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Motivations and Barriers for Women Orthopaedic Surgeons Considering Arthroplasty Fellowship

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ABSTRACT

Background: Arthroplasty is one of the least gender-diverse orthopaedic subspecialties. While previous studies have looked at factors influencing fellowship choices for women, few studies have attempted to understand the decision for or against arthroplasty specifically. Working to better understand fellowship choice is a critical step in the process of increasing women recruitment.

Methods: An anonymous survey was distributed using REDCap to women orthopaedic surgeons and trainees through listservs, social media groups, and residency programs. Surgeons who had decided on a specific subspecialty or already completed fellowship were included. Responses were obtained from 164 surgeons (72 arthroplasty surgeons, 92 other subspecialties). *Chi*-squared and Fisher's Exact tests were then performed.

Results: The most important factor for those who chose arthroplasty was enjoyment of the surgeries. The biggest concerns from those in the arthroplasty group about the field were work–life balance, ability to become pregnant and/or have a healthy pregnancy, and sex bias from referring physicians. Of those who ultimately chose another subspecialty, 30.4% considered arthroplasty "a little" and 8.7% considered it "strongly." The most important dissuaders for the group that considered arthroplasty were concerns about "boy's club" culture, concerns about the physicality of the surgeries, and a lack of mentors.

Conclusion: While the decision to choose a career path is multifactorial, our hope is that through the identification of modifiable factors we can increase women representation in arthroplasty. Increasing mentorship, implementing practical solutions to improve work–life balance, supporting healthy pregnancies, and mitigating the physical demands of surgery could help address current disparities.

The lack of gender diversity in orthopaedics has been well-described [1–5]. Orthopaedic surgery has the lowest percentage of women residents of any field (15%) and the smallest proportion of full-time women faculty (19%) [4]. While there have been modest increases in women trainees since the early 2000's, the rate of change remains small [3,6].

While much of the research on orthopaedic gender disparities has been focused on medical students and residents there has been growing interest in fellowship disparities [7–9]. Cannada et al. found that women applicants had higher match success compared to their men counterparts (96 versus 81%). Pediatrics (25%) had the greatest percentage of women applicants while hip/knee/tumor (combined category; 6%) and spine (3%), had the least [8].

Arthroplasty has some of the lowest gender diversity of any subspecialty [10,11]. No published number exists as to the exact number of women in arthroplasty fellowships or currently practicing. Medicare data from 2013 showed that approximately 2% of arthroplasty surgeons were women and of all surgeons submitting >10 annual total knee arthroplasty or total hip arthroplasty claims only 1.9 and 1.4% were women, respectively [12,13]. In a 2016 AAOS survey, only 3.2% of women orthopaedists self-reported as arthroplasty surgeons [14]. As of 2017, only 3.2% of women in United States (US) academic settings were arthroplasty surgeons [15]. Representation of women in professional societies remains low–recent estimates report 3.1% for the American Association of Hip and Knee Surgeons (AAHKS), 0.6% for The Hip Society, and 0.6% for

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The Knee Society [16,17]. The proportion of women in leadership roles is also low–in the 2019 to 2020 academic year, 100% of the 94 fellowship directors for arthroplasty programs were men [18] and as of 2020, only 1 of 70 arthroplasty division chiefs in the US was a woman, the lowest representation of any subspecialty [19]. Based on available evidence, we estimate that less than 5% of adult reconstruction surgeons are women.

Prior studies have explored what motivates women residents to pursue specific fellowship paths and found that intellectual stimulation, enjoyment of the subspecialty, and mentorship were important factors [7,20]. Recently Lieberman et al. looked at factors that influence women residents' consideration of arthroplasty fellowship. They found that women and men residents had similar interest in arthroplasty (46 versus 41%) and similar confidence in their own abilities. However, they found that fewer women were encouraged by faculty to go into the field. Both women and men perceived that other residents and faculty felt that men were "better Adult Reconstruction surgeons" even if they themselves did not agree [9].

The goal of our study was to further identify motivations and barriers that may impact women residents' decisions to pursue or not pursue arthroplasty fellowship.

Materials and Methods

An anonymous survey was distributed to women orthopaedic surgeons and trainees through listervs, social media groups, and residency program directors using a link to a REDCap survey between March 1 and May 31, 2022. One attempt per platform was made to reach potential participants. Participants were asked demographic questions including year in training, number of women attendings in their department, number of women arthroplasty attendings at their institution, type and geographic location of institution, and if they were planning to or previously had completed an arthroplasty fellowship. Any trainees who had not yet decided on a subspecialty were excluded.

