



Providing complex GI surgical care with minimally invasive approaches: a survey of the practice patterns of Fellowship Council alumni

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Abstract

Introduction The Fellowship Council (FC) oversees 172 non-ACGME surgical fellowships offering 211 fellowship positions per year. These training programs cover multiple specialties including Advanced gastrointestinal (GI), Advanced GI/MIS, Bariatric, Hepatopancreaticobiliary (HPB), Flexible Endoscopy, Colorectal, and Thoracic Surgery. Although some data have been published detailing the practice environments (i.e., urban vs. rural) and yearly total case volumes of FC alumni, there is a lack of granular data regarding the practice patterns of FC graduates. The aim of this study was to gather detailed data on the specific case types performed and surgical approaches employed by recent FC alumni.

Methods A 21-item survey covering 64 data points was emailed to 835 FC alumni who completed their fellowship between 2013 and 2017. Email addresses were obtained from FC program directors and FC archives.

Results We received 327 responses (39% response rate). HPB, Advanced Colorectal, and Advanced Thoracic alumni appear to establish practices focused on their respective fields. Graduates from Advanced GI, Adv GI/MIS, and Bariatric programs appear to build practices with a mix of several complex GI case types including bariatrics, colorectal, foregut, HPB, and hernia cases.

Conclusions This is the first large data set to provide granular information on the practice patterns of FC alumni. FC trained surgeons perform impressive volumes of complex procedures, and minimally invasive approaches are extremely prevalent in these practices. Further, many graduates carve out practices with large footprints in robotics and endoscopy.

Keywords Fellowship · Minimally invasive surgery · Surgical education

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In 1997, the Minimally Invasive Surgery Fellowship Council (MISFC) was established to ensure a more organized and robust experience for surgical trainees seeking additional experience with MIS techniques [1]. Over the ensuing 20 years, the MISFC grew to oversee fellowships in many areas of gastrointestinal (GI) surgery including Advanced GI, Advanced Colorectal, Adv GI/MIS, Advanced Thoracic, Bariatrics, Flexible Endoscopy, and Hepatopancreaticobiliary (HPB). Now called the Fellowship Council (FC), this organization accredits more than 170 surgical fellowships with more than 200 total positions available annually [2].

In order to establish curricula and accreditation criteria for its fellowships, the FC collaborates with national and international organizations with expertise in the core content of these fellowships [3–6]. Several of these organizations also award graduates with certificates based on objective achievements in the core content areas of the fellowship

[7–9]. Despite these concrete accreditation criteria for programs and specific certification criteria for individual graduates, little is known regarding the eventual practice patterns of FC program alumni.

Although some work has been published regarding the typical practice environments (i.e., urban vs. rural) and annual case volumes of FC alumni, these data do not include granular information on the case types performed (i.e., foregut, colorectal, bariatric, etc.) or surgical techniques employed (i.e., laparoscopy, robotics, flexible endoscopy, etc.) when FC graduates enter independent practice [10]. This type of information would be expected to have particular interest from prospective fellowship applicants as well as fellowship program directors so that training could be targeted toward the actual footprint of cases seen in practice. The aim of this study was to gather detailed data regarding the specific case types performed and surgical approaches employed by recent FC alumni.

Methods

Survey development and administration

A working group of FC Board and Executive Committee members developed a 21-item survey that contained 64 data points. The working group was composed of fellowship program directors who supervise programs in Advanced GI, Bariatrics, HPB, and MIS. Both academic and non-academic institutions were represented within the working group. The survey was administered and collected via Google Forms®. The full survey is available in the Supplemental Materials.

All FC fellows who graduated between 2013 and 2017 ($n = 835$) received an email in February 2018 from the FC president with an invitation to take the survey and an explanation of its purpose. Individuals who had completed multiple fellowships were instructed to complete only one survey but to indicate all fellowship types completed. Email addresses were obtained from FC program directors and existing FC archives. To increase response rate, alumni received email reminders from the FC at 2 and 4 weeks. The FC also emailed program directors separately and encouraged them promote participation by sending a personal reminder to their recent alumni. Eight weeks after the initial invitation, the survey was closed, and the results were exported for analysis.

