



Original Research

Trends in interventional radiology: Survey of medical students at an educational symposium

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Received : 21 October 19
Accepted : 27 November 19
Published : 28 December 19

DOI
10.25259/AJIR_28_2019

Quick Response Code:



ABSTRACT

Objective: Symposia are great avenues to expose students to interventional radiology (IR) and gauge their interest in the field. This study compares student interest and knowledge of the specialty before and after a state-wide IR symposium.

Materials and Methods: A state-wide IR symposium consisted of lecture didactics and interactive hands-on IR simulations. Pre-symposium and post-symposium survey assessments were provided to each attendee to complete. The surveys remained anonymous and were performed for quality assurance purposes. The survey included questions on knowledge of IR, interest in IR, application strategies for the IR match, and career options in IR.

Results: A total of 101 medical students registered for the symposium. Thirty-nine completed the pre-symposium survey and 40 completed the post-symposium survey. About 71.1% of the respondents reported "Little Knowledge" of IR before the symposium, which decreased to 40.5% after the symposium. Furthermore, 21% of the respondents believed that they had a "Good Foundation" in IR before the symposium and 59.5% after the symposium ($P < 0.0001$). The percentage of students planning to pursue IR increased from 35.9% to 45.9% ($P = 0.160$) after the symposium. About 77.8% reported that having an IR clinic is important in their career in the post-symposium survey compared to 64.1% in the pre-symposium survey ($P = 0.077$).

Conclusions: Symposia are an effective method in exposing medical students to IR. Students have expressed both strong interest in the field and increased knowledge post-symposium. Prospective applicants have reported dual applying to the integrated IR and diagnostic radiology (DR) residencies due to their concern about the competitive nature of integrated IR due to small number of positions available.

Keywords: Education, Medical students, Symposium, Interventional radiology, Residency

INTRODUCTION

The evolution of the new integrated interventional radiology (IR) training pathway has gained significant popularity among trainees early in their medical careers. The American Board of Medical Specialties officially recognized IR as an independent residency in September 2014, largely due to the efforts put forth by the Society of Interventional Radiology.^[1] In subsequent years, medical students' interest in the specialty has grown, as approximately 600 medical students applied for 119 positions in the first large-scale American College of Graduate Medical Education (ACGME) match in 2017.^[2-4] In 2018, the integrated IR residency led all other

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specialties in competitiveness, with a match rate of 58.3% for the US Allopathic seniors who ranked an IR program at the top.^[2]

Since the initiation of the integrated IR residency, there has been a need to introduce the field of IR to medical students early in their training. In a 2018 survey, the study of medical students at a large state university-based medical school, Kallianos *et al.* concluded that there is a growing interest in the field of IR and that the number of applications for integrated IR positions will increase.^[5] Despite the enthusiasm expressed by medical students, the US medical school curricula provide little exposure to IR; though 70.5% of the US medical schools offer IR electives, 84.6% of these electives are strictly reserved for senior medical students.^[6]

The integration of IR lectures into medical school curriculum is an alternative strategy that is effective in increasing IR exposure and interest in the field.^[7] In 2017, DePietro *et al.* compared medical student knowledge of IR before and after the integration of an IR lecture series in a gross anatomy course.^[7] Despite 73% of the pre-lecture group reporting little knowledge of IR, 64% of those who attended would consider a career in IR, compared with 24% beforehand.^[8]

Another option that has become popular in recent years is the medical student symposium, which serves as an alternate experience to increase medical student exposure to IR. Data from surveyed medical students at local IR symposiums have shown that these events can increase student knowledge of and interest in IR.^[9,10] However, these studies were published before 2015, 2 years before the first large-scale ACGME integrated IR match, and therefore could not measure students' perspectives on the competitive nature of the match. This study examines the impact of a state-level symposium in spreading awareness of IR and measuring student interest in IR, future application behavior, and perspectives on the clinical role of an interventional radiologist in the first through the 4th year medical students.