Respondents who said they were planning to or previously had completed an arthroplasty fellowship were asked about factors that influenced their decision to choose arthroplasty and potential areas of concern. Respondents who said they were not planning to complete an arthroplasty fellowship were asked which fellowship they were planning to pursue, if they considered arthroplasty, and how much certain factors influenced their choice to not go into arthroplasty.

All questions regarding influencing factors were asked and scored on a Likert scale from 1 to 5 where 1 represents "not important," 2 "slightly important," 3 "moderately important," 4 "important," and 5 "very important." "N/A" was also an answer option for all questions. Descriptive statistics were used to report overall survey results. Descriptive statistics were performed to compare differences in influencing factors by different groups. *Chi*-squared and Fisher's exact tests were used for categorical variables as appropriate for parametric and nonparametric distribution. *T*-tests were used for continuous variables after distributions were verified. All statistics were completed using SAS 9.4 (Cary, North Carolina). This study was determined to be exempt by the University of Utah Institutional Review Board.

Due to the electronic survey design we were not able to calculate a response rate. As described previously, surveys were sent via email to individual residency program coordinators; however, we do not know how many were actually forwarded to women residents at individual programs. Surveys were also distributed electronically via social media and listservs, however, we were unable to track the actual number of women who saw the survey on these platforms. Demographic data were collected for all respondents (Table 1). A total of 164 female surgeons completed the survey with 43.9% of those (n = 72) being women who are planning to, or have already completed an arthroplasty fellowship. There were 56.1% (n = 92) of the women who were planning to or had already completed a fellowship in a different subspecialty. There were 59.8% of respondents who were attendings, 7.3% fellows, and 32.9% residents. The majority of respondents currently worked at academic centers (60.4%), with the remainder in private practice (13.4%), "privademics" (13.4%), and "other" (0.6%).

The majority of women had no female arthroplasty attendings at their current institution (72.4%). Of those who did have women arthroplasty attendings, 23.3% had 1, 3.1% had 2, and 0.6% had 3, with no respondents reporting more than 3 at their institution.

Results

Table 2 shows the average scores for factors influencing the arthroplasty surgeons' decision to choose arthroplasty, ranked from most important (highest score) to least important (lowest score). The top 3 most important factors were enjoyment of surgeries, enjoyment of the patient population, and the intellectual stimulation. The least important factors were a positive perception of work–life balance, salary, and women mentors specifically. It should be noted that 27.8% of women chose "N/A" when asked about the importance of women arthroplasty mentors, suggesting that at least a fourth of women did not have any women arthroplasty mentors and could not answer this question.

Table 3 shows the averages for responses about which factors worried or concerned those in the arthroplasty group. Work–life

Table 1
Demographics.

Individual Variables	n (%)
Year in Training	
PGY 1	2 (1.2)
PGY 2	9 (5.5)
PGY 3	9 (5.5)
PGY 4	14 (8.5)
PGY 5	20 (12.2)
Fellow	12 (7.3)
Attending	98 (59.8)
Year exposed to arthroplasty	
Before undergrad	5 (3.1)
Undergrad	20 (12.2)
Med School	99 (60.4)
PGY 1 to 5	40 (24.4)
Geographic location	
Northeast	28 (17.2)
Midwest	16 (9.8)
Southwest	47 (28.8)
West	18 (11.0)
Southeast	54 (33.3)
Number of women arthroplasty attendings at your institution	
0	118 (72.4)
1	38 (23.3)
2	5 (3.1)
3	1 (0.6)
Number of women attendings at your institution	Mean = 4.0 (range 0 to 20)
Type of institution	
Academic	99 (60.4)
Private practice	22 (13.4)
Privademic	22 (13.4)
Other	1 (0.6)
Arthroplasty fellowship	
Yes	72 (43.9)
No	92 (56.1)

PGY, post-graduate year

Table 2
Influencing Factors for Arthroplasty Surgeons

How Much did Each of the following Factors Influence Your Decision to Choose Arthroplasty:	Mean (Standard Deviation)
Enjoyment of surgeries	4.9 (0.3)
Enjoyed patient population	4.4 (0.8)
Intellectual stimulation (including enjoyment of research)	4.2 (0.9)
Mentors	4.1 (1.1)
Perceived happiness of faculty	4.1 (0.9)
Clicked with "culture"	3.7 (1.1)
Positive perception of work–life balance	3.5 (1.2)
Salary	3.0 (1.3)
Women mentors specifically	2.0 (1.4)

balance (3.5), ability to become pregnant and/or have a healthy pregnancy (3.3), and bias from referring physicians based on gender (3.2) were the most concerning factors with average scores between "moderately important" and "important."

