

Original Research

An Analysis of Academic Background and Research Activity Among Pediatric Orthopaedic Surgery Division Chiefs and Fellowship Program Directors

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Abstract:

Background: Pediatric orthopaedics has seen a large increase in the number of practicing surgeons. As a field that is concentrated at tertiary referral centers, research productivity can be a critical component of academic advancement for pediatric orthopaedic surgeons. Little has been published on the academic profiles of pediatric orthopaedic leaders, and therefore, this study sought to highlight the demographics of these individuals.

Methods: Pediatric orthopaedic division chiefs and fellowship program directors (PD) were identified for all Pediatric Orthopaedic Society of North America (POSNA) accredited fellowship programs in the 2020-2021 application cycle. A combination of organizational and public websites was used to compile the academic profiles of these leaders, including demographic variables and research productivity. Division chiefs, dual chief/PDs, and PDs were then compared, as were leaders when stratified by fellowship size.

Results: A total of 46 POSNA-accredited fellowships were identified. A total of 12 surgeons holding dual roles as division chief and PD, 34 division chiefs, and 34 PDs formed the three groups for comparison. Division chiefs had greater median years-in-practice (25.0 vs. 13.0, $p<0.001$), PubMed publications (62.0 vs. 27.0, $p=0.050$), and more frequently were appointed as "Professor" (58.8% vs. 23.5%, $p=0.010$) compared to fellowship PDs alone. Leaders working at programs with >1 fellowship position/year were more likely to have completed a fellowship at their home program (40.0% vs. 8.0%, $p=0.001$) and had higher research productivity across all metrics (all $p<0.05$) than leaders at programs with 1 position/year. Female representation among division chiefs or dual chief/PDs and fellowship PDs was 10.9% and 14.7%, respectively.

Conclusions: When compared to fellowship PDs, pediatric division chiefs had higher research productivity and academic appointments. Division leaders at larger programs additionally had higher research output and were more commonly trained at their current institution. Female representation among pediatric orthopaedic leaders was higher than the field of orthopaedics at large but lagged behind reported POSNA membership.

Levels of Evidence: Not Applicable

Key Concepts:

- Pediatric orthopaedic division chiefs have more research publications and more frequently hold the academic title of “Professor” than fellowship program directors.
- Pediatric orthopaedic leaders at larger fellowship programs (>1 position/year) had more publications than those at smaller programs.
- Women represented 10.9% of pediatric orthopaedic division chiefs and 14.7% of fellowship program directors.
- Nearly 1 in 4 pediatric orthopaedic leaders had completed an additional degree beyond their traditional medical training.

Introduction

Pediatric orthopaedics as a subspecialty has seen an over 1.5-fold increase in surgeons over the last 30 years.¹ Correspondingly, there has been a large increase in the number and size of pediatric orthopaedic fellowship programs as well as the number of fellowship applicants.^{2,3} The increased demand for pediatric-trained orthopaedic surgeons may be partly explained by a general shift in the treatment of pediatric conditions to surgeons with pediatrics-specific training⁴ as well as a recognition that complication rates in treating certain pediatric conditions are typically lower when treated by pediatric subspecialized surgeons rather than adult-specialized surgeons.⁵⁻⁸

Pediatric orthopaedics is becoming increasingly concentrated at tertiary referral centers due to increased subspecialization and the requirement for supportive ancillary services such as pediatric specific anesthesiology and intensive care units.^{9,10} Research activity can be a critical component of promotional tracks for these subspecialists at such institutions with stringent criteria for academic advancement. A recent study by Bi et al. found that orthopaedic department chairs tended to have more publications than their junior peers, further

emphasizing the importance of research activity in academic promotion within orthopaedics.

The same study also reported that orthopaedic chairs were more likely to be men, and both orthopaedic chairs and residency program directors were more likely to lead a program in proximity to where they completed their residency training. While this study provided insight into the orthopaedic field in general, there is a sparse amount of literature detailing the backgrounds and research activity of leaders in the pediatric orthopaedic subspecialty specifically.¹¹

This study, therefore, sought to examine pediatric orthopaedic division chiefs and pediatric fellowship program directors (PDs), highlighting any demographic or academic differences to better understand factors associated with career progression in the field. Such data also allows for future comparison of pediatric orthopaedic leadership to other subspecialties. The authors hypothesized that most division chiefs and PDs would be male and that division chiefs would have a higher number of publications than PDs.