Definition of terms used

The survey asked alumni to estimate percentages and raw numbers of case types performed in practice. The categories included general surgery, bariatrics, advanced/complex HPB, MIS hernia, complex open hernia, foregut, colorectal,

and thoracic. To clarify the classification of hernia cases, respondents were instructed to include “straightforward inguinal and ventral hernias” in the general surgery category, to include “laparoscopic or robotic inguinal and ventral hernias” in the MIS hernia category, and to include “abdominal wall reconstruction” in the complex open hernia category. Strict definitions of the remaining categories were not provided on the survey, so respondents were responsible for classifying cases according to their own definitions of these terms.

When asked to estimate raw numbers of certain cases performed per year, alumni were given several options (i.e., none, 1–10 cases/year, 11–50 cases/year, 51–100 cases/year, and > 100 cases/year). As part of our analysis, we reported the proportion of alumni who performed “some” cases (at least one case/year), a “moderate volume” of cases (at least 11 cases/year), or a “high volume” of cases (at least 51 cases/year) within a specific category.

The survey also asked alumni to estimate the frequency with which they employed various surgical approaches in practice (i.e., open surgery, laparoscopy/thoracoscopy, robotic surgery, and flexible endoscopy). As part of our analysis, we reported how frequently respondents used “MIS approaches” in practice. In this study, “MIS approaches” was used as an umbrella term for laparoscopy/thoracoscopy, robotics, and flexible endoscopy.

Data analysis

All data analysis was performed in Microsoft Excel. Responses were sorted by fellowship type, and results were reported for each of the seven FC fellowship types (Advanced GI, Advanced Colorectal, Adv GI/MIS, Advanced Thoracic, Bariatric, Flexible Endoscopy, and HPB). If a respondent indicated that they had completed multiple fellowships (i.e., HPB and Adv GI/MIS) or that they had completed a single fellowship that was dual accredited (i.e., Advanced GI/MIS/Flexible Endoscopy), then their data were included in the analysis for each fellowship type completed. Thus, some responses were used in analysis multiple times across fellowship types. This minimal risk study was determined to be exempt from IRB review by the University of Texas Southwestern.

Results

Demographics

Overall, we received 327 responses for 39% cumulative response rate. When accounting for respondents who completed multiple fellowships (e.g., completing separate HPB and Advanced Thoracic fellowships) or those who completed

a single fellowship that was accredited in multiple specialties (e.g., completing an Adv GI/MIS/Bariatric fellowship), there were 512 fellowship accreditations represented in this data set. Of these 512, there were 193 with accreditations in Adv GI/MIS, 192 bariatrics, 48 HPB, 33 flexible endoscopy, 19 advanced colorectal, 16 advanced GI, and 11 advanced thoracic. Figure 1 shows a Venn diagram of the different fellowship types included in this data set. Table 1 compares the proportions of fellowship alumni responding to this survey to the actual complement of fellowships offered by the FC.

For the entire cohort, 73% of respondents reported their practice was in an urban setting, 11% reported a purely rural practice, 13% reported practicing in multiple locations with

