Surgical Exploration and Discovery Program: Early Exposure to Surgical Subspecialties and Its Influence on Student Perceptions of a Surgical Career

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OBJECTIVE: Interest in pursuing a surgical career has been declining among North American medical students. Numerous factors are known to influence student interest in pursuing surgery as a career, such as prestige, income potential, and overall lifestyle. Given that many of these factors are rooted in bias, it may be possible to properly address several of these stereotypes through first-hand, early exposure to the field of surgery via the Surgical Exploration and Discovery (SEAD) Program. The purpose of this study is twofold: (1) to investigate whether participation in an intensive, 2-week surgical program may alter student opinion, bias, and/or preconceived assumptions of a career in surgery, and (2) to determine whether these changes in perception, if present, has an impact on student interest in pursuing a surgical career compared to baseline.

DESIGN: This was a prospective cohort study. The analysis cohort consisted of 30 first-year medical students who participated in the 2-week SEAD program. The control group consisted of 29 first-year medical students who did not participate in the SEAD program. Both the SEAD and control groups completed two surveys: (1) an entry survey distributed prior to the start of the SEAD program, and (2) an exit survey distributed upon completion of the SEAD program. The surveys were designed to assess students' motivations for choosing a specialty in medicine, previous surgical experience, as well as perceptions and biases surrounding a surgical career, pre- and post-exposure.

SETTING: Undergraduate Medical Education, Faculty of Medicine, at the University of Ottawa in Ottawa, Ontario, Canada.

PARTICIPANTS: 30 medical students in the SEAD group, and 29 in the control group.

RESULTS: Students' perceptions of the lifestyle, call schedule as a staff or resident, diversity of practice and gender changed significantly following the SEAD program compared to students in the control group. Furthermore, students' perceptions of surgeons as intimidating declined following the 2-week program ($p = 0.003$), however they were more likely to view surgery as a field requiring physical strength ($p = 0.022$). Overall, there was no significant change with regards to desire to pursue a career in surgery in the treatment group ($p = 0.625$) or in the control group ($p = 1.00$).

CONCLUSIONS: Early exposure to surgery through the SEAD program alters student perceptions of surgical specialties, yet it does not significantly influence students to pursue a career in the surgical field. Nonetheless, participation in the SEAD program continues to assist medical students with career decision making. (J Surg Ed 76:1248–1257. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Undergraduate medical education, surgical education, medical students, career, stereotype, surgery

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INTRODUCTION

In recent years, interest in pursuing a surgical career among North American medical students has declined.[1-10] This reality has sparked concern within the surgical community with respect to the quality of its future workforce and its ability to meet the demands of the aging population.[5] To address the nationwide attrition in surgical residency applications, numerous studies have been conducted to uncover the many considerations that influence students' career decision-making.[1,3-5,11,12] Among others, these factors include lifestyle, prestige, presence of role models, and exposure and participation within a particular specialty.[1,3-5,11,12] Specific to surgery, prestige and income potential has been cited as positive influential factors, while a less flexible lifestyle has been cited as a negative influential factor.[5]

Furthermore, there exist stereotypes attributed to both surgeons and surgical subspecialties – a factor which has been reported to negatively influence medical student career decision-making, often before adequate, first-hand exposure has occurred.[11,13,14] Interestingly, several studies have shown that interactions with surgical faculty and exposure to surgical practice – whether brief or longer-term – have transformed students' negative perceptions of the field into more positive ones.[6,14,15] These findings are not entirely surprising, given the lack of exposure to surgical specialties amongst medical school pre-clerkship curriculums.[16] Gawad et al.[17] have accurately noted that even during clerkship, only a handful of the many surgical subspecialties are explored by any individual student. Consequently, many students will have completed their 4-year medical education without having experienced over half of the surgical subspecialties available to them. Given that the majority of medical students decide which specialty to pursue prior to starting clerkship,[5,18] integrating a stronger surgical presence in the pre-clerkship years would not only provide a more robust medical curriculum, but may also improve student interest in pursuing a surgical career. In addition, early exposure to surgery would facilitate a more accurate depiction of the specialty and help eliminate any false perceptions, bias, or stereotypes commonly attributed to surgery.

