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Research Article

Characterization of Orthopaedic Surgery Research Fellowships: Public Availability, Compensation, and Association with Doximity Residency Rankings

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Keywords: orthopaedic surgery residency, research fellowships, Doximity rankings, residency competitiveness, medical student research

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Conflicts of Interest Statement for Dr. Lasun Oladeji

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Visit Dr. James Cook

Conflicts of Interest Statement for Dr. James Cook

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Conflicts of Interest Statement for Kylee Rucinski, PhD

Introduction

Orthopaedic surgery is one of the most competitive specialties for medical students, with research experience playing a critical role in residency applications. Dedicated research fellowships before, during, or after medical school can boost an applicant's research productivity and competitiveness. However, centralized information about these opportunities is limited. This study aimed to identify publicly available orthopaedic surgery research fellowships and analyze their availability, location, duration, financial compensation, and association with Doximity rankings of orthopaedic surgery residencies.

Methods

An online search of Orthogate.com and MSOS.com was performed on March 15th, 2024, to identify orthopaedic surgery research fellowships. Data on geographic location, number of positions, financial compensation, and duration were collected. A Spearman's correlation assessed the relationship between residency program Doximity rankings and fellowship availability.

Results

A total of 143 research fellowship positions were identified across 80 programs, with an average fellowship duration of 1 year. Of these programs, 73% offered financial compensation, with an average reported salary of $27,677 per year. The Southeast had the highest concentration of research fellowships (33%), followed by the Northeast (27%), Midwest (22%), and West (18%). Only 24% of orthopaedic surgery residency programs publicly offered research fellowships. Higher Doximity-ranked residency programs were significantly associated with a greater number of research fellowship positions ($p<.001$) ($r2=-1.0$).

Conclusion

This study highlights the strong association between higher Doximity-ranked residency programs and the availability of orthopaedic surgery research positions. The findings emphasize the need for a centralized platform to improve access to these opportunities and enhance residency programs' visibility to prospective candidates.
Keywords: orthopaedic surgery residency, research fellowships, Doximity rankings, residency competitiveness, medical student research

Level of Evidence

IV

INTRODUCTION

Orthopaedic surgery is consistently one of the most competitive among specialties for medical students to successfully match with for residency training in the US. In 2024, 1,448 applicants attempted to match into 916 orthopaedic residency positions, such that it was the 4th highest applicant-to-position ratio among all specialties participating in the National Residency Matching Program (NRMP) ("Charting Outcomes: Characteristics of U.S. MD Seniors Who Matched to Their Preferred Specialty: 2024 Main Residency Match" 2024). This ratio of 1.58 is similar to the 1.64 ratio for the 2022 match ("Charting Outcomes in the Match Characteristics of Applicants Who Match to Their Preferred Specialty in the 2022 Main Residency Match: Senior Students of U.S. MD Medical Schools" 2022), and it reflects increased competitiveness for this specialty over the past decade ("Charting Outcomes in the Match Characteristics of Applicants Who Match to Their Preferred Specialty in the 2014 Main Residency Match" 2014; "Charting Outcomes in the Match Characteristics of Applicants Who Match to Their Preferred Specialty in the 2016 Main Residency Match: U.S. Allopathic Seniors" 2016; "Charting Outcomes in the Match Characteristics of Applicants Who Match to Their Preferred Specialty in the 2018 Main Residency Match: U.S. Allopathic Seniors" 2018; "Charting Outcomes in the Match Characteristics of Applicants Who Match to Their Preferred Specialty in the 2020 Main Residency Match: Senior Students of U.S. MD Medical Schools" 2020). The mean United States Medical Licensing Examination (USMLE) scores for medical students applying to orthopaedic surgery residency are consistently among the highest when compared to other specialties, further reflecting the highly qualified and competitive pool of applicants vying for residency training positions in orthopaedic surgery ("Charting Outcomes: Characteristics of U.S. MD Seniors Who Matched to Their Preferred Specialty: 2024 Main Residency Match" 2024). Not only are USMLE scores higher, but orthopaedic surgery applicants also have higher average grades, Alpha Omega Alpha (AOA) honors status, and gold humanism honors society membership compared to medical students not applying for an orthopaedic surgery

residency position (Rosenthal, Howard, Schlussel, et al. 2009; Sephien, Kumar, Zwygart, et al. 2022; DePasse et al. 2016; Schrock et al. 2017; Tishad et al. 2025). Membership in AOA and gold humanism honors society make applicants more competitive compared to their peers in medical school.

