Education

Leadership trends among orthopaedic trauma surgery fellowship directors: a cross-sectional demographic review

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ABSTRACT

Background:
Fellowship directors in orthopaedic trauma surgery have an immense impact on the current and future trainees within orthopaedics. The purpose of our study was to evaluate and better understand the characteristics that are shared among current orthopaedic trauma surgery fellowship directors to provide a framework for aspiring leaders and to present a demographic snapshot.

Methods:
Orthopaedic trauma fellowship programs were identified using the Orthopaedic Trauma Association Directory for 2019 to 2020. Data for each fellowship director was gathered via online review, email, telephone, and curriculum vitae collection.

Results:
Demographic information was gathered for 72 fellowship directors. Of these, 93% of the leadership was male. Additionally, 40 (55%) fellowship directors responded to the racial classification question. Of those responding, 37 identified as Caucasian, one as Asian-American, one as Hispanic/Latino, and one as African American. The mean age of the current fellowship directors (51.4 yr), h-index (15.1), year of residency (2001) and fellowship (2003) graduation, time of employment at current institution (13.8 yr), time since training until fellowship director appointment (9.8 yr) were analyzed. The top residency and fellowship programs that produced future fellowship directors were University of Pittsburgh (n = 4) and Harborview Medical Center (n = 17).

Conclusions:
Our investigation highlighted the qualifications of orthopaedic trauma fellowship directors and can guide future leaders. A select few institutions train a disproportionate share of the current fellowship directors. Gender and racial diversity are limited in this population of leaders.

Level of Evidence:
Level III.

Key Words
leadership, orthopaedic trauma, fellowship director, education, diversity

INTRODUCTION

Understanding personal qualities and academic accolades that leaders possess is an important process for those striving for leadership roles in any profession. Frequently, certain qualities and backgrounds are similar among leaders, but rarely are they quantified or evaluated. A summary of demographic and training backgrounds can provide a helpful snapshot to better understand the current landscape of leadership and can highlight trends and imbalances that may be present but otherwise may go unnoticed.

There is limited evidence describing the qualifications and experience that are associated with coveted leadership positions in orthopaedics. Prior authors have analyzed demographic trends of residency program directors and department chairs in specialties outside of orthopaedics.[1–4] More recently, these trends have been assessed for both orthopaedic spine and adult reconstruction fellowship directors.[5–7] To the authors' knowledge, objective measures of what factors allow for leadership roles in the academic orthopaedic trauma surgery profession have yet to be

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examined, which has left trainees and younger surgeons who aspire to achieve leadership roles within orthopaedic trauma surgery without a potential roadmap for success. The aims of our investigation were to describe the demographics of orthopaedic trauma surgery fellowship directors and to provide direction to those seeking leadership roles. The hypothesis for this study was that certain institutions would produce a large proportion of the leadership and that there would be clear demographic trends for ethnicity, gender, and backgrounds of the current trauma fellowship directors.

METHODS AND MATERIALS

Ethical Review and Study Design

Institutional review board approval and informed consent were not required for this study that used previously published and publicly available data.

Data Collection

A cross-sectional demographic review of current orthopaedic trauma surgery fellowship directors in the United States (US) as of March 2020 was performed. The Orthopaedic Trauma Association (OTA) Directory for 2019 to 2020 was used to identify all fellowship directors. All fellowship directors and codirectors for each program were identified. Demographic and educational training data for each fellowship director were recorded from curricula vitae (CV). If information of interest was not available on the fellowship director's CV, it was gathered from institutional biographies, Scopus Web of Science (www.scopus.com), and email questionnaires to the fellowship administrators and program coordinators, with follow-up by telephone calls if there was no response. The demographic information of interest included: age, gender, race, past residency and fellowship training and year of graduation, years since fellowship completion until hired at current institution and also fellowship director appointment, years in fellowship director role, years at current institution, individuals' research standing via Scopus h-Index, and additional qualifications such as AO fellowship or multiple academic degrees.

To record the individual Scopus h-index for every fellowship director who was included in the study, the Scopus database (Elsevier BV, Waltham, MA, USA) was queried to access each specific research profile. This database uses a search engine feature that operates the most extensive repository of peer-reviewed scientific literature with a citation tracking component. All collected data were then reviewed by the lead author (AJS) and cross-referenced with the fellowship director directory to ensure accuracy.