MATERIALS AND METHODS

To address the aforementioned unmet need in the medical school curriculum, a 1-day state-level IR symposium was created in early March before the 2019 ACGME match. The department of radiology at a large medical school-affiliated hospital supported the development of the event. The symposium planning committee consisted of two faculty

2019 NJIR Symposium PRE-event Survey				
1) What is your level of training?				
M1	M2	M3	M4	
2) How much do you know about IR?				
a) What is IR?	b) Little Knowledge	c) Good Foundation	d) I'm a speaker	
3) Are you planning on pursuing IR as a career choice?				
No	Yes		Not Sure	
4) Are you actively participating with IR on social media?				
No	Yes			
5) Between 1 and 5, how informative were pre-event communications and website?				
1	2	3	4	5
6) Do you plan on using this symposium as an opportunity to build new contacts in IR?				
No	Yes			
7) Between 1 and 5, how likely are you to recommend this event to someone else?				
1	2	3	4	5
8) Your interest in IR BEFORE the symposium has				
1 (Not Interest)	2 (Disinterest)	3 (Neutral)	4 (Interest)	5 (Strong Interest)
9) I plan on applying for the which of the following residencies:				
1) IR-DR integrated residency				
2) DR				
3) Dual-apply (both 1 and 2)				
4) Surgical specialty				
5) Not IR or DR				
10) How important is having an IR clinic to you (1 = extremely unimportant, 5 = extremely important)?				
1	2	3	4	5
11) I desire an IR career involving:				
a. Clinical duties: admitting privileges, rounding on patients, following patients after their procedure				
b. Strictly procedures that require minimal patient follow up				
c. Mix between a) and b)				
12) Does the competitive IR match rate affect how you will apply?				
a. No - I will still apply IR				
b. Yes - I plan on applying for DR in addition to IR/DR				
c. Yes - I plan on applying for a surgical specialty as backup				
d. Yes - I am more likely to pursue another specialty altogether				

Figure 1: Pre-symposium and post-symposium surveys.

2019 NJIR Symposium POST-event Survey				
1) What is your level of training?				
M1	M2	M3	M4	
2) How much do you know about IR?				
a) What is IR?	b) Little Knowledge	c) Good Foundation	d) I'm a speaker	
3) Are you planning on pursuing IR as a career choice?				
No	Yes	Not Sure		
4) Are you actively participating with IR on social media?				
No	Yes			
5) Did you use this symposium as an opportunity to build new contacts in IR?				
No	Yes			
6) Between 1 and 5, how likely are you to recommend this event to someone else?				
1	2	3	4	5
7) Your interest in IR AFTER the symposium has				
1 (Not Interest)	2 (Disinterest)	3 (Neutral)	4 (Interest)	5 (Strong Interest)
8) I plan on applying for the which of the following residencies:				
1) IR-DR integrated residency				
2) DR				
3) Dual-apply (both 1 and 2)				
4) Surgical specialty				
5) Not IR or DR				
9) How important is having an IR clinic to you (1 = extremely unimportant, 5 = extremely important)?				
1	2	3	4	5
10) I desire an IR career involving:				
a. Clinical duties: admitting privileges, rounding on patients, following patients after their procedure				
b. Strictly procedures that require minimal patient follow up				
c. Mix between a) and b)				
11) Does the competitive IR match rate affect how you will apply?				
a. No - I will still apply IR				
b. Yes - I plan on applying for DR in addition to IR/DR				
c. Yes - I plan on applying for a surgical specialty as backup				
d. Yes - I am more likely to pursue another specialty altogether				
12) Between 1 and 5, how satisfied were you with the quality and amount of sessions offered?				
1	2	3	4	5
13) Between 1 and 5, how satisfied were you with the hands-on workshops?				
1	2	3	4	5
14) Between 1 and 5, how satisfied were you with the venue?				
1	2	3	4	5
15) Between 1 and 5, did you think the event met your expectations?				
1	2	3	4	5
16) Between 1 and 5, how likely are you to participate in one of our events in the future?				
1	2	3	4	5

Figure 1: Pre-symposium and post-symposium surveys.

course directors, two medical student course coordinators, and 10 medical students from all five medical schools across the state. The official symposium website, social media, and electronic mail were the primary sources of advertisement.