One initiative that certainly enhances student exposure to the field of surgery early on in their medical careers is the Surgical Exploration and Discovery (SEAD) Program. The SEAD Program was founded by Dr Nada Gawad at the University of Toronto in 2012,[17] and has since expanded to 5 other North American Sites. This program has facilitated improved understanding of a career in surgery, and has positively influenced overall student interest in pursuing a surgical career.[17] Additionally, the SEAD program has enabled student participants the unique opportunity to rule in or out various surgical subspecialties from personal experience early on in their medical education,[17,19] providing them with a more well-rounded approach to career decision-making based off of factual experience rather than perceived knowledge. Given that medical students often make career choices based on factors rooted in bias,[6] it may be possible to properly address a number of surgical stereotypes through early exposure via the SEAD Program.

The purpose of this study is twofold: (1) to investigate whether an intensive, 2-week surgical program may alter student opinion, bias, and/or preconceived assumptions of a career in surgery when compared to a control group of medical students who did not participate in the program, and (2) to determine whether these changes in perception, if present, have an impact on student interest in pursuing a surgical career compared to baseline.

MATERIAL AND METHODS

Participants and Study Design

This was a prospective cohort study that evaluated the influence of participation in an intensive surgical education program on surgical perceptions, by comparing a group of students who participated in the SEAD program (SEAD Group) to a similar group who did not participate in the program (Control Group).

The study population consisted of a cohort of 59 first-year undergraduate medical students from the University of Ottawa. The SEAD and Control groups consisted of 30 and 29 students, respectively.

A total of 70 first year medical students applied to participate in the SEAD program. Prior to participant selection, applicants were allocated into 1 of 3 categories based on baseline level of interest in pursuing a surgical career (very interested, somewhat interested, unsure). Random selection of 10 students from each group was performed to ensure a diverse array of participants. Regardless of baseline interest in pursuing surgery, all 30 members of the SEAD group were eager to gain exposure to the field of surgery through the SEAD Program.

The control group consisted of 29 first-year medical students who did not participate in the SEAD program. No intervention was applied to this group of students,

however they were not restricted from gaining exposure to surgery (outside of the SEAD program) during their 2-week involvement in this study (e.g. through independent clinical electives, research opportunities, etc.). Recruitment of subjects in the control group was carried out by contacting first year medical students at the University of Ottawa via the Surgery Interest Group (SIG) mailing list. Subscription to this list was voluntary and students could unsubscribe at any time. Incentive for students to participate was twofold: (1) students were awarded 2 hours of extracurricular involvement toward the SIG, and (2) students were automatically entered into a draw to win 1 of 3 suture kit prizes.

Recruitment for study participation was performed following the final selection of SEAD participants and in no way influenced student involvement in the program. Participation for both the SEAD and Control groups was voluntary. Institutional ethics approval was received and informed consent was obtained from all study participants prior to their involvement in the study.

SEAD Program Curriculum

Since its implementation at the University of Ottawa in 2014, The SEAD Program has run annually for 4 consecutive years. The current structure of The SEAD Program at the University of Ottawa remains similar in layout to previous years,[19] modeled from the original outline developed by Gawad and colleagues at the University of Toronto.[17] Students who had just completed their first year of medical school participated in this 2-week summer program, which consisted of 3 major components:

(1) *Morning OR Observerships:* Students were assigned to observe surgical procedures in the mornings (8 am-12 pm) throughout the program. Efforts were made to ensure an adequate representation of all 9 surgical subspecialties for each student; however, due to constraints such as time and subspecialty case availability, most students observed between 6 and 8 subspecialties during the program. The order of specialties observed was arbitrary and was unrelated to the specialty hosting the career talk and simulation workshop on that particular day.

(2) *Lunchtime Career Discussions:* Each day of the program, students gathered at the uOttawa Simulation Center for lunch (12 pm-1 pm), to listen and participate in an informal discussion led by a surgeon from a given subspecialty. Topics covered included scope of practice, residency and fellowship, research opportunities, lifestyle factors, job market outlook, and weekly responsibilities. Each of the 9 surgical subdivisions hosted 1 career discussion.

