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An Analysis of Research from Faculty at U.S. Adult Reconstruction Fellowships

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ABSTRACT

We reviewed all articles published in three major orthopaedic journals from January 2010 to December 2014. Any article focusing on adult reconstruction of the hip or knee was reviewed for first and last authorship, institution, and level of evidence. Three institutions had authored work from arthroplasty faculty that fell within the top five most published institutions in all three journals, while one institution ranked first in all three journals. 43 of 67 (64.2%) reconstruction fellowships had at least one publication included in this study. The majority of the adult reconstruction literature published by faculty at U.S. reconstruction fellowships stems from a few academic centers with the ten most prolific institutions accounting for 65.9% of all U.S. fellowship publications.

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The field of adult reconstruction is a well-established yet evolving field. The training of fellows in adult reconstruction was approved as a fellowship by the Accreditation Council for Graduate Medical Education (ACGME) in 1989 and presently, there are 67 reconstruction fellowships listed on the AAHKS website [1]. With the number of primary and revision hip and knee arthroplasties growing at an exponential rate [2], there will be an increasing need not only for fellowship trained subspecialists to accommodate the growing patient population, but also specialists who are well equipped to advance the field via high level research endeavors.

Roughly 90%–91% of current orthopaedic residents will apply to a sub-specialty fellowship at some point in their career [3,4]. There are several factors that influence the resident's decision process when choosing a sub-specialty and subsequent fellowship. One such factor is the academic productivity of the faculty at an institution given the influence that it may have on the fellow's ability to understand, design and potentially complete research during a fellowship. In the present study, we evaluated the first and last authors in three major orthopaedic journals in an attempt to characterize which institutions associated with arthroplasty fellowships have faculty producing the largest volume of research. To our knowledge, there is no literature comparing publication volume between faculty at U.S. adult reconstruction fellowships.

Methods

Authorship Selection

We selected three major orthopaedic journals, which frequently publish arthroplasty-related articles and reviewed all articles within the *Journal of Bone and Joint Surgery* (JBJS), *Clinical Orthopaedic and Related Research* (CORR), and *Journal of Arthroplasty* (JOA) over a five-year period from January 2010 to December 2014. Any original scientific work focusing on adult reconstruction of the hip or knee was reviewed for authorship, institution, and level of evidence according to the most recent JBJS guidelines [5]. Articles not pertaining to arthroplasty-related basic science, perioperative, diagnostic or clinical management topics were excluded. Only articles whose first and/or senior author's institutions were listed as a U.S. adult reconstruction fellowship (as indicated by the fellowship listing on the American Association of Hip and Knee Surgeons' [AAHKS] website) [1] were included in our study. We electronically searched each first and last author to ensure that they were clinical orthopaedic surgery faculty associated with an arthroplasty fellowship. Medical students, research assistants, residents, fellows, and non-clinical faculty were excluded in our analysis. Authors and institutions from other U.S. fellowships were not included in the

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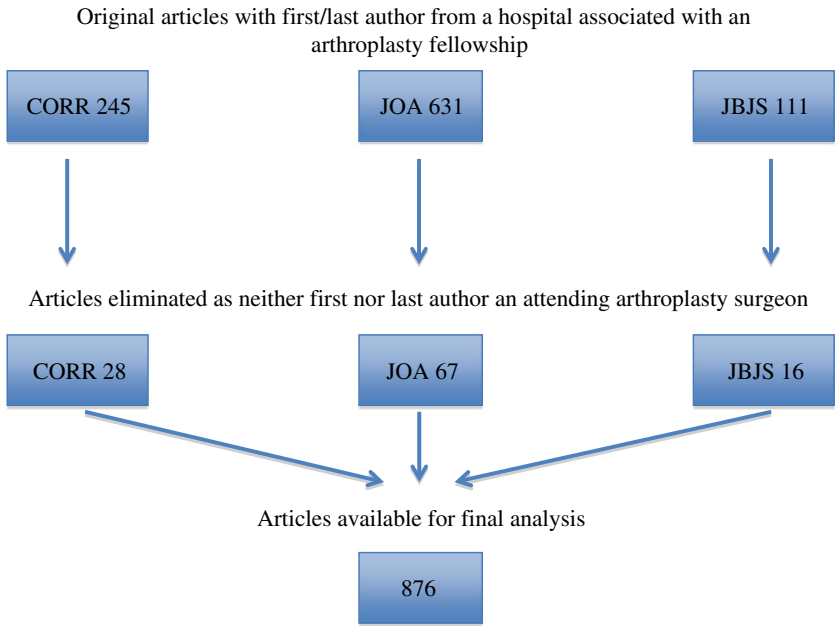