The symposium curriculum consisted of didactic lectures and hands-on interactive exercises. The itinerary is shown in Figure 1. Seventeen speakers from eight different institutions in the northeast served as faculty and provided educational sessions at the symposium. The curriculum was

created to highlight the breadth of procedures performed by interventional radiologists and the innovation in IR. The latter half of the educational sessions emphasized the importance of recruiting more women into IR and the match statistics from the most recent match cycles. The symposium concluded with interactive hands-on workshops. This session was led by industry representatives and included simulations for chemoembolization, coiling systems for aortic and neurovascular aneurysms, cryoablation for bone tumors, percutaneous biopsies, and thoracentesis.

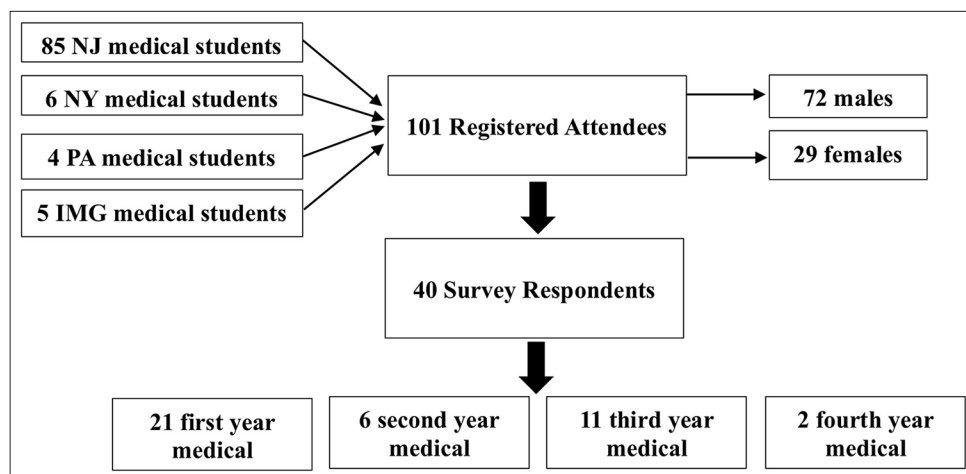


Figure 2: Demographics of medical student attendees. IMG: International medical graduate.

A pair of survey assessments, pre-symposium and post-symposium, were given to each attendee to complete [Figure 1]. The survey included questions on demographics, interest in IR, application strategies for the IR match, and career options in IR. All surveys were anonymous with a sequential number assigned to each pair of surveys to match the pre-event and post-event responses. This study was performed to measure the quality assurance of the symposium. All surveys were deidentified and remained anonymous. Thus, this study was exempt from IRB review.

Statistical analysis was performed using SPSS version 23 (SPSS Inc., Chicago, IL, USA, 2017). Chi-square analysis was used for all normally distributed categorical variables. Student's paired *t*-test was used for the Likert scale data. Statistical significance for all analyses was determined to be $P \leq 0.05$.

RESULTS

A total of 101 medical students registered for the symposium: 72 males and 29 females. Eighty-six attend medical school in New Jersey, 6 in New York, 4 in Pennsylvania, and 5 in the Caribbean islands. Of that total, 39 completed the pre-symposium survey and 40 completed the post-symposium survey. Twenty-one respondents were identified as the 1st year medical students, 6 as the 2nd year medical students, 11 as the 3rd year medical students, and 2 as the 4th year medical students. The demographics information is shown in Figure 2.

