

**Top Down or Bottom Up? Longitudinal assessment of the influence of professional practice gaps in gastrointestinal and endoscopic surgery on program content for the Annual Meeting of the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES)(2011-2016): a report from the SAGES Continuing Education Committee (CEC).**

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**Introduction**

In 2016, the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) celebrated its 35<sup>th</sup> anniversary. Since its inception, SAGES has stressed the importance of educating its members in the latest technology and techniques. In fact, SAGES' mission is "to improve quality patient care through education, research, and innovation and leadership, principally in gastrointestinal and endoscopic surgery." The SAGES Continuing Education Committee (CEC) is the organization's clearinghouse for this effort with responsibility for overseeing major educational programs including the Annual Scientific Meeting. To this end, the SAGES CEC works to enact the standards, policies, and requirements of the Accreditation Council for Continuing Medical Education (ACCME) and the American Board of Surgery (ABS). In doing so, the SAGES CEC has developed an effective means for identifying gaps in learners' knowledge, competency, and performance through direct survey of Annual Meeting attendees. The findings from prior gap analyses of individual Annual Meetings were published in 2011[1], 2012[2] and 2014[3]. These reports have revealed consistent patterns related to perceived gaps and topics of interest among Annual Meeting attendees, including learners' consistent identification of four common topics as foci of interest: bariatric surgery, colon and rectal diseases, surgery of the foregut, and hernia repair (alphabetical order). The gap analyses are instrumental in allowing the SAGES Program Directors and Committee responsible for creating the Annual Meeting agenda in developing relevant content in order to address the needs of members attending it. As with prior manuscripts, this manuscript will summarize the knowledge, competence, and performance gaps identified by attendees of a specific Annual Meeting, the 2016 SAGES Scientific Session and Postgraduate Courses held in Boston, Massachusetts. Additionally, it will expand on this analysis through the longitudinal assessment of such gaps from the 2011 through 2016 Annual Meetings in order to identify trends in these gaps over this time period.

**Methods**

*Learning theme and anticipated practice change data collection*

The Assessment Task Force (ATF), a working group of the CEC which reports to the Program Committee, is charged with overseeing the analysis of the Annual Meeting. Since 2011, the ATF has grouped the Annual Scientific Meeting content into a set of common learning themes. Five themes are clinical in character (bariatric, hernia, foregut, colorectal, hepatopancreatobiliary (HPB)/solid organ), two are technological in nature (flexible endoscopy, new technologies/skill acquisition), and two are practice-based (academic/educational [e.g., simulation-based education, implementing milestones, fellowship training], professional/economic [e.g., health care reform, use of electronic medical record, use of social media]).

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As with prior Annual Meetings, the 2016 immediate post-meeting questionnaire contained both learning theme-specific and overall meeting-specific sections, which attendees filled out within two weeks of the completion of the Annual Meeting. Respondents to the survey identified two of the nine learning themes corresponding to the majority of educational offerings they attended. In addition, respondents indicated anticipated practice changes within each learning theme that they planned to implement in their clinical practices. Attendees of postgraduate (PG) and hands on (HO) courses were asked to complete a series of case volume (5-point scale with volume ranges of none, 1–3, 4–10, 11–30, and >30 cases) and comfort level responses (Likert-type scale with 1 = very uncomfortable to 5 = very comfortable) related to the procedures and topics taught at the PG/HO course. The overall program-specific portion of the survey included a needs assessment for content of future meetings (5-point Likert scale, 1 = Not Relevant to 5 = very Relevant). Finally, those attendees eligible for continuing medical education (CME) credit had the option to complete a series of multiple choice questions derived from their chosen learning theme in order to obtain Self-Assessment CME credit, applicable to Part 2 of the American Board of Surgery's Maintenance of Certification (MOC) program.

Everyone who completed the immediate post-meeting survey received an electronically generated 3-month follow-up survey in which each person determined the degree to which they had successfully implemented the anticipated practice changes chosen (three point scale: fully implemented, partially implemented, not implemented). For respondents indicating partial or failed implementation of an intended practice change, a follow-up question attempted to determine the cause of the incomplete implementation via a list of eleven potential barriers. These barriers fell into four broad categories: (1) no barriers present, (2) environmental/institutional barriers, (3) individual-based/practitioner barriers, and (4) miscellaneous barriers. PG/HO course attendees were also asked to estimate their case volume and comfort level for performing the learned procedures over the 3 months since the Annual Meeting.

#### *Data analysis*

All data were de-identified and a descriptive statistical analysis was completed. Response rates were tabulated with frequency counts for learning themes, anticipated practice change objectives, degree of implementation, and case volume ranges. Mean scores were calculated for all comfort level questions as well as for the educational content topics. Following an assessment of the 2016 Scientific Session and Postgraduate Courses responses, a longitudinal analysis was performed comparing analysis data from all Annual Meetings dating from 2011.

### **Results**

#### *Response rates*

The 2016 Annual SAGES Scientific Session and Postgraduate Courses took place from March 16<sup>th</sup> to March 19<sup>th</sup> in Boston, Massachusetts. Table 1 lists response rates. Of the total 2,786 medical students, surgical residents and fellows, practicing surgeons and physicians, nurses, allied health professionals, and industry representatives who attended the event, 697 (25.0%) completed an immediate post-meeting questionnaire. Of the 1,551 physicians and surgeons practicing within the United States eligible for CME credits 669 (43.1%) completed the immediate post-meeting questionnaire. Among CME eligible respondents, almost all (603 of 669, 90.1%) completed the Self-Assessment MOC component of the survey. Self-Assessment MOC respondents represented 21.6% of the total meeting attendees and

38.8% of those attendees eligible for CME. The 3-month follow-up questionnaire received 451 responses (64.7%).

Year	Location	Overall Attendance	CME Eligible Attendance Rate (n)	Immediate Survey Response Rate (n)	CME-Eligible Survey Response Rate (n)	MOC Response Rate from all CME Eligible Respondents	3 Month Response
2011	San Antonio	2088	68% (1425)	44% (916)	N/A*	N/A*	40% (363)
2012	San Diego	2306	65% (1505)	35% (797)	42% (637)	N/A*	46% (367)
2013	Baltimore	2376	64% (1525)	29% (689)	43% (663)	92% (609)	14% (96)
2014	Salt Lake City	2185	58% (1271)	32% (694)	25% (542)	92% (497)	31% (215)
2015	Nashville	2424	74% (1801)	23% (562)	30% (538)	95% (510)	87% (490)
2016	Boston	2786	56% (1551)	25% (697)	43% (669)	90% (603)	65% (451)

\*Data not available or not collected. MOC questions were not started until 2013

Table 1. SAGES Annual Meetings from 2011 to 2016 including location, number of attendees, and response rate to the immediate post-meeting and 3-month follow-up surveys.