Fig. 1. Methodology of study collection.

study if they were not the first or senior authors. If the first and senior author's institutions were disparate fellowship sites, both institutions were included and recorded.

Assignment of Points

One point was given per institution and manuscript. If the first and senior authors were faculty at the same institution, only one point was assigned for that paper. If the first and last authors were from different institutions, each institution was assigned one point. We also performed a subgroup analysis looking at overall assigned points per arthroplasty faculty and arthroplasty fellow, respectively, at each institution. We obtained the number of arthroplasty faculty per institution from individual institutions' website (if available) or from personal communication with institution administrators. We obtained the number of fellows per institution through communication with the AAHKS and through communication with individual institutions.

Results

Our initial review yielded 990 articles with authors associated with an arthroplasty fellowship. 111 articles came from JBJS, 245 from CORR, and 634 from JOA. We then eliminated 16 articles from JBJS, 28 from CORR, and 67 from JOA as neither the first nor last author was an attending arthroplasty surgeon as indicated by our individual electronic credentials review. This left 879 articles available for final analysis (Fig. 1). The first and/or senior authors represented a total of 894 institutions. Three intuitions fell within the top five most-published fellowships in all three journals (Tables 1–3), while one institution ranked first in all three journals and was the most published institution overall (Table 4). The top three most published institutions accounted for 33.9% of all authored work from faculty affiliated with U.S. arthroplasty fellowships and the combined top ten programs accounted for 64.2% of all publications from faculty at institutions associated with U.S. fellowships. In addition, we performed a subgroup analysis of points per faculty and per fellow with the most published overall institution again ranking first in a ratio of points per faculty (Table 5). 43 of 67 (64.2%) U.S. reconstruction fellowships were represented by at least one faculty publication included in this study. The mean level of evidence of the articles included was 3.2 ± 1.0 for JBJS, 3.4 ± 1.1 for CORR, and 3.3 ± 1.0 for JOA, respectively. 25.3% of JBJS's manuscripts were Level I or II evidence, 20.2% of CORR's papers were level I or II evidence, and 24.7% of JOA's papers were Level I or II evidence.

Discussion

This study is the first that we are aware of to evaluate academic productivity of attending surgeons associated with adult reconstruction fellowships. We feel that our findings will be useful to residents interested in an academic career in adult reconstruction and can provide insight

Table 1
Journal of Bone and Joint Surgery Authorship Analysis.

Institution	# First and/or Senior Authorship
Rothman Institute	18
Mayo Clinic, MN	14
Hospital for Special Surgery	9
UCSF	7
Rush University	6
Rubin Institute	6
Washington University	5
Massachusetts General	5
Duke University	3
University of Virginia	2
University of Utah	2
UC Davis	2
Stanford University	2
University of Pennsylvania	2
NYU	2
Cleveland Clinic, OH	2
VCU	1
USC	1
Southern Illinois University	1
OrthoCarolina	1
New England Baptist	1
Methodist Hospital	1
Insall Scott Kelly Institute	1
CORE Institute	1
Case Western Reserve Univ.	1
Brigham & Women's Hospital	1
Anderson Clinic	1

Table 2
Clinical Orthopaedics and Related Research Authorship Analysis.