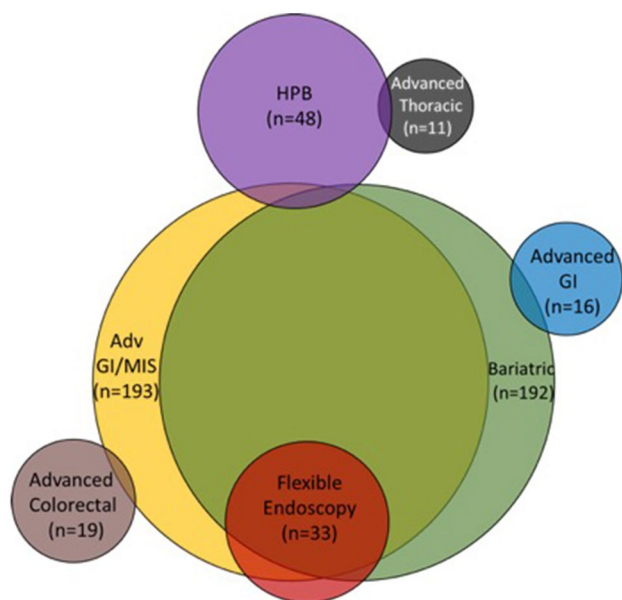


Fig. 1 Venn diagram of survey responses by fellowship type. Each circle is labeled with the fellowship type it represents and the total number of survey responses related to that fellowship. Overlapping segments represent respondents who completed multiple fellowships or single fellowships with multiple accreditations

a mix of urban and rural settings, and 3% described their practice as an “other” classification such as suburban or military. Additionally, 55% reported part or all of their practice was based at a private practice or community hospital, 46% at an academic medical center, 9% at a public or county hospital, and 5% at a Veterans Affairs (VA) or Department of Defense (DOD) hospital (15% reported multiple practice types). Overall, 47% of respondents estimated that more than 20% of their practice was general surgery, and 24% estimated that more than 40% of their practice was general surgery.

All respondents completed their fellowship training between 2013 and 2017. Responses were slightly skewed toward more recent graduates. Overall 16% entered practice in 2013; another 15% entered practice in 2014; and 23%, 22%, and 24% entered practice in 2015, 2016, and 2017, respectively. In terms of practice maturity, 22% of alumni surveyed reported that they were still early in the process of building referrals for their desired practice, and another 33% stated that their referral base was growing but their complex case volume was still < 50% of their ultimate goal. In contrast, 27% of alumni reported that their complex case volume was > 50% or their ultimate goal and 17% reported their case volumes were consistent with a mature practice. In total, 88% reported that they were satisfied with their first job after fellowship and 84% were still members of the practice they had joined immediately after fellowship.

Surgical approaches used in practice

FC alumni demonstrated a high utilization of MIS approaches in practice as 71% of respondents indicated that > 75% of their cases were performed via an MIS approach. Additionally, 62% of alumni reported performing some robotic cases in practice, and 20% reported devoting more than 25% of their practice to robotic cases. Similarly, 84% of alumni reported performing some flexible endoscopy cases in practice, and 28% reported that > 25% of their total

Table 1 Observed proportion of alumni responding to this survey vs. actual proportion of FC fellowship positions offered per year

Types of program accreditation offered by the FC	Observed portion of respondents who were alumni of this program type ^a (%)	Actual proportion FC fellowships carrying this accreditation ^b (%)	Observed% – actual%
Advanced GI	4.9	6.6	–1.7
Adv GI/MIS	59.0	57.7	+1.4
Bariatric	58.7	43.9	+14.8
Flexible endoscopy	10.1	2.6	+7.5
HPB	14.7	6.6	+8.0
Advanced colorectal	5.8	4.6	+1.2
Advanced thoracic	3.4	5.1	–1.7

^aTotal is > 100% as some respondents completed multiple fellowships or trained at a dual accredited program

^bTotal is > 100% as some fellowships carry multiple accreditations (e.g., Adv GI/MIS/Bariatric)

practice volume was flexible endoscopy. A detailed breakdown of surgical approaches by fellowship type is shown in Table 2.

Case types performed in practice

Regarding alumni of *Advanced GI* fellowships, fewer than 15% of respondents reported high case volumes in any case category. Rather, most alumni reported at least a moderate yearly volume of cases in the categories of inguinal hernia, ventral hernia, foregut, and colorectal while roughly one-third reported a moderate volume of bariatrics cases. All respondents reported at least some MIS cases in the foregut, inguinal hernia, and ventral hernia categories with a majority also reporting at least some MIS cases in advanced HPB and colorectal disciplines. Detailed case type data for *Advanced GI* alumni are shown in Fig. 2A.