Applicants seeking residency training in orthopaedic surgery often attempt to strengthen their candidacy through participation in research endeavors. With the USMLE Step 1 examination transitioned to pass/fail scoring in 2022, an applicant's research experiences as well as the quality and quantity of research abstracts, presentations, and publications likely serve as increasingly important distinguishers among candidates. In 2024, the mean numbers of abstracts, presentations, and publications of allopathic (MD), osteopathic (DO), and United States international medical graduate (IMG) applicants who successfully matched into orthopaedic surgery residency training were 23.8, 11.2, and 30.3, respectively ("Charting Outcomes: Characteristics of U.S. MD Seniors Who Matched to Their Preferred Specialty: 2024 Main Residency Match" 2024; "Charting Outcomes: Characteristics of U.S. DO Seniors Who Matched to Their Preferred Specialty: 2024 Main Residency Match" 2024; "Charting Outcomes: Characteristics of International Medical Graduates Who Matched to Their Preferred Specialty: 2024 Main Residency Match" 2024). In contrast, those who did not match into this specialty had averages of 18, 7, and 27, suggesting that research activity may influence an applicant's chances of matching ("Charting Outcomes: Characteristics of U.S. MD Seniors Who Matched to Their Preferred Specialty: 2024 Main Residency Match" 2024; "Charting Outcomes: Characteristics of U.S. DO Seniors Who Matched to Their Preferred Specialty: 2024 Main Residency Match" 2024; "Charting Outcomes: Characteristics of International Medical Graduates Who Matched to Their Preferred Specialty: 2024 Main Residency Match" 2024). Importantly, these numbers have steadily grown over the past decade for applicants who have successfully matriculated into orthopaedic surgery residency (**Figure 1**) ("Charting Outcomes in the Match Characteristics of Applicants Who Match to Their Preferred Specialty in the 2014 Main Residency Match" 2014; "Charting Outcomes in the Match Characteristics of Applicants Who Match to Their Preferred Specialty in the 2016 Main Residency Match: U.S. Allopathic Seniors" 2016; "Charting Outcomes in the Match Characteristics of Applicants Who Match to Their Preferred Specialty in the 2018 Main Residency Match: U.S. Allopathic Seniors" 2018; "Charting Outcomes in the Match Characteristics of Applicants Who Match to Their Preferred Specialty in the 2020 Main Residency Match: Senior Students of U.S. MD Medical Schools" 2020; "Charting Outcomes: Characteristics of International Medical Graduates Who Matched to Their Preferred Specialty: 2024 Main Residency Match" 2024).

Based on this evidence and its importance to their goals, individuals who desire to match into orthopaedic surgery residency training programs are often seeking dedicated research experiences before, during, or after medical school (Cotter, Polce, Lee, et al. 2021). There are some research fellowships offered at institutions across the US that are designed to fulfill this purpose, with some programs also providing clinical exposure, mentorship, and/or financial compensation. Importantly, orthopaedic surgery program directors often consider these research fellowships to be an effective way to make an applicant more competitive in The Match (Cotter et al. 2022). However, despite their growing need and importance, there is very limited centralized information regarding orthopaedic surgery research fellowships in the US. Therefore, the purpose of this study was to identify publicly available orthopaedic surgery research fellowships and characterize each with respect to availability, location, duration, financial compensation, and association with Doximity rankings of orthopaedic surgery residencies.

METHODS

An online search using Orthogate.com and MSOS.com (Medical Student Orthopedic Society) was conducted on March 15, 2024, to identify all publicly available research fellowships at active orthopaedic surgery residency programs in the United States, as well as at institutions without residency programs. The date March 15, 2024 was specifically chosen as this was the day of Match Day in 2024. If an orthopaedic surgery applicant does not successfully match, they will likely look for a research position following Match Day. For each fellowship program, data was collected on the institution's geographic region, the number of positions available, whether financial compensation was provided, the amount of compensation, and the length of the fellowship. Means, medians, ranges, and percentages were calculated where applicable.

