Original Research

The effect of early surgical exposure on surgical match rates at a Canadian medical school

Benjamin Keefe[1]
Tamara Selman[1,2]
David Hodgson[1]
Erin Donovan[1]
Connor McGuire[1,2]
Dafydd Davies[1,3]

1. Faculty of Medicine, Dalhousie University, Halifax, NS
2. Division of Plastic Surgery, Dalhousie University, Halifax, NS
3. Division of Pediatric General & Thoracic Surgery, IWK, Halifax, NS

Correspondence to
Dr. Dafydd Davies;
daviesd@dal.ca

Purpose: This research aims to assess whether there is an association between pre-clerkship surgical exposure programs and surgical residency match rate.

Materials & Methods: A three-year cohort of graduated medical students at a Canadian University were analyzed retrospectively to compare surgical match rates based on early exposure to surgery through the Surgical Exploration and Discovery (SEAD) program. Students were excluded from the study if they did not participate in the CaRMS R-1 match. There was a total of 330 medical graduates included in this analysis.

Results: Through our analysis we have determined that the odds of matching to surgery were almost four times greater (OR = 3.93 [95% CI: 2.05 - 7.52]) for those exposed to this program across all years studied. During the three-year study period, approximately 34% of Dalhousie graduates who participated in the program matched to surgery, significantly higher than Dalhousie's overall surgical match rate (15.5%) during the same period.

Conclusion: As the first of its kind, this research provides initial evidence that early surgical exposure through the SEAD program at Dalhousie does achieve its goal of introducing and exposing students to the many fields of surgery, while also increasing surgical match rate among participants.

Introduction

Choosing a specialty is one of the looming decisions that hangs over a medical student throughout their four years of medical school. Decisions about one's career in medicine become increasingly difficult when there is limited formal exposure to a specialty in the preclinical curriculum. For example, lack of exposure to surgery in the pre-clerkship years may explain why interest in surgical specialties is declining.[1] Between 2006 and 2016, the percentage of applicants ranking surgical specialties as first choice on Canadian Residency Matching Service (CaRMS) applications decreased from 21.7% to 17.2%.[1] Applications to surgical specialties have also decreased in the United States.[1] Early exposure to surgery in preclinical education has been shown to enhance students' surgical knowledge and help them reaffirm or rule out surgery as a specialty.[2–4] For this reason, programs like Surgical Exploration and Discovery (SEAD) have been introduced as an optional adjunct to the medical curriculum at various Canadian medical schools. SEAD

is a 2-week intensive surgical elective experience started at the University of Toronto and later adopted at Dalhousie University in 2015 by Dr. Connor McGuire and Dr. Kit Moran.

While many students enter medical school with a surgical specialty in mind, the interest in surgery has been shown to decrease throughout the four years of medical school.[5] This is in line with the overall decline in interest in surgical specialties. In a survey of US medical students, 45% of first-year students were interested in surgery while only 7% of graduating students matched to a surgical specialty.[5] This decline in interest has been attributed to three major factors: lack of surgical education, gender bias, and perception of surgeons and surgical culture.[1] As discussed above, exposure to surgery in the pre-clerkship years, such as the experience one would gain through SEAD, has been shown to increase students' surgical knowledge and help them reaffirm their desire or rule surgery out. The perception of gender bias in surgery is also decreased by early exposure. [6] In a study conducted at the University of Ottawa, participation in SEAD resulted in reduced agreement with various statements related to gender bias, including "surgery is male dominated" and "gender discrimination is more pronounced in surgery than other medical professions".[6] Finally, exposure to surgery early in one's medical education also positively influences the perception of surgeons and surgical culture.[4] In another study conducted at the University of Ottawa, students who completed SEAD found surgeons significantly less intimidating after completing the program than beforehand.[7] Students also found that several specialties seemed more approachable post-SEAD, and that many specialties also had a better work-life balance than they previously thought.[7]

As previously discussed, the SEAD program has many benefits. Three cohorts of Dalhousie SEAD participants have since completed the CaRMS (Canadian Resident Matching Service) R-1 match. This study is intended to investigate the surgical residency match rates of Dalhousie SEAD participants compared to their classmates who did not participate in the program.