Institution	# First and/or Senior Authorship
Rothman Institute	37
Mayo Clinic, MN	23
Washington University	23
Hospital for Special Surgery	19
UCSF	17
Rush University	16
Massachusetts General	10
Rubin Institute	10
Anderson Clinic	8
Stanford University	8
University of Pennsylvania	8
Colorado Joint Replacement	5
Lenox Hill, NY, NY	5
University of Utah	5
Case Western Reserve Univ.	4
Duke University	3
Joint Implant Surgeons	3
Mayo Clinic, AZ	3
New England Baptist	3
OrthoCarolina	3
VCU	3
Cleveland Clinic, OH	2
Methodist Hospital	2
Scripps Clinic	2
UC Davis	2
Carilion Clinic-Virginia Tech	2
Brigham & Women's Hospital	1
Columbia University	1
Florida Orthopaedic Institute	1
Insall Scott Kelly Institute	1
Mayo Clinic, FL	1
Southern Illinois University	1
Wake Forest University	1

Table 3
Journal of Arthroplasty Authorship Analysis.

Institution	# First and/or Senior Authorship
Rothman Institute	79
Hospital for Special Surgery	62
Mayo Clinic, MN	42
Rush University	34
Rubin Institute	31
NYU	29
University of Pennsylvania	27
Cleveland Clinic, OH	24
UCSF	21
Massachusetts General	17
Anderson Clinic	16
Columbia University	16
Stanford University	16
OrthoCarolina	14
Duke University	11
University of Utah	11
Washington University	10
Lenox Hill, NY, NY	9
Scripps Clinic	9
UC Davis	9
Brigham & Women's Hospital	8
New England Baptist	8
Florida Orthopaedic Institute	7
Indiana University	5
University of Virginia	5
Methodist Hospital	4
Southern Illinois University	4
VCU	4
Case Western Reserve Univ.	3
Mayo Clinic, AZ	3
Mayo Clinic, FL	3
USC	3
Baylor College of Medicine	2
Carilion Clinic-Virginia Tech	2
Cleveland Clinic, FL	2
Colorado Joint Replacement	2
CORE Institute	2
Emory University	2
Insall Scott Kelly Institute	2
Joint Implant Surgeons	2
Wake Forest University	2
Northshore University	1
Univ. Texas Health Center	1

into the institutions with arthroplasty attendings producing research published in some of the most well-known orthopaedic journals. We found the majority of articles published to be level III evidence or below. This may indicate a need for more high level, evidence-based studies by attendings at U.S. fellowships.

The top institutions account for the majority of research published from attendings at U.S. reconstruction fellowships. The three most-published fellowship locations accounted for fifteen, ten, and nine percent of all research stemming from faculty at U.S. arthroplasty fellowships, respectively. The top ten programs account for approximately two-thirds of all published research. Twenty-four of the fellowship locations listed by AAHKS did not appear in any of the three journals evaluated. This disparity likely reflects the emphasis that the attendings publishing in these journals place on research. There is likely a large discrepancy in the number of attendings at a particular institution in addition to the amount of resources and manpower available to faculty and their fellows, with some institutions being private practices with few faculty. However, our subgroup analysis revealed that many of the most published institutions also had the highest ratios of points per faculty and points per fellow.

It is estimated that 90% of orthopaedic residents will eventually apply for and complete a fellowship [3]. In a survey of residents, PGY-3 and above, 21% of those responding indicated a desire to pursue a fellowship in hip or knee arthroplasty [4], which represented the second most popular fellowship choice behind sports. In the same study, eighteen percent of those surveyed indicated that research in a given subspecialty field was "very important," while nineteen percent of responders indicated that an academic career was "very important." Forty percent indicated that there is interesting research in the field of arthroplasty. For those considering arthroplasty fellowships compared to those that were considering alternate sub-specialties, the arthroplasty group had greater aspirations for pursuing research as an academic orthopaedic surgeon. In contrast, forty-five and forty-four percent, respectively, of those surveyed indicated that an academic career and research interest in the fellowship specialty that they were considering were "not important." Thus, to many residents, the academic productivity of attendings at a program may not be foremost in their decision making process when considering fellowship options.