Attendance and survey response rates since 2011 demonstrate a trend of increasing overall attendance year after year with the exception of the 2014 meeting in Salt Lake City, which demonstrated a dip from 2012 (Table 1.). A relatively consistent number of CME eligible practicing physicians from the United States have continued to attend the meeting with peak attendance in 2015. Meeting survey response rates demonstrate a fluctuation over this time period, with response rate ranging from 1/4<sup>th</sup> to 1/3<sup>rd</sup> of attendees. The ability to obtain Self-Assessment CME credit, applicable to Part 2 of the ABS MOC program began in 2013. Since this time, over 90% of CME eligible attendees completing the immediate post-meeting questionnaire have opted for such credit. Response rates to the 3 month follow up survey have remained variable.

### Needs Assessment

Needs assessment data related to desired future topics for the Annual Meeting are listed in Figure 1. The top five perceived gaps of attendees at the 2016 Annual Meeting included the following: 1) management of complications during laparoscopic surgery, 2) technical tips and tricks, 3) introducing new procedures into practice, 4) ventral hernia repair, and 5) inguinal hernia repair. Table 2 lists a comparison of the top 5 perceived gaps generated from needs assessment data from the 2011 through 2016 Annual Meetings.

Gap Topic	Year of Annual Meeting						No. years ranked
	Ranking (Score)						
	2011	2012	2013	2014	2015	2016	
Reoperative Laparoscopic Surgery	1 <sup>st</sup> (4.24)	1 <sup>st</sup> (4.15)	3 <sup>rd</sup> (4.10)	4 <sup>th</sup> (3.80)	5 <sup>th</sup> (3.84)		4
Introducing new procedures into your practice	2 <sup>nd</sup> (4.04)	2 <sup>nd</sup> (4.09)	5 <sup>th</sup> (4.07)	5 <sup>th</sup> (3.80)	5 <sup>th</sup> (3.84)	3 <sup>rd</sup> (3.83)	5
Advanced laparoscopic techniques	3 <sup>rd</sup> (4.04)	3 <sup>rd</sup> (3.96)					2
GERD/Barrett's/Nissen/foregut surgery	4 <sup>th</sup> (3.95)	4 <sup>th</sup> (3.90)					2
Treatment of colorectal disease	5 <sup>th</sup> (3.90)						1
Ventral hernia repair		5 <sup>th</sup> (3.82)	2 <sup>nd</sup> (4.10)	3 <sup>rd</sup> (3.81)	2 <sup>nd</sup> (3.88)	4 <sup>th</sup> (3.81)	4
Management of complications during laparoscopic surgery			1 <sup>st</sup> (4.34)	1 <sup>st</sup> (4.06)	1 <sup>st</sup> (4.14)	1 <sup>st</sup> (3.99)	4
Endoscopic management of surgical complications			4 <sup>th</sup> (4.09)				1
Enhanced recovery after surgery (ERAS)				2 <sup>nd</sup> (3.88)		5 <sup>th</sup> (3.78)	2
Difficult cholecystectomy/Prevention of bile duct injury					3 <sup>rd</sup> (3.87)		1
Management of acute gastrointestinal surgical emergencies					4 <sup>th</sup> (3.87)		1
Technical tips and tricks						2 <sup>nd</sup> (3.97)	1
Inguinal hernia repair						5 <sup>th</sup> (3.78)	1

Table 2. Comparison of the top 5 perceived gaps generated from needs assessment data from the 2011 through 2016 Annual Meetings

Table 2 compares the top 5 perceived gaps generated from needs assessment data over the period from 2011 to 2016. In brief, attendees only identified four topics as a top 5 gap during the majority of years (i.e., 3 or more years): 1) introducing new procedures into practice (5/5 years); 2) reoperative laparoscopic surgery (4/5 years); 3) ventral hernia repair (4/5 years); and 4) management of complications during laparoscopic surgery (4/5 years).

