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Interim Analysis of a Prospective, Multi-Institutional Study of Surgery Resident Experience with Flexibility in Surgical Training

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Abstract

Background—The Flexibility in Surgical Training (FIST) consortium project was designed to evaluate the feasibility and resident outcomes of optional subspecialty-focused training within general surgery residency training.

Study Design—Following approval by the American Board of Surgery, R4 and R5 residents were permitted to customize up to 12 of the final 24 months of residency for early tracking into one of nine subspecialty tracks. A prospective IRB-approved study was designed across seven institutions to evaluate the impact of this option on operative experience, in-service exam (ABSITE) and ACGME milestone performance, and resident and program director (PD) perceptions. FIST residents were compared to chief residents prior to FIST initiation (controls) as well as residents during the study period who did not participate in FIST (no specialization track, NonS).

Results—From 2013–17, 122 of 214 chief residents (57%) completed a FIST subspecialty track. There were no differences in median ABSITE scores between FIST, NonS residents, and controls. ACGME milestones at the end of the R5 year favored the FIST residents in 13 of 16 milestones compared to NonS. Case logs demonstrated an increase in track-specific cases compared to NonS residents. Resident and PD surveys reported a generally favorable experience with FIST.

Conclusion—In this prospective study, FIST is a feasible option in participating institutions. All FIST residents, regardless of track, met requirements for ABS Board eligibility, despite

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modifications to rotations and case experience. Future studies will assess the impact of FIST on ABS exam results and fellowship success.

Keywords

Surgical Education; Flexibility in Surgical Training (FIST); General Surgery Residency

Introduction

Surgical training in the United States has evolved over the past two decades with an increasing proportion of residents pursuing subspecialty training after general surgery residency^{1,2}. Despite this trend, some fellowship directors feel residents arrive unprepared for fellowship³. Major factors influencing this trend toward increased fellowship training include changing management of common diseases, the shift toward minimally invasive surgery and non-surgical management of some entities, and the work hours limitations⁴. In order to meet changing workforce needs and variations in learner style, the American Board of Surgery (ABS), its component Boards and associated Boards, in cooperation with the relevant Residency Review Committees (RRCs), have created multiple training paradigms. Our group has reported previously on an interim analysis of these early specialization program (ESP) tracks in cardiothoracic (CT) and vascular (Vasc) surgery^{5, 6}.

Building on the early success of ESP in these subspecialties, and in response to prior calls for residency redesign^{7, 8}, in 2011 the ABS approved flexible rotations for general surgery residency training, referred to as FIT (flexibility in training)⁹. FIT allows residents dedicated time in rotations tailored to their eventual specialty choice. This optional program allows residents and their program directors (PDs) to customize up to 12 months in the last 36 months of training (with no more than six months of flexible training in a single year). Residents opting for flexibility tracks are required to meet the ACGME case log minimums despite being allowed to spend as many as 12 months in customized rotations; additionally, if all training requirements are met, they are eligible for ABS certification in general surgery. Flexibility tracks provide for early and more in-depth experience with a subspecialty than would be achieved by standard scheduling but do not reduce fellowship training time or count toward fellowship case requirements. Suggestions for rotations by specialty track are listed on the ABS website and were derived by specialty area leaders who suggest specific rotations for residents who intend to undertake fellowship training in a given area. For example, residents planning careers in acute care surgery are advised to increase their cardiothoracic and vascular experience with the flexible option, in addition to rotations on trauma surgery⁹.

The current multi-institutional study was designed to investigate the feasibility of FIT in a consortium of residency programs that met in 2012 to agree to prospectively evaluate this training option. Feasibility of incorporating the myriad training tracks; resident outcome as assessed by objective measures of the following metrics: ACGME milestones, operative case logs, ABS in-service training exam (ABSITE) scores; and subjective attitudinal surveys were incorporated into the study. Trainees in these tracks would be compared to those not

involved in subspecialty tracks as well as those residents prior to initiation of the flexibility option, to determine if such information could inform future residency redesign efforts.