Knowledge of IR was measured in both pre-symposium and post-symposium attendees. About 71.1% of the respondents reported "Little Knowledge" of IR before the symposium, which decreased to 40.5% after the symposium. Furthermore, only 21% of the respondents believed that they had a "Good Foundation" in IR before the symposium and this value increased to 59.5% post-symposium. There was a statistically

significant association between pre- and post-symposium responses for this survey question ($P < 0.0001$). Survey responses are shown in Table 1. About 86% of the preclinical students and 67% of the clinical students reported "Little Knowledge" of IR, as shown in Figure 3.

A majority of respondents were undecided in whether they wanted to pursue IR as a career, but this decreased from 64.1% pre-symposium to 51.4% post-symposium. The percentage of those who were certainly pursuing IR increased from 35.9% to 45.9% ($P = 0.160$). About 25.0% of the respondents reported "Strong Interest in IR" compared to the 15.4% of respondents on the pre-symposium survey ($P = 0.535$), as shown in Figure 4.

About 77.8% of medical students reported that having an IR clinic was either "important" or "extremely important" in their professional career in the post-symposium survey compared to 64.1% of medical students in the pre-symposium survey ($P = 0.077$). Thirty-nine of 39 students in the pre-symposium survey and 35 of the 36 students in the post-symposium survey responded that they would desire clinical duties including admitting privileges and rounding on patients as part of their IR career.

About 51.4% of respondents reported that they would dual apply for the IR integrated residency and a diagnostic radiology (DR) only residency, while 20.0% and 14.3% would apply for the integrated IR only and DR only, respectively. About 14.3% of respondents decided that they would pursue neither IR nor DR at the conclusion of the symposium. About 0% of respondents would apply for a surgical specialty, as shown in Figure 5.

About 34.3% of respondents stated that the competitiveness of IR would not affect how they would apply for residency, while 40.0% would also apply for DR residency positions. About 14.3% of respondents reported that they would consider an

Table 1: Survey assessment responses.

Question	Answer option	Pre-symposium response n (%)	Post-symposium response n (%)	P
Knowledge of IR		n=38 (100)	n=37 (100)	<0.0001
	Strong foundation	0 (0)	0 (0)	
	Good foundation	8 (21.0)	22 (59.5)	
	Little knowledge	27 (71.1)	15 (40.5)	
	What is IR?	3 (7.9)	0 (0)	
IR as a career choice		n=39 (100)	n=37 (100)	0.160
	Yes	14 (35.9)	17 (45.9)	
	No	0 (0)	1 (2.7)	
	Not sure	25 (64.1)	19 (51.4)	
Interest in IR		n=39 (100)	n=36 (100)	0.535
	Strong interest	6 (15.4)	9 (25.0)	
	Interest	29 (74.4)	24 (66.7)	
	Neutral	4 (10.2)	2 (5.5)	
	Disinterest	0 (0)	1 (2.8)	
	No Interest	0 (0)	0 (0)	
Importance of IR clinic		n=39 (100)	n=36 (100)	0.077
	Extremely important	6 (15.3)	8 (22.2)	
	Important	19 (48.7)	20 (55.6)	
	Ambivalent	12 (30.8)	8 (22.2)	
	Unimportant	1 (2.6)	0 (0)	
	Extremely unimportant	1 (2.6)	0 (0)	
IR career involving		n=39 (100)	n=36 (100)	0.744
	Clinic duties and procedures	34 (87.2)	30 (83.3)	
	Strictly procedures with minimal patient follow-up	0 (0)	1 (2.8)	
	Clinic duties including admitting privileges and rounding on patients	5 (12.8)	5 (13.9)	
Residency strategy		n=35 (100)	n=35 (100)	0.129
	Dual apply to IR integrated residency and DR residency	18 (51.4)	18 (51.4)	
	IR integrated residency only	7 (20.0)	7 (20.0)	
	DR residency only	6 (17.1)	5 (14.3)	
	Surgical residency	1 (2.9)	0 (0)	
	Neither IR nor DR residency	3 (8.6)	5 (14.3)	

IR: Interventional radiology, DR: Diagnostic radiology

alternate specialty altogether, while 11.4% of respondents stated that they would apply for a surgical specialty as backup.