Regarding alumni of *Adv GI/MIS* fellowships, 36% of respondents reported high volumes of MIS bariatrics cases and 27% reported high volumes of MIS inguinal hernia cases. Most alumni reported at least a moderate yearly volume of cases in the MIS categories of inguinal hernia, ventral hernia, foregut, and bariatrics while roughly one-third reported at least a moderate volume of colorectal cases. Nearly all respondents reported at least some MIS cases in the foregut, inguinal hernia, and ventral hernia categories. Two-thirds of alumni also reported at least some MIS cases in bariatric and colorectal disciplines. Detailed case type data for *Advanced GI/MIS* alumni are shown in Fig. 2B.

Regarding alumni of *Bariatric* fellowships, 42% of respondents reported high volumes of MIS bariatrics cases and 27% reported high volumes of MIS inguinal hernia cases. Most alumni reported at least a moderate yearly volume of cases in the MIS categories of inguinal hernia, ventral hernia, foregut, and bariatrics. Nearly all respondents reported at least some MIS cases in the foregut, inguinal hernia, and ventral hernia categories. More than 70% of alumni also reported at least some MIS colorectal cases. Detailed case type data for *Bariatric* alumni are shown in Fig. 2C.

Regarding alumni of *Flexible Endoscopy* fellowships, 39% of respondents reported high volumes of MIS bariatrics cases, 36% reported high volumes of MIS inguinal hernia cases, and 24% reported high volumes of MIS foregut cases.

Most alumni reported at least a moderate yearly volume of bariatrics cases, and more than two-thirds reported at least moderate volumes of MIS inguinal hernia, ventral hernia, foregut cases. More than one-third also reported a moderate volume of MIS colorectal cases. Detailed case type data for *Flexible Endoscopy* alumni are shown in Fig. 2D.

Regarding alumni of *HPB* fellowships, 88% reported at least a moderate volume of open advanced HPB cases, and 40% reported a high volume of these open cases. In terms of MIS advanced HPB cases, most alumni reported at least a moderate volume of these cases, but only 8% reported a high volume. Additionally, approximately one-quarter of alumni reported at least moderate yearly volumes of MIS cases in the foregut and inguinal hernia categories, while nearly 30% reported a moderate volume of open foregut cases. Detailed case type data for *HPB* alumni are shown in Fig. 2E.

Regarding alumni of *Advanced Colorectal* fellowships, all respondents reported at least a moderate volume of MIS colorectal cases in practice, and 74% reported a high volume of these MIS cases. In terms of open colorectal cases, most alumni reported at least a moderate volume of these cases, and 21% reported a high volume. Additionally, approximately one-quarter of alumni reported at least moderate yearly volumes of MIS cases in the inguinal hernia and ventral hernia categories. Detailed case type data for *Advanced Colorectal* alumni are shown in Fig. 2F.

Regarding alumni of *Advanced Thoracic* fellowships, 82% of respondents reported at least a moderate volume of MIS thoracic cases in practice, and 73% reported a high volume of these MIS cases. In terms of open thoracic cases, 45% of alumni reported at least a moderate volume of these cases, but none reported a high volume. Additionally, most alumni reported moderate yearly volumes of MIS foregut cases. Detailed case type data for *Advanced Thoracic* alumni are shown in Fig. 2G.

Impact on other surgeon's case volumes

Of the 327 respondents, 25 (8%) indicated that they were solo practitioners, while the remaining 92% had at least one partner. Excluding solo practitioners, when FC alumni were asked to estimate the impact they had on partners' utilization of MIS approaches, 73% of alumni indicated that their

Table 2 Surgical approaches employed in practice by different types of FC alumni

Practice pattern	Adv. GI (n = 16) (%)	Adv. GI/MIS (n = 193) (%)	Bariatric (n = 192) (%)	Flexible endoscopy (n = 33) (%)	HPB (n = 48) (%)	Adv. colorectal (n = 19) (%)	Adv. thoracic (n = 11) (%)
> 75% of practice uses MIS approaches	72	79	81	79	15	100	91
> 25% of practice is robotic	19	22	20	23	4	47	27
> 25% of practice is endoscopy	19	29	28	54	8	48	45