Statistical Analysis

A sample size calculation was not done because all of the current fellowship directors for trauma orthopaedics in the United States during the applicable time period were included in this study. Pearson correlation coefficients were determined via SAS 9.4 (Statistical Analytics System, Cary, North Carolina) software. Data were interpreted according to Mukaka's guide for correlation coefficients.[8] Values under 0.3, 0.3 to 0.5, 0.5 to 0.7, 0.7 to 0.9, and greater than 0.9 are indicative of negligible, low, moderate, high, and very high positive correlation, respectively.[8] A P value of less than 0.05 was considered significant.

TABLE 1. Demographics of trauma fellowship directors

Demographics and training	n (%)
Male	67 (93)
Female	5 (7)
Race	
Caucasian	90% (n = 36)
Asian-Americans	2% (n = 1)
Hispanic/Latinos	2% (n = 1)
African American	2% (n = 1)
Mean age	51.40 yr ± 9.97 (n = 67)
Mean fellowship director Scopus h-index	15.11 ± 12.49 (n = 72)
Other qualifications (AO fellowship or multiple degrees)	12 (16)
Fellowship directors	83% (n = 60)
Fellowship codirectors	14% (n = 10)
Assistant fellowship directors	3% (n = 2)

AO, Arbeitsgemeinschaft für Osteosynthesefragen Foundation Fellowship.

RESULTS

Information was completed for 72 fellowship directors (including directors, codirectors, and assistant directors of fellowships) (Table 1). Of the total 72 fellowship directors, 67 (93%) of the leadership were male, and five (7%) were female. Additionally, 40 (55%) fellowship directors responded to the race classification question. Of those responding, 37 fellowship directors identified as Caucasian, one as Asian-American, one as Hispanic or Latino, and one as African American. The mean age of the current fellowship directors was 51.4 yr (SD 10.0 yr). The mean Scopus h-index was 15.1 (SD 12.5). The mean calendar years for completion of residency and fellowship training were 2001 (SD 9.8 yr) and 2003 (SD 9.3 yr) (Table 2). The mean duration from fellowship graduation until fellowship director appointment was 9.8 yr (SD 6.6 yr) (Table 2). The mean duration of employment for a fellowship director at his or her current institution was 13.8 yr (SD 7.1 yr) (Table 2). The mean duration that a fellowship director held his or her position was 8.4 yr (±6.2 yr) (Table 2). The average time from initial hire until fellowship director appointment was 5.3 yr (±5.1 yr) (Table 2). The percentages of fellowship directors currently working at the same institution where he or she completed residency training was 13% (n = 10), 11% (n = 8) where he or she completed fellowship training, and 3% (n = 2) where he or she completed both residency and fellowship training (Table 2).

The Scopus h-indices for the fellowship directors are displayed as ranges that include 1 to 15 (61%, n = 44), 15 to 30 (24%, n = 17), 30 to 45 (13%, n = 9), and 45 to 60 (3%, n = 2) (Figure 1). Specifically, the most impactful fellowship director in research currently has a Scopus h-index value of 54 (Table 3). For comparison, the tenth most impactful orthopaedic trauma surgery fellowship director in research has a Scopus h-index value of 30 (accessed March 31st, 2020). Years as fellowship director and Scopus h-index were found to have low correlation (r = 0.33, P = 0.03). Similarly, age and

TABLE 2. Education, employment, and leadership progression of trauma fellowship directors

Education and employment progression	Mean score ± SD
Mean calendar year of residency graduation	2001 ± 9.78 (n = 69)
Mean calendar year of fellowship graduation	2003 ± 9.26 (n = 66)
Mean duration from fellowship graduation to earning position of fellowship director	9.79 yr ± 6.56 (n = 42)
Mean duration of employment at current institution	13.38 yr ± 7.09 (n = 47)
Mean duration that fellowship director has held position as fellowship director	8.42 yr ± 6.22 (n = 42)
Mean time from year of hire by current institution to year promoted to fellowship director	5.34 yr ± 5.13 (n = 41)
Institutional loyalty	n (%)
Fellowship directors currently working at same institution as residency training	10 (13.89)
Fellowship directors currently working at same institution as fellowship training	8 (11.11)
Fellowship directors currently working at same institution as both residency and fellowship training	2 (2.78)
Society leadership	*r* (*p*)
Years as fellowship director vs. Scopus h-index	0.33 (0.03)
Age vs. Scopus h-index	0.45 (<0.0001)

SD, standard deviation.