We recognize many of the weaknesses of this study, which include the fact that we only evaluated first and senior authors. This method excluded many institutions that would otherwise have appeared more often in our rankings. We modeled this data collection method after a previously published bibliometric analysis of orthopaedic research [6], which also used first and senior authors. There were many multi-institution manuscripts, and our method allowed us to focus our attention on one to two institutions per paper. We also individually searched each authors' academic affiliation and level of training in order to exclude medical students, residents, research assistants, fellows and non-clinical faculty that are often only temporarily associated with an institution or fellowship. By excluding these authors, several papers did not make our list. Another weakness of this study was our limited inclusion of three journals during a five-year time period. We felt that these journals represented three of the top journals publishing literature from faculty at U.S. reconstruction fellowships. Our five-year cutoff was an arbitrary restriction, but represents the most recent publication trends. We limited our inclusion criteria only to articles dealing with hip or knee arthroplasty-related topics, and there is the potential that we missed papers published from U.S. fellowships. Our subgroup analysis attempts to control for discrepancies in number of faculty and fellows per institution, though eight of the most published authors' institutions

Table 4
Overall Authorship Analysis Combining All Three Journals.

Institution	# First and/or senior authorship
Rothman Institute	134
Hospital for Special Surgery	90
Mayo Clinic, MN	79
Rush University	56
Rubin Institute	47
UCSF	45
Washington University	38
University of Pennsylvania	37
Massachusetts General	32
NYU	31
Cleveland Clinic, OH	28
Stanford University	26
Anderson Clinic	25
OrthoCarolina	18
University of Utah	18
Columbia University	17
Duke University	17
Lenox Hill, NY, NY	14
UC Davis	13
New England Baptist	12
Scripps Clinic	11
Brigham & Women's Hospital	10
Case Western Reserve Univ.	8
Florida Orthopaedic Institute	8
VCU	8
Methodist Hospital	7
University of Virginia	7
Colorado Joint Replacement	6
Mayo Clinic, AZ	6
Southern Illinois University	6
Indiana University	5
Joint Implant Surgeons	5
Carilion Clinic-Virginia Tech	4
Insall Scott Kelly Institute	4
Mayo Clinic, FL	4
USC	4
CORE Institute	3
Wake Forest University	3
Baylor College of Medicine	2
Cleveland Clinic, FL	2
Emory University	2
Northshore University	1
Univ. Texas Health Center	1

Table 5
Overall Authorship Points per Faculty and Fellow at a Given Institution.

Institution	Points per Faculty	Points per Fellow
Rothman Institute	19.1	33.5
Rubin Institute	15.7	15.7
UCSF	15	45
Mayo Clinic, MN	9.9	39.5
Washington University	7.6	12.7
Rush University	7	7
UC Davis	6.5	13
Anderson Clinic	6.3	6.3
University of Pennsylvania	5.3	18.5
Hospital for Special Surgery	4.5	11.3
Stanford University	4.3	8.7
Columbia University	4.3	17
Cleveland Clinic, OH	3.5	7
Duke University	3.4	8.5
University of Utah	3	6
Massachusetts General	2.7	8
Florida Orthopaedic Institute	2.7	2
OrthoCarolina	2.3	4.5
Methodist Hospital	2.3	3.5
University of Virginia	2.3	3.5
Scripps Clinic	2.2	3.7
Lenox Hill, NY, NY	2	2.3
Case Western Reserve Univ.	2	8
VCU	2	4
Mayo Clinic, FL	2	4
Mayo Clinic, AZ	1.5	6
Southern Illinois University	1.5	6
Wake Forest University	1.5	3
Brigham & Women's Hospital	1.3	3.3
Carilion Clinic-Virginia Tech	1.3	4
Colorado Joint Replacement	1.2	3
Indiana University	1	2.5
Joint Implant Surgeons	1	2.5
NYU	0.8	15.5
USC	0.8	4
Insall Scott Kelly Institute	0.7	1
Emory University	0.7	2
New England Baptist	0.6	2.4
Univ. Texas Health Center	0.5	1
Baylor College of Medicine	0.4	1
CORE Institute	0.3	0.75
Cleveland Clinic, FL	0.3	0.5
Northshore University	0.3	1

were again among the top ten institutions with the highest points per faculty ratio.

Conclusion

There is a discrepancy in the amount of research published between clinical faculty at U.S. reconstruction fellowships that indicates a higher value on publication and resource utilization among the most published institutions. There are a few adult reconstruction centers that produce the majority of literature published by arthroplasty attendings who work with fellows. Residents interested in an academic career in the field of adult reconstruction may consider some of the institutions represented in our study.

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