Materials & Methods

This research is a retrospective cohort study focusing on Dalhousie Medicine's graduating classes of 2019, 2020, and 2021. Research Ethics Board approval was obtained prior to the study, and all participants consented to having their data used for this Dalhousie SEAD-related research. At the time of this study, these classes were the only three at Dalhousie to have had the opportunity to both, participate in SEAD during their first year of medical school, and to go through the residency matching process. Specialty match results for each of these classes were provided by Dalhousie's Undergraduate Medical Education (UGME) department and general demographics for complete classes were provided by the school's admissions department. Data on gender, specialty match, and location of match (reported as inside or outside Atlantic Canada) for each of the SEAD cohorts was collected by the SEAD team. Additional information from the 2021 cohort, specifically pre-program survey results were also included to assess potential confounders in the data. Since this study concerns rates of surgical match in Canada through the Canadian Residency Matching Service (CaRMS) R-1 match, students were excluded from the study if they did not participate in this match. Additional data on match rates in Canada were obtained through the CaRMS website. For the purpose of data analysis, the following specialties were considered surgical: cardiac surgery, general surgery, neurosurgery, obstetrics and gynecology, orthopedic surgery, otolaryngology - head and neck surgery, plastic surgery, urology and vascular surgery. The remaining specialties were classified as non-surgical.

Pearson's Chi-squared test was used to determine statistically significant differences in surgical match rate based on participation in SEAD for each graduating year, as well as in total. In order to quantify the relationship between SEAD and surgical match rate, a simple logistic regression was also conducted. Statistical significance for each of these tests was done using 95% confidence, with p-values less than 0.05 considered significant. The statistical analysis was completed using STATA version 15.

Results

Descriptive statistics were calculated for each of the participating classes, and these results are summarized in Table 1 (below). A total of 330 Dalhousie Medicine graduates were included in the analysis. A total of 51 of the graduates matched to a surgical specialty, 275 matched to a non-surgical specialty, and 4 were unmatched. Of those who participated in SEAD, 33.9% matched to a surgical specialty, whereas only 11.4% of non-SEAD participants matched to a surgical specialty ($p < 0.001$). In total, the surgical match rate at Dalhousie over this 3-year period was 15.5%, already higher than the surgical match rate in Canada, which was 11.4% during the same period. Year of graduation had no statistically significant effect on surgical match rate ($p = 0.865$).

For the Class of 2021 cohort an additional pre-program survey collected data on student preferences prior to the program, including interest in surgical and non-surgical specialties. These values were collected on a Likert scale (1-5) as follows: 1 – "No interest", 2 – "Low interest", 3 – "Somewhat interested", 4 – "Interested", 5 – "Highly interested". In that cohort, surgical specialty interest had a mean rating of 2.70, whereas non-surgical specialty interest had a mean rating of 3.75.

Table 1 | Descriptive statistics for the analytical sample used in this study.

	Surgical Match	Non-Surgical Match	Unmatched	Total	p-value
Total (n= 330)	51 (15.5%)	275 (83.3%)	4 (1.2%)	330	--
SEAD (all years)					
Yes	20 (33.9%)	38 (64.4%)	1 (1.7%)	59	
No	31 (11.4%)	237 (87.5%)	3 (1.1%)	271	>0.001
Year					
2019	20 (17.5%)	92 (80.7%)	2 (1.8%)	114	
2020	15 (13.3%)	97 (85.8%)	1 (0.9%)	113	
2021	16 (15.5%)	86 (83.5%)	1 (1.0%)	103	0.865

Simple logistic regression was performed to quantify the relationship between surgical match and each of the independent variables (SEAD participation and year of graduation). A statistically significant relationship was found between participation in SEAD and surgical match rate (OR = 3.93 [95% CI: 2.05 - 7.52]), with the odds of matching to a surgical specialty almost 4 times higher for participants in the SEAD program. This regression model can be found in Table 2.