(3) *Afternoon Workshops:* Following the career discussion, a 3-hour (1 pm-4 pm) hands-on simulation workshop was led by the same surgical subspecialty that hosted the lunchtime talk, and consisted of common procedures performed within their specialty. The goals of the workshops were to engage students, develop and build upon their basic surgical skills, facilitate rapport with staff and resident surgeons, and to provide exposure to the breadth of practice of each subspecialty. Each session was led by 1-2 staff surgeons, and 4-5 surgical residents to maximize individual instruction.

Baseline Testing

On the first morning of the SEAD program, time was allotted for participants in the SEAD group to complete the online "SEAD Study Entry Survey." This survey consisted of three major components: (1) baseline demographic characteristics and importance of various lifestyle factors in choosing a residency program; (2) previous exposure and interest in each of the 9 surgical subspecialties; and (3) incoming bias and perceptions related to each of the 9 surgical subspecialties. Students were also asked to rank their current top 3 choices for residency, surgical or nonsurgical. A variety of question styles were employed in the survey, including but not limited to: simple yes/no responses, ranking of surgical subspecialties based on several career markers, and responding to various statements regarding surgical stereotypes using a Likert Scale. Please refer to the "SEAD Study Entry Survey" in supplementary materials for a detailed outline.

The Control Group received the "SEAD Entry Survey" via e-mail to complete along a similar timeline as the experimental group. The survey administered to both study groups was identical. The response rate for both the SEAD and Control groups was 100%.

Student responses for both groups were blinded to the SEAD directors and all parties involved in interpretation of the study results. A third party medical student was responsible for randomly generating and distributing 4-digit codes to each SEAD participant that would serve as their "Study ID." This student was not involved in any aspect of the SEAD program. For the control group, students were asked to create their own 4-digit "Study ID." This was done to eliminate the need for control group members to e-mail the third party medical student to be given a study ID, thereby allowing them to complete the survey immediately upon receipt of request from authors. All study participants were instructed to use the same "Study ID" for both the entry and exit surveys.

Final Testing

On the final day of the program, SEAD participants were asked to complete the "SEAD Exit Survey." This survey

was nearly identical to the Entry Survey, with two minor exceptions: (1) the removal of several demographic characteristics, as these could be linked back to the subject's original response through their Study ID, and (2) the addition of a section evaluating overall student experience in each of the 9 surgical subspecialties over the course of the 2-week SEAD program. Please refer to the "SEAD Study Exit Survey" in supplementary materials for a detailed outline.

Two weeks following completion of the "SEAD Entry Survey," members of the Control Group were sent a link to complete the "SEAD Exit Survey." This survey was identical in composition to that filled out by the SEAD participants. Students were asked to leave the added section blank if they did not gain additional exposure to any of the 9 surgical subspecialties within the 2-week period following completion of the entry survey. The response rate for both the SEAD and Control groups was 100%; however, certain sections were left partially incomplete by a small proportion of students in the control group.

Test Design

All second-year medical student coordinators contributed to the development of the pre- and post-exposure SEAD surveys. Several components of the surveys were modeled based on factors previously reported to influence medical students' career decision-making.[5,11,13-15,20-22] Collaboration with a staff surgeon and Undergraduate Surgical Education Coordinator was carried out to evaluate the strength, accuracy, and completeness of the survey design.

Statistical Analysis

The Mann Whitney test, Fischer Exact Two tail test and independent samples *t*-test were used to analyze baseline demographics data. Fischer exact two tail test was used to compare the factors for choice of specialty between the SEAD and the control group. Wilcoxon signed rank test was used to evaluate change in bias and perception following the SEAD program. A $p < 0.05$ was indicative of statistical significance. All statistical tests were conducted using SPSS Software (SPSS v 21; IBM Corp, 2012).

RESULTS

Thirty first-year medical students participated in and completed the SEAD program. The control group consisted of 29 first-year medical students, all of whom completed both the entry and exit surveys. All students in the SEAD and control groups were included for analysis ($n = 59$).