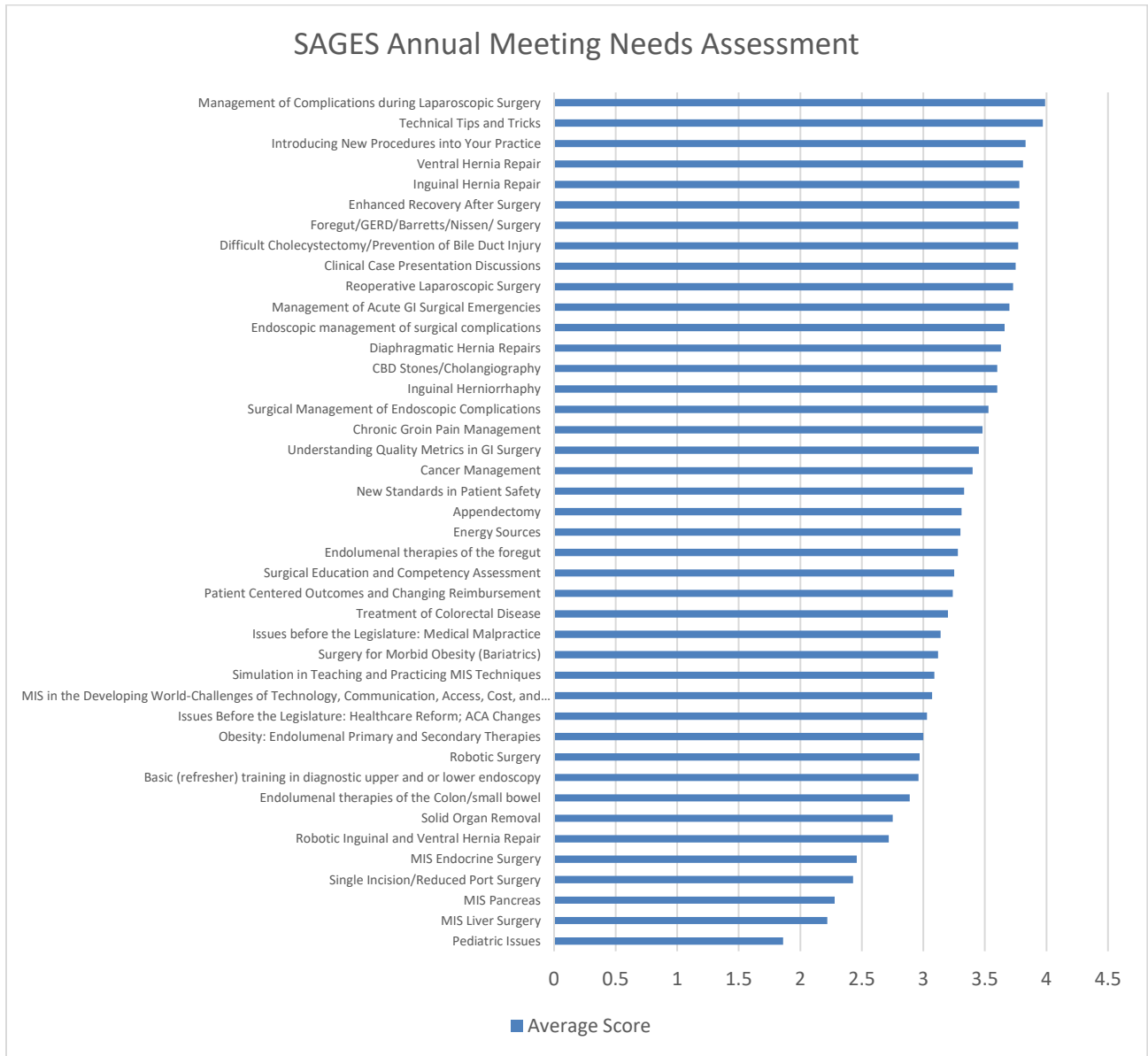


Figure 1. Needs assessment conducted following the 2016 SAGES Annual Meeting revealing interest in future session topics as determined by Likert scale rating of 0 to 5 (0 = no interest, 5 = great interest).

### Learning Themes Practice Gaps

For the 2016 Annual Meeting, the top four chosen learning themes were hernia (25.7%), foregut (20.0%), bariatrics (18.3%), and colorectal (8.5%). The next four most popular learning themes received

similar support from respondents: HPB/solid organ (6.1%), flexible endoscopy (6.1%), new technologies/skill acquisition (6.8%), and academic/educational (6.4%). The professional/economic theme received the lowest support (2%). Combinations of the top four learning themes were the four most popular learning theme pairings, accounting for almost half of all responses: 1) bariatrics & foregut (17.0%); 2) foregut & hernia (12.5%); 3) bariatrics & hernia (12.3%); and 4) colorectal & hernia (7.1%). Hernia & HPB/solid organ was the fifth most common learning them pairing (5.5%).

Learning Theme	Year						Lowest Rank	Highest Rank
	Percentage (Ranking)							
	2011*	2012*,†	2013	2014	2015	2016		
Foregut	25.5(1 <sup>st</sup> )	18.8 (3 <sup>rd</sup> )	22.2 (1 <sup>st</sup> )	20.9 (1 <sup>st</sup> )	25.5 (1 <sup>st</sup> )	20 (2 <sup>nd</sup> )	3 <sup>rd</sup>	1 <sup>st</sup>
Hernia	18.9 (2 <sup>nd</sup> )	19.0 (2 <sup>nd</sup> )	18.7 (2 <sup>nd</sup> )	18.9 (2 <sup>nd</sup> )	22.9 (2 <sup>nd</sup> )	25.7 (1 <sup>st</sup> )	2 <sup>nd</sup>	1 <sup>st</sup>
Bariatrics	17.9 (3 <sup>rd</sup> )	19.5 (1 <sup>st</sup> )	16.8 (3 <sup>rd</sup> )	15.5 (3 <sup>rd</sup> )	18 (3 <sup>rd</sup> )	18.3 (3 <sup>rd</sup> )	3 <sup>rd</sup>	1 <sup>st</sup>
Colorectal	14.0 (4 <sup>th</sup> )	14.7 (4 <sup>th</sup> )	15.7 (4 <sup>th</sup> )	12.3 (4 <sup>th</sup> )	10 (4 <sup>th</sup> )	8.5 (4 <sup>th</sup> )	4 <sup>th</sup>	4 <sup>th</sup>
New Tech/Skill Acquisition	8.5 (5 <sup>th</sup> )	10.1 (5 <sup>th</sup> )	8.6 (5 <sup>th</sup> )	8.6 (5 <sup>th</sup> )	6.7 (5 <sup>th</sup> )	6.8 (5 <sup>th</sup> )	5 <sup>th</sup>	5 <sup>th</sup>
HPB/Solid Organ	5.5* (6 <sup>th</sup> )	6.6 (6 <sup>th</sup> )	5.8 (6 <sup>th</sup> )	5.6 (8 <sup>th</sup> )	3.5 (8 <sup>th</sup> )	6.1 (7 <sup>th</sup> )	8 <sup>th</sup>	6 <sup>th</sup>
Flexible Endoscopy	4 (7 <sup>th</sup> )	3.7 (8 <sup>th</sup> )	5.6 (7 <sup>th</sup> )	6.4 (7 <sup>th</sup> )	4.6 (7 <sup>th</sup> )	6.1 (7 <sup>th</sup> )	8 <sup>th</sup>	7 <sup>th</sup>
Academic/Educational	3.4 (8 <sup>th</sup> )	5.4 (7 <sup>th</sup> )	4.9 (8 <sup>th</sup> )	8.4 (6 <sup>th</sup> )	6.7 (6 <sup>th</sup> )	6.4 (6 <sup>th</sup> )	8 <sup>th</sup>	6 <sup>th</sup>
Professional/Economic	2.1 (9 <sup>th</sup> )	2.2 (9 <sup>th</sup> )	1.4 (9 <sup>th</sup> )	3.3 (9 <sup>th</sup> )	1.9 (9 <sup>th</sup> )	2 (9 <sup>th</sup> )	9 <sup>th</sup>	9 <sup>th</sup>

Table 3. Percentage of the percentage of respondents who chose each learning theme and its ranking from 2011 to 2016.

Table 3 lists the percentage of respondents who chose each learning theme from 2011 to 2016 and its ranking for each year. In general, since 2011, learning theme popularity shows consistency with the four most common learning themes remaining (in alphabetical order) bariatrics, colorectal, foregut, and hernia. The professional/economic learning theme remains the least commonly selected, and the four other learning themes consistently receive approximately 5% of responses.