Discussion

The SEAD program was established by Dr. Nada Gawad at the University of Toronto in 2012.[2] The program offers first-year medical students an opportunity for early and broad surgical exposure. Without SEAD, this level of exposure may not be available to medical students until they enter their clerkship clinical experiences.[7] There is evidence to show that early surgical exposure through the SEAD program influences medical students' perception of surgery and allows them to make informed career decisions earlier.[7] This is the first study that is directly looking into the influence of the SEAD program on surgical match rates through the Canadian Residency Matching Service (CaRMS).

The SEAD program curriculum at Dalhousie University

The SEAD program was implemented at Dalhousie University by Dr. Connor McGuire and Dr. Kit Moran.8 It has run for four consecutive years for the classes of 2019, 2020, 2021, and 2022. Unfortunately, due to the COVID-19 pandemic, both the classes of 2023 and 2024 have not participated in SEAD. The current structure of the program is like those run prior to the pandemic. For a detailed description of the SEAD curriculum at Dalhousie, see Figure 2.

Canadian Residency Matching Service

In Canada, the process of applying to any residency training program is done through the Canadian Residency Matching Service (CaRMS), a centralized service that matches applicants to specialty programs following a selection and interview process. Certain specialties tend to have more applicants than available training opportunities. Surgical specialties tend to be competitive; otolaryngology–head and neck surgery was the most competitive specialty in the 2021 match, with a 49% success rate.[9] Applicants to other surgical specialties were successful between 59% and 86% of the time.[9] SEAD allows applicants to develop an early understanding of the implications of a surgical career.10 Therefore, an earlier interest in a surgical career allows students more time to prepare and seek opportunities helpful to the application process to match into surgery. This has been demonstrated by a previous study examining elective choices by SEAD participants at Dalhousie University. SEAD has been shown to influence de-

Table 2 | Simple logistic regression model showing the association between SEAD participation and surgical match rate among Dalhousie graduates.

Logistic Regression	Odds Ratio	p-value	95% Confidence Interval
Early Surgical Exposure (Reference: Non-SEAD)			
SEAD	3.93	<0.001	[2.05 - 7.52]
Graduating Year (Reference: 2019)			
2020	0.67	0.285	[0.32 - 1.39]
2021	0.72	0.390	[0.35 - 1.50]
Constant	0.18	–	–