There were no statistical differences in baseline characteristics between the two groups with regards to student age, gender, percent considering surgery as a career, and number of students who had mentors in surgery ($p > 0.05$) (Table 1). Students reported having mentors in various subspecialties (general surgery, cardiac surgery, plastic surgery, urology, vascular surgery, and orthopedic surgery). All SEAD participants with previous surgical mentorship reported having a positive experience with their mentor. Of those in the control group who had an existing mentor, 10 reported having a positive experience and 4 reported their

TABLE 1. Baseline Characteristics

	Control ($n = 29$)	Treatment ($n = 30$)	p Value
Hours observed Median (25th-75th percentile)	18 (9-43.5)	5.75 (0-18.5)	0.003
Gender	F = 16 M = 13	F = 15 M = 15	0.796
Age Mean (standard deviation)	23.24 (1.35)	23.17 (2.39)	0.298
Considering surgery as a career *N* (%)	17 (65)*	19 (63)	1.00
Mentor in surgery *N* (%)	9 (31)	4 (13)	0.125
Mentor specialties	General surgery (6) Cardiac surgery (1) Plastic surgery (2) Urology (1) Vascular surgery (1) Orthopedic surgery (3)	Orthopedic surgery (5) Urology (1)	
Perception of mentorship	Positive (10) Neutral (4) Negative (0)	Positive (5) Neutral (0) Negative (0)	

* $n = 26$ for this question only.

experience as neutral. The survey revealed a discrepancy between the 2 groups with respect to previous surgical exposure, as evidenced by the number of hours of surgery observed – students in the SEAD group had observed a median of 5.75 hours in the OR compared to 18 hours for the control group ($p = 0.003$). Following completion of the exit survey, the median number of hours observed in surgery for SEAD and control group members increased significantly, to 36 hours ($p < 0.001$) and 30 hours ($p = 0.001$), respectively.

Students in the experimental and control groups shared a similar perspective with respect to the factors that they valued in guiding their future choice of specialty ($p < 0.05$). One notable difference observed was that 31% of students in the control group agreed that their ideal career choice would have little call as a resident, compared to only 6.7% in the SEAD group ($p = 0.021$) (Supplementary Table 1).

The number of students interested in any surgical subspecialty at baseline was not significantly different between the 2 groups – 63% of students in the SEAD group and 65% of students in the control group ($p = 1.00$) (Table 1). Following completion of the SEAD program, the net change in interest in surgery was +7% for the experimental group ($p = 0.727$), compared to −4% for the control group ($p = 1.00$). Seventeen percent of students in the SEAD group developed a new interest in surgery (in any of the subspecialties) compared to 0% of students in the control group ($p = 0.0298$). Ten percent of students in the SEAD group were able to rule out a prior interest in surgery, compared to only 4% in the control group ($p = 0.391$).

Regarding subspecialty-specific interest amongst SEAD participants, the largest net gain in interest was vascular surgery (+27%), while the largest net losses were cardiac and orthopaedic surgery (−20% and −10%, respectively). There was less variability in the control group, with the largest net gains occurring in general surgery, cardiac surgery, and otolaryngology (+14%, +10%, and +10%, respectively), and the largest net loss occurring in neurosurgery (−3%). These results are displayed in Table 2.

Students in both the SEAD and control groups shared similar perceptions surrounding surgeons and a surgical career. Both groups agreed with statements that described surgeons as confident, surgery as a competitive yet rewarding profession, and a prestigious career with challenging cases that would keep one interested. Furthermore, students in both groups disagreed with the statements that surgery is a gender balanced field, that surgery allows for work-life balance, and that it is a field with comparable working hours to other specialties. Student opinion did not change following the

TABLE 2. Interest in Surgical Subspecialty Before and After Intervention*

Specialty	% Interested at Baseline		Final % Interested		% That Developed New Interest		% That Ruled Out a Prior Interest		Net Change in % Interested	
	Control	SEAD	Control	SEAD	Control	SEAD	Control	SEAD	Control	SEAD
Urology	34	43	41	50	14	20	7	13	8	7
Thoracic surgery	41	30	41	23	10	7	10	13	0	−7
General surgery	59	77	72	70	14	17	0	23	14	−7
Neurosurgery	24	33	21	30	0	7	3	10	−3	−3
Vascular surgery	24	23	31	50	10	37	3	10	7	27
Cardiac	34	47	45	27	17	0	7	20	10	−20
Orthopedic surgery	55	53	59	43	7	7	3	17	3	−10
Plastic surgery	41	37	45	33	10	7	7	10	3	−3
Otolaryngology	31	40	41	37	14	3	3	7	10	−3
Any surgical specialty	**65**	**63**	**62**	**70**	**0**	**17**	**4**	**10**	**−4**	**7**

*SEAD group $n = 30$, control group $n = 26$.

intervention for these statements ($p > 0.05$) (Supplementary Table 2).