Methods

A group of general surgery PDs and leaders in surgical education created a consortium of nine residency programs known as the Flexibility in Surgical Training (FIST) consortium to prospectively collect data on residents participating in flexibility tracks (i.e., FIT) as allowed by the ABS. Informed consent was obtained from participating residents, regardless of track, including those not enrolled in a specialty track (NonS), prior to collection of data. Data regarding resident track, ABSITE score, ACGME milestones, and defined category case log reports were de-identified and compiled in a centralized database. Residents and PDs were surveyed on an annual basis regarding their experience with flexibility rotations. The 50 residents who completed training in 2013, prior to initiation of FIST but within the study period, serve as a historical control cohort and are referred to as “controls” for the context of this study. Statistical analysis included testing groups for normality using D’Agostino & Pearson normality test. Parametric groups were compared using ANOVA with Tukey’s multiple comparisons test and nonparametric groups were compared using Mann-Whitney or Kruskal-Wallis test with Dunn’s multiple comparisons test as appropriate.

Results

There were 214 residents from seven general surgery programs who participated in the FIST consortium (Table 1) from 2013–2017 across nine flexibility tracks (Table 2). Resident participation in flexibility at each program ranged from 0% – 91% with an average participation in at least one flexible rotation of 57%. The most common flexible tracks were gastrointestinal surgery (GI Surg) (13%), CT (11%), and surgical oncology (Surg Onc) (10%) (Table 3). In this study, for the purposes of both CT and vascular surgery, a trainee who was either formally enrolled in CT or vascular ESP or simply in a “flexible track” (without the strict rotation requirements of the ESPs) were included as “flexible track” trainees in their respective specialties.

Two residency programs that initially were part of the 9-member consortium declined further participation after initial involvement; one cited lack of interest and feasibility after initial interest in FIST while the other experienced a change in leadership and was no longer able to provide administrative support for data collection for purposes of this study. Therefore, residents from these two programs were excluded from the data analysis.

ABSITE Performance

The PGY 5 ABSITE raw score was compared among FIST, NonS, and control residents. There was no difference in performance across these groups ($p=0.19$) (Figure 1). Additionally, there was no significant difference when the PGY 5 ABSITE was compared across FIST tracks ($p=0.25$, data not shown). Similar results were found when PGY 4 ABSITE scores were compared between FIST and NonS residents ($p = 0.09$, data not shown).

ACGME Milestones

Residents participating in FIST scored significantly higher on 13 of 16 ACGME milestones when compared to NonS (Table 4). The majority of FIST and NonS residents achieved the highest level on the milestones.

Case Logs

Residents in CT surgery and vascular surgery flexible tracks performed significantly more cases than the controls in their respective specialties. CT track residents performed significantly more thoracic cases than NonS and control residents (Thoracic Cases: CT 128 vs NonS 31, $p<0.001$; CT 128 vs Control 34, $p<0.001$; Kruskal-Wallis comparison of all groups $p<0.001$; all case log data represents the median number of cases and p-value represents results from multiple comparison test; Figure 2A). Vascular track residents performed significantly more vascular cases than control and had a trend toward increased cases compared to NonS (Vascular cases: Vasc 183 vs NonS 104, $p=0.18$; Vasc 183 vs Control 87, $p=0.02$; Kruskal-Wallis comparison of all groups $p=0.002$; Figure 2B).

FIST residents with a focus on abdominal surgery (Colorectal (CRS) and GI Surgery) performed significantly more alimentary operations than the NonS residents. The control residents also performed significantly more alimentary operations than the NonS residents (Alimentary: CRS 263 vs NonS 190, $p=0.03$; GI Surg 261 vs NonS 190, $p=0.01$; Control 230 vs NonS 190, $p=0.01$; CRS and GI Surg vs Control, non-significant; Kruskal-Wallis comparison of all groups $p<0.001$; Figure 2C). Residents in the GI Surgery track performed more abdominal operations and endoscopies than NonS residents while the control residents also performed more abdominal operations than NonS residents (Abdominal cases: GI Surg 326 vs NonS 271, $p=0.01$; Control 326 vs NonS 271, $p=0.01$; GI Surg vs Control, non-significant; Kruskal-Wallis comparison of all groups $p<0.001$; Endoscopy: GI Surg 192 vs NonS 130, $p=0.01$; GI Surg 192 vs Control 151, non-significant; Kruskal-Wallis comparison of all groups $p=0.003$; data not shown).