Materials and Methods

All information sources used in this work were publicly available, making this study exempt from institutional review board approval.

A list of Pediatric Orthopaedic Society of North America (POSNA) and Accreditation Council of Graduate Medical Education (ACGME) accredited general pediatric orthopaedic surgery fellowships was obtained for the 2020-2021 application cycle from the POSNA website.¹² The number of positions available per year and geographic region for each fellowship were recorded from this resource. All subspecialty pediatrics fellowships and positions (e.g., pediatric sports medicine, hip preservation) were excluded from this analysis.

All corresponding pediatric orthopaedic surgery division leaders (variably titled) were identified through a search of fellowship program websites; they are hereafter referred to as “division chiefs.” The fellowship PD for each program was also identified using a similar search. For instances where there were co-division chiefs or co-program directors, the more senior individual based on years in practice was included for analysis. Multiple programs had division chiefs who held the dual role of fellowship PD in which case they were separated out as a third group for comparison.

After identification of division chiefs and PDs, individual profiles and curriculum vitae available on program websites, organization websites, Doximity, and LinkedIn were searched to identify sex, training institutions (medical school, residency, and fellowship[s]), date of last fellowship (used to calculate years in practice), and academic title (Professor, Associate professor, Assistant professor, or other). Author sex was determined by searching for gender-specific pronouns (he/him/his/himself and she/her/hers/herself) in the biographical section of institutional websites and other online resources. Also recorded was the completion of a general pediatric orthopaedic fellowship (excluding further subspecialization such as pediatric sports medicine), any additional fellowships (and the subspecialty), extra degrees beyond an MD equivalent (e.g., MPH), and

dual appointments (e.g., neurosurgery). Corresponding author profiles were then identified through Scopus, and the number of associated documents in Scopus was recorded. The Scopus h-index was recorded.¹³ PubMed publications were identified through a search in Spring 2021 based on a combination of author last name, first initial, and middle initial. The resulting list was then vetted to ensure inclusion of only those publications belonging to that individual. The number of Scopus documents, Scopus h-index, and number of PubMed publications were considered the metrics of research productivity.

Analyses were conducted using IBM SPSS (Version 24.0, Armonk, NY) with a significance threshold of $p < 0.05$. When comparing groups, categorical variables were analyzed using Fisher’s Exact and Chi-Squared analyses. Continuous variables were analyzed using Kruskal-Wallis tests and reported as medians with interquartile ranges (IQR). Pairwise comparisons between two groups were made using Mann-Whitney U tests. In an effort to examine any relationship between fellowship program size and the characteristics of these leaders, chiefs and PDs were stratified by fellowship program size using a cutoff of one fellowship position per year; characteristics were compared between the subsequent groups.

Results

A total of 46 POSNA-accredited pediatric orthopaedic surgery fellowships were identified for the 2020-2021 cycle. Of these, 25 were also ACGME-accredited. Of the 46 programs, 12 had surgeons holding the dual roles of division chief and fellowship PD. Therefore, the characteristics of 34 division chiefs, 12 individuals holding the dual role of division chief and fellowship PD, and 34 fellowship PDs served as the basis for this study.

Median years-in-practice was higher for division chiefs compared to dual chiefs/PDs and PDs (25.0 vs. 18.5 and 13.0, respectively, $p < 0.001$). A greater proportion of division chiefs held an academic title of “Professor” compared to fellowship PDs (58.8% vs. 23.5%, $p = 0.010$), though this was not significantly different across the three groups. Division chiefs had higher median Scopus

h-indices than dual chief/PDs and fellowship PDs (19.5 vs. 14.5 and 9.0, respectively, $p=0.033$). There were no differences in other research productivity metrics across groups. In pairwise comparison of division chiefs and fellowship PDs, chiefs had higher median PubMed publications ($p=0.0496$), Scopus h-indices ($p=0.013$), and Scopus documents ($p=0.021$). There were no differences in research metrics when comparing division chiefs to dual chief/PDs or dual chief/PDs and fellowship PDs. No statistical differences were found pertaining to the frequency of other recorded characteristics between the

two groups including PubMed publications per year and over the past 5 years (Table 1).

