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ORIGINAL RESEARCH

What Kind of Surgeon Will You Be? An Analysis of Specialty Interest Changes Over the Course of General Surgery Residency

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Abstract

Background Integrated surgical residency programs and early specialization tracts have increased, with proposed benefits including shorter training time and increased exposure. Drawbacks include a loss of breadth and the need for earlier trainee career decisions. We sought to assess the rate of changing specialty interests over the course of general surgery residency, and what, if any, factors influenced that decision.

Methods An 11-question, web-based survey was sent to alumni (2009–2019) of a single academic general surgery residency training program. It queried demographics and experiences during medical school and residency, whether specialty interest changed, and if so, what factors influenced that decision.

Results The survey was emailed to 53 alumni and completed by 59% (n = 31). The majority were male (n = 24, 77%) and Caucasian (n = 26, 84%). All 31 respondents went on to fellowship training. Three individuals (10%) did not declare a specialty interest when applying to residency. Of the 28 who declared an interest, the majority (n = 17, 61%) changed their interest over the course of residency and ultimately applied to fellowship in a different field. Amongst these, only six (25%) had previous exposure in medical school to the field they ultimately went in to. All who changed specialties (n = 17) reported an impactful clinical rotation influencing their decision.

Conclusions Nearly two-thirds of general surgery residents at a single academic institution changed their specialty interest over the course of residency. Our findings suggest that while integrated programs may provide benefits, many medical students are not being exposed to these potential fields.

Keywords Surgical training · General surgery residency · Integrated residency programs · Early specialization · Training programs

Introduction

Over the past decade, there have been significant paradigm shifts in surgical training. First, specialization and fellowship training have increased, with approximately 80% of general surgery residents pursuing additional training with fellowship [1–3]. Furthermore, the implementation of duty hour restrictions to 80 hours per week by the Accreditation Council for Graduate Medical Education (ACGME) in 2003 has reduced the total number of in-hospital hours for trainees. At the same time, the average individual entering medical school is now older, and student debt at graduation has steadily increased [4–6].

These pressures have combined to popularize integrated surgical residency programs and early specialization programs. In integrated residency programs, medical students apply and matriculate directly into a training program that aims to combine the traditional general surgery residency and specialty fellowship into a single training path. These programs exist for plastic surgery, vascular surgery, and cardiothoracic surgery [7]. General surgery programs have also implemented early specialization programs, whereby trainees can begin specialized training in their subspecialty in their senior years of general surgical

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residency and typically decrease the length of training by one year. This was made possible in 2011, when the American Board of Surgery (ABS) approved a policy to allow customization of up to 12 months of a resident's last 36 months of residency for early tracking [8].

Proposed benefits of both integrated and early specialization training programs include shorter training time, recruitment of competitive applicants, and increased and earlier exposure to the specific field that the trainee will ultimately practice. Perceived drawbacks include a loss of breadth of practice (at the expense of depth) as well as concerns that trainees are making career decisions at a less mature stage [3, 6, 7, 9]. Studies have shown that a medical student's exposure influences their specialty decision [10–14]. An early subspecialty career choice, therefore, may be made without adequate exposure to the remaining various subspecialties of surgery. With these questions in mind, we sought to survey graduates of the Johns Hopkins General Surgery Residency Program over the last decade to assess their medical school and residency exposures and their specialty interests over the course of training.

Material and Methods

After Johns Hopkins Institutional Review Board approval, alumni of the general surgery residency program who graduated between the years 2009 through 2019 with an active, available email address were sent an email containing a link to an 11-question survey generated using the Qualtrics XM Platform (Qualtrics, Provo, UT). Email addresses were obtained from a departmental-maintained repository of alumni contact information and through internet searches. Questions included sex, race/ethnicity, years of surgical residency, what surgical specialties they had clinical rotations or experiences in during medical school, if they participated in research during medical school (and if so, in what field), if they applied to an integrated surgical program, what surgical subspecialty they declared interest in on their residency application and/or in residency interviews, if they did dedicated research time during residency (and if so, in what field), and any factors that influenced the decision to change specialties for those whose specialty interest changed over the course of residency (Appendix). Categorical variables were compared between those who changed their specialty interest and those who did not using chi-squared tests. Continuous variables were compared using two-tailed *t* tests. Statistical analysis was performed using Stata version 15.1 (StataCorp, College Station, TX).

