residents. To investigate the role of individual fellow-led services, transplant, thoracic, and pediatric surgical services were evaluated and compared to resident-led services using PGY1-5 resident evaluations, and similar PGY levels, including PGY1-2, PGY3, and PGY4-5 residents.

Statistical analyses

Exploratory factor analysis was used to determine the factor structure and unidimensionality of each of the seven factors and Cronbach's alpha was used to measure internal consistency and reliability. Each index measure was created as a mean score of the variable groupings. Mixed linear modeling was used to assess the relationship between fellow-led and resident-led services and the outcomes while adjusting for gender. Simple intercept-only models were initially fit to quantify the amount of intraclass correlation (ICC) present within each evaluation cluster. A general unstructured variance-covariance structure was assumed and restricted maximum likelihood estimation (REML) was used to estimate the variance components. Data are presented as gender-adjusted mean ± SD. All statistical analyses were performed using Stata15 (StataCorp, College Station, TX). A p-value of less than 0.05 was considered statistically significant.

Results

Educational category assessment

The 31 variables loaded onto 7 factors, which included clinical experience, educational experiences, clinical staff, workload, feedback, treatment of residents, and overall rotation. Factor loadings ranged from 0.74 to 0.95 and Cronbach's alpha levels ranged from 0.89 to 0.97 (Table 1).

Cumulative resident evaluations

Overall, 1169 resident evaluations were obtained. Among PGY1-5 resident evaluations (Fig. 2A), fellow-led surgical services were rated significantly higher ($p < 0.05$) regarding clinical experience (7.26 ± 0.11 vs. 6.96 ± 0.10; $p = <0.001$), clinical staff (7.12 ± 0.12 vs 6.85 ± 0.10; $p = <0.001$), treatment of residents (7.62 ± 0.10 vs. 7.47 ± 0.08; $p = 0.048$), and overall rotation (7.03 ± 0.12 vs. 6.74 ± 0.10; $p = 0.020$) when compared to resident-led services. However, no differences were noted in educational experiences, workload, and feedback. Gender was not found to be a statistically significant confounder for any category and PGY level.

Regarding similar PGY levels, PGY1-2 residents rated resident-led services significantly higher in the area of educational experiences (6.90 ± 0.13 vs. 6.59 ± 0.15; $p = 0.006$) with no differences in other categories compared to fellow-led surgical services (Fig. 2B).

Clinical Experience
Quality Of Patient Care Experiences
Mix Of Common And Uncommon Surgical Cases
Ability To Exercise Patient Responsibilities Commensurating With PGY Level

Educational Experiences
Available Set Of Educational Objectives
Clarity Of Educational Objectives
Matching Of Educational Objectives With Rotation Experience
Quality Of Didactic Activities
Commitment To Resident Education
Availability To Participate In Educational Activities
Overall Educational Experience

Clinical Staff
Availability Of Faculty For Assistance With Patient Care
Availability Of Faculty To Discuss Patient Management
Number Of Nursing Staff
Quality Of Nursing Staff

Workload
Adequacy Of The Number of Patients On Service
Amount Of Service Work
Number Of Patients For Which You are Responsible
Night Call Schedule
Degree of Scut Work
Availability Of Relief When Fatigued or Excessive Workload

Feedback
Frequency Of Formal Evaluations
Constructiveness Of Feedback From Formal Evaluations
Frequency Of Informal Evaluations
Constructiveness Of Feedback From Informal Evaluations

Treatment of Residents
Treatment By Faculty/Staff/Attendings
Responsiveness Of Faculty To Resident Issues/Complaints

Overall Rotation
Overall Education
Overall Supervision
Overall Clinical Support
Overall Workload
Overall Treatment Of Residents

Fig. 1. Individual variables and category construction.

Table 1
Category analysis and alpha level following variable collapse.