Doximity residency rankings are subjective rankings that are formulated based on evaluations submitted by practicing orthopaedic surgeons, fellows, and residents, which are then voted on by the same populations ("Doximity Residency Navigator," n.d.). To evaluate the association between Doximity ranking scores and the availability of orthopaedic surgery research fellowships, the 201 orthopaedic surgery residency programs were categorized into four quartiles based on their Doximity ranking (1–50, 51–100, 101–150, and 151–201). For each group, the number of available research fellowships were identified. A Spearman's correlation was performed to assess whether higher Doximity scores were associated with a greater number of research fellowship positions. Statistical significance was defined as $p < 0.01$.

RESULTS

Using the search strategy described, 80 publicly available orthopaedic surgery research fellowship programs were identified, offering a total of 143 fellowship positions (**Appendix**). On average, each program offered 2 positions (median=1, range=1-11), with an average fellowship duration of 1 year (median=1, range=0.83-2). Fifty-eight programs (73%) provided financial support, and among the 29 programs that reported salary/stipend amounts, the av-

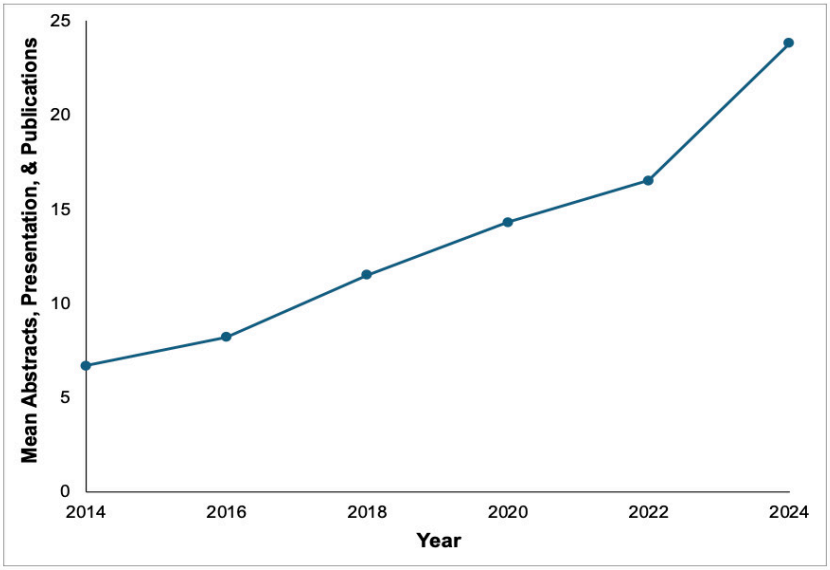

Figure 1: Mean research abstracts, presentation, and publications by MD applicants successfully matching into orthopaedic surgery residency between 2014-2024.

Figure 1

erage was $27,677 per year (median=$30,000, range=$10,000-$67,808 per year).

Forty-nine (24%) of the 201 orthopaedic surgery residency programs and 8 institutions without residency programs offered research fellowships, with several institutions offering multiple distinct research fellowship programs. Among these 49 institutions, 13 (27%) were located in the Northeast, 16 (33%) in the Southeast, 11 (22%) in the Midwest, and 9 (18%) in the West (**Figure 2**) (Lack et al., n.d.).

For orthopaedic surgery residency programs offering research fellowships, those ranked 1–50 on Doximity offered 24 fellowships, those ranked 51–100 offered 14, programs ranked 101–150 offered 5, and those ranked 151–201 offered 4. Spearman's correlation indicates a strong association (r^2=-1.0) between higher Doximity rankings and the availability of research fellowships, as the Quartile ranking moves toward 1, the number of fellowship positions significantly increases (p=<.001) (**Figure 3**).

DISCUSSION

A total of 143 publicly available orthopaedic surgery research fellowship positions were identified to be offered at 80 institutions across the United States, with the majority described as 1-year positions with financial support. Among the 72% of programs that reported salary/stipend amounts, the average compensation was $27,677 per year, with the highest salary listed at $67,808 per year. While most of these positions were offered by institutions with orthopaedic surgery residency programs, 8 were affiliated with institutions without a residency. The Southeastern region of the United States had the highest concentration of research fellowships, followed by the Northeastern, Midwestern, and Western regions. Overall, only 24% of orthopaedic surgery residency programs publicly offered research fellowships at the time of the search. Among these, residency programs with higher Doximity rankings were found to offer significantly more research fellowship positions.