### Anticipated Practice Changes and Their Implementation

Anticipated practice changes of respondents to the immediate post-meeting survey fell into four major categories: 1) improvement in minimally invasive surgery (MIS) or other techniques / procedures [MIS

techniques]; 2) better clinical management of disease processes related to learning theme [clinical management]; 3) enhanced recognition and treatment of procedure-related complications [complications]; and 4) all other desired practice changes not falling into categories 1 through 3 [other]. Table 4 lists which categories were the most commonly cited by respondents as an anticipated change for each learning theme. For three of the top four learning themes, anticipated practice changes were predominantly related to management of the clinical topic: hernia (62%), bariatrics (74%), and colorectal (74%). For foregut, the majority of anticipated practice changes were related to MIS techniques (51%).

Practice Change Category	Learning Theme	Percentage Cited (examples)
Clinical Management	Bariatrics	74% (Management reflux after sleeve, evaluation reflux pre-operative)
	Colorectal	74% (Impact technology, management perforated diverticulitis)
	HPB/Solid organ	72% (Treatment CBD stones, patient selection)
	Hernias	62% (Procedure selection, patient selection)
	Professional/ Economics	68% (Quality improvement in practice, multimodal pain therapy)
	Academic / Education	48% (Simulation quality improvement, situational awareness)
MIS / Other technique	Foregut	51% (Use of new technologies, hiatal hernia closure)
	New Technology / Skills Acquisition	42% (Use of new technologies, global use technologies)
Complications	Flexible Endoscopy	43% (Endoscopy for complications, treatment POEM complications)
Other	Academic / Education	9% (Career priorities/life balance)
	Professional/ Economics	9% (Career priorities/life balance)

Table 4. Most commonly cited categories for anticipated practice changes for each learning theme

Among top anticipated practice changes for the four most popular learning themes for 2016, the major barriers to implementation were typically environmental/institutional related issues (i.e., lack of administrative support, cost to implement, insurance related issues) in lieu of individual/practitioner-based causes (i.e., lack of time, insufficient knowledge, or not remembering to implement) or other/miscellaneous barriers: hernia (30%); foregut (44%); bariatrics (36%); and colorectal (45%). Table

5 is a longitudinal comparison of the top anticipated practice change for foregut, hernia, bariatrics, and colorectal learning themes with their degree of full implementation and major barrier(s) to implementation from 2011 to 2016.

Learning Theme		2011	2012	2013	2014	2015	2016
Foregut							
	Δ Category	Clin. Mgt.	Clin. Mgt.	Clin. Mgt.	Clin. Mgt.	Clin. Mgt.	MIS tech.
	Rate of full implementation (response rate)	72% (90/125)	66% (42/64)	71.8% (28/39)	72.5% (50/69)	69% (44/64)	66.7% (24/36)
	Category Major Barrier (most frequently cited)	Environ. (Admin. support) 13/42	Environ. (Admin. support) 41/100	Environ. (Admin. support) 8/66	Environ. (Admin. support) 25/122	Environ. (Admin. support) 19/166	Environ. (Cost) 23/87
Hernia							
	Δ Category	Clin. Mgt.	MIS tech.	Clin. Mgt.	MIS tech.	Clin. Mgt.	Clin. Mgt.
	Rate of full implementation (response rate)	56.3% (50/89)	51% (42/82)	87.5% (21/24)	74.1% (43/58)	87% (26/30)	88.2% (67/76)
	Major barrier	Individual (Time) 7/26	Environ. (Admin. support) 28/97	Environ. (Admin. support / cost/insurance/patient compliance) 1/6	Individual (Time) 6/39	Individual (Knowledge) 5/108	Environ. (Admin. support) 29/134
Bariatrics							
	Δ Category	Clin. Mgt.	MIS tech.	Clin. Mgt.	Compl.	Compl.	Clin. Mgt.

	Rate of full implementation (response rate)	69.8% (44/63)	41% (26/64)	41.9% (13/31)	71.2% (37/52)	69% (27/39)	94.1% (32/34)
	Major barrier	Environ. (Cost) 7/22	Environ. (Admin. support) 31/90	Environ. (Cost) 2/18	Environ. (Admin. support); Individual (Recall) 4/55	No perceived barrier	None provided
Colorectal							
	Δ Category	Clin. Mgt.	MIS tech.	MIS tech.	Clin. Mgt.	Clin. Mgt.	MIS tech.
	Rate of full implementation (response rate)	66.7% (36/54)	41.5% (22/53)	84.0% (21/25)	65.2% (15/23)	47% (7/15)	62.5% (10/16)
	Major barrier	Environ. (Cost) 7/17	Environ. (Admin. support) 20/61	Environ. (Admin. support); Individual (Knowledge) 12/32	Environ. (Cost / insurance) 8/80	Environ. (Admin. support) 20/49	Environ. (Cost) 12/39

Table 5. Top anticipated practice change for foregut, hernia, bariatrics, and colorectal learning themes with their degree of full implementation and major barrier(s) to implementation from 2011 to 2016

Among the remaining learning themes from 2016, the major barriers to full implementation of anticipated changes at 3 months were environmental/institutional in nature for the HPB/solid organ learning theme (69%), whereas individual-/practitioner-based barriers predominated for the professional/economic (63%), academic/education (47%), and new technology/skill acquisition (38%) learning themes; other/miscellaneous barriers were the most common for the flexible endoscopy learning theme (29%). The four most successful anticipated changes resulting in full implementation were from the following learning themes: 1) bariatrics (94% for managing reflux after gastric sleeve); 2) hernia (94% for using new materials for repairs); 3) flexible endoscopy (93% for ability to assess new techniques); and 4) foregut (91%, for increasing use of MIS for foregut conditions). The four anticipated changes resulting in the least effective implementation were from the following learning themes: 1) academic/educational (33% for introduction of new procedures and technology into my community and/ or rural practice); 2) hernia (40% for increasing use of an algorithm for the non-operative and

surgical management of chronic groin pain after inguinal hernia repairs), 3) flexible endoscopy (43% for improving power to differentiate FEC and FES), and 4) colorectal (44% for increasing ability to identify and treat emergency colorectal conditions amenable to MIS).