The trend of increased cases was also seen in the other FIST tracks. Surg Onc and Transplant (Txp) performed significantly more pancreas cases (Surg Onc 21 vs NonS 14, $p=0.02$; Txp 32 vs NonS 14, $p=0.01$; Surg Onc and Txp vs Control 17, non-significant; Kruskal-Wallis comparison of all groups $p<0.001$; Figure 2D), and Txp performed significantly more liver cases (Txp 27 vs NonS 11, $p=0.01$; Txp 27 vs Control 13, $p=0.03$; Kruskal-Wallis comparison of all groups $p=0.006$; data not shown). Pediatric track (Peds) residents performed more pediatric cases (Peds 51 vs NonS 28, $p=0.02$; Peds 51 vs Control 38, $p=0.02$; Kruskal-Wallis comparison of all groups $p<0.001$), and plastic surgery track (PRS) residents performed more plastics cases (PRS 59 vs NonS 20, $p=0.001$; PRS 59 vs Control 32, non-significant; Control 32 vs NonS 20, $p=0.03$; Kruskal-Wallis comparison of all groups $p<0.001$; data not shown).

When considering total case numbers, residents participating in a FIST track performed significantly more total cases than NonS or control residents (FIST 1046 vs NonS 915, $p=0.01$; FIST 1046 vs Control 1039, non-significant; NonS 915 vs Control 1039, $p=0.02$; ANOVA comparison of all groups $p=0.005$; Figure 2E) however, there was no significant

difference in total chief cases between the comparison groups (FIST 223 vs NonS 210 vs Control 230, ANOVA comparison of all groups $p=0.18$, Figure 2F). All residents, regardless of track, met the ACGME case log minimum.

Survey findings

Review of the subsequent resident and PD surveys continues to show overall strong favorability for the FIST track options as well as improved mentorship and autonomy, (data now shown, but similar to previously reported results¹⁰).

Discussion

Residents in FIST tracks were uniformly successful in multiple measures, despite shortened numbers of months in the “standard” residency experience. Residents who participated in the FIST tracks performed better on the majority of ACGME milestones (although the “clinical significance” of this statistical difference is unclear) and performed more cases in their chosen subspecialty than their contemporaneous NonS residents, while simultaneously meeting all ACGME case minimums. FIST residents also endorsed strong feelings of mentorship and autonomy related to spending more time on a single service, similar to prior reported data¹⁰. This increased autonomy and mentorship was also seen in ESP track residents, as previously reported⁵. PDs report residents who have the most success with FIST are the highly motivated residents who identify a subspecialty track early in their training. Trainees in these tracks are undoubtedly a highly motivated and self-selecting group who have met the minimum case requirements on services outside of their FIST track thus allowing more rotation time on their selected FIST track.

Much of the early success of FIST is at least partially related to program selection. All programs in this study are university-based training programs that have the case volume and complexity to support both a general surgery residency and multiple fellowships. Additionally, these training programs have at least five residents per class allowing for increased flexibility in scheduling. Early during the course of the study, two programs dropped out due to feasibility and interest issues, and an additional program that was included in this analysis did not have any resident complete a FIST track but was interested in participating to supply data. Therefore, three out of the original nine consortium programs were non-participants in FIST suggesting this option of embracing FIT is not for all programs.