While there were many perceptions (listed above) that persisted, several changes in student perception were observed for the SEAD group. A significant decrease in the proportion of participants that perceived surgeons as intimidating occurred (50% pre-SEAD vs 36.7% post-SEAD, $p = 0.003$). A significant increase in the proportion of students that believed surgery to be a specialty requiring physical strength was observed (26.7% pre-SEAD vs 43.4% post-SEAD, $p = 0.022$). No significant change in opinion for these two statements was observed in the control group ($p = 0.317$ and 0.175, respectively) (Supplementary Table 2).

In the final component of the survey where students were asked to rate various statements regarding each of the 9 surgical subspecialties on a Likert Scale, several significant changes were observed for both the SEAD and control groups. In the SEAD group, staff and residents in the fields of urology, plastic surgery, orthopedic surgery, vascular surgery, and otolaryngology were deemed more approachable post-exposure ($p < 0.05$). SEAD participants also changed their perceptions of the work-life balance of several surgical subspecialties. Urology and otolaryngology were perceived to have a better work-life balance compared to other specialties than initially perceived ($p = 0.015$, $p = 0.001$, respectively). In contrast, general surgery was perceived to have a less satisfying work-life balance compared to other specialties ($p = 0.013$). Furthermore, students in the SEAD group described plastic surgery as being more gender balanced ($p = 0.018$), orthopedic surgeons as having longer working hours ($p = 0.001$), and otolaryngology as having significant career flexibility ($p = 0.006$) as well as more outpatient than in-hospital patient care ($p = 0.018$) than initially perceived. These changes in perception were not significant for the control group. However, following completion of the exit survey, a higher percentage of students in the control group felt that a career in urology is prestigious (69.0% vs 37.9%, $p = 0.047$), that general surgeons enjoy favorable career flexibility (65.5% vs 58.6%, $p = 0.041$) and that general surgeons are able to develop a long-term relationship with patients (41.4% vs 17.2%, $p = 0.016$). These results are displayed in Supplementary Table 3.

DISCUSSION

The SEAD program offers first year medical students the unique opportunity to gain early and broad exposure to surgery, one that may not otherwise be available until clerkship. Numerous studies have linked first-hand exposure with enhanced perceptions of surgery. Kozar et al.[15] showed that even a brief, 1-hour interaction between first-year medical students and practicing surgeons had a positive influence on student perceptions of a career in general surgery. A study by Cochran et al.[6] showed that medical students' perceptions of surgeons and surgical careers predominantly improved following their surgical clerkship rotation. Additionally, a recent study out of McMaster University revealed that negative perceptions of urology, such as poor lifestyle and narrow range of practice, were correlated to a lack of exposure and faculty involvement in undergraduate medical education. Following adequate exploration and mentorship, more positive perceptions were established.[14] In this study, we found that the SEAD program influenced a number of student perceptions, biases and preconceived assumptions surrounding surgical subspecialties when compared to a control group, but that it did not significantly alter the number of students interested in pursuing a surgical career.

Baseline Characteristics

As previously noted, there was a significant difference in previous surgical exposure between the SEAD and control groups, with students having observed a mean of 5.75 and 18 hours in the OR, respectively. This is likely a function of the selection process. Students in the SEAD group were randomly selected to participate in the program with an equal distribution of students that were very interested, somewhat interested and unsure of pursuing a career in surgery. In contrast, the control group was selected as a convenience sample, consisting of student members of the SIG who likely wished to gain further surgical extracurricular involvement through participation in our study. The voluntary nature of this selection process likely bred students with a higher baseline interest in surgery to respond. Interestingly, students in both the experimental and control groups reported similar baseline interest in surgery (63% and 65%, respectively), which goes against what would have been expected based on the aforementioned selection process. This may be attributed to subjective interpretation of the survey question itself. As part of the entry survey, students were asked to report whether or not they had considered a career in each of the 9 surgical subspecialties. This statement may hold a different meaning for individual students, with some requiring more strict criteria to answer "yes" compared to others.