Clark et al (Clark, Brown, and Mulcahey 2021). evaluated orthopaedic surgery research fellowships in the United States for medical students in 2020 and 2021, identifying a total of 30 programs offering fellowships for medical students. Similar to the current study, Clark et al (Clark, Brown, and Mulcahey 2021). found that 70% of programs offered salaries and the majority were located in the Northeast. Their study reported an average number of publications earned by students completing a fellowship as 10.8, demonstrating the utility of these positions to increase a medical student's research output and bolster their residency competitiveness. It is unclear if orthopaedic research fellowships have significantly increased in recent years, or if they were lower during Clark's study due to limitations caused by the COVID-19 pandemic.

Other studies have investigated the benefits of orthopaedic surgery research fellowships, with one reporting a 91% successful match rate for medical students, from 2001 to 2018, who participated in one of these orthopaedic research-focused programs (Egol, Shields, Errico, et al. 2020). Interestingly, this study's cohort scored an average of 4 points lower on USMLE Step 1 compared to the national average for those successfully matching into orthopaedic surgery residency training programs, indicating the potential ability for a research fellowship to ameliorate potentially perceived weaknesses of applicants. Beyond improving an applicant's research portfolio and associated likelihood of matching into an orthopaedic surgery resi-

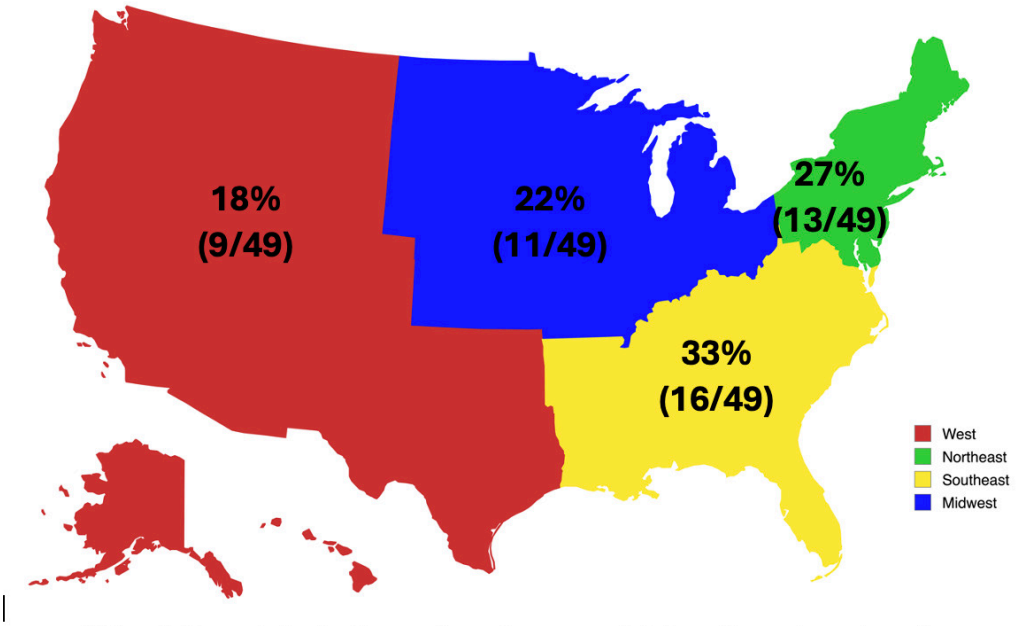

Figure 2: Percentage of orthopaedic surgery research fellowship programs by region.

