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TITLE PAGE

Supporting Underrepresented Minority Students and Advancing Educational and Health Equity: Travelers Summer Research Fellowship (TSRF) Program Radiology Panel

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Supporting Underrepresented Minority Students and Advancing Educational and Health Equity: Travelers Summer Research Fellowship (TSRF) Program Radiology Panel

Abstract

Objective: The COVID-19 pandemic has highlighted the racial disparities in health outcomes within our nation. This is especially relevant in the field of radiology where the lack of minority representation is particularly striking. The purpose of this paper is to describe a pipeline program designed to support underrepresented minority (URM) students and provide a model to bridge URMs to careers in medicine hence cultivating health equity.

Methods: We designed a radiology pipeline program within The Travelers Summer Research Fellowship Program (TSRF) to give underrepresented students an opportunity to engage with radiologists. Participants experience a rich inquiry-based curriculum and completed pre- and post-intervention surveys that measured motivational factors for medical education and interest level in medical careers.

Results: 29 undergraduate students participated in the 2021 TSRF Program. The data comparing the pre- and post-surveys demonstrated that the TSRF program played a positive role in sparking interest in radiology, debunking misperceptions about radiologists, and boosting participant confidence regarding medical school applications.

Discussion: We created an interactive curriculum for URM students to cultivate a new generation of radiologists that will reflect and better meet the needs of the populations they are serving thereby mitigating the current health disparities in our nation.

Description of the Problem:

The political events and crises of recent years have brought to light the adverse effects of structural racism in our communities and the resulting racial disparities in health outcomes. The COVID-19 pandemic combined with nationwide protests for racial justice have highlighted the lack of diversity among U.S. healthcare providers.

As of 2019, racial and ethnic populations that are underrepresented in medicine, make up 33.9% of the total U.S. population [1]. These same groups are expected to account for most of the U.S. population by 2050 [2]. This is especially relevant when considering that people of color in the U.S. suffer at higher rates from comorbidities and are more likely to be underinsured or uninsured [3].

In the field of radiology, the lack of cultural representation is clearly evident. In 2020 diagnostic radiology was the 9th largest ACGME specialty, yet it ranked 17th for representation of women and 18th for inclusion of racial and ethnic populations that are underrepresented in the medical profession [4]. While showing signs of improvement compared to 2014, when the field of radiology ranked last in underrepresented minority (URM) inclusion, progress has been slow [5].

With the growing diversity of our patient populations, the need to create a diverse and equitable workforce in healthcare has never been greater. Radiologists are called to serve the underprivileged, expand high-quality healthcare services, and promote inclusive policymaking that incorporates perspectives of diverse stakeholders, all of which are most effectively executed by a diverse group that possesses an array of experiences and insights [6]. As radiologists increasingly become active participants in direct patient care, it is important to note that racial or ethnic backgrounds shared between providers and patients have been shown to "enhance

communication, patient satisfaction, and compliance with medical recommendations, as well as overall healthcare outcome" [7]. As a result, cultural diversity in radiology is crucial for the efficiency and success of evidence-based practice and results in higher quality care and a better workplace environment.

A major contributor to the lack of diversity within the field of radiology is the lack of early exposure. Early exposure to radiology has been shown to increase interest in radiology as a career option, increase appreciation of the field of radiology, and increase research opportunities thereby making prospective radiology applicants more competitive [8]. This issue presents a unique opportunity for physicians and faculty alike to bridge the educational gap by providing the necessary exposure for students to succeed.

What Was Done:

The Travelers Summer Research Fellowship Program (TSRF) was created in 1969 to give qualified URM undergraduate students an opportunity to learn about medicine and health issues that affect traditionally underserved populations. Prior to participating in TSRF, students are selected based on an extensive application process, which includes current schooling level, race and ethnicity, gender, level of financial need, etc. In addition, applicants are asked to submit a personal statement, transcript, and two letters of recommendation.

We designed a radiology pipeline program within the summer fellowship with the following goals in mind 1) closing the education gap 2) overcoming obstacles to medical school and 3) improving recruitment and retention. We solicited anonymous voluntary student feedback using surveys that measured 1) motivational factors for medical education 2) reasons for attending the program and 3) interest in health and medical careers.