Importantly, Johns Hopkins does not currently have an integrated vascular or cardiothoracic residency program. It has fellowships in both vascular surgery and cardiothoracic surgery, as well as an option for early specialization into vascular surgery from general surgery. Plastic surgery is an integrated, independent residency, but also accepts fellows post-general surgical training. The standard general surgery training pathway includes five years of clinical training interrupted with two years of dedicated academic development/research time, although this time is customized to the trainee with some graduates not performing dedicated research time and others extending the number of years for research or extra-clinical pursuits.

Results

A total of 67 trainees graduated from the Johns Hopkins General Surgery residency between the years 2009 and 2019, with 72% being men ($n = 48$). Active email addresses were available for a total of 53 alumnae (79% of all). The survey was completed by 59% ($n = 31/53$) of those it was sent to. The majority of respondents were male (77%, $n = 24$) and Caucasian (84%, $n = 26$). General surgery residency length varied from four (early specialization where individual did four years of general surgery before proceeding to two-year fellowship at the same institution) to 10 years (five clinical years and five years to obtain a PhD) with an average of 7.1 years. All 31 respondents pursued fellowship training after general surgery residency.

Just over 90% ($n = 28$) of respondents declared a subspecialty interest on their residency application and/or during residency interviews, and three (10%) were undecided (Table 1). No one in this cohort applied to an integrated surgical residency program in additional to general surgery. While 39% ($n = 11$) of these 28 individuals did not change their specialty interest over the course of surgical residency, the majority (61%, $n = 17$) did change their interest and applied for fellowship in a different field than the one they declared interest in when applying to residency. The mean length of residency was longer (7.5 years) for individuals who applied for fellowship in the same specialty they had declared interest in versus those who changed specialty interest (6.6 years), although not statistically significant ($p = 0.055$). Rates of changing specialty interest did not vary by gender (62% of males versus 57% of females, $p = 1.0$).

As medical students, 77% ($n = 24$) of respondents had a clinical rotation in general/acute care surgery, 71% ($n = 22$) in surgical critical care/intensive care unit, and 68% ($n = 21$) in surgical oncology (Fig. 1). On average, each respondent was exposed to 6.5 surgical specialties during medical school. There was the least exposure as a medical student to neurosurgery ($n = 4$, 13%), orthopedic surgery ($n = 4$, 13%), and urology ($n = 5$, 16%). Amongst the general surgery subspecialties, exposure was lowest for breast, transplant, and endocrine surgery, with only 19% ($n = 6$), 19% ($n = 6$), and 23% ($n = 7$) of respondents having a clinical rotation in those fields

Table 1 Declared interest on general surgery residency application/interviews and fellowship choices of 31 alumni of the Johns Hopkins General Surgery Residency Program, 2009–2019

Subspecialty	Number who declared interest (%) 28 (90%), n = 3 (10%) undecided	Number who changed interest (%) 17 (61%)	Number who applied to fellowship (%) 31 (100%)
Surgical oncology	11 (36%)	7 (64%)	5 (16%)
Cardiothoracic	4 (13%)	3 (75%)	5 (16%)
Trauma	3 (10%)	1 (33%)	3 (10%)
Vascular	3 (10%)	2 (67%)	5 (16%)
Colorectal	2 (7%)	1 (50%)	3 (10%)
Pediatric surgery	2 (7%)	1 (50%)	2 (7%)
Transplant	1 (3%)	0 (0%)	5 (16%)
General surgery	1 (3%)	1 (100%)	0 (0%)
Urology	1 (3%)	1 (100%)	0 (0%)
Breast	0	N/A	1 (3%)
Endocrine	0	N/A	1 (3%)
Plastics	0	N/A	1 (3%)

during medical school, respectively. Less than half of respondents had medical school rotations in subspecialties that also have integrated surgical residency programs—45% (n = 14) of respondents rotated on vascular surgery, 48% (n = 15) on cardiac or thoracic surgery, and 39% (n = 12) on plastic surgery. The majority (86%, n = 24/28) had a medical school rotation in the field that they declared interest in.