Fig. 2 **A** Practice patterns among ADVANCED GI Alumni ($n = 16$). **B** Practice patterns among ADVANCED GI/MIS Alumni ($n = 193$). **C** Practice patterns among BARIATRIC Alumni ($n = 192$). **D** Practice patterns among FLEXIBLE ENDOSCOPY Alumni ($n = 33$). **E** Practice patterns among HPB Alumni ($n = 48$). **F** Practice patterns among COLORECTAL Alumni ($n = 19$). **G** Practice patterns among THORACIC Alumni ($n = 11$). □—some MIS, ▨—some open, ▩—moderate volume MIS, ▪—moderate volume open, ■—high volume MIS, ▩—high volume open

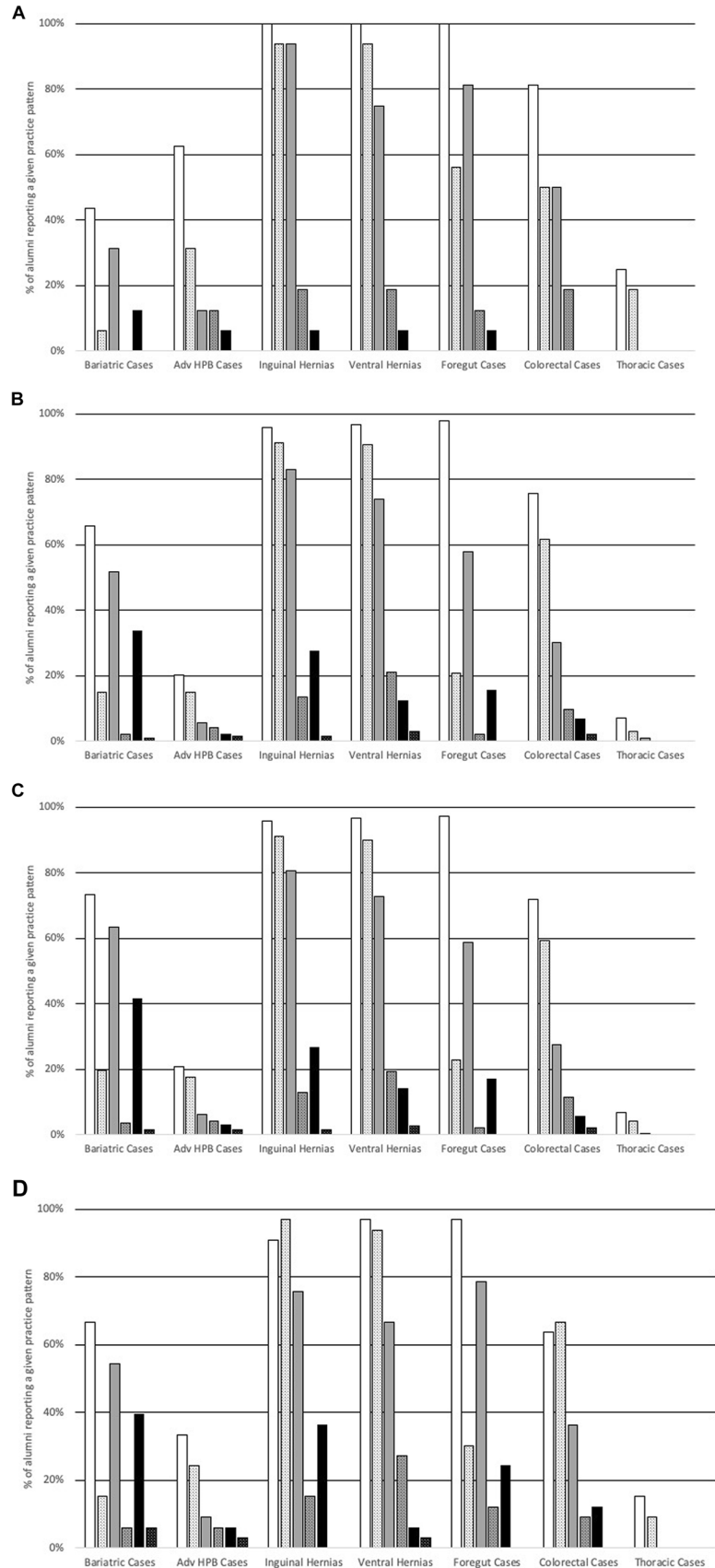
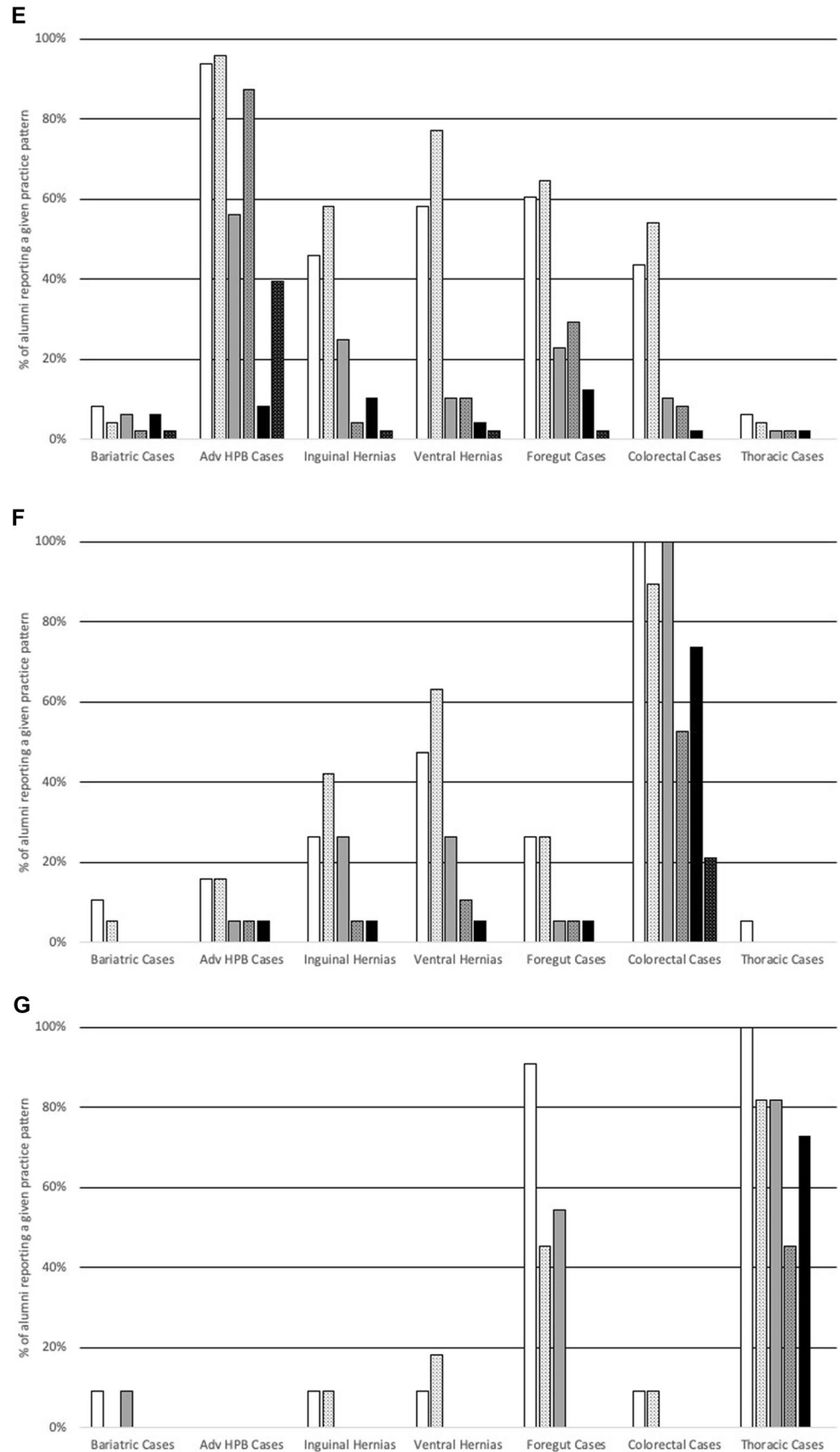