Categories	Alpha Level
Clinical Experience	0.91
Educational Experience	0.95
Clinical Staff	0.97
Workload	0.90
Feedback	0.97
Treatment of Residents	0.89
Overall Evaluation	0.97

PGY3 residents rated resident-led services significantly higher in the area of workload (7.19 ± 0.23 vs. 6.89 ± 0.25; $p = 0.040$) with no differences in other categories compared to fellow-led surgical services (Fig. 2C). However, PGY4-5 residents rated fellow-led services significantly higher in all categories, including clinical experience (8.03 ± 0.25 vs. 6.97 ± 0.19; $p = <0.001$), educational experiences (7.87 ± 0.25 vs. 7.03 ± 0.19; $p = <0.001$), clinical staff (7.62 ± 0.26 vs. 7.00 ± 0.21; $p = <0.001$), workload (7.57 ± 0.29 vs. 6.80 ± 0.22; $p = <0.001$), feedback (7.40 ± 0.31 vs. 6.65 ± 0.25; $p = <0.001$), treatment of residents (8.06 ± 0.23 vs. 7.36 ± 0.17; $p =$

A.

Categories	Fellow-Led Services (n=217)	Resident-Led Services (n=952)	P-Value
Clinical Experience	7.26 ± 0.11	6.96 ± 0.09	**<0.001**
Educational Experiences	6.95 ± 0.12	6.94 ± 0.10	0.841
Clinical Staff	7.12 ± 0.12	6.85 ± 0.10	**<0.001**
Workload	6.73 ± 0.13	6.64 ± 0.11	0.360
Feedback	6.40 ± 0.16	6.32 ± 0.14	0.343
Treatment of Residents	7.62 ± 0.10	7.47 ± 0.08	**0.048**
Overall Rotation	7.03 ± 0.12	6.74 ± 0.10	**0.020**

B.

Categories	Fellow-Led Services (n=112)	Resident-Led Services (n=554)	P-Value
Clinical Experience	7.03 ± 0.15	6.94 ± 0.11	0.453
Educational Experiences	6.59 ± 0.15	6.90 ± 0.13	**0.006**
Clinical Staff	7.00 ± 0.15	6.81 ± 0.12	0.089
Workload	6.49 ± 0.17	6.56 ± 0.13	0.612
Feedback	5.89 ± 0.20	6.17 ± 0.17	0.051
Treatment of Residents	7.50 ± 0.13	7.53 ± 0.11	0.712
Overall Rotation	6.87 ± 0.15	7.02 ± 0.12	0.168

C.

Categories	Fellow-Led Services (n=69)	Resident-Led Services (n=146)	P-Value
Clinical Experience	7.27 ± 0.23	7.19 ± 0.21	0.579
Educational Experiences	7.15 ± 0.25	7.24 ± 0.24	0.466
Clinical Staff	7.20 ± 0.24	7.06 ± 0.23	0.287
Workload	6.89 ± 0.25	7.19 ± 0.23	**0.040**
Feedback	6.94 ± 0.28	6.91 ± 0.27	0.820
Treatment of Residents	7.57 ± 0.23	7.47 ± 0.22	0.464
Overall Rotation	7.30 ± 0.23	7.30 ± 0.22	0.964

D.

Categories	Fellow-Led Services (n=36)	Resident-Led Services (n=251)	P-Value
Clinical Experience	8.03 ± 0.25	6.97 ± 0.19	**<0.001**
Educational Experiences	7.87 ± 0.25	7.03 ± 0.19	**<0.001**
Clinical Staff	7.62 ± 0.26	7.00 ± 0.21	**<0.001**
Workload	7.57 ± 0.29	6.80 ± 0.22	**<0.001**
Feedback	7.40 ± 0.31	6.65 ± 0.25	**<0.001**
Treatment of Residents	8.06 ± 0.23	7.36 ± 0.17	**<0.001**
Overall Rotation	7.93 ± 0.26	6.99 ± 0.20	**<0.001**

Fig. 2. Resident Evaluations for Fellow-Led and Resident-Led Services. Cumulative (A), PGY1-2 (B), PGY3 (C), and PGY4-5 (D) resident evaluations.

<0.001), and overall rotation (7.93 ± 0.26 vs. 6.99 ± 0.20; p = <0.001) (Fig. 2D). Gender was not found to be a statistically significant confounder for any category and PGY level.

Transplant surgery

Among PGY1-5 resident evaluations, the fellow-led transplant surgery service was rated significantly higher in all 7 categories (Fig. 3A). Regarding similar PGY levels, PGY1-2 residents rated the fellow-led transplant services significantly higher in the areas of clinical experience, clinical staff, workload, treatment of residents, and overall rotation, while PGY3 residents rated it significantly higher in all categories (Fig. 3B and C). However, no differences were noted for any category between the fellow-led transplant service and resident-led services for PGY4-5 residents (Fig. 3D).