Institutional Review Board approval was obtained from the home institution. The course format includes immersive case presentations and a 2-hour educational session with a panel discussion and questions-and-answer session. An anonymous pretest survey of participants was conducted regarding prior exposure to the field and knowledge of the field of radiology (Appendix A). Student pre-course instruction included reviewing C.R.E.A.T.E modules (http://www.create-rad.com/radtorials), an online peer-reviewed educational database of radiology learning modules. Posttest anonymous surveys, identical to the pretest surveys, followed the activity to evaluate participant exposure.

Both URM and non-URM radiology faculty, many of which were women, were recruited to participate in the 2-hour session and instructed to highlight clinical applications of imaging. Each faculty member curated cases that were designed to demonstrate the breadth of cases that their respective subspecialties encounter on a daily basis. The faculty also described various aspects of their work, especially direct patient care, image-guided interventions, teaching, and research. Selecting an eclectic group of faculty members allowed for unique perspectives on the field of radiology and demonstrated that the burden of reducing health disparities falls on everyone equally.

Following the data collection, we computed descriptive statistics for each categorical variable. For the survey questionnaires, all pre- versus post-intervention responses were compared using the Fisher's exact test, except for the "I have/would like a mentor in the field of medicine or biomedical sciences" prompts, which were analyzed using the chi-squared test.

Preliminary Outcomes:

Demographics:

The participants were pre-STEM (Science, Technology, Engineering, and Mathematics) students attending universities in regions across the U.S. including Northeast (48%), Midwest (17%), South (17%), West (10%) and U.S. territories (7%).[1] Most students identified as either Black/African American (31%) or Latinx/Caribbean (31%) or both (10%). Furthermore, while 76% of students identified as cisgender females and 24% identified as cisgender males, none identified as transgender, genderqueer people, gender non-conforming people or non-binary people. Students indicated a range of parental educational attainment from less than high school (21%), high school graduate (24%), college graduate (17%) to a postgraduate degree (38%). The sociodemographic characteristics of the participants were summarized in Table 1.

Pre- and Post-survey Comparisons:

Participants expressed an interest in a variety of specialties other than radiology: such as cardiology, pediatrics, emergency medicine, etc. Many students spoke of their desire for medical exposure: "I wanted to learn about the different careers in medicine and get *exposure* to research." Additionally, many others spoke about their place as underrepresented minorities in medicine and/or their desire to understand and improve health equity: "I wanted to know what paths *physicians of color* have taken to get to where they are and what challenges they have faced."[2]

After the educational session, the majority of students recognized radiologists as physicians (93% strongly agreed, 7% agreed) as compared to before the educational session when only 62% strongly agreed and just 34% agreed. Similarly, when asked if a radiologist's job included direct patient care, more students agreed after the event (32% strongly agreed, 57% agreed) than before the event (3% strongly agreed, 41% agreed). Moreover, the students found

[1] Regions as determined by the U.S. Census Bureau.
[2] Emphasis by the authors.

the impact of radiologists on healthcare more impactful after the event (82% found it very significant, 18% found it significant) than before the event (45% found it significant). Finally, when asked if they were considering or would consider a career in radiology, the students embraced the idea more after the event (18% strongly agreed, 50% agreed) than before the event (10% agreed, 55% neither agreed nor disagreed). Results of the pre- and post-TRSF participation survey analyses were summarized in Table 2.

Discussion:

We implemented a pipeline program in radiology for URM students as part of an existing summer fellowship at our institution aimed at increasing URM representation in medical schools and ultimately within the healthcare workforce. We designed the educational sessions to go beyond direct instruction and engage in a student-centered approach that prioritized inquiry-based learning, fostered exploration, and provided real-life experiences using case studies. We trust that these efforts will generate culturally competent healthcare professionals and improve medical work environments.

Data comparing the pre- and post-surveys showed that TSRF played a positive role in sparking participant interest in the field of radiology by debunking long-held perceptions about radiologists and educating students on the steps necessary to pursue a career in radiology. Following the program, many participants expressed a newfound interest in radiology and stated they felt more confident in applying to a radiology residency program. Finally, after interacting with our radiologists, the students were more inclined to recognize radiology as a diverse medical field, both in terms of race/ethnicity and gender.