Table 4 is based on the responses from the nonarthroplasty group. There were 60.9% of those who chose other specialties who did not consider arthroplasty at all, while 30.4% considered it "a little" and 8.7% considered it "strongly." Table 4 illustrates what other specialties were chosen by respondents including by those who considered arthroplasty. For example, 70% of women who ultimately chose foot/ankle considered arthroplasty compared to only 22.7% of those who chose pediatrics.

Table 5 shows the average Likert scores for the dissuaders in the nonarthroplasty group with a score of 5.0 indicating an important dissuader and a score of 1.0 indicating a nonimportant dissuader. The most important overall dissuaders were respondents not finding arthroplasty surgeries to be interesting (3.4), lack of mentors (2.7), concerns about "boy's club" or culture (2.6), and poor experience during residency rotation (2.6). The data were then further separated to compare the dissuaders for those who considered arthroplasty against those who did not to determine if there were significant differences between these groups. The top 3 dissuaders for the group who considered arthroplasty were concerns about "boy's club" or culture (2.9), concerns about the physicality of the surgeries (2.8), and lack of mentors (2.8). Significant differences were identified when comparing these groups—the group that considered arthroplasty found the surgeries to be more interesting/enjoyable (2.4 versus 4.0), was more worried about the physicality of surgeries (2.8 versus 2.0), was more worried about work–life balance (1.8 versus 1.3), and had more concerns about fellowship match (1.7 versus 1.2).

Table 3
Areas of Concern for Arthroplasty Surgeons.

Within the Field of Arthroplasty, How Much do Each of the following Areas Concern or Worry You:	Mean (Standard Deviation)
Work–life balance	3.5 (1.2)
Ability to become pregnant and/or have a healthy pregnancy	3.3 (1.4)
Bias from referring physicians based on gender	3.2 (1.4)
Bias from patients based on gender	3.1 (1.4)
Inability to have close relationships with men mentors	2.7 (1.4)
Perceptions of close relationships with men mentors	2.6 (1.3)
Physicality of surgeries/strength required	2.5 (1.3)
Sexual harassment	2.1 (1.3)

Table 4
Nonarthroplasty Subspecialties and Considerations.

Specialty	Overall (n (%))	Did Not Consider Arthroplasty (n = 56) (n (%))	Considered Arthroplasty (n = 36) (n (%))
Sports	17 (18.5)	8 (47.1)	9 (52.9)
Hand	23 (25.0)	14 (60.9)	9 (39.1)
Foot/Ankle	10 (10.9)	3 (30)	7 (70)
Sarcoma	8 (8.7)	4 (50)	8 (50)
Pediatrics	22 (23.9)	17 (77.3)	5 (22.7)
Spine	5 (5.4)	3 (60)	2 (40)
Trauma	17 (18.5)	11 (64.7)	6 (35.3)
None	1 (1.1)	0	1 (100)
Did you consider arthroplasty			
Not at all	56 (60.9)		
A little	28 (30.4)		
Strongly	8 (8.7)		

Discussion

Orthopaedic surgery is known to be the least gender-diverse medical specialty, and within it, hip and knee arthroplasty one of the least diverse subspecialties. To improve recruitment, we must have a better understanding of the motivating factors and barriers for those considering and entering the field. To our knowledge, this is the largest group of women surgeons ever surveyed on this specific topic.

For women who chose arthroplasty, the most important motivating factors were enjoyment of surgeries, enjoyment of the patient population, and intellectual stimulation. This is similar to previous findings where enjoyment of surgeries was the most important driver for subspecialty choice for men and women [7,9,20].