DISCUSSION

With the emergence of the new integrated IR residency, there has been recent interest in assessing medical student interest, exposure to the field, and application strategies. Symposia are effective method to expose trainees to the field.^[9,10] The level of interest in IR among medical students is high, as evidenced by the symposium receiving 101 registrants. Approximately 30% of the attendees were female, which may be due to a disparity in the field. Although the small sample size precludes any conclusion of this sort, current estimates suggest only 10% of IR attending are female.

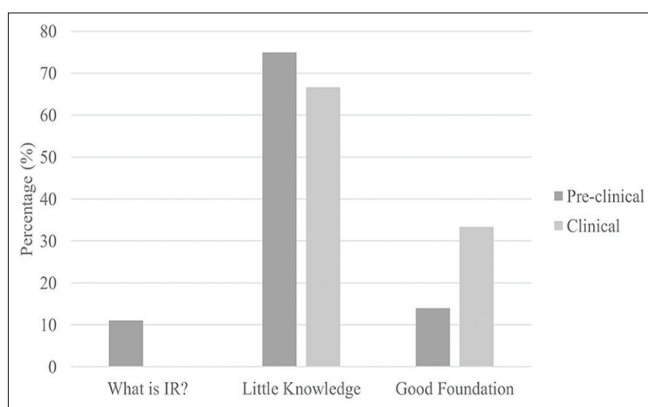


Figure 3: Pre-symposium and post-symposium responses for evaluating knowledge of interventional radiology between pre-clinical and clinical students.

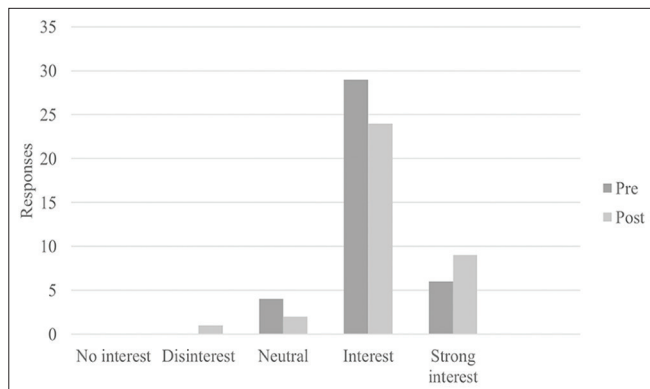


Figure 4: Pre-symposium and post-symposium responses for survey question "How interested are you in interventional radiology?"

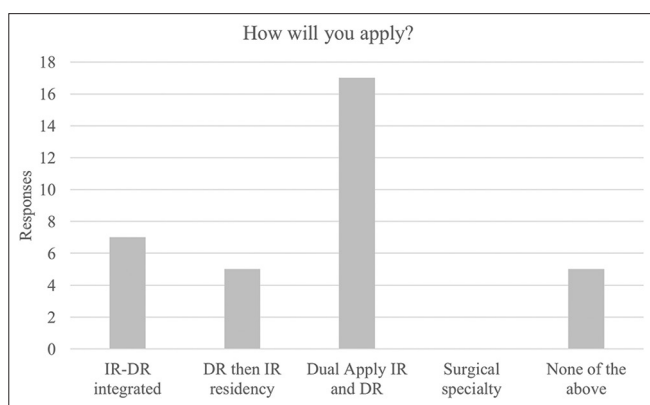


Figure 5: Pre-symposium and post-symposium responses for residency application strategies.