The majority of respondents (n = 28, 90%) participated in research in medical school, with 79% (n = 22) of those 28 participating specifically in surgical research. Specifically, 68% (n = 15) of these 22 did research in the field that they declared interest in on their residency application or interviews. There was no difference in rates of changing specialty interest between those who did and did not do research during medical school (p = 1.0).

Nearly 84% (n = 26) of surveyed alumni had dedicated research/academic development time during general surgery residency. Of these 26, 61% (n = 14/23 who had declared an interest) did research in the field that they had declared interest in when applying to residency. A larger proportion (73%, n = 19/26) did research in the field in which they then applied to fellowship. There was no difference in rates of changing specialty interest between those who did and did not do research during residency (p = 0.27).

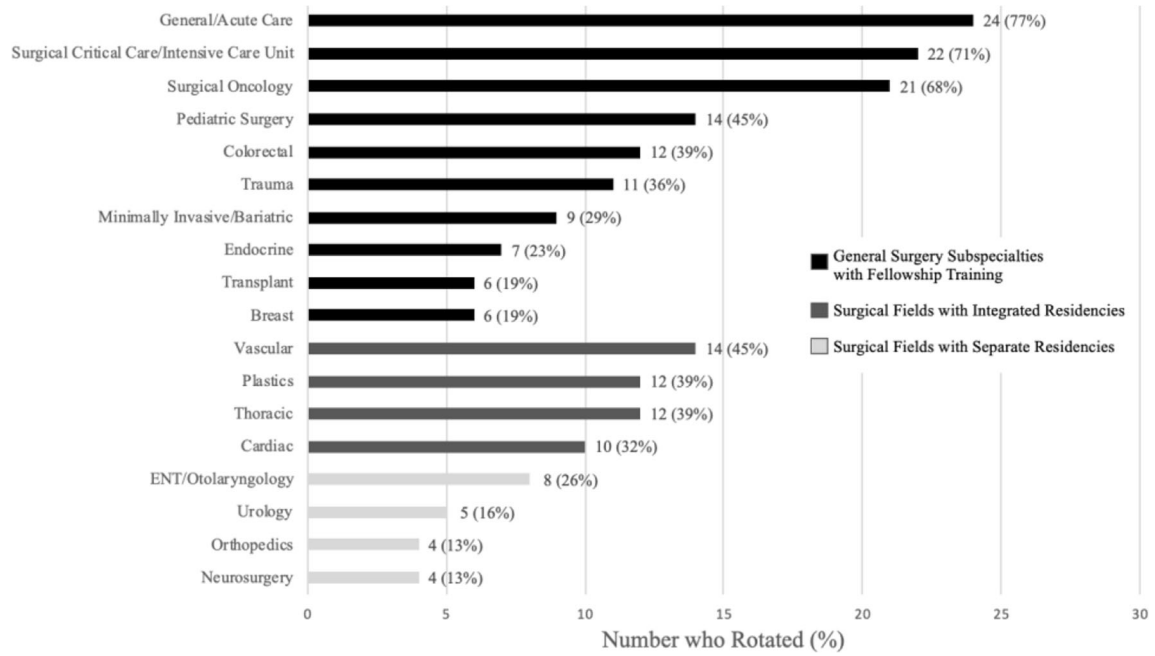

Fig. 1 Exposure to surgical subspecialties in medical school of 31 graduates of the Johns Hopkins General Surgery Residency Program, 2009–2019

All 17 individuals who changed their specialty interest over the course of residency cited an impactful clinical rotation as influencing their decision. Other factors included mentorship (88%, $n = 15$) and research experience (59% $n = 10$). Of all 31 respondents, 61% ($n = 19$) did a medical school rotation in the field they ultimately went to fellowship in. Amongst the 17 individuals who changed their interest over the course of residency, only 6 (35%) had been exposed in medical school to the field they ultimately went in to.

Just over one-third (36%, $n = 11/31$) of responding Johns Hopkins General Surgery alumni pursued fellowship in a field that has an integrated residency program as an available training paradigm (cardiothoracic, vascular, or plastics). Of these 11, seven (64%) changed their specialty interest over the course of residency, two (18%) kept the same interest throughout, and two (18%) began residency undecided.