While significant benefits were seen in the FIST group, it is important that the gains observed were not at the expense of the NonS group. The majority of the NonS group scored well on the ABSITE, met the highest level on ACGME milestones, and performed more than 900 total cases during residency. However, sustaining a robust training experience for non-participants (NonS) is critical to maintain for PDs who are considering adopting these training opportunities. The option for flexibility is highly sought after by some applicants to residency training programs and has a high satisfaction with residents and PDs¹⁰. Representative comments from the survey data include a PD comment, “I like that it gives residents the opportunity to spend a significant amount of time to concentrate on one subspecialty of interest that they would certainly not otherwise get with standard training.

With this concentrated experience, residents essentially assume the role of a fellow and thus have increased exposure to complex operative procedures, increased autonomy with simpler procedures, and opportunities to lead their respective health care teams.” A comment from a resident highlights one of the challenges in scheduling: “There were a few rotations I did not do because there simply wasn’t time to do both. While I somewhat regret missing those rotations, on the whole, I would make the same decision.” Importantly, successful implementation of flexibility allows for trainees to obtain an important balance of the breadth of general surgery with a focused experience in a subspecialty compared to those in an integrated residency who lose experience in the breadth of general surgery. As elucidated by our survey data, FIST residents may be required to forego highly regarded chief level rotations to NonS residents or other FIST residents in order to spend more time in their area of choice. This maintains fairness and distribution of the resident workload. Participants in this study used FIST to further their subspecialty pursuits, which is consistent with the typical career desires of residents in these participating institutions. While an increasing number of trainees desire subspecialty focused careers, an over-emphasis on subspecialty training may worsen the workforce shortages in general surgery^{11–13}. For a trainee who desires to be a general surgeon, the flexibility option could be used to enhance training by increasing exposure to one of several areas, such as GI surgery, acute care surgery, and/or endoscopy. Such additional exposure could be useful if the resident has committed to a surgical position that requires a specific skill set, as might exist in a practice where endoscopy is heavily featured, for instance.

Limitations of this study include a relatively small consortium where all programs included are large, university-based, and with residents who predominately pursue fellowship training. Thus, experience may not translate to smaller programs or when few residents are interested in pursuing a subspecialty fellowship to balance the potential impact on NonS residents. Additionally, the programs included in this study had a variable rate of resident participation in FIST such that some of the differences reported in this study may be due to between-program differences and not necessarily differences in FIST versus NonS residents.

Conclusions

In this prospective study, FIST has proven to be a feasible option for the residents and training programs at the majority of participating institutions. All residents, regardless of track, met requirements for ABS certification eligibility, despite modifications to rotations and case experience. Future studies will assess the impact of FIST on ABS exam results and fellowship success.

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Abbreviations

ABS	American Board of Surgery
ABSITE	American Board of Surgery In-service Training Exam
ACGME	Accreditation Council for Graduate Medical Education
ACS	Acute Care Surgery/Surgical Critical Care
CRS	Colorectal Surgery
CT	Cardiothoracic Surgery
ESP	Early Specialization Program
FIT	Flexibility in Training
FIST	Flexibility in Surgical Training
GI Surg	Gastrointestinal Surgery
NonS	No specialization track
Peds	Pediatric Surgery
PD	Program Director
PRS	Plastic Surgery
RRC	Residency Review Committee
Surg Onc	Surgical Oncology
Txp	Transplant
Vasc	Vascular

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Figure 1. PGY 5 ABSITE Scores. PGY 5 ABSITE raw scores by track. Center line, median; box, 25th–75th percentile; whiskers, 2.5–97.5%, dots representing outliers. ABSITE, American Board of Surgery In-service Training Exam; FIST, residents in flexibility tracks, NonS = non-flexibility residents

Figure 2.

Resident case logs. ACGME-defined category report comparing case logs of residents in selected FIST tracks with NonS residents and historical controls. P-value represents results of ANOVA or Kruskal-Wallis test, as appropriate. Shading represents result of multiple comparison test as delineated by the legend. Dashed line represents ACGME defined category minimum. Center line, median; box, interquartile range; whiskers, 2.5–97.5%, dots representing outliers.