When stratifying pediatric orthopaedic leaders by fellowship program size >1 position per year (N=30) versus 1 position per year (N=50), it was found that those working at larger programs had a greater median of years-in-practice (24.0 vs. 18.0, $p=0.049$). Larger programs also more commonly had leaders that hailed from their home fellowship (40.0% vs. 8.0%, $p=0.001$). Division chiefs and PDs from larger programs had higher research productivity metrics except for first author

Table 1. Comparison of Pediatric Orthopaedic Leadership

	Chief	Dual Chief/PD	Fellowship Director	P-value
N	34	12	34	-
Female Sex	3 (8.8)	2 (16.7)	5 (14.7)	0.726
Time in Practice (yrs)	25.0 (19.8-32.0)	18.5 (15.3-22.0)	13.0 (10.0-24.0)	<0.001
Completed Pediatric Fellowship	30 (88.2)	12 (100.0)	34 (100.0)	0.115
Home Residency	10 (29.4)	1 (8.3)	8 (23.5)	0.402
Home Fellowship	5 (14.7)	2 (16.7)	9 (26.5)	0.522
≥2 Fellowships	4 (11.8)	0 (0)	8 (23.5)	0.166
Extra Degree	6 (17.6)	5 (41.7)	8 (23.5)	0.243
MBA	2 (5.9)	2 (5.9)	2 (5.9)	
MS or MSc	2 (5.9)	2 (5.9)	2 (5.9)	
MPH	1 (2.9)	0 (0)	2 (5.9)	
Other*	3 (8.8)	1 (2.9)	2 (5.9)	
Academic Title				0.055
Professor	20 (58.8)	5 (41.7)	8 (23.5)	
Associate	7 (20.6)	4 (33.3)	14 (41.2)	
Assistant	2 (5.9)	1 (8.3)	8 (22.9)	
Other	5 (14.7)	2 (16.7)	4 (11.4)	
Dual Appointment	2 (5.9)	1 (8.3)	0 (0.0)	0.367
PubMed Publications	62.0 (29.5-64.8)	41.5 (29.5-64.8)	27.0 (10.8-79.8)	0.098
Pubs/year	2.2 (1.0-5.4)	2.1 (1.5-4.3)	2.3 (0.7-4.4)	0.836
Last 5 Years	18.5 (5.8-37.0)	20.0 (9.0-35.5)	13.5 (4.0-29.8)	0.499
Last 5, First Author	1.0 (0.0-3.3)	0.5 (0.0-5.5)	1.0 (0.0-3.3)	0.956
Last 5, Last Author	6.5 (1.8-14.3)	7.5 (0.3-11.0)	3.0 (1.0-13.8)	0.752
Scopus h-Index	19.5 (10.8-27.3)	14.5 (7.3-16.5)	9.0 (5.0-20.3)	0.033
Scopus Documents	74.5 (30.5-133.5)	39.5 (30.3-74.3)	31.5 (11.0-93.3)	0.058

*Chiefs: 1 each MHCM, MMSc (1 individual with dual MS, MBA). Dual Chief/PDs: 1 MMM. PDs: 1 each PhD, MMM.