Thoracic surgery

Among PGY1-5 resident evaluations, the fellow-led thoracic surgery service was rated significantly higher in all 7 categories (Fig. 4A). Regarding similar PGY levels, PGY1-2 residents rated the fellow-led thoracic service significantly higher in the area of clinical staff, while PGY3 residents rated resident-led services

A.

Categories	Transplant Service (n=71)	Resident-Led Services (n=952)	P-Value
Clinical Experience	7.72 ± 0.15	6.96 ± 0.09	**<0.001**
Educational Experiences	7.39 ± 0.15	6.94 ± 0.10	**<0.001**
Clinical Staff	7.48 ± 0.15	6.82 ± 0.11	**<0.001**
Workload	7.21 ± 0.17	6.65 ± 0.11	**<0.001**
Feedback	6.83 ± 0.20	6.30 ± 0.13	**<0.001**
Treatment of Residents	8.06 ± 0.14	7.47 ± 0.09	**<0.001**
Overall Rotation	7.69 ± 0.15	7.02 ± 0.20	**<0.001**

B.

Categories	Transplant Service (n=37)	Resident-Led Services (n=554)	P-Value
Clinical Experience	7.67 ± 0.20	6.93 ± 0.12	**<0.001**
Educational Experiences	7.15 ± 0.21	6.89 ± 0.13	0.131
Clinical Staff	7.41 ± 0.21	6.78 ± 0.13	**0.010**
Workload	7.08 ± 0.24	6.56 ± 0.14	**0.013**
Feedback	6.30 ± 0.27	6.14 ±0.17	0.478
Treatment of Residents	8.14 ± 0.18	7.53 ± 0.11	**<0.001**
Overall Rotation	7.65 ± 0.20	7.02 ± 0.12	**<0.001**

C.

Categories	Transplant Service (n=18)	Resident-Led Services (n=146)	P-Value
Clinical Experience	8.03 ± 0.28	7.15 ± 0.21	**<0.001**
Educational Experiences	7.89 ± 0.28	7.24 ± 0.23	**<0.001**
Clinical Staff	7.97 ± 0.30	7.02 ± 0.24	**<0.001**
Workload	8.01 ± 0.29	7.13 ± 0.23	**<0.001**
Feedback	7.93 ± 0.33	6.90 ± 0.27	**<0.001**
Treatment of Residents	8.31 ± 0.28	7.43 ± 0.22	**<0.001**
Overall Rotation	8.09 ± 0.27	7.25 ± 0.22	**<0.001**

D.

Categories	Transplant Service (n=18)	Resident-Led Services (n=251)	P-Value
Clinical Experience	7.52 ± 0.34	6.99 ± 0.20	0.076
Educational Experiences	7.43 ± 0.32	7.04 ± 0.20	0.144
Clinical Staff	7.33 ± 0.31	7.01 ± 0.22	0.173
Workload	6.89 ± 0.37	6.83 ± 0.23	0.834
Feedback	7.07 ± 0.38	6.65 ± 0.25	0.178
Treatment of Residents	7.60 ± 0.30	7.38 ± 0.17	0.419
Overall Rotation	7.33 ± 0.34	7.01 ± 0.21	0.273

Fig. 3. Resident Evaluations for the Transplant Service and Resident-Led Services. Cumulative (A), PGY1-2 (B), PGY3 (C), and PGY4-5 (D) resident evaluations.

higher in the area of workload (Fig. 4B and C). However, PGY4-5 residents rated the fellow-led thoracic surgery service significantly higher for all 7 categories when compared to resident-led services (Fig. 4D).

Pediatric surgery

Among PGY1-5 resident evaluations, the fellow-led pediatric surgery service was rated significantly lower in all 7 categories compared to resident-led services (Fig. 5A). Regarding similar PGY levels, PGY1-2 and PGY3 residents rated resident-led services significantly higher in all 7 categories (Fig. 5B and C). However, no differences were noted for any category between the pediatric service and resident-led services for PGY4-5 residents (Fig. 5D).