Figure 2

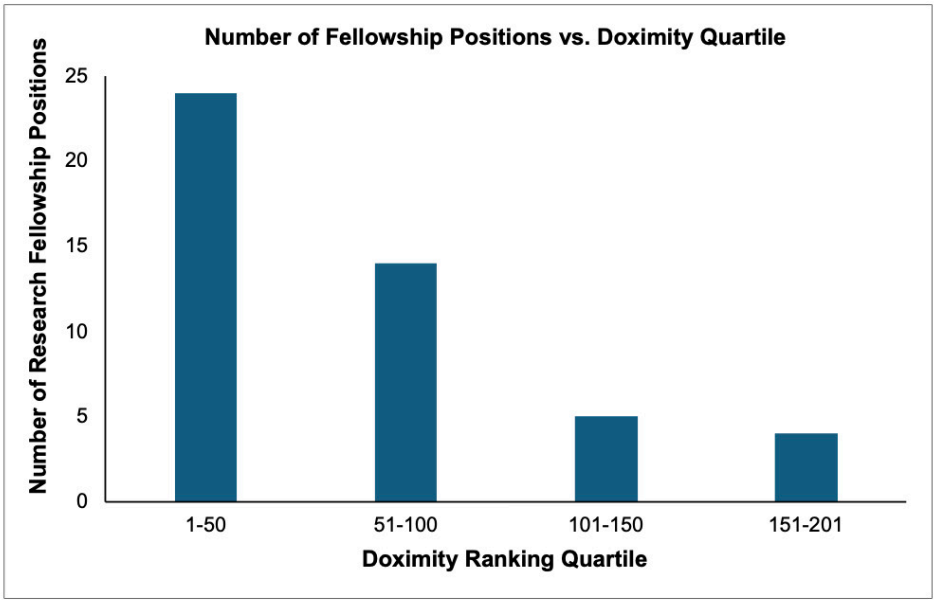

Figure 3: Number of research fellowship positions offered by orthopaedic surgery residency programs by Doximity ranking quartiles.

Figure 3

dency training program, these fellowships can enhance research acumen and performance, expand orthopaedic surgery knowledge base, and develop key relationships with mentors, which can all further increase the likelihood of matching (Milner et al. 2022).

To the authors' knowledge, this is the first study to report an average salary offered by orthopaedic surgery research fellowship programs. This is an important factor in deciding if and when to pursue one of these opportunities as many interested individuals have incurred considerable student loan debts and are solely responsible for their living expenses. Our findings indicate that many research fellowship programs offer financial compensation, however, the range is broad, the mean is approximately half of the national average wage index, and employee benefits may be limited ("National Average Wage Index," n.d.). Because of this, fellows may need to take on additional loans or pur-

sue other means of financial support during an orthopaedic surgery research fellowship.

In conjunction with previous studies (Clark, Brown, and Mulcahey 2021; El Shatanofy, Brown, Berger, et al. 2021; Ponce et al. 2024), the present study exposes the need for a centralized website for institutions to publicize their orthopaedic surgery research fellowships. Orthogate.com currently serves as a centralized platform for listing orthopedic surgery research fellowships; however, its use is not universal, and the information available may be incomplete or inconsistently updated. While Orthogate provides a valuable resource, reliance on this platform alone may still leave gaps in accessibility and awareness for students seeking research opportunities. A more standardized, widely adopted, and regularly maintained centralized database could further enhance transparency and efficiency in the research fellowship application process, benefiting both applicants and residency programs. The current lack of centralized information creates challenges for students who must navigate multiple incomplete sources or rely on word of mouth to discover opportunities that may significantly impact their career goals and timing. A comprehensive, universally utilized website would streamline this process, making it easier for students to identify research fellowships that align with their academic goals and personal circumstances. Such a platform would also benefit residency programs by increasing their program's visibility and helping them attract high-quality candidates.

While our study provides insights into the availability of orthopaedic surgery research fellowships and their characteristics, it is limited by this reliance on publicly available data, which may not fully capture all available positions or include fellowships that are not publicized online. Additionally, the subjective nature of Doximity rankings may not fully reflect the research strength or focus of each residency program. More detailed information regarding the structure, opportunities, roles, responsibilities, metrics and outcomes of research fellowships is needed to optimize awareness and benefits for applicants and institutions, which again highlights the need for a centralized website for this purpose. This will also allow for further study to determine if research years are consistently associated with higher match rates, which will allow interested individuals to their own risk-versus-reward.