Discussion

In this survey of the graduates of a single academic general surgery residency program over the last decade, all respondents went on to specialized fellowship training. When applying for general surgery residency, the large majority (90%) indicated their intended specialty, but nearly two-thirds (61%) of those individuals changed interest over the course of residency and applied to fellowship in a different field. Every individual who changed their specialty interest stated that an impactful clinical rotation influenced their decision. Amongst these same individuals, only about one-third (35%) had a medical school rotation in the field in which they ultimately pursued a career.

Medical students are first faced with the broader decision of what field of medicine to pursue (e.g., medicine, surgery, pediatrics) and spend the clinical years of their education gaining exposure and rotating through each of these fields. Typically, students spend approximately two months on a surgical clerkship. Most surgical clerkships consist of general surgery, some of the subspecialties, and some surgical specialties that have independent residency training programs (e.g., neurosurgery, orthopedic surgery, otolaryngology). It is certainly difficult, if not impossible, to expose medical students to all of the subspecialties within surgery, particularly as surgery becomes increasingly specialized [2]. On average, each of our respondents rotated through 6.5 fields during medical school. Even amongst these individuals—who applied to general surgery residency and thus had additional exposure time through sub-internships and electives—there are many fields they never experience until becoming surgical house staff. Furthermore, less than half of respondents had medical school rotations in the subspecialties that currently have integrated surgical residency programs (45% in vascular surgery, 48% in cardiothoracic surgery, and 39% in plastic surgery). Results from the Association of American Medical Colleges (AAMC) Graduation Questionnaire show that 85% of medical students change their preferred residency specialty over the course of medical school [15]. Many studies have demonstrated that experiences as a medical student strongly influence specialty choice [11–14]. Indeed, 86% of our respondents had a medical school rotation in the field in which they declared an interest. Therefore, if integrated training tracts—with their proposed benefit of shorter and more focused training—are to be further popularized and utilized, so too should a system exist to provide medical students with exposure to these fields [3, 6, 7].

One potential solution is to restructure the surgical clerkship to include more, shorter-duration specialty experiences. For example, in a two-month clerkship, rather than have students rotate on a single surgical service for the whole two months or two services each for one month, students could spend two weeks each in four fields. The disadvantage to this approach is the loss of familiarity and teambuilding that occurs with a longer duration experience, but the benefit is student exposure to more disciplines of surgery. A second potential solution is to use the surgical sub-internship to provide additional exposure for those students who have expressed an interest in surgery and hence have pursued a sub-internship. This could include requiring that the sub-internship field is different than those the student was already exposed to in their core surgical clerkship, or similarly requiring several different subspecialty exposures rather than a single, longer experience on one service. A final potential solution is to give particular priority to exposure to those fields in which an integrated surgical residency exists, so that students have a chance to experience the specialty and decide if they are interested in applying directed to these residency training programs.

The "traditional" tract, where a trainee applies to and completes a fellowship after general surgery residency, should remain for those who do not have exposure, are unsure, or who change their mind. Indeed, nearly two-thirds of our respondents changed their specialty interest over the course of general surgery residency. Those who argue against early specialization raise this concern, that students make a narrow, specialized career decision at a less mature stage [6, 7, 9]. While the traditional pathway generally takes more years, it leaves many more options open compared with integrated programs. Integrated residency programs, however, appear to have lower rates of attrition than general surgery residencies, although there is less data and shorter time periods to assess [16, 17]. A meta-analysis of 22 studies reporting on attrition rates of nearly 20,000 residents from general surgery programs found a pooled attrition prevalence of 18% (95% CI 14–21%) [16]. The most common cause of attrition was uncontrollable lifestyle, followed by choosing to join another specialty in 19–39% of those who left general surgery residency. When individuals changed specialty, anesthesia was

the most frequent new residency [16]. The attrition rates of surgical specialties with independent residencies are less robustly reported on, but generally have been lower than those of general surgery with attrition prevalence of 14% for neurosurgery, 6% for otolaryngology, and 5% for orthopedics [18–20]. The attrition rate for integrated vascular surgery residency has been reported at 0–6%, for integrated cardiothoracic surgery residency 0–3%, and for plastics 3% [17, 21].