Discussion

As surgical practice becomes more specialized and a growing number residents pursue additional specialty training, the impact of fellowship training on surgery residencies requires investigation. Although prior studies have focused on case volume and the number of index cases,[8–12] little is known regarding resident perceptions and evaluations of fellow-led surgical services. To investigate this, we compared general surgery and integrated cardiothoracic and vascular surgery residents' monthly surgical service evaluations between fellow-led and resident-led surgical services. This study demonstrates that surgical residents value the experiences and resources of fellow-led surgical services compared to resident-led services at specific PGY levels. Overall, each fellow-led service may provide unique educational opportunities and

A.

Cumulative	Thoracic Service (n=59)	Resident-Led Services (n=952)	P-Value
Clinical Experience	7.67 ± 0.17	6.96 ± 0.09	**<0.001**
Educational Experiences	7.32 ± 0.17	6.94 ± 0.10	**0.005**
Clinical Staff	7.32 ± 0.17	6.83 ± 0.11	**<0.001**
Workload	6.97 ± 0.19	6.64 ± 0.11	**0.040**
Feedback	6.72 ± 0.21	6.30 ± 0.14	**0.013**
Treatment of Residents	7.77 ± 0.15	7.46 ± 0.09	**0.017**
Overall Rotation	7.54 ± 0.17	7.02 ± 0.10	**<0.001**

B.

PGY1-2	Thoracic Service (n=10)	Resident-Led Services (n=554)	P-Value
Clinical Experience	7.49 ± 0.38	6.92 ± 0.12	0.125
Educational Experiences	6.90 ± 0.37	6.89 ± 0.13	0.975
Clinical Staff	7.66 ± 0.38	6.77 ± 0.13	**0.016**
Workload	6.29 ± 0.43	6.54 ± 0.14	0.547
Feedback	5.99 ± 0.47	6.13 ± 0.17	0.757
Treatment of Residents	7.05 ± 0.33	7.52 ± 0.11	0.135
Overall Rotation	6.86 ± 0.37	7.02 ± 0.12	0.668

C.

PGY3	Thoracic Service (n=31)	Resident-Led Services (n=146)	P-Value
Clinical Experience	7.32 ± 0.25	7.17 ± 0.21	0.387
Educational Experiences	7.06 ± 0.26	7.21 ± 0.23	0.281
Clinical Staff	7.10 ± 0.27	6.99 ± 0.23	0.531
Workload	6.82 ± 0.26	7.14 ± 0.23	**0.044**
Feedback	6.67 ± 0.31	6.86 ± 0.27	0.278
Treatment of Residents	7.57 ± 0.26	7.43 ± 0.22	0.394
Overall Rotation	7.30 ± 0.25	7.26 ± 0.22	0.757

D.

PGY4-5	Thoracic Service (n=18)	Resident-Led Services (n=251)	P-Value
Clinical Experience	8.48 ± 0.32	6.98 ± 0.19	**<0.001**
Educational Experiences	8.26 ± 0.30	7.02 ± 0.19	**<0.001**
Clinical Staff	7.88 ± 0.29	7.01 ± 0.21	**<0.001**
Workload	8.20 ± 0.35	6.80 ± 0.22	**<0.001**
Feedback	7.84 ± 0.37	6.64 ± 0.24	**<0.001**
Treatment of Residents	8.44 ± 0.28	7.35 ± 0.17	**<0.001**
Overall Rotation	8.46 ± 0.32	6.98 ± 0.19	**<0.001**

Fig. 4. Resident Evaluations for the Thoracic Service and Resident-Led Services. Cumulative (A), PGY1-2 (B), PGY3 (C), and PGY4-5 (D) resident evaluations.

resources for different PGY levels.

This study presents a novel and unique method, using resident perceptions and evaluations, contributing to the growing body of literature regarding the impact of fellowship training on general surgery residency training. Previous studies have utilized ACGME operative logs, case data over time, surveys of case numbers, as well as surveys of GS program directors, fellows, and resident opinions.[8–14,16–21] Collectively, the impact of fellowship training on surgical resident education remains unclear. Most studies rely on limited data with questionable generalizability. While some studies have demonstrated that fellows have a clear, negative impact on total cases and index cases for surgical residents,[9,10,22,23] others have demonstrated minimal impact, or even increased case volume secondary to a fellow's presence.[12,19,24,25] Although appropriate case volume and achieving adequate numbers of index cases are crucial to surgical training, these prior assessment methods fail to account for other crucial aspects of surgical training including clinical experience, educational experiences, leadership, feedback, and learning, all of which often occur outside of the operating room.