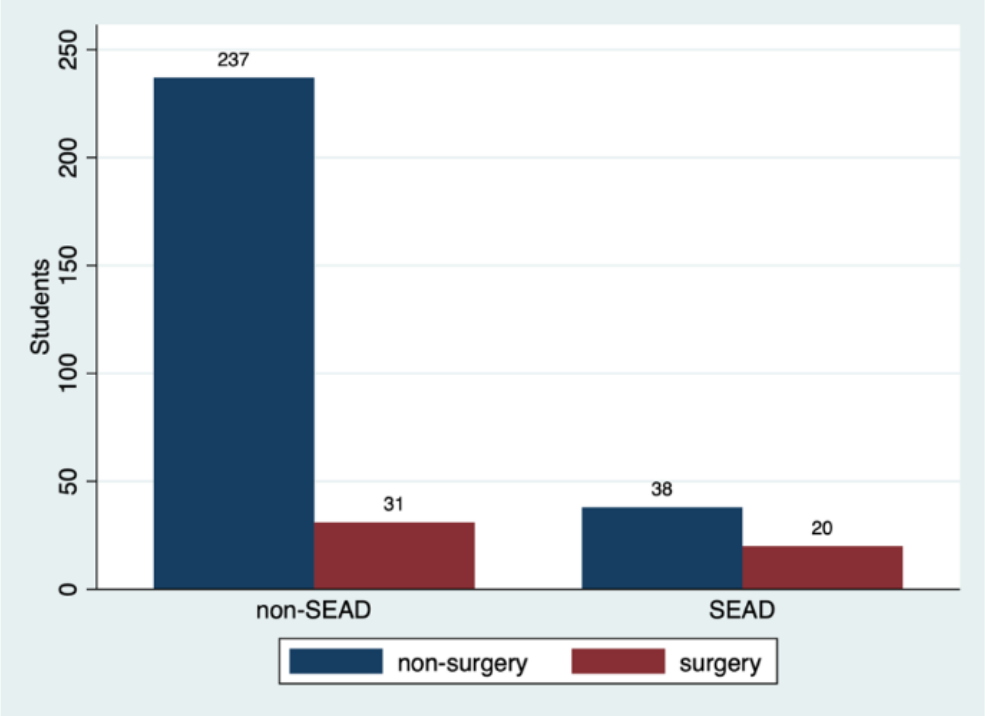


Figure 1 | Frequency of surgical and non-surgical match for both the SEAD and non-SEAD cohorts.

cisions to complete electives in surgery in second- and fourth-year medical school.[8] Completion of electives in various specialties has been shown to affect the match rates in surgical and non-surgical specialties.[8]

Our Findings

The first three SEAD cohorts to graduate from Dalhousie Medicine were evaluated in this study to understand the surgical match rate of SEAD participants versus their non-SEAD classmates. Recent studies have shown that surgical interest is declining in medical students, and that this may be due to a lack of exposure to surgery in preclinical years.[1-4] Of the 330 Dalhousie Medicine graduates in the classes of 2019, 2020 and 2021, the odds of matching to a surgical specialty of a SEAD participant versus a non-participant was nearly 4 times higher (OR = 3.93 [95% CI: 2.05 - 7.52]) and met statistical significance. This suggests that participation in SEAD and the resultant 2-week intensive surgical elective experience during a medical student's pre-clinical education may not only stimulate their interest in surgery, but it may also make them more likely to match to a surgical specialty.

Limitations

A limitation of the current study is the confounding variable of interest in surgery prior to SEAD. Despite the program targeting all students, regardless of interest in pursuing surgery, SEAD is a 2-week intensive surgical elective. Therefore, it is more likely that those with a greater interest in a surgical specialty will put their name forward. However, it is worth noting that almost 50% of the class does put their name forward each year and several who apply do not pursue surgery. Furthermore, pre-program survey results from the class of 2021 cohort demonstrated on a scale of 1 to 5 (1 being no interest, and 5 being highly interested), a mean score of 3.75 for interest in non-surgical specialties. This value falls between somewhat interested (3) and interested (4). In addition, the same survey collected interest in each of the surgical specialties. The mean rating was 2.70 for interest in surgical specialties, falling between low interest (2) and somewhat interested (3). Although this number cannot be compared to interest across the entire class, it is important to note that SEAD participants were also considering non-surgical specialties prior to the program. The SEAD program is not intended to, nor does it select students who are only interested in surgery. This data was not collected for the 2019 and 2020 cohorts. Additionally, there are possible other confounders to note. The first is that students may have had pre-existing connections in the surgical world, for example family and/or close friends in surgical specialties, which encouraged them to go into the field. Data on surgical connections was not gathered and thus this aspect was not accounted for. The second is the missing individualized data for the non-SEAD cohort. Age, gender, previous education, and marital status may be confounding variables in the relationship between SEAD participation and surgical match. The random selection of program participants for SEAD mediates these confounding variables to an extent.