Scopus h-index also had low correlation (r = 0.45, $P < 0.0001$) (Table 2).

The six residency programs that produced the greatest number of the current fellowship directors were University of Pittsburgh (n = 4), Harvard Combined Orthopaedic Residency Program (n = 3), Hospital for Special Surgery (n = 3), University of California San Francisco (n = 3), University of North Carolina Chapel Hill (n = 3), and University of Tennessee – Campbell Clinic (n = 3) (Figure 2).

The six fellowship programs that produced the greatest number of future fellowship directors were Harborview Medical Center (n = 17), R. Adams Cowley Shock Trauma Center (n = 8), Tampa General Hospital (n = 8), University of California Davis (n = 5), Hospital for Special Surgery (n = 4), and University of Pittsburgh (n = 4) (Figure 3).

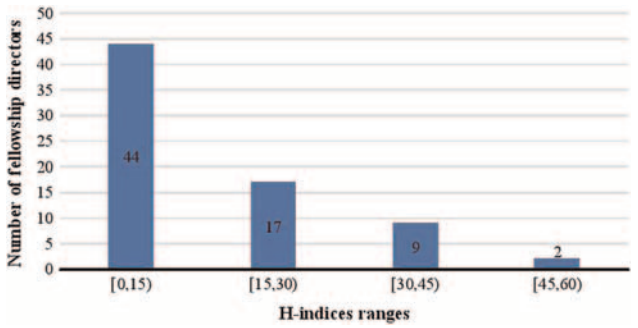

FIGURE 1. A representation of the Scopus H-indices of all trauma fellowship directors. Note: The Scopus h-index values are as of February 1, 2020. Interval notation is used. "[" indicates that the range includes the adjacent numerical value; ")" indicates the range does not include the adjacent numerical value.

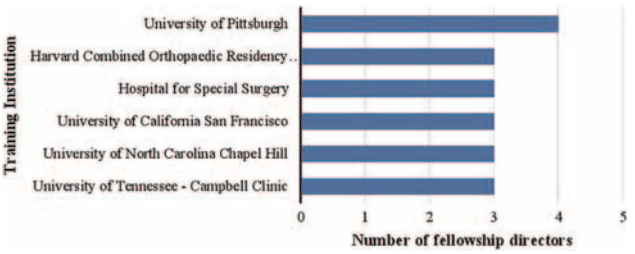

FIGURE 2. A summary of the most attended residency training programs among current trauma fellowship directors. Note: residency programs at which at least three fellowship directors trained were included.

DISCUSSION

The role of fellowship director in orthopaedic trauma surgery comes with significant responsibilities because they directly influence the selection and development of orthopaedic surgeons that are nearing attending status. Our study was able to identify key features with regard to the backgrounds of orthopaedic trauma fellowship directors. Particularly, our data suggest that a large percentage of trauma fellowship directors trained at specific residency and fellowship programs; this may bring to light the impact of program selection by aspiring academic leaders in the field. Additionally, the current landscape of orthopaedic trauma is lacking gender and racial diversity in the fellowship director role. Our data highlight a discrepancy that may have otherwise gone unnoticed. Interestingly, the average trauma fellowship director is younger and has a lower average h-index than their counterparts in other orthopaedic subspecialties.[5,6]

A review of fellowship director training data suggests that where orthopaedic trauma fellowship directors trained might imply that certain residency and fellowship programs provide an enhanced path to guide orthopaedic surgeons toward leadership positions. Two studies specifically analyzed data regarding the orthopaedic surgery fellowship match program.[9,10] Krueger *et al.*[9] suggested that matching at a fellowship program may be based on connections and concluded that at the residency level, fellowship match results seemed to be associated with Doximity (www.doximity.com) orthopedic residency program rankings. The study proved that more favorable fellowship match results were observed from applicants applying from residency programs ranked higher on the Doximity list.[9] Our study displayed a

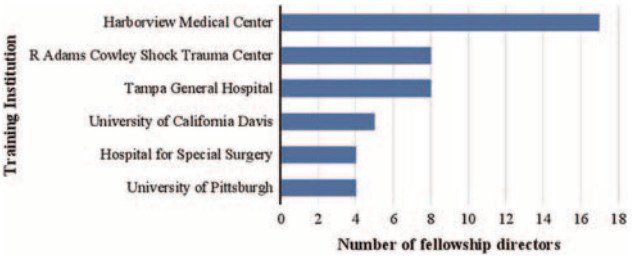

FIGURE 3. A summary of the most attended fellowship training programs among current trauma fellowship directors. Note: fellowship programs at which at least four fellowship directors trained were included.