In conclusion, this study identified and characterized publicly available orthopaedic surgery research fellowships, providing valuable information for interested applicants, who are considering one of these opportunities. Despite identifying 143 publicly available positions across two platforms, our findings emphasize the need for a more comprehensive, centralized website for institutions to advertise their orthopaedic research fellowships. This would help improve transparency and accessibility for interested applicants in these valuable opportunities as the demand for them is likely to increase with growing competition for orthopaedic surgery residency positions.

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APPENDIX

The 80 publicly available orthopaedic surgery research fellowship programs that offer a total of 143 fellowship positions.

Table 1: Placeholder

State	City	Doximity Rank	Hospital/ University/ Medical Center	Number of Research Positions	Paid (1) Unpaid (0)	Salary	Length of Time (Years)
Alabama	Birmingham	50	University of Alabama Medical Center Program	3	Paid	Not Reported	1.00
California	San Francisco	12	University of California (San Francisco) Program	1	Unpaid	-	0.83
California	Los Angeles	23	University of Southern California/ LAC+USC Medical Center Program	1	Unpaid	-	1.00
California	Los Angeles	38	Cedars-Sinai Medical Center Program	2	Paid	Not Reported	1.00
California	Orange	108	University of California (Irvine) Program	1	Paid	Not Reported	1.00
Colorado	Aurora	48	University of Colorado Program	1	Unpaid	-	1.00
Colorado	Vail		Steadman Philippon Research Institute	5	Paid	$20hr + $500/ month	1.00
Connecticut	Farmington	55	University of Connecticut Program	1	Paid	Not Reported	1.00
Florida	Miami	22	University of Miami/ Jackson Health System Program	1	Unpaid	-	1.00
Florida	Miami	22	University of Miami/ Jackson Health System Program	1	Paid	Not Reported	1.00
Florida	Tampa	35	University of South Florida Morsani Program	1	Paid	Not Reported	1.00
Florida	Orlando	95	Orlando Health Program	1	Paid	Not Reported	1.00
Florida	Atlantis	198	HCA Florida JFK Hospital/ University of Miami Miller School of Medicine	2	Paid	Not Reported	1.00

State	City	Doximity Rank	Hospital/ University/ Medical Center	Number of Research Positions	Paid (1) Unpaid (0)	Salary	Length of Time (Years)
			GME Consortium Program				
Florida	Orlando		Orlando Health Jewett Orthopedic Institute	2	Paid	Not Reported	1.00
Illinois	Chicago	5	Rush University Medical Center Program	4	Paid	Not Reported	1.00
Illinois	Chicago	27	McGaw Medical Center of Northwestern University Program	1	Unpaid	-	1.00
Illinois	Chicago	71	University of Chicago Program	1	Paid	Not Reported	1.00
Illinois	Chicago	96	University of Illinois College of Medicine at Chicago Program	1	Paid	Not Reported	1.00
Illinois	Des Plaines		American Hip Institute	3	Paid	10000	1.00
Illinois	Naperville		Duly Health and Care Spine Research Fellowship	1	Paid	35000	1
Illinois	Chicago		Rush University Medical Center Program	8	Paid	35000	1.00
Indiana	Indianapolis	83	Indiana University School of Medicine Program	1	Paid	30000	1.00
Louisiana	New Orleans	78	Tulane University Program	1	Paid	24000	1.00
Louisiana	Shreveport	79	Louisiana State University (Shreveport) Program	1	Paid	Not Reported	1.00
Louisiana	New Orleans	112	Louisiana State University Program	3	Paid	$1150/ month	1.00
Maryland	Baltimore	32	Johns Hopkins University Program	1	Paid	35000	1.00
Maryland	Baltimore	32	Johns	2	Paid	Not	1.00