Table 2. Pediatric Orthopaedic Leadership by Fellowship Program Size

	>1 Position/Year	1 Position/Year	P-value
N	30	50	-
Female Sex	2 (6.7)	8 (16.0)	0.306
Time in Practice (yrs)	24.0 (16.3-28.3)	18.0 (11.0-26.0)	0.049
Completed Pediatric Fellowship	28 (93.3)	48 (96.0)	0.628
Home Residency	9 (30.0)	10 (20.0)	0.309
Home Fellowship	12 (40.0)	4 (8.0)	0.001
≥2 Fellowships	5 (16.7)	7 (14.0)	0.746
Extra Degree	10 (33.3)	9 (18.0)	0.119
MBA	1 (3.3)	5 (10.0)	
MS or MSc	3 (10.0)	3 (6.0)	
MPH	1 (3.3)	2 (5.0)	
Other*	5 (16.7)	0 (0)	
Academic Title			0.129
Professor	16 (53.3)	17 (34.0)	
Associate	9 (30.0)	16 (32.0)	
Assistant	1 (3.3)	10 (20.0)	
Other	4 (13.3)	7 (14.0)	
Dual Appointment	0 (0.0)	3 (6.0%)	0.288
PubMed Publications	69.0 (32.5-141.5)	29.5 (10.7-67.5)	0.002
Pubs/year	2.8 (1.5-7.9)	1.9 (0.6-3.7)	0.026
Last 5 Years	20.0 (13.0-52.3)	11.5 (3.0-27.0)	0.006
Last 5, First Author	1.0 (0.0-4.3)	1.0 (0.0-3.0)	0.845
Last 5, Last Author	8.0 (2.8-17.0)	2.5 (0.0-13.0)	0.035
Scopus H-Index	21.0 (12.8-32.8)	11.0 (5.0-17.3)	0.001
Scopus Documents	93.5 (36.3-170.0)	32.5 (11.0-76.0)	0.001

*Continuous variables reported as median and IQR. *Program >1: 2 MMM, 1 each PhD, MHCM, MMSc (One surgeon in a smaller program with dual MS, MBA).*

publications over the past 5 years (all $p < 0.05$). No other statistical differences were found between the two strata (Table 2).

Discussion

This study of pediatric orthopaedic leadership found greater years-in-practice for pediatric division chiefs compared to dual division chief/PDs and fellowship PDs. Research productivity metrics were additionally higher for division chiefs compared to fellowship PDs. Surgeon-leaders at larger fellowship programs (with >1 fellow per

year) were more likely to have completed a fellowship at their current institution of practice.

Prior research indicated that 42% of POSNA and American Academy of Pediatrics (AAP) Section on Orthopaedics members worked at medical school-affiliated hospitals,¹⁰ underscoring the fact that pediatric orthopaedic surgeons very commonly work in academic practices where research activities factor into academic promotion. As research productivity correlates with academic rank in orthopaedic surgery, academic-minded

surgeons may see research output as vital to a successful career.¹⁴⁻¹⁶ In the current study, it was shown that division chiefs had higher research productivity metrics than PDs. Additionally, pediatric orthopaedic leaders at larger programs had higher research productivity metrics than those at smaller programs, which may be in part due to a greater number of colleagues and opportunities for co-authorship.

The h-index is a validated metric for evaluating publication productivity as it considers both research output as well as research impact. Compared to median h-indices of 5 for all academic orthopaedic surgeons and 13 among orthopaedic chairpersons, respectively, the research metrics of pediatric orthopaedics faculty are relatively higher, again demonstrating the academic emphasis of the field.¹⁴ The authors theorize that division chiefs and PDs are likely at different time points along similar career trajectories, and the difference in cumulative research productivity shown in this study likely reflects the earlier career stage of PDs. This supposition is supported by the similar annual research output and lower number of years in practice that was found among PDs in this study as well as the higher academic titles found for division chiefs. Though prior work indicating that publication output rates wane after achieving division chief promotional level, this was not observed in our study.¹⁷ Rather, division chiefs continued to publish both first and last author studies at similar rates compared to fellowship PDs.

It should be noted that while an individual's publications appear to correlate with career success, this does not mean that research correlates with leadership ability. Many studies have therefore sought to understand what makes for a successful program director or academic chair, finding that emotional competency, leadership, and other personality traits are also keys to success.^{18,19}

This study also showed that, among larger pediatric orthopaedic fellowship programs, surgeons in leadership positions were much more likely to have completed their fellowship at their current place of work compared to surgeons at smaller programs. Bi et al. similarly

observed that chairs and PDs frequently had trained at their current place of work, which was attributed to the strong relationships built during training.²⁰ While there were no differences in the proportion of chiefs or PDs who trained at their current institution of practice, it is likely that because larger programs typically employ more orthopaedic surgeons, they are able to recruit more of their alumni for faculty positions. Additionally, it is possible that family developments may lead an individual to seek work at their place of training in an attempt to keep his or her family in a single location.