This study is limited by its small sample size and restriction to one academic, urban program, which may not be generalizable to all surgical trainees and programs. It also has the inherent limitations of a survey study, such as nonresponse error [22]. Specifically, the survey was sent to the 53 alumnae who had available email addresses of a total of 67 trainees during the study period, raising a potential for selection bias. The demographics of those who responded to the survey were, however, similar to the demographics of the residency as a whole (i.e., 72% of all graduates from 2009 to 2019 male vs. 77% of the survey respondents). Compared to all surgical trainees across the country, more of our residents take time for dedicated full-time research—84% of Johns Hopkins General Surgery residents versus an estimated 36% of trainees from all general surgery residencies participating in the National Resident Matching Program (determined from a survey sent to program directors) [23]. About a quarter of our graduates (28% of all graduates 2009–2019, 23% of survey respondents) are woman, compared with 40% of all general surgery residents (per the 2018 Physician Specialty Data Report from the Association of American Medical Colleges) [24]. A larger majority (84%) of our respondents were Caucasian, as compared to an estimate of 62% Caucasian general surgery residents in a survey administered after the 2008 American Board of Surgery In-Service Training Examination to all categorical general surgery residents [25].

This study, however, reinforces the fact that medical student clinical exposures have a great impact on specialty interest. This trend continues into residency training, with all of the nearly two-thirds of our respondents whose intended specialty changed over the course of residency citing impactful clinical rotations as a reason for their decision. This would suggest that medical students interested in a surgical career need exposure to the fields offering integrated residencies in order to apply and take advantage of these fast-tracked programs. The limited amount of time on a surgical clerkship, combined with the increased subspecialization of surgery, however, makes this a difficult task to achieve.

Conclusions

In this survey study of a decade of alumni from a single academic general surgery residency, 90% of respondents declared interest in a specific surgical subspecialty when applying to residency, 61% then changed that interest over the course of residency, and all applied to fellowship. Of those who changed specialty interest, all were influenced by an impactful clinical rotation, and only 35% had rotated as a medical student on the surgical subspecialty that they ultimately pursued a fellowship in. On the other hand, 86% of those who declared a specialty interest had rotated on that service as a student. The most common medical student surgical rotations were general/acute care surgery, surgical intensive care unit, and surgical oncology, whereas less than half of respondents had exposure to the fields that have integrated residency programs (cardiothoracic, vascular, and plastics). These findings highlight the importance of exposure as a medical student to the various possible surgical fields, particularly for those specialties that have integrated resident programs or early specialization tracts.

Code Availability Available to review

Authors' Contributions K Giuliano—formation of study question, study design, survey design and distribution, data analysis, data interpretation, manuscript preparation; E Etchill—study design, survey design, data interpretation, manuscript preparation; S DeBrito—formation of study question, study design, data interpretation, manuscript preparation; B Sacks—formation of study question, study design, survey design, data interpretation, manuscript preparation.

Data Availability Available to review

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethics Approval This study was approved by the Johns Hopkins Institutional Review Board.

Consent to Participate Completion of the survey served as the study participants' informed consent (and was stated as such in the survey).

References

1. Borman KR, Vick LR, Biester TW, Mitchell ME. Changing demographics of residents choosing fellowships: longterm data from the American Board of Surgery. J Am Coll Surg. 2008;206:782–8; discussion 788-789. https://doi.org/10.1016/j.jamcollsurg.2007.12.012.
2. Stitzenberg KB, Sheldon GF. Progressive specialization within general surgery: adding to the complexity of workforce planning. J Am Coll Surg. 2005;201:925–32. https://doi.org/10.1016/j.jamcollsurg.2005.06.253.
3. Longo WE, Sumpio B, Duffy A, et al. Early specialization in surgery: the new frontier. Yale J Biol Med. 2008;81:187–91.
4. Craft JA, Craft TP. Rising medical education debt a mounting concern. Graduates also face less favorable repayment terms, shortage of training positions. Mo Med. 2012;109:266–70.