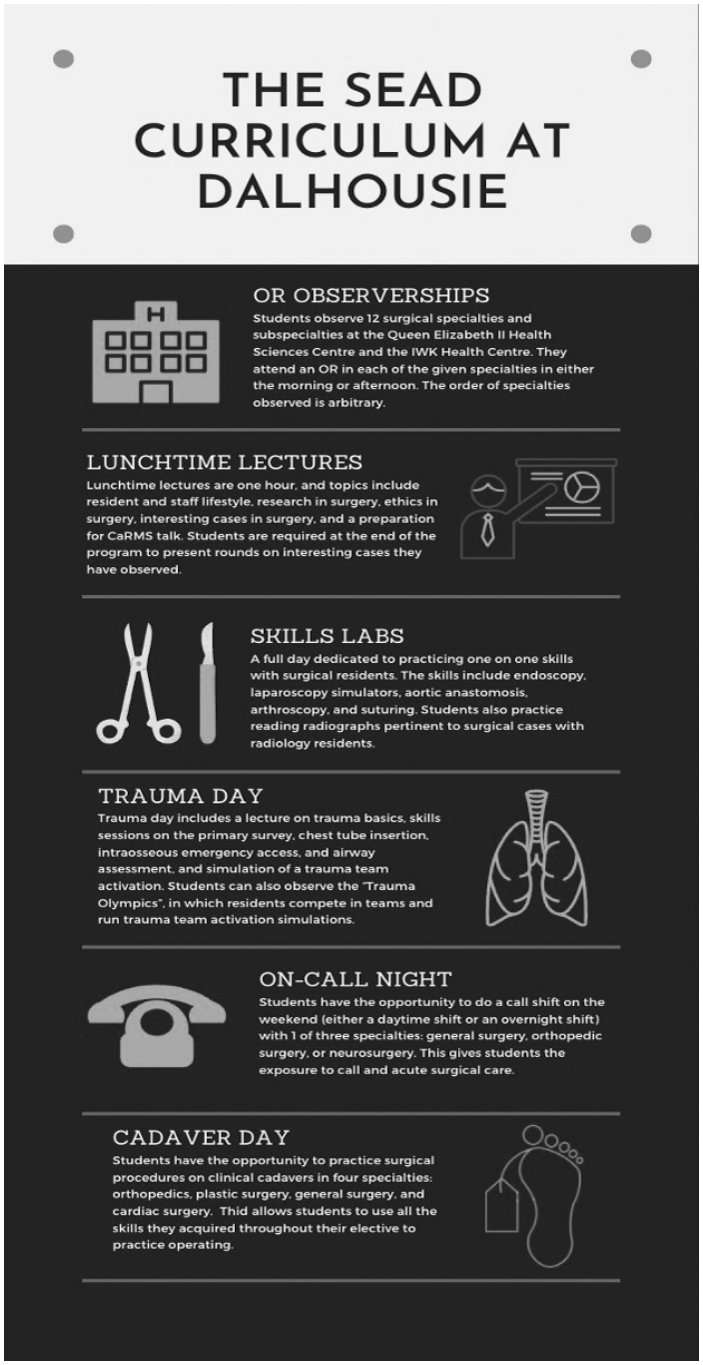


Figure 2 | The SEAD curriculum at Dalhousie.

Discussion

This study demonstrates that SEAD participants matched to surgical specialties at a significantly higher rate than their non-SEAD classmates. In fact, the odds of matching to a surgical specialty were almost 4 times higher for SEAD participants. As the first of its kind, this research provides initial evidence that early surgical exposure through the SEAD program at Dalhousie does achieve its goal of introducing and exposing students to the many fields of surgery, while also increasing surgical match rate among participants. This new evidence demonstrates that SEAD has greater benefits than previously thought, including an increase in surgical residency match rate among participants in the program relative to their non-SEAD classmates. Further investigation into this topic is warranted, including an exploration of the effects of some confounding factors that were unavailable in this analysis. Additionally, further research could confirm the generalizability of these results across other pre-clerkship surgical exposure programs and with the SEAD program at other institutions.

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