State	City	Doximity Rank	Hospital/ University/ Medical Center	Number of Research Positions	Paid (1) Unpaid (0)	Salary	Length of Time (Years)
			Hopkins University Program			Reported	
Maryland	Baltimore	54	University of Maryland Program	6	Paid	30000	1.00
Maryland	Baltimore	158	Sinai Hospital of Baltimore Program	1	Paid	Not Reported	1.00
Maryland	Annapolis		Luminis Health	1	Paid	Not Reported	1
Massachusetts	Boston	60	Tufts Medical Center Program	2	Paid	Not Reported	1.00
Michigan	Clinton Township	47	Henry Ford Health/Henry Ford Macomb Hospital Program	4	Paid	Not Reported	1.00
Minnesota	Rochester	2	Mayo Clinic College of Medicine and Science (Rochester) Program	1	Unpaid	-	1.00
Minnesota	Rochester	2	Mayo Clinic College of Medicine and Science (Rochester) Program	11	Paid	Not Reported	1.00
Minnesota	Minneapolis	25	University of Minnesota Program	2	Paid	Not Reported	2.00
Minnesota	Minneapolis	25	University of Minnesota Program	1	Paid	40,000	1.00
Minnesota	Not Stated			3	Paid	$22/hr	1.00
Mississippi	Jackson	84	University of Mississippi Medical Center Program	1	Paid	Not Reported	1.00
Missouri	St Louis	3	Washington University/B-JH/SLCH Consortium Program	1	Paid	67,808	1.00
Missouri	St Louis	3	Washington University/B-JH/SLCH Consortium Program	5	Paid	26,660	1.00
New Jersey	Camden	166	Cooper Medical School of Rowan University/ Cooper University Hospital	1	Unpaid	-	1.00

State	City	Doximity Rank	Hospital/ University/ Medical Center	Number of Research Positions	Paid (1) Unpaid (0)	Salary	Length of Time (Years)
			Program				
New York	New York	1	Hospital for Special Surgery/ Cornell Medical Center Program	2	Paid	Not Reported	1.00
New York	New York	18	New York Presbyterian Hospital (Columbia Campus) Program	1	Unpaid	-	1.00
New York	Mineola	73	NYU Grossman Long Island School of Medicine Program	2	Paid	Not Reported	1.00
New York	Brooklyn	109	Maimonides Medical Center Program	1	Paid	Not Reported	2.00
New York	Manhasset		Northshore University Hospital	2	Unpaid	-	1.00
North Carolina	Durham	8	Duke University Hospital Program	1	Paid	Not Reported	1.00
North Carolina	Charlotte	13	Carolinas Medical Center Program	1	Paid	Not Reported	1.00
North Carolina	Winston-Salem	33	Wake Forest University School of Medicine Program	2	Unpaid	-	1.00
Ohio	Dayton	117	Kettering Health Network Program	1	Paid	38400	1.00
Ohio	Toledo	174	Mercy St Vincent Medical Center Program	1	Paid	Not Reported	1.00
Pennsylvania	Philadelphia		Rothman Spine Institute	7	Paid	Not Reported	1
Pennsylvania	Philadelphia		Rothman Spine Institute	6	Unpaid	-	1
Pennsylvania	Philadelphia		Rothman Spine Institute	1	Paid	Not Reported	2
Pennsylvania	Philadelphia	16	Sidney Kimmel Medical	1	Paid	24000	1.00

State	City	Doximity Rank	Hospital/ University/ Medical Center	Number of Research Positions	Paid (1) Unpaid (0)	Salary	Length of Time (Years)
			College at Thomas Jefferson University/ TJUH Program				
Pennsylvania	Pittsburgh	93	UPMC Medical Education Program	1	Paid	Not Reported	1.00
Rhode Island	Providence	40	Brown University Program	2	Paid	30000	1.00
South Carolina	Charleston	85	Medical University of South Carolina Program	1	Paid	Not Reported	1.00
Tennessee	Nashville	9	Vanderbilt University Medical Center Program	1	Paid	Not Reported	1.00
Tennessee	Memphis	19	University of Tennessee/ Campbell Clinic Program	2	Paid	Not Reported	1.00
Texas	Austin	80	University of Texas at Austin Dell Medical School Program	1	Paid	35000	1.00
Texas	Galveston	103	University of Texas Medical Branch Hospitals Program	1	Unpaid	-	1.00
Texas	Houston		Baylor College of Medicine Program	2	Paid	30000	1.00
Utah	Salt Lake City	11	University of Utah Health Program	3	Paid	Not Reported	1.00
Virginia	Alexandria		Anderson Orthopaedic Research Institute	6	Paid	35000	1.00
Virginia	Roanoke		Carilion Clinic- Virginia Tech Carilion School of Medicine Program	3	Paid	Not Reported	1.00