Out of all residency specialties in the U.S., orthopaedic surgery has the lowest proportion of female residents. Additionally, female representation among American Academy of Orthopaedic Surgeons (AAOS) members is just 6.5%.²¹ This gender disparity within the specialty is even more severe in orthopaedic leadership positions, with only 2.0% of orthopaedic department chairs identifying as female.²⁰ In the current study, female representation in pediatric orthopaedic leadership was found to be higher, with 11% of division chiefs or dual chief/PDs and 15% of fellowship PDs identified as female. However, these proportions are still below the reported 21% female POSNA membership.²¹ In summary, the pediatric orthopaedic subspecialty in terms of surgeon distribution by sex may be ahead-of-the-curve in terms of diversity and inclusion, but there is still work to do. Understanding the current makeup of orthopaedic leadership is crucial in the current and future quest to create a diverse and welcoming community in orthopaedics, and especially within pediatric orthopaedics, which is a top specialty choice for female orthopaedic residents.^{22,23}

The current study also found that almost one quarter of pediatric orthopaedic leadership had an extra degree, reflecting a trend within orthopaedic surgery for physicians to obtain a second degree during or after completion of their medical training. This trend may not be isolated to orthopaedics, as research has also shown that advanced degrees were common among cardiothoracic and neurosurgery chairs.^{24,25} Prior

research showed that, among orthopaedic surgery department chairs, 15.0% of physicians had an additional degree, which was most commonly an MBA.²⁰ In the current study, it was also found that the MBA was the most common extra degree among leaders in pediatric orthopaedics. Obtaining an MBA, which can be done before, during, or after postgraduate surgical training, may reflect an increased focus on the business aspect of medicine by modern day leaders.

A recent study by Shlykov et al. observed that 28% or more of recent pediatric orthopaedic fellowship graduates pursue a second (or even third) fellowship.²⁶ Dual fellowship in pediatric sports medicine in particular is becoming increasingly common, representing nearly half of pediatric dual-trained surgeons.²⁷ The current study showed that 15.0% of leaders in pediatric orthopaedics (division chiefs and fellowship PDs) completed two or more fellowships. Additionally, a higher proportion of PDs than division chiefs or dual chief/PDs had completed ≥ 2 fellowships (23.5% vs. 11.8% and 0%, respectively) suggesting that this move toward extra training has affected more recent trainees more than their more senior colleagues. However, this difference did not reach statistical significance, highlighting a need for further study on the topic.

Several limitations in this study should be noted. First, all information was collected via publicly available resources. While all institutions had website information regarding program leaders, this data was not standardized, and these third-party sites could contain factual inaccuracies or outdated information. Second, though publication counts were recorded from PubMed and Scopus, it can be difficult to differentiate article authorship when authors have common names. However, a meticulous search to confirm appropriate authorship including cross-referencing institutional affiliation likely minimized any error in research productivity recorded. Additionally, no correction for multiple comparisons (e.g., Bonferroni correction) was made in this study. However, most of the p-values shown would have still indicated statistical significance even if this had been done. Further demographic data such as ethnicity was not collected,

as there is no method of reliable collection of such information from online sources. Lastly, in comparison to the >150 orthopaedic residency programs in the U.S., there are relatively fewer pediatric orthopaedic divisions with nearly 25% of chiefs serving in the co-role of fellowship PD. These surgeons serving dual roles were separated into a third group for comparison, though it may be difficult to draw conclusions regarding these individuals given the small sample size.

Conclusion

Compared with fellowship PDs, pediatric orthopaedic division chiefs had more research publications and were more likely to hold the title of full professor. Division chiefs also had greater median years-in-practice. Additionally, pediatric orthopaedic leaders at larger fellowship programs more frequently had completed fellowship at their current institution. Female representation in pediatric orthopaedic leadership, although greater than in orthopaedic leadership in general, still lags behind the proportion of female membership in POSNA.

Additional Links

- Pediatric Orthopedic Fellowship: From Applying for Fellowship to Securing a Job (POSNAcademy)—
<https://bit.ly/3OqsRKA>.
- Resident Review: Starting out Strong - 5 Tips for the New Orthopaedic Fellow (POSNAcademy)—
<https://bit.ly/3PL8cRU>.

Disclaimer

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