Fig. 2 (continued)



hiring led to at least some additional MIS cases among their partners. Additionally, 49%, felt that their presence led to a moderate volume of additional MIS cases performed by their partners. Finally, 17% indicated that their presence led to a high volume of additional MIS cases performed by their partners.

Discussion

Although previous publications have documented some general details of the practice patterns of FC alumni, this is the first data set to provide granular detail on the specific case types performed and surgical approaches employed by FC fellowship graduates [10]. The current study reveals that FC alumni perform an impressive variety of complex GI and abdominal wall cases, and these cases are very commonly completed with MIS approaches including laparoscopy/thoracoscopy, robotic surgery, and flexible endoscopy.

MIS approaches have consistently been shown to have several advantages over open surgery across multiple disease processes and surgical procedures, and our data suggest that FC training produces graduates that employ laparoscopic and other MIS techniques at very high rates that may be substantially higher than other surgeons in practice [11–17]. Although we did not include a comparison group of non-fellowship trained surgeons in our study, published data from national registries in the United States indicate that, only 35% of colectomies for cancer are performed laparoscopically, 24% of inguinal hernias are repaired laparoscopically, and 18% of ventral hernias are repaired laparoscopically [18–21]. In our cohort, with the exception of HPB alumni, MIS approaches far exceed open approaches with > 70% of graduates reporting that more than three-quarters of their cases were performed with MIS approaches (Table 2).

For the entire cohort, these practice patterns paint the picture of general surgeons with additional expertise in MIS techniques. Graduates from Advanced GI, Adv GI/MIS, Bariatric, and Flexible Endoscopy programs appear to either carve out a high volume niche in one case type (e.g., MIS inguinal hernia, bariatrics, or foregut) or moderate volume areas of focus in several cases types. However, these alumni appear to maintain broad based practices as nearly all perform at least some inguinal hernia, ventral hernia, and foregut cases, while > 75% perform at least some colon cases and most perform some bariatrics (Fig. 2A–D). Since these are broad based fellowships, and graduates typically enter practices which include general surgery call, our findings are not surprising.

Alumni of Advanced Colorectal and Advanced Thoracic programs trend more toward specialty practices, including MIS colorectal and a combination of MIS foregut and thoracic cases, respectively (Fig. 2F–G). Both of

these fellowship types also appear to produce graduates with higher adoption rates of robotic surgery and flexible endoscopy relative to other FC fellowships (Table 2). Since these fellowships have a more narrow focus and involve disease process that may be especially amenable to robotic and endoscopic interventions, these practice patterns were expected.

With respect to HPB, these alumni appear to be a special cohort with predominantly open approaches in practice (Table 2). Certainly, MIS techniques for complex HPB operations, such as major liver and pancreatic resections, have not yet been widely adopted [22]. Given the trends towards referral of these patients to high volume centers, HPB graduates also have a much heavier focus on advanced HPB cases, either open or MIS, relative to other alumni (Fig. 2E) [23, 24].