Ninety-one percent of respondents who at least partially implemented desired practice changes felt that such changes either fully (64%) or somewhat (27%) improved patient safety in their practice. Among those respondents who did not implement desired practice changes, video study (24%) was the most popular educational activity that they felt would help implement the change, followed by simulation-based training (16%), preceptorship/mentoring (14%), and cadaveric-based training (9%).

Appendix 1 has a complete analysis of respondents' top five anticipated practice changes and their degree of implementation from the immediate post-meeting survey and three month follow-up survey, respectively, for each learning theme. Appendix 2 includes a longitudinal comparison of the top anticipated practice changes and their degree of implementation for each learning theme from 2011 through 2016. Appendix 3 lists sessions at the Annual Meeting related to each learning theme from 2011 through 2016.

### Self-Assessment MOC Questions

Answers for the self-assessment maintenance of certification (MOC) questions were tracked. Each learning theme was provided four multiple choice questions. One MOC question in the Professional/Economic learning theme that regarded the implantation of an ERAS program was answered correctly 100% by respondents. On the other end of the spectrum, a question in the Flexible Endoscopy learning theme regarding obligatory tests for the evaluation of a patient with gastroesophageal reflux was answered incorrectly by respondents over 94% of the time. Questions with the highest successful first answers from the remaining learning themes included the following (alphabetical): academic/educational = teaching techniques on surgical rounds (91%), bariatrics = risks regarding gastric balloon placement (88%), colorectal = treatment for large benign rectal polyp (68%), flexible endoscopy = treatment of gastroesophageal reflux (86%), foregut = treatment for Barrett's with dysplasia (80%), hernia = comparison of primary sutured closure to mesh reinforced closure in a primary ventral hernia (96%), HPB/solid organ = critical view of safety in the setting of an inflamed gallbladder (90%), and new technologies/skill acquisition = asymptomatic umbilical hernia in a postpartum patient (67%). On the flip side, questions from the learning themes with the lowest successful first answer rate, other than flexible endoscopy, were the following: academic/educational = benefits of tele-mentoring (79%); bariatric = gastroesophageal reflux after sleeve gastrectomy (33%); colorectal = role of laparoscopy in septic patient with perforated diverticulitis (68%); foregut = test selection for evaluation of gastroesophageal reflux (45%); HPB/solid organ = role of endoscopic retrograde cholangiopancreatography, intra-operative cholangiogram, and common bile duct exploration in patient with dilated common bile duct (31%); hernia = risk of incisional hernia formation (75%); new technologies/skill acquisition = complications following peroral endoscopic myotomy (73%); and professional/economic = Centers for Medicare and Medicaid Services quality measures (46%).

### Post-Graduate Courses

A total of eight PG courses and four HO courses took place at the 2016 Annual Meeting. Table 6 lists PG and HO courses per learning theme from 2011 and 2016.

Learning Theme	Year and course type	Total
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	2011		2012		2013		2014		2015		2016		
	PG	HO	PG	HO	PG	HO	PG	HO	PG	HO	PG	HO	
Hernia			1	1	2	1	2		2	1	1	1	12
Foregut	1				1				1				3
Bariatric	1	1	1		1	1	1	1	1		1	1	10
Colorectal	1	1	1	1	1	1			1		1	1	9
New Technologies/ Skill Acquisition	1	1	1	1							1		5
Hepatopancreatobiliary/ Solid Organ					1		1	1	1		2	1	7
Flexible Endoscopy	1	1	1	1	1	1		1	1	1			9
Professionalism/ Economics	1	1	1				2		1	1	2		9
Total	6	5	6	4	7	4	6	3	8	3	8	4	64

Table 6. SAGES Annual Meeting Postgraduate (PG) and Hands-On (HO) Courses according to learning theme from 2011 to 2016.

The number of PG and HO courses per meeting and in each learning theme shows a trend toward the most the number of PG and HO courses reflecting the popularity of the particular learning theme for that course. Foregut surgery represents an exception to this trend, however, since it had fewer PG / HO courses during this time period than all of the learning themes.

Attendees to each course answered questions in the immediate post-meeting survey regarding steps used in pre-operative preparation, performance volume, and outcomes. An average of responses to questions regarding frequency of steps, performance, or observations leading up to the course and after the course are provided in Figure 2 & 3. Attendees of the hernia postgraduate course experienced an increased likelihood to use literature during the preparatory phases of a hernia repair. In addition, an increased likelihood to use quality data to determine next steps was endorsed.

Figure 4 demonstrates the changes in confidence levels for learning objectives for each course and change in case volumes pre-course to 3 months post-course, respectively, for the PG and HO courses. In brief, endoluminal therapies remained a rare technique for attendees of the bariatric PG courses three months after the Annual Meeting. This finding is also true for common bile duct explorations and management of bile duct injuries. On the other hand, attendees of the colorectal PG course reported increased adoption of the endoscopic and endoanal techniques. Finally, PG courses that focused on skill acquisition and general knowledge regarding surgical technique, including pre-operative patient optimization with enhanced recovery programs, were successful in encouraging attendees to synthesize new information and use it in surgical practice.