Understanding how fellow-led surgical services impact the non-operative aspects of surgical training is crucial to providing the best training for residents. Surgical resident perceptions and evaluations of the impact of fellow-led surgical services have not been well studied. Within the literature, only a limited number of studies have surveyed resident perceptions and opinions across a wide range of surgical fields. In surveying resident opinions on the presence of MIS fellows, Ratter et al. determined that 24% of residents felt that their education was impeded by working with fellows, and 65% of residents feared that fellows would interfere with their training.[26] Similarly, Poenarue et al. demonstrated that general surgery residents felt less competent in treating pediatric

A.

Categories	Pediatric Service (n=87)	Resident-Led Services (n=952)	P-Value
Clinical Experience	6.62 ± 0.15	6.97 ± 0.10	**0.004**
Educational Experiences	6.36 ± 0.15	6.94 ± 0.10	**<0.001**
Clinical Staff	6.68 ± 0.15	6.84 ± 0.11	0.143
Workload	6.17 ± 0.17	6.65 ± 0.11	**<0.001**
Feedback	5.83 ± 0.19	6.32 ± 0.14	**<0.001**
Treatment of Residents	7.13 ± 0.13	7.47 ± 0.09	**<0.001**
Overall Rotation	6.47 ± 0.15	7.02 ± 0.10	**<0.001**

B.

Categories	Pediatric Service (n=65)	Resident-Led Services (n=554)	P-Value
Clinical Experience	6.48 ± 0.31	7.10 ± 0.25	**0.032**
Educational Experiences	6.24 ± 0.18	6.89 ± 0.13	**<0.001**
Clinical Staff	6.70 ± 0.18	6.80 ± 0.13	0.459
Workload	6.24 ± 0.19	6.55 ± 0.13	0.062
Feedback	5.62 ± 0.23	6.15 ± 0.17	**0.003**
Treatment of Residents	7.20 ± 0.15	7.53± 0.11	**0.006**
Overall Rotation	6.44 ± 0.17	7.02 ± 0.2	**<0.001**

C.

Categories	Pediatric Service (n=20)	Resident-Led Services (n=146)	P-Value
Clinical Experience	7.97 ± 0.84	6.99 ± 0.20	**0.002**
Educational Experiences	6.62 ± 0.30	7.18 ± 0.27	**0.001**
Clinical Staff	6.53 ± 0.31	6.96 ± 0.26	**0.024**
Workload	5.99 ± 0.32	7.06 ± 0.27	**<0.001**
Feedback	6.41 ± 0.35	6.85 ± 0.29	0.051
Treatment of Residents	6.90 ± 0.30	7.40 ± 0.26	**0.006**
Overall Rotation	6.54 ± 0.30	7.22 ± 0.26	**<0.001**

D.

Categories	Pediatric Service (n=4)	Resident-Led Services (n=251)	P-Value
Clinical Experience	6.25 ± 0.18	6.89 ± 0.13	0.233
Educational Experiences	7.92 ± 0.76	7.04 ± 0.19	0.231
Clinical Staff	7.84 ± 0.67	7.02 ± 0.21	0.199
Workload	7.05 ± 0.87	6.83 ± 0.22	0.790
Feedback	6.40 ± 0.88	6.65 ± 0.25	0.773
Treatment of Residents	8.20 ± 0.75	7.37 ± 0.17	0.261
Overall Rotation	7.86 ± 0.83	7.00 ± 0.20	0.289

Fig. 5. Resident Evaluations for the Pediatric Service and Resident-Led Services. Cumulative (A), PGY1-2 (B), PGY3 (C), and PGY4-5 (D) resident evaluations.

surgical diseases when working in the presence of a pediatric surgery fellow.[27] Other studies in the fields of obstetrics, gynecology, and urology have demonstrated that fellows have not been well perceived, and, in fact, detracted from resident education, resources, and clinical opportunities.[16,21]

This is the first study to assess resident perceptions and evaluations of fellow-led services using resident service evaluations comparing general surgery subspecialties with core surgical services. In this study, we demonstrated that several variables, including clinical experience, clinical staff, treatment of residents, and overall rotation were rated higher for fellow-led services compared to resident-led services for PGY1-5 resident evaluations. When assessing service evaluations by PGY level, we found that senior (PGY4-5) residents reported significant advantages to training while rotating on fellow-led services. Despite the close proximity in PGY level to fellows, senior residents still reported significant benefits to rotating on fellow-led services in terms of clinical experience, educational experiences, feedback, treatment of residents, overall rotation, and other categories. This demonstrates that although case volume and index cases are important to surgical training, senior residents appreciate and receive additional educational value and benefits while rotating on services with fellows. Junior (PGY1-2) and mid-level (PGY3) residents, however, reported similar ratings for fellow-led and resident-led services.