Study Limitations:

This study has several limitations. While participants included both cisgender males and females, none identified as trans, genderqueer, gender non-conforming, or non-binary. Nonetheless, the undergraduate students varied widely in racial/ethnic background. In fact, most of the participants identified as Black/African American and/or Latinx/Caribbean; groups that have experienced an alarming decline in medicine and science as of recent decades. What is more, while most undergraduate students were children of parents with postsecondary levels of education, over 2 in 5 participants were first-generation college students: higher than the national average [3].

The study is also limited by the relatively small number of students surveyed, however, as a pilot study the initial data collected shows that it is a promising and valuable program, and we plan to aggregate this data with the following years to bolster our understanding regarding this program's effectiveness. Future directions include following the progress of the students who participate in this program throughout the residency application process, training, and medical career to assess long term impact and career choice. Additionally, faculty mentors can aid in promoting future exposures to the field of radiology by encouraging applicants to participate in similar endeavors such as the NIH Dimensions Summer Internship (NDSI) and the ACR PIER Internship program. Additionally, we plan to participate annually in TSRF and implement more didactic sessions to introduce basic concepts of radiology, and pair students interested in radiology research with a project of their interest and research mentor.

Conclusion:

We believe that it is of the utmost importance for medical providers and personnel to engage with URM pre-STEM students. We have an ethical obligation to increase diversity within our healthcare force and create a positive impact on patient care and the work environment. As

we continue to strive for educational equity and reducing health disparities within our local communities, our mission is to share the successes of TSRF and promote the implementation of similar programs at other institutions. We are inspired by our short-term accomplishments and look forward to sharing the long-term effectiveness of our program as we continue this dialogue and improve upon our efforts to bridge underrepresented students to careers in radiology.

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Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Table 1. Respondent Characteristics (N=29)

Characteristic	Freq. (%)
Gender	
Cis Male	7 (24.1)
Cis Female	22 (75.9)
Race/Ethnicity	
Black/African American	9 (31.0)
East Asian	1 (3.5)
Latinx/Caribbean	9 (31.0)
Middle Eastern/North African	3 (10.3)
South Asian	3 (10.3)
White/European American	1 (3.5)
More than One	3 (10.3)
Parent Highest Education Level	
Less than High School	6 (20.7)
High School Graduate	7 (24.1)
College Graduate	5 (17.2)
Postgraduate Degree	11 (37.9)

Table 2. Survey Responses Pre- vs. Post-Intervention

Question	Pre-Intervention (N=29) Freq. (%)	Post-Intervention (N=28) Freq. (%)	*p*-value
A radiologist is a doctor/physician			
Strongly Disagree	0 (0)	0 (0)	0.005
Disagree	0 (0)	0 (0)	
Neutral	1 (3.5)	0 (0)	
Agree	10 (34.5)	2 (7.1)	
Strongly Agree	18 (62.1)	26 (92.9)	
I have had prior exposure to the field of radiology			
Strongly Disagree	4 (13.8)	0 (0)	0.049
Disagree	9 (31.0)	6 (21.4)	
Neutral	8 (27.6)	5 (17.9)	
Agree	8 (27.6)	16 (57.1)	
Strongly Agree	0 (0)	1 (3.6)	
A part of a radiologist's job includes direct patient care			
Strongly Disagree	1 (3.5)	0 (0)	<0.001
Disagree	3 (10.3)	1 (3.6)	
Neutral	13 (44.8)	2 (7.1)	
Agree	12 (41.4)	16 (57.1)	
Strongly Agree	0 (0)	9 (32.1)	
Describe the impact of radiologists on patient care			
Neutral	2 (6.9)	0 (0)	0.015
Significant	13 (44.8)	5 (17.9)	
Very Significant	14 (48.3)	23 (82.1)	
I find the field of radiology interesting			
Strongly Disagree	0 (0)	0 (0)	0.002
Disagree	1 (3.5)	1 (3.6)	
Neutral	16 (55.2)	3 (10.7)	
Agree	7 (24.1)	15 (53.6)	
Strongly Agree	5 (17.2)	9 (32.1)	
I am considering/would consider a career in radiology			
Strongly Disagree	0 (0)	0 (0)	0.001
Disagree	8 (27.6)	2 (7.1)	
Neutral	16 (55.2)	7 (25.0)	
Agree	3 (10.3)	14 (50.0)	