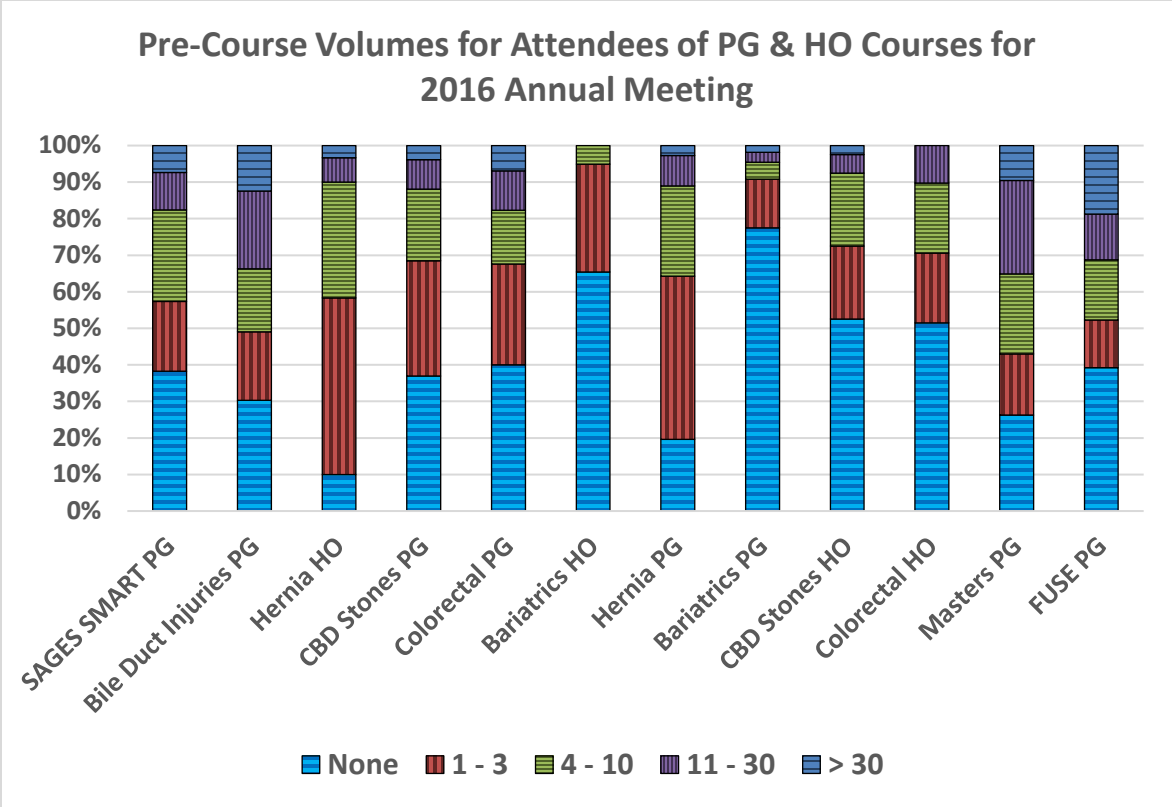


Figure 2. Average pre-course volumes with percentage of attendees of the 2016 Annual Meeting PG & HO courses responding for each range.

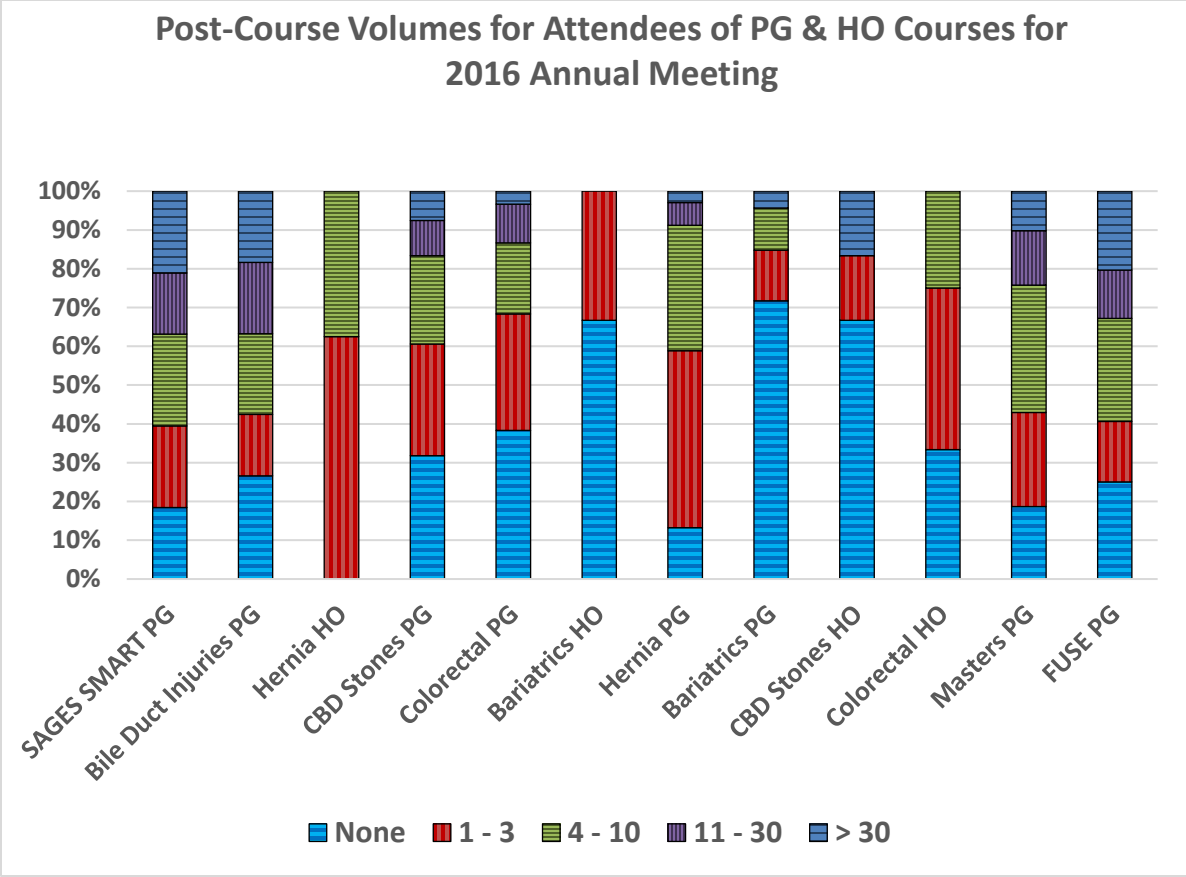


Figure 3. Average post-course volumes with percentage of attendees of the 2016 Annual Meeting PG & HO courses responding for each range.