Our data come from a large sample (327 surgeons) who completed training within the past 5 years. This was a voluntary, anonymous survey with an aggregate response rate of 39%. Although fewer than half of eligible alumni submitted a response, several of our findings suggest that this sample was a reasonable representation of our population of interest. First, 73% of our respondents reported practicing in urban settings and 46% stated that they practiced at an academic medical center. These results closely mirror a 2015 survey published by Park and colleagues ($N=234$) in which 75% of FC alumni reported urban practices and 49% reported academic practices [10]. Further, our respondents showed a relatively uniform division among stages of practice maturity; respondents also had a relatively even distribution of years in practice. Finally, our distribution of survey responses from alumni of Advanced GI, Adv GI/MIS, Advanced Colorectal, and Advanced Thoracic fellowships fell within 2% of the actual distribution of fellowship positions that the FC offers annually (Table 1).

Our data does have some limitations, however. First, we relied on self-reported estimates of case volumes and case types which may decrease the precision of our results. However, although we admit that surgeons may not know exact volumes of certain cases performed per year, we feel surgeons in practice should be expected to give accurate estimates of their yearly case volumes within the ranges we provided (i.e., no cases, 1–10 cases/year, 11–50 cases/year, 51–100 cases/year, > 100 cases/year). Also, for much of our analysis, we chose to combine laparoscopic, robotic, and endoscopic cases under a single umbrella of “MIS approaches.” Critics may question why flexible endoscopy cases were included under this umbrella, but we feel that this approach has evolved beyond a diagnostic modality and has become an important tool in the surgeons’ armamentarium for treating of morbid obesity (gastric balloons), rectal and esophageal cancers (endoscopic mucosal resections), and benign foregut and HPB diseases (POEM

for achalasia and ERCP for choledocholithiasis, respectively). We anticipate that the importance of endoscopy within the realm of minimally invasive surgery will only continue to increase.

Additionally, we observed a disproportionately high volume of alumni who reported training at fellowships accredited in bariatrics and flexible endoscopy (Table 1). The FC offers 113 fellowship positions at programs accredited in Adv GI/MIS, and 51 of these programs carry a dual accreditation in bariatrics (49) or flexible endoscopy (2). Although the remaining 62 programs are purely Adv GI/MIS, many of these programs still expose fellows to substantial volumes of bariatrics and flexible endoscopy. In fact, many prospective fellows do not distinguish between purely Adv GI/MIS programs and dual accredited programs during the application process. Thus, we suspect that some survey respondents erroneously indicated that they graduated from Adv GI/MIS/Bariatric or Adv GI/MIS/Bariatric/Flexible Endoscopy programs when they actually trained at a purely Adv GI/MIS program. This likely accounts for the substantial overlap seen among these programs in the Venn diagram of responses (Fig. 1). It also suggests that data for bariatric and flexible endoscopy programs (Fig. 2C and D) may be somewhat skewed to resemble Adv GI/MIS alumni practice patterns (Fig. 2B).

We also observed a disproportionately high number of responses from HBP alumni. Unlike the responses from bariatric and flexible endoscopy alumni, these responses did not commonly co-occur with other fellowship types (Fig. 1). Further, these respondents' data were clearly unique compared to the remainder of our cohort with practices focused much more on open HPB cases and much less on MIS cases relative to other alumni (Fig. 2E). Thus, we suspect that HPB alumni had a more robust response rate than the rest of the cohort perhaps because this is a smaller group of fellowships, and completion of the survey was more effectively promoted by HPB Program Directors.

Conclusion

This study is the first published data that defines the actual practice patterns of FC alumni. These data help us understand how FC training adds to general surgery residency training by providing additional exposure to complex GI cases and MIS techniques. Many of these fellowship types are currently undergoing further optimization including revision of accreditation requirements and educational curricula. We anticipate that practice patterns of FC alumni will continue to have a solid foundation within general surgery and MIS techniques but may evolve further regarding expertise in specific content areas.

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Compliance with ethical standards

Disclosures Yumi Horii is employed as the Executive Director of the Fellowship Council. Vanessa Cheung is employed as an Administrative Coordinator at the Fellowship Council. Drs. Weis, Alseidi, Jeyarajah, Schweitzer, and Scott have no financial disclosures related to the content of this study.

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