TABLE 3. Research impact of trauma fellowship directors as determined by Scopus h-index

Fellowship director research productivity		
Fellowship director name	**h-index**	**Fellowship program**
Roy Sanders	54	Tampa General Hospital trauma fellowship
Theodore Miclau III	46	University of California, San Francisco trauma fellowship
Wade R. Smith	43	OrthoONE Trauma at Swedish trauma fellowship
Michael J. Gardner	41	Stanford University School of Medicine trauma fellowship
George Haidukewych	40	Orlando Regional Medical Center trauma fellowship
William Ricci	37	Hospital for Special Surgery trauma fellowship
David Seligson	37	University of Louisville trauma fellowship
Lawrence Webb	35	Georgia Orthopaedic Trauma Institute trauma fellowship
Peter A. Cole	34	Regions Trauma Center/ University of Minnesota Orthopaedic trauma fellowship
Robert V. O'Toole	30	R. Adams Cowley Shock Trauma Center trauma fellowship

Note: The Scopus H-index values are as of February 1, 2020.

parallel trend that translated into trauma leadership, as the top six residency programs that were attended by trauma fellowship directors produced 26.4% of current leadership.

Among fellowships programs, the top six programs produced 63.9% of all current trauma fellowship directors. Of note, one fellowship program in particular was responsible for 17 of the 72 fellowship directors, which is roughly one-fourth of this population. This trend was also observed in the fields of orthopaedic spine and adult reconstruction.[5,6] The concentration of programs training future fellowship directors in trauma as well as spine and adult reconstruction fellowship directors supports the trend that certain institutions are more poised to develop future leaders.[5,6] It also is possible that these same programs are providing their orthopaedic surgeons-in-training more resources to grow a robust academic portfolio. Formby *et al.*[11] highlighted the fact that a significant proportion of literature in the adult reconstruction subspecialty is generated by a small group of academic institutions. Overall, this suggests that academic leadership opportunities correlate with site-specific training from distinct fellowship programs. These programs potentially have training curricula that foster an environment to develop future leaders. Some possibilities are that these high-producing programs may train residents to acquire vital skills that translate well into leadership roles, they may be more likely to provide a professional network to facilitate the progression from a physician in training to a leader, or perhaps these programs offer more resources to support scholarly efforts. Ultimately, the data that were collected in this study substantiate the concept that attending and graduating from specific training programs has a predilection to produce future program directors.

Our data also suggest that there is a large gender disparity present among orthopaedic trauma fellowship directors, as female fellowship directors represented 7% (n = 5) of all current trauma fellowship directors. This discrepancy parallels the current gender distribution seen in orthopaedics, as orthopaedic surgery holds some of the lowest proportions of current female residents among specialties.[12,13] In 2017, the American Medical Association reported that even though women compose 35.2% of active physicians across all specialties, the percent of active physicians in orthopaedics was only 5.5%.[14] The number of female trauma fellowship directors is only slightly better than that found in adult reconstruction (0%, n = 0) and spine (4%, n = 4).[5,6] The orthopaedic community is making progress, and the total amount of female orthopaedic residents has increased over the past decade.[13] As younger female orthopaedic surgeons mature and progress through their practices, the number of women fellowship directors is likely to improve. However, the differences remain significant, and these changes at the training level take time to translate into changes at the director level, which is typically realized later in a surgeons career.[13] Our data may be useful in highlighting the programs that are actively recruiting female surgeons and supporting their academic progress and involvement in leadership roles.

Trauma leadership also displayed a lack of racial diversity at the fellowship-director level. Among respondents, ninety percent of the trauma fellowship directors identified as Caucasian, 2% as Asian-American, 2% as Hispanic/Latinos, and 2% of fellowship directors as African American. This reflects an underrepresentation of racial diversity relative to the estimated general population provided by the US Census Bureau update from 2019. They report that Caucasians account for 60.1% of the current population, followed by Hispanic and Latinos (18.5%), African Americans (17.3%), and Asians (5.3%).[15] Similar to a lack of gender diversity, this also is not a new issue. Many studies have described the underrepresentation of particular racial backgrounds within the field of orthopaedics.[16–20] Efforts to foster diversity in leadership positions should be pursued by the orthopaedic trauma community.