Student Perceptions of Surgical Subspecialties

The results from our study support the SEAD program as an avenue capable of altering certain preconceived notions regarding surgical subspecialties. It has been shown previously that although students may not

receive much first-hand exposure to surgery in the pre-clerkship curriculum, they are still exposed to many stereotypes of surgery, whether accurate or not, that may deter them from pursuing a surgical career.[23] Given that students often decide against a career in surgery without much prior exposure,[11,13,14] Hill et al.[11] performed a study aiming to identify and understand the stereotypes of surgeons and surgery held by medical students that may influence their desire to pursue a surgical career. Their findings demonstrated that surgeons are perceived as confident and intimidating, and that the field of surgery is viewed as masculine, competitive, and requiring sacrifice. This was congruent with our study, where 50% of students in the SEAD group agreed that surgeons were intimidating. However, following completion of the SEAD program, there was a significant decrease in this value to 36.7%. Additionally, after completing the SEAD program, students perceived the staff and residents in 5/9 of the surgical subspecialties as more approachable. Students also reported significant changes in perception within individual subspecialties regarding favorable work-life balance, gender balance of residents and staff, and career flexibility. These results parallel findings from multiple prior studies that demonstrate that even short interventions with staff surgeons and residents can favorably change student perceptions.[3,6,14,15,24] These findings suggest the possibility that some incoming student biases toward surgery may be incongruent with reality. Dispelling false preconceived assumptions early during pre-clerkship can be a key step toward encouraging students to explore surgery as a potential future career, and seek out mentors that can assist them along their chosen career path.

In addition to observing several shifts in perception, the SEAD program was also able to reinforce several already positive stereotypes attributed to surgery. Students in the SEAD group still perceived surgeons as confident individuals post-intervention, and continued to agree that surgery is a highly prestigious, rewarding profession that offers interesting and challenging cases. This consistency in opinion was also seen in the control group, however, which supports the idea that not all incoming surgical bias is necessarily misguided.

While many of the changes in perception were positive post-intervention, the development of several more negative perceptions was also observed. After completion of the SEAD program, a higher proportion of students believed general surgeons to have a worse work-life balance and orthopedic surgeons to have longer working hours compared to other specialties. The overall goal of the SEAD program is not to recruit all students into pursuing a surgical residency, but rather to assist them in their career decision making process. Thus, whether or not these perceptions are accurate is not necessarily important – the main point is in helping students form their own opinions through first-hand exposure, to facilitate them choosing a career that best aligns with their interests.

Similarly, several negative perceptions of surgery persisted following participation in the SEAD program. Post-exposure, students still disagreed that surgery is a gender balanced field, that surgery is a field allowing for work-life balance, and that it has comparable working hours to other specialties. While this finding may be explained by genuine accuracy of the statements, another potential explanation involves varied student exposure throughout the SEAD program. In other words, shifts in student perceptions on these statements may have occurred in both directions, ultimately averaging out to a similar mean value post-exposure. While an effort was made to ensure that all SEAD participants gained OR exposure to all 9 surgical subspecialties, many students ended up observing general and orthopedic surgical procedures on several occasions, due to increased availability compared to other subspecialties such as plastic surgery or otolaryngology. It is possible that some stereotypes linked to surgery are more attributable to certain subspecialties than others, and therefore may have generated a skewed perception amongst students based on their individual exposure during the program.

With respect to the control group, three changes in perception were noted following completion of the exit survey, which was an unexpected finding. A higher proportion of students felt that a career in urology is prestigious, and that general surgeons enjoy favorable career flexibility and are able to develop a long-term relationship with their patients. Although students in the control group did not participate in the SEAD program, they were not restricted from being able to engage in outside clinical electives or research opportunities in the field of surgery during their involvement in our study. In fact, the median number of hours observed in surgery increased significantly for control group members during this time period, as outlined in the results section. Therefore, it is possible that a subset of students had a true change in opinion through first-hand, non-SEAD surgical exposure. Given that student responses for these perceptions were answered using a Likert scale, it also remains possible that unintentional, slight variation was recorded in their exit survey responses for these statements, attributable to recall bias.