5. Jauhar S. From all walks of life–nontraditional medical students and the future of medicine. N Engl J Med. 2008;359:224–7. https://doi.org/10.1056/NEJMp0802264.
6. Campbell ST, Dave DR. Two sides to every story: early specialization in medical education. Med Sci Educ. 2018;28:243–6. https://doi.org/10.1007/s40670-017-0489-y.
7. Grant SB, Dixon JL, Glass NE, Sakran JV. Early surgical subspecialization: a new paradigm? Part I Bull Am Coll Surg. 2013;98:38–42.
8. The American Board of Surgery. Training & certification. Flexible rotations. http://www.absurgery.org/default.jsp?policyflexrotations. Accessed 1 May 2020.
9. Ferguson C. The arguments against fellowship training and early specialization in general surgery. Arch Surg. 2003;138:915–6.
10. Schmidt LE, Cooper CA, Guo WA. Factors influencing US medical students' decision to pursue surgery. J Surg Res. 2016;203:64–74. https://doi.org/10.1016/j.jss.2016.03.054.
11. Berman L, Rosenthal MS, Curry LA, et al. Attracting surgical clerks to surgical careers: role models, mentoring, and engagement in the operating room. J Am Coll Surg. 2008;207:793–800, 800.e1–2. https://doi.org/10.1016/j.jamcollsurg.2008.08.003.
12. Chen H, Hardacre JM, Martin C, Lillemoe KD. Do medical school surgical rotations influence subspecialty choice? J Surg Res. 2001;97:172–8. https://doi.org/10.1006/jsre.2001.6135.
13. Haggerty KA, Beaty CA, George TJ, et al. Increased exposure improves recruitment: early results of a program designed to attract medical students into surgical careers. Ann Thorac Surg. 2014;97:2111–4; discussion 2114. https://doi.org/10.1016/j.athoracsur.2014.02.029.
14. Patel MS, Mowlds DS, Khalsa B, et al. Early intervention to promote medical student interest in surgery and the surgical subspecialties. J Surg Educ. 2013;70:81–6. https://doi.org/10.1016/j.jsurg.2012.09.001.
15. 2019 report on residents executive summary. In: Assoc. Am. Med. Coll. https://www.aamc.org/data-reports/students-residents/interactive-data/report-residents/2019/executive-summary. Accessed 9 Apr 2020.
16. Khoushhal Z, Hussain MA, Greco E, et al. Prevalence and causes of attrition among surgical residents: a systematic review and meta-analysis. JAMA Surg. 2017;152:265–72. https://doi.org/10.1001/jamasurg.2016.4086.
17. Chen H, Reddy RM, Palmer SW, et al. Attrition rates in integrated vascular and cardiothoracic surgery residency and fellowship programs. J Vasc Surg. 2019;69:236–41. https://doi.org/10.1016/j.jvs.2018.07.074.
18. Lynch G, Nieto K, Puthenveettil S, et al. Attrition rates in neurosurgery residency: analysis of 1361 consecutive residents matched from 1990 to 1999. J Neurosurg. 2015;122:240–9. https://doi.org/10.3171/2014.10.JNS132436.
19. Prager JD, Myer CM, Myer CM. Attrition in otolaryngology residency. Otolaryngol–Head Neck Surg. 2011;145:753–4. https://doi.org/10.1177/0194599811414495.
20. Walker JL, Janssen H, Hubbard D. Gender differences in attrition from orthopaedic surgery residency. J Am Med Womens Assoc 1972. 1993;48:182–4 193.
21. Yang MK, Meyerson JM, Pearson GD. Resident attrition in plastic surgery: a national survey of plastic surgery program directors. Ann Plast Surg. 2018;81:360–3. https://doi.org/10.1097/SAP.0000000000001526.
22. Jones TL, Baxter MAJ, Khanduja V. A quick guide to survey research. Ann R Coll Surg Engl. 2013;95:5–7. https://doi.org/10.1308/003588413X13511609956372.
23. Robertson CM, Klingensmith ME, Coopersmith CM. Prevalence and cost of full-time research fellowships during general surgery residency: a national survey. Ann Surg. 2009;249:155–61. https://doi.org/10.1097/SLA.0b013e3181929216.
24. ACGME residents and fellows by sex and specialty, 2017. In: AAMC. https://www.aamc.org/data-reports/workforce/interactive-data/acgme-residents-and-fellows-sex-and-specialty-2017. Accessed 22 Sep 2020.
25. Wong RL, Sullivan MC, Yeo HL, et al. Race and surgical residency: results from a national survey of 4339 US general surgery residents. Ann Surg. 2013;257:782–7. https://doi.org/10.1097/SLA.0b013e318269d2d0.