Currently, there are two other published studies that investigated the demographic and academic characteristics of fellowship directors within spine surgery and adult reconstruction subspecialties in orthopaedics.[5,6] In comparison to those subspecialties, the average age and relative average Scopus h-index of trauma fellowship directors (average age: 51.4 yr old; average Scopus h-index: 15.1) are lower than spine fellowship directors (average age: 52.9 yr old; average Scopus h-index: 23.8) and adult reconstruction fellowship directors (average age: 52.6 yr old; average Scopus h-index: 16.5).[5,6] Moreover, both spine and adult reconstruction fellowship directors had a lower average timeline from fellowship graduation until fellowship director appointment at 8.6 and 9.6 yr, respectively, when compared to the trauma fellowship directors at 9.8 yr.[5,6] When taking into account the average h-index of the three orthopaedic subspecialties, trauma fellowship directors may have lower averages than in spine and adult reconstruction for many reasons. A study by Cannada *et al.*[21] discussed the current state of the orthopaedic trauma subspecialty. The study surmised that orthopaedic trauma is growing in popularity, leading to a recent proliferation of trauma fellowships to match the expansion on the applicant population. Additionally, the study suggested that the efforts by the OTA have

improved the lifestyle of fellows and fellowship training as a whole, which has further added to the growing interest in the subspecialty. Potentially, the development of so many new fellowship programs has allowed for younger orthopaedic surgeons to step into the fellowship director role. Additionally, the lower average h-index among trauma fellowship directors may be explained by the difference in impact factors of research journals in both spine and adult reconstruction. In orthopaedic spine surgery research journals, the audience is not just limited to orthopaedic surgeons but includes spine neurosurgeons as well. Meanwhile, adult reconstruction is currently a larger subspecialty than trauma with more fellowships and a larger population of surgeons. In addition, trauma as a defined fellowship is a newer phenomenon than the other fellowships, which may contribute to fewer late career directors with very high impact factors. More focused studies in the future might be needed for a full understanding of these differences.

Limitations and Future Perspectives

We must acknowledge several limitations of our investigation. First, our study relied on the use of self-reported CVs for data collection. This may introduce the potential for bias with the possibility of reporting errors such as duplication of events, failure to list appropriate research or leadership activities, and outdated information. Second, we were unable to obtain complete data for all individual fellowship directors who were included in the study. As a result, partial data and relying on what was identified through online resources and emails or phone calls were used. Their input could have provided additional value to our metrics. This is noticeable in the race reporting section, as only 40 of the 72 fellowship directors responded (55%). Nonetheless, we believe the trend in racial disparity still holds true and is portrayed by our results. Third, the cross-sectional study design provides data at a single point in time. As such, some of the trends may be subject to change temporally. A future study ideally would provide, a sequential comparison year-by-year to highlight variation over time. Fourth, our group relied on Scopus h-indices to assess research and scholarly proficiency. Scopus h-index may not be the perfect measure, but h-index does have its strengths and is considered to have a good correlation with other bibliometric indicators.[22]

Despite these shortcomings, our study has several strengths. Our group used the comprehensive OTA database that provided highly accurate information on Accreditation Council for Graduate Medical Education accredited programs and enabled us to design a system to optimize data collection. Additionally, our rigorous methodology was a strategy obtained from similar studies that demonstrated effective research technique.[5,6] Moreover, this is the first study to our knowledge that assesses demographic trends and training backgrounds in leadership among orthopaedic trauma fellowship directors.

CONCLUSIONS

Our investigation critically evaluates the qualifications and demographic backgrounds of orthopaedic trauma surgery fellowship directors in the US and highlights several interesting trends. Certain institutions at the residency and fellowship levels tend to train surgeons who become fellowship directors more frequently than others. Additionally, lower proportions of female and other underrepresented surgeons in medicine are apparent in this population of leaders. Ultimately, this information can guide individuals who strive to become academic leaders in orthopaedic trauma and direct initiatives to achieve greater diversity.

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