Table 1

Flexibility in Surgical Training Participating Institutions

Participating institution*
Brigham and Women's Hospital
Emory University
Johns Hopkins University
Massachusetts General Hospital
Northwestern University
Oregon Health and Science University
Washington University in St Louis

*
Two institutions dropped out as noted in the text and are therefore not included on this list

Table 2

Available Flexibility in Surgical Training Tracks

FIST track	Abbreviation
Acute care surgery/surgical critical care	ACS
Cardiothoracic surgery	CT
Colorectal surgery	CRS
Gastrointestinal surgery	GI Surg
Pediatric surgery	Peds
Plastic surgery	PRS
Surgical oncology	Surg Onc
Transplantation	Txp
Vascular surgery	Vasc

FIST, Flexibility in Surgical Training

Table 3

Resident Participation in Flexibility in Surgical Training Tracks by Program

Program	Total in FIST, n (%)	NonS residents, n (%)	ACS, n (%)	CT, n (%)	CRS, n (%)	GI surg, n (%)	Peds, n (%)	PRS, n (%)	Surg onc, n (%)	Txp, n (%)	Vasc, n (%)
A	22 (92)	2 (8)	1 (4)	7 (29)	1 (4)	7 (29)	0 (0)	0 (0)	3 (13)	1 (4)	2 (8)
B	31 (91)	3 (9)	2 (6)	9 (26)	2 (6)	1 (3)	6 (18)	0 (0)	5 (15)	2 (6)	4 (12)
C	21 (68)	10 (32)	0 (0)	0 (0)	0 (0)	4 (13)	2 (6)	7 (23)	5 (16)	3 (10)	0 (0)
D	13 (65)	7 (35)	1 (5)	5 (25)	1 (5)	2 (10)	0 (0)	0 (0)	3 (15)	1 (5)	0 (0)
E	14 (42)	19 (58)	0 (0)	4 (12)	1 (3)	4 (12)	1 (3)	1 (3)	1 (3)	1 (3)	1 (3)
F	21 (39)	33 (61)	4 (7)	0 (0)	2 (4)	10 (19)	0 (0)	0 (0)	4 (7)	1 (2)	0 (0)
G	0 (0)	18 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Totals	122 (57)	92 (43)	8 (4)	25 (11)	7 (3)	28 (13)	9 (4)	8 (4)	21 (10)	9 (4)	7 (3)

ACS, acute care surgery/surgical critical care; CT, cardiothoracic surgery; CRS, colorectal surgery; FIST, flexibility in surgical training; GI surg, gastrointestinal surgery; NonS, no specialization track; Peds, pediatric surgery; PRS, Plastic surgery; Surg onc, surgical oncology; Txp, transplantation; Vasc, vascular surgery

Table 4

ACGME Milestones by track.

Milestone	FIST (% level 4)	NonS (% level 4)	p Value
PC1	93.1	80.7	0.02
PC2	94.1	87.7	0.20
PC3	85.3	70.2	0.01
MK1	86.3	63.2	<0.001
MK2	90.2	73.7	0.01
SBP1	92.2	86.0	0.26
SBP2	89.2	66.7	0.001
PBLI1	86.2	73.7	0.09
PBLI2	88.2	63.2	<0.001
PBLI3	89.2	70.2	0.003
PROF1	90.2	71.9	0.005
PROF2	89.2	75.4	0.02
PROF3	80.4	45.6	<0.001
ICS1	93.1	77.2	0.005
ICS2	94.1	82.5	0.02
ICS3	91.2	63.2	<0.001

Data represents % of residents in each group attaining level 4 in that category of the milestones.

Flexibility in surgical training residents scored significantly higher than residents with no specialization track on 13 of 16 ACGME milestones.

ACGME, Accreditation Council for Graduate Medical Education; PC, Patient Care; MK, Medical Knowledge; SBP, Systems-Based Practice; NonS, no specialization track; PBLI, Practice-Based Learning and Improvement; PROF, Professionalism; ICS, Interpersonal and Communication Skills