Table 2. Survey Responses Pre- vs. Post-Intervention

Question	Pre-Intervention (N=29) Freq. (%)	Post-Intervention (N=28) Freq. (%)	*p*-value
Strongly Agree	2 (6.9)	5 (17.9)	
	(N=25)	(N=10)	
Reason for answering "Neutral" or "Disagree"			
Less impact on patients' lives compared to a primary care specialty	4 (16.0)	0 (0)	0.221
I do not feel that I am a qualified applicant for radiology	1 (4.0)	0 (0)	
I do not identify with people who pursue radiology	1 (4.0)	2 (20.0)	
I do not know enough about the field to make a decision right now	16 (64.0)	5 (50.0)	
Not an interesting field	3 (12.0)	3 (30.0)	
I think that radiology is a culturally diverse subspecialty			
Strongly Disagree	1 (3.5)	0 (0)	<0.001
Disagree	8 (27.6)	2 (7.1)	
Neutral	16 (55.2)	6 (21.4)	
Agree	4 (13.8)	14 (50.0)	
Strongly Agree	0 (0)	6 (21.4)	
I think that there is gender diversity in the field of radiology			
Strongly Disagree	1 (3.5)	0 (0)	0.001
Disagree	6 (20.7)	2 (7.1)	
Neutral	17 (58.6)	6 (21.4)	
Agree	4 (13.8)	13 (46.4)	
Strongly Agree	1 (3.5)	7 (25.0)	
I have a mentor in the field of medicine or biomedical sciences			
Yes	15 (51.7)	16 (57.1)	0.681
No	14 (48.3)	12 (42.9)	
I would like a mentor in the field of medicine or biomedical sciences			
Yes	27 (93.1)	25 (89.3)	0.670

Table 2. Survey Responses Pre- vs. Post-Intervention

Question	Pre-Intervention (N=29) Freq. (%)	Post-Intervention (N=28) Freq. (%)	*p*-value
No	2 (6.9)	3 (10.7)	

All comparisons were performed using Fisher's exact test, except for "I have a mentor…", which was analyzed using the chi squared test

Appendix A.

Selected Questions	Pre-event survey	Post-event survey
A radiologist is a doctor/physician		
Strongly agree	62%	93%
Agree	34%	7%
Neither agree nor disagree	3%	
Disagree		
Strongly disagree		
A part of a radiologist's job includes direct patient care		
Strongly agree	3%	32%
Agree	41%	57%
Neither agree nor disagree	45%	7%
Disagree	10%	4%
Strongly disagree		
Describe the impact of radiologists on patient care		
Very significant	45%	82%
Significant	45%	18%
Neither significant nor insignificant	7%	
Insignificant		
Very insignificant		
I find the field of radiology interesting		
Strongly agree	17%	32%
Agree	24%	54%

Neither agree nor disagree	55%	11%
Disagree	3%	4%
Strongly disagree		
I am considering/would consider a career in radiology		
Strongly agree	7%	18%
Agree	10%	50%
Neither agree nor disagree	55%	25%
Disagree	28%	7%
Strongly disagree		
I believe that I am a strong future candidate for application to a radiology program		
Strongly agree	3%	14%
Agree	17%	39%
Neither agree nor disagree	69%	43%
Disagree	10%	4%
Strongly disagree		
I think that the field of radiology is a culturally diverse subspecialty		
Strongly agree	3%	21%
Agree	14%	50%
Neither agree nor disagree	55%	21%
Disagree	28%	7%
Strongly disagree		
I think that there is gender diversity in the field of radiology		
Strongly agree	3%	25%
Agree	14%	46%
Neither agree nor disagree	58%	21%
Disagree	21%	7%
Strongly disagree	3%	

Highlights

We implemented a pipeline program in radiology for underrepresented minority premedical students aimed at increasing underrepresented minority representation in medical schools and within the healthcare workforce. Our hope is that by creating opportunities for exposure to radiology through pipeline programs that focus on targeting diverse youth, we will be able to increase educational equity and reduce health disparities in radiology.