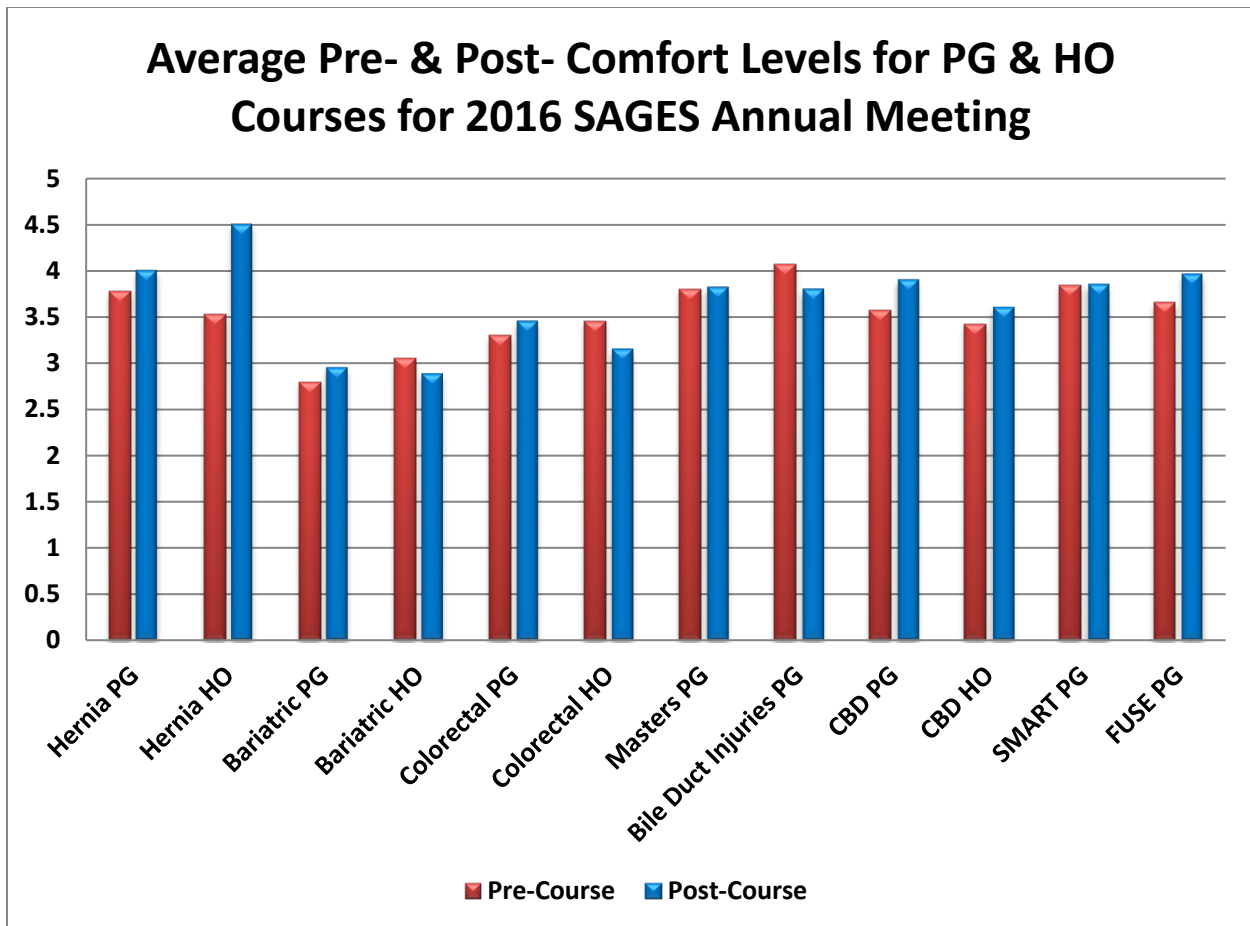


Figure 4. Average of pre-course and post-course comfort level responses (1= Very Uncomfortable, 5 = Very Comfortable) for questions posited to participants of 2016 SAGES Annual Meeting Post-Graduate and Hands-On Courses.

The majority of attendees of PG and HO courses demonstrated an increase or maintenance in comfort regarding the general topics covered by the course. In 2016, this finding was most pronounced in the hernia and common bile duct PG and HO courses. Focused areas in which attendees did profess greater comfort 3 months after the meeting included dealing with bariatric complications for both PG and HO course attendees, endoscopic management of colorectal diseases including colonoscopy and transanal approaches, and biliary surgery including minimally invasive/laparoscopic common bile duct exploration.

#### **Discussion**

This longitudinal assessment of perceived gaps of attendees completing surveys related to the 2011 – 2016 SAGES Annual Meetings reveals an interesting dichotomy: content development for Annual Meetings has both top-down and bottom-up influences. The 2016 Annual Meeting needs assessment showed an interest of attendees in future areas of focus including the management of complications in laparoscopic surgery, tips and tricks from the experts, introducing new technology into one’s practice following by ventral hernia repair, inguinal hernia repair, and enhanced recover after surgery (figure1). Of these top 5, three have been consistently within the top 5 identified needs since 2011, reflecting a bottom up influence related to topics important to attendees: 1) Introducing new technology into one’s

practice (every year); management of complications in laparoscopic surgery (4 years), ventral hernia repair (4 years) (Table 2). Reoperative laparoscopic surgery dropped out of the top five for the first time in 2016, after having been the top need in 2012-2011. More recently, however, several top five perceived needs became apparent to respondents after the topic was featured during an annual meeting: 1) enhanced recovery after surgery (2<sup>nd</sup> in 2014, the year the topic was introduced, and 5<sup>th</sup> in 2016); 2) difficult cholecystectomy/prevention of bile duct injury (3<sup>rd</sup> in 2015, the year CBD injury was a major topic); 3) management of acute GI surgical emergencies (4<sup>th</sup> in 2015, the year this topic was also discussed). Such a finding indicates that top down programming of the Annual Meeting can help attendees recognize deficiencies of which they are less consciously aware. Clearly, certain topics are consistently perceived as important to attendees, influencing program decisions in terms of planning; nonetheless, the program itself seems to influence perceived needs of attendees by emphasizing topics that increases attendees' perceived need to know.

Among perceived needs, hernia remains the most commonly cited procedural topic with ventral hernia holding the number four spot and inguinal hernia entering in at number five. The other highly rated perceived needs tend to be practice elements that are common to gastrointestinal and endoscopic surgical practice in general. This fact, too, is not surprising. For example, surgeons specializing in bariatrics and colorectal surgery are both interested in guidance on how to introduce a new procedure or technology into practice. Moreover, each specialist may have interest in utilizing an enhanced recovery after surgery protocol, receiving information on complication management, and learning tricks to complete surgical procedures more efficiently and with better outcomes.

Learning themes allow attendees of the Annual Meeting to identify sessions that focus on their own perceived practice gaps. For 2016, the learning themes of bariatrics, colorectal, foregut, and hernia remained in the top four (Table 3). In fact, these four topics have consistently been the top four learning theme chosen by respondents to the immediate post-meeting survey since 2011. Of these, hernia, foregut, and bariatrics have each had about a 20% response rate, whereas colorectal has decreased from a 15% response rate in 2011 to less than 10% in 2016. Three learning themes have remained at the same rank every year: 1) Colorectal (4<sup>th</sup>); 2) New technology/skills acquisition (5<sup>th</sup>); and 3) Professional / Economics (9<sup>th</sup>). The popularity of the top four learning themes from 2011 to 2016 in part is a reflection of the fact that MIS procedures in these clinical topics have demonstrated advantages and are commonly performed.