Overall, our 1-day symposium was effective in increasing medical student exposure to and knowledge of IR. Before the symposium, >70% of respondents reported little knowledge of IR, which is comparable to 75% reported in a survey conducted by Commander *et al.* on over 400 students. Preclinical students, in particular, reported knowing less about IR, with 86% reporting very little to knowledge of IR compared with 67% among clinical students. The nearly 40% increase in respondents who reported a good foundation of IR after the symposium is within the range of 25–49% increase reported by Alexander *et al.* and Kattapuram *et al.*, respectively.^[9,10] Studies have shown that increased knowledge and exposure to a field contribute to more medical students ultimately considering it as a career.^[11] As Goldman *et al.* suggested, multi-institutional symposia not only introduce students to the field of IR but also they serve as an important recruiting tool.^[12] With this in mind, future symposia should focus on the breadth of the field, while still maintaining the clinical focus of IR.

A greater clinical presence of IR has been emphasized as part of the integrated IR residency, and the association of program directors has emphasized the importance of

recruiting students who envision a career as a clinician. The importance of clinical IR for both patients and hospitals is evident as it has been shown that having an inpatient IR service leads to improved outcomes and financial margins.^[13] Based on just the pre-symposium data, it is clear that medical students already perceived IR as a clinically involved specialty. About 14% of more respondents considered IR clinic to be important or very important after the symposium. The importance of clinical IR should continue to be stressed toward all future applicants, and symposia should make an effort to include clinical workshops to showcase this aspect of IR.

In the post-survey, we noted a trend toward increased interest in IR among the survey participants. Before the symposium, 89.8% of respondents were already interested in IR and 36% of respondents were considering a career in IR. These values are much higher compared to a general medical school population, in which only 11% of students consider a career in IR.^[14] It is likely that more of the students attending our symposium were already interested in IR and pursuing it as a career since they were attending a voluntary symposium on a weekend. Regardless, there was 10% increase in participants who had a strong interest in IR, which also translated to 10% increase among respondents who are considering IR as a career choice. While the majority (51.4%) of respondents were still not sure if they were considering IR as a career choice after the symposium, this may be attributed to the fact that most participants were in their pre-clinical years of medical school and need more clinical exposure to make a definitive career decision. The question "Are you planning on pursuing IR as a career choice?" could have instead been phrased as "Would you consider a career in IR?" As this would include all students who are interested but have not decided against other career options.

There is much uncertainty in how medical students plan to enter IR. There was no significant change between the pre- and post-symposium surveys for the residency strategy question. Most applicants plan to dual apply to the integrated IR residency and the DR residency with a small percentage (20%) applying only to integrated IR residencies. This uncertainty can be due to the limited data on the matching trends for the integrated IR residency program. Further research needs to be considered in evaluating what concerns students perceive to be the most important when strategizing their application process.

This study has considerable limitations. First and foremost, our analyses are based on compilations of one symposium worth of match data and this constraint provides a small sample size, giving the study less power. In addition, our results only represent data from a single time point and a longitudinal study which includes follow-up data would

provide more insight into if and how these single-day symposia affected attitudes and future application behavior of participants. The results from our symposium can also not be generalized to other symposia, as student responses may vary based on presentation quality and presenter style. However, this study still offers evidence in support of multi-institutional, statewide symposia as an effective way to expose medical students to the field of IR.

CONCLUSIONS

Educational symposiums are effective in exposing medical students to interventional radiology. Students have expressed both strong interest in the field and increased knowledge post-symposium. Prospective applicants have reported dual applying to the integrated IR and diagnostic radiology (DR) residencies due to their concern about the competitive nature of integrated IR due to small number of positions available. As interventional radiology continues to gain more popularity in the NRMP residency match, it is important to raise awareness about the field.

Declaration of patient consent

Institutional Review Board (IRB) permission obtained for the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Jain N, O'Neill S, Chandra V, Sokalaw S, Alam A, Kumar A, *et al.* Trends in interventional radiology: Survey of medical students at an educational symposium. *Am J Interv Radiol* 2019;3:12.