After conducting a subgroup analysis assessing each fellow-led service, it is clear that fellow-led services may provide unique educational opportunities and resources for different PGY levels. For the transplant surgery service, junior and mid-level residents reported significant advantages to training including clinical experience, educational experiences, workload, treatment of

residents, overall rotation as well as other categories. At our institution, junior residents are exposed to a wide range of surgical pathologies and patient care experiences, while participating in shift work (12 hour shifts) and always being accessible to the transplant fellow. In addition, mid-level residents are predominantly responsible for conducting vascular access cases and kidney transplants, which contributes heavily to the well-perceived experience of a PGY-3 resident. For senior residents, there was a trend towards increased ratings of the fellow-led transplant service, although this was not statistically significant.

For thoracic surgery, we found that junior and mid-level residents evaluated and perceived the thoracic surgery service similar to resident-led services, although senior residents rated the thoracic surgery service significantly higher in all categories. Our thoracic surgery service is currently divided into two services, one which is led by a fellow, and the other by a senior resident. The ability to lead independently while functioning with a fellow at a similar level may explain why senior residents highly value such an educational opportunity and experience. Although case volume and index cases are important for the technical aspects of surgical training, these results demonstrate that surgical residents value the non-technical components of surgical training including clinical experiences, educational experiences, feedback, treatment, and overall rotation experiences.

As surgical residency programs conduct internal reviews to improve surgical training, assessment of fellow-led service evaluations from residents should be analyzed critically. If fellow-led services can significantly enhance the training, educational opportunities, and resources of a residency program, surgical residents should continue to rotate on fellow-led services. However, if fellow-led services are not perceived as enhancing the educational experiences and opportunities of residents, resident exposure to such services may need to be reassessed. For pediatric surgery services, we found that junior and mid-level residents perceived and evaluated the pediatric surgery service lower than resident-led services, although senior residents rated it similarly to resident-led services. However, it is difficult to formulate conclusions regarding senior residents, as only a limited number of residents rotated in pediatric surgery in our study. Across the country, it is well known that pediatric surgery is a predominantly fellow-run surgical service requiring senior knowledge in the care of critical pediatric patients. After critically analyzing these evaluations, our pediatric surgery service has implemented significant program changes to enhance the clinical experiences, learning, autonomy, and independence of surgical residents. Preliminary pediatric surgery service evaluations following implementation of these changes have demonstrated marked improvement, even mirroring those of other fellow-led services.

This study has several limitations. First, resident service evaluations were only obtained from a single institution. Thus, these result may have questionable generalizability as resident roles and contributions may vary across institutions. Second, the resident service evaluation forms utilized in this study have not been well-validated to fully assess resident perceptions and evaluations. Third, evaluating each individual fellow-led service against resident-led services may have contributed to underpowered comparisons and, thus, it may be difficult to draw accurate conclusions. Fourth, although statistically significant differences were observed for categories between fellow-led and resident-led services, the differences in ratings, such as a “6” versus a “7,” may not provide high educationally-meaningful value and relevance. Our future work will focus on multi-institutional studies using a well-validated and educationally-meaningful tool to evaluate resident perceptions and evaluations.

In conclusion, this is the first study to assess the resident perceptions and evaluations of fellow- and resident-led services in core general surgery services and subspecialties. Surgical residents appear to value the experiences and opportunities presented by fellow-led surgical services. Each fellow-led service may provide unique opportunities and resources for different PGY levels. If educational opportunities and resources are not providing at least similar experiences to further resident education in the setting of fellow-led services when compared to resident-led services, curriculum changes may need to be implemented to provide the best training for surgical residents.

Level of evidence

Research Article (Retrospective Review).

Conflicts of interest

None to report.

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