Anticipated practice changes from 2011 to 2016 also demonstrate a degree of consistency. For example, the most commonly sought practice changes in 2016 were typically related to improving aspects of clinical management (six of the nine learning themes; three of the top four learning themes). This desire to improve upon a particular clinical management issue, as opposed to issues related to complications or surgical techniques, is consistently the most popular type of anticipated practice change among the top four learning themes seen across the entire time period reviewed (Table 5). Encouragingly, full implementation rates for desired practice changes among the top four learning themes were high, with a large majority exceeding 65 %. Such a finding suggests that the Annual Meeting is effective in helping to change attendees clinical practice in positive ways. Barriers to full implementation of top anticipated practice changes within the four most popular learning themes were predominantly environmental in nature, especially lack of administrative support for the change or high implementation cost. When a barrier was more individual-based, insufficient knowledge and lack of time were typically responsible for the difficulty in implementation.

Like perceived needs, the top anticipated practice changes for each learning theme demonstrate a level of consistency from 2011-2016. For example, within the hernia learning theme for 2016, the most popular anticipated changes for survey responders involved improving appropriate application of the hernia repair techniques, patient selection, knowledge of hernia repair materials, and comfort with new hernia repair techniques. These four areas of anticipated change remained common from 2011 to 2016, with each of these options rising to the top of the anticipated changes list for the hernia learning theme during this period (Table 5, Appendices 1 and 2). Moreover, if one reviews the list of courses and sessions offered at each Annual Meeting and the topics covered within those courses, they address each of these anticipated changes (Appendix 3). This fact could represent a top down influence of content development in the Annual Meeting in which an element of the topics covered leads survey respondents to provide these preferential anticipated changes. More likely, however, these findings suggest a bottom up influence in which these goals for improving one's practice are being met by the course directors who recognize these interests from prior survey responses and confirm that each session will include a focus on one or more of these efforts for the practicing surgeon attending it. Similar patterns emerge when looking at other popular learning themes.

SAGES members include a diverse group of surgeons with varying degrees of specialization. As a result, specific clinical focus areas are found not only in courses and sessions dedicated to a specific clinical topic, but they are also found in courses focusing on general areas of the surgical practice. For example, a session from 2014 entitled Enhanced Recovery After Surgery – How You Can Optimize Perioperative Care, Improve Outcomes, and Decrease Costs applies general principles related to ERAS to hernia repair, foregut, bariatrics, and colorectal procedures. Additionally, SAGES has offered courses and sessions covering universal surgical practice topics to appeal to the broad range of surgical specialists attending the Annual Meeting. This effort produced courses that represent a more general focus (i.e., new technologies and skill acquisition, academics and education, flexible endoscopy, and professional and economics) with less focus on the common popular clinical areas. Interestingly, these courses receive significant interest even if the associated learning themes were not selected as a primary interest by attendees in the post-meeting questionnaire. This pattern is repeatedly demonstrated in a review of the courses from 2011 to 2016 (Appendix 3). Thus, despite the fact that attendees select the clinic areas of focus routinely as the top learning themes at the SAGES Annual Meeting, the program routinely has a high percentage of sessions that fall within the non-clinical learning themes of new technologies and skill acquisition, academic and education, and professionalism and economics. Continued effort to offer sessions discussing universal surgical practice topics will allow SAGES to continue to attract a diverse group of attendees to the Annual Meeting.

As with prior analyses, review of the rate of first time correct responses to the 2016 MOC multiple choice questions demonstrates a wide range from just above 30% to over 95%. Interpreting this data remains challenging. Scores could reflect the actual knowledge base of the respondents. In this situation, poor scores would suggest that the topic was not adequately addressed at the Annual Meeting, whereas high scores would suggest that learning occurred. On the other hand, scores could be a reflection of the quality of the multiple choice question itself. In this case, a poor score would be the

result of a poorly designed question and a high score would be due to a question that was too easy in its scope. Hence, caution must be taken when interpreting MOC question results.

Review of the 2016 PG and HO courses reveals variability related to volume changes pre- and post-course. Although many courses appeared to have a decrease in the frequency of responders endorsing the “none” response from pre- to post-course, only the Hernia HO course had none such “none” responses post-course at 3-month follow-up. This Hernia HO course also had the greatest increase in confidence levels for the responders from pre- to post-course (  $\Delta$  approaching 1 full unit). Interestingly, this same course was the HO course chosen to expand the successful 2015 ADOPT pilot program<sup>4,5</sup> to all its participants, suggesting a degree of effectiveness. Upon review of PG and HO courses from 2011 to 2016, the hernia and bariatric learning themes have the two highest total number of courses, whereas the colorectal learning theme is tied with the professional/economic and flexible endoscopy learning themes for the third highest total. Foregut, a top four learning theme, had the lowest number of courses for those learning themes with courses. The new technologies / skills acquisition learning theme has waned in popularity, having four of its five courses held in 2011-2012, whereas the hepatobiliary / solid organ learning theme has waxed, with six of its seven courses taking place from 2014-2016. This increase for hepatobiliary / solid organ themed courses may reflect the growing expansion of MIS techniques in liver surgery.

Limitations to our longitudinal analysis do exist, most notably the response rates. The immediate post-meeting response rate has demonstrated a decline over the period, from a high of 44% of meeting attendees in 2011 to a low of 23% in 2015. The 3-month follow-up response rates have been even more variable, ranging from 14% of those who were invited to fill out the follow up survey in 2013 to 87% in 2015. Thus, the introduction of forms of bias into the analysis of the data is a real possibility. Nonetheless, the percentages in general reach values deemed acceptable for surveys such as these.

In summary, this longitudinal analysis of professional practice gaps identified at SAGES Annual Meetings from 2011 to 2016 demonstrates a consistency related to attendees’ preferred learning themes, the types of anticipated practice changes identified by them, and the barriers encountered to their full implementation after the Annual Meeting. In addition, it reveals a dynamism in the crafting of the content for these Annual Meetings in which topics are selected based on perceived needs of the attendees in a bottom up fashion as well as introduced to attendees in a top down manner, creating a need to know. This complex interaction remains a critical component of the planning process for future SAGES Annual Meetings.

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