Career Decision-Making

Similar to findings observed by Head et al.[19] and Gawad et al.,[17] more students in the SEAD group were able to rule in or rule out an interest in various surgical

subspecialties, reinforcing SEAD as an effective career decision-making tool. In our study, 17% of students in the SEAD group compared to 0% in the control group developed a new interest in any of the surgical subspecialties, and 10% of students in the SEAD group were able to rule out a previous interest compared to 4% in the control group. Although SEAD was helpful in ruling in or out an interest in surgery, it did not yield a significant change in the overall number of students considering a career in surgery for either group (+2 and −1 for SEAD and control groups, respectively). This is consistent with a previous study by Head et al.[19] where the net median change in number of students interested in surgery in the SEAD and control groups was -1 and 0, respectively. In our study, there was inconsistency in the change in interest between different surgical subspecialties, which could be attributed to two factors: (1) true change in student interest, and/or (2) instructor and workshop variability. Overall, this demonstrates that although SEAD is an effective career decision-making tool, it does not necessarily increase the total number of students wishing to pursue a career in surgery to a significant degree.

Despite not reaching statistical significance, a net increase in 2 students (7%) interested in surgery, post-intervention, may in fact be meaningful. In a study by O'Herrin et al.[3] which surveyed a total of 84 students, only 6 students were interested in a surgical career prior to beginning clerkship, however 12 of those students ultimately ended up matching into a surgical residency program. This represents a 7% increase after enhanced exposure, as found amongst the SEAD participants in our study. Of course, our findings are currently based on perceived student interest, and would require follow-up to determine whether or not this translates into increased surgical residency applications.

Limitations and Future Directions

There are several limitations to this study. First, the control group was a convenience sample, as students were recruited on a voluntary basis through communications distributed by the SIG at the University of Ottawa. Ideally, the control group would have been randomly selected from the first-year medical student class using parameters identical to that of SEAD participant selection. Class size and willingness to participate without the opportunity to partake in the SEAD program limited this ability. Despite this selection bias, the 2 groups were similar at baseline, differing only in the number of hours observed in the operating room. Second, despite being grounded by previous literature, there was no validation of the surveys used. Future work toward external validation of our questionnaire, through repeated use within the University of Ottawa or other SEAD curricula, would be prudent to ensure its reproducibility. Third, not all students completed the survey in its entirety. Some sections were left unanswered, decreasing the sample size for the control group specifically for certain questions. Fourth, given the large number of data points analyzed for statistical significance, it is possible that some of our significant findings represent a random effect, or in other words, false positives. This raises the possibility of type I error being present, and should be considered when interpreting the data presented. Fifth, the proportion of students reported to have an interest in pursuing a surgical career is merely subjective at this time. Follow-up studies would be necessary in order to correlate these figures with the actual number of fourth-year medical students who ultimately apply for a surgical residency position. Finally, this was a prospective cohort study done at a single center. Liaising with other medical schools can be considered in future studies to increase sample size and evaluate site-specific differences. Staff surgeons, residents and surgical subspecialty group dynamic may vary between institutions; thus, including multiple centers would allow for a better understanding of the effect of these differences on students' perception of each surgical subspecialty.

CONCLUSIONS

As it currently stands within many medical school curricula, exposure to surgery is often self-directed – mainly via pursuit of pre-clerkship observerships or research opportunities. There are certainly stereotypes and biases that exist surrounding the culture of surgery, some of which may dissuade medical students from engaging in such experiences. As such, many students who are not considering surgery during pre-clerkship do not receive sufficient clinical and hands-on exposure to the field until much later in their medical education, specifically during surgical clerkship rotations. Furthermore, many students rotate through as few as 2-3 subspecialties during their core surgical rotations, while SEAD exposes students to all 9 surgical subspecialties. The findings of this study present a strong argument to incorporate additional exposure to the various surgical subspecialties into the undergraduate medical curriculum. By helping dissolve false perceptions of a surgical career early on, opportunities such as the SEAD program may be able to address the attrition rate seen among surgical residency applications.

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INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL

This study was approved by the Institutional Research Ethics Board (Protocol #: 20170418-01H).

COMMERCIAL ASSOCIATIONS OR FINANCIAL DISCLOSURES

None.

PRODUCTS REFERENCED

None.

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SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jsurg.2019.03.001.