One of the least powerful motivating factors for women who chose arthroplasty was a positive perception of work–life balance. Similarly, when asked about which factors worried or concerned those in the arthroplasty group, work–life balance was the most concerning topic followed by pregnancy concerns. Within the nonarthroplasty group, those who considered arthroplasty were significantly more likely to be worried about work–life balance than their counterparts ($P = .035$). Addressing these concerns is important both for the well-being of women in arthroplasty and for recruiting more women to the subspecialty. Not every surgeon who is a woman will choose to have children, but for those who do there are certain biologic and logistical hurdles that cannot be ignored. Prior studies across surgical specialties have shown that women surgeons report lower satisfaction with work-life integration and parenting duties, higher rates of burnout, and greater domestic responsibilities. Women are also much more likely to have modified their practice to accommodate childcare. Notably, for both men and women, a high degree of support from colleagues for work–life integration had the strongest association with career satisfaction [21].

While thise type of data does not exist specifically for women in arthroplasty, they likely face many of the same issues. As arthroplasty reimbursements continue to fall many surgeons have increased their surgical volumes to compensate [22,23]. This strategy of increased productivity may be especially difficult to maintain for women surgeons who already report greater domestic demands and higher levels of burnout. Several strategies exist for improving work–life balance including on-site/extended-hour childcare, increased scheduling flexibility, more equitable division of labor among families, and increased support from colleagues.

Pregnancy was also a top area of concern for arthroplasty surgeons. Data show that rates of infertility and pregnancy complications are much higher for women surgeons, including women

Table 5
Dissuaders for Nonarthroplasty Group.

How Much did Each of the following Factors Influence Your Decision to NOT Choose Arthroplasty (Dissuaders):	Overall	Did Not Consider Arthroplasty (n = 56)	Considered Arthroplasty (n = 36)	*P* Value
	Mean (Std)	Mean (Std)	Mean (Std)	
Did not find surgeries to be interesting/enjoyable	3.4 (1.5)	4.0 (1.3)	2.4 (1.4)	**<.001**
Lack of mentors	2.7 (1.6)	2.7 (1.6)	2.8 (1.5)	.7622
Concerns about "boys club" or culture	2.6 (1.6)	2.4 (1.6)	2.9 (1.6)	.1246
Poor experience during residency rotation	2.6 (1.5)	2.7 (1.6)	2.3 (1.4)	.2559
Lack of women mentors specifically	2.4 (1.5)	2.3 (1.4)	2.5 (1.5)	.5723
Concerns about physicality of the surgeries	2.3 (1.4)	2.0 (1.2)	2.8 (1.4)	**.0051**
Concerns about acceptance from patients or coworkers due to gender	2.0 (1.4)	1.8 (1.2)	2.3 (1.5)	.1172
Difficulty using the instruments due to size or weight	2.0 (1.3)	1.8 (1.3)	2.3 (1.4)	.1573
Did not like the patient population	2.0 (1.2)	2.1 (1.3)	1.8 (1.1)	.3486
Concerns about abuse, harassment, or bullying related to arthroplasty	1.9 (1.3)	1.8 (1.3)	2.0 (1.3)	.5360
History of abuse, harassment, or bullying related to arthroplasty	1.8 (1.3)	1.8 (1.3)	1.8 (1.3)	.9508
Concerns about timing and social stigma surrounding pregnancy	1.6 (1.2)	1.6 (1.1)	1.7 (1.2)	.5820
Lack of exposure to the field	1.6 (0.9)	1.6 (0.9)	1.7 (1.2)	.6386
Concerns about work–life balance	1.5 (1.0)	1.3 (0.8)	1.8 (1.2)	**.0350**
History of sexual harassment related to arthroplasty	1.5 (1.1)	1.4 (1.1)	1.5 (1.0)	.9374
Concerns about sexual harassment related to arthroplasty	1.5 (1.0)	1.4 (1.0)	1.6 (1.1)	.2329
Concerns about matching into fellowship	1.4 (1.0)	1.2 (0.6)	1.7 (1.3)	**.0304**
Concerns about cement (PMMA) in the OR	1.3 (0.9)	1.3 (0.8)	1.4 (0.9)	.5837
Concerns about radiation exposure in the OR	1.3 (0.8)	1.3 (0.7)	1.3 (0.9)	.7164
Salary	1.1 (0.3)	1.1 (0.2)	1.2 (0.4)	.2608

Std, standard deviation.
Bold values are $P \leq 0.05$.

orthopaedists specifically, than age-matched controls [24,25]. Women surgeons are more likely to delay childbearing, utilize assisted reproductive technology to achieve pregnancy, and suffer from postpartum depression [24,25]. The obstetrics and gynecology literature has shown that rates of pregnancy complications and miscarriages in the general population are higher in those who engage in heavy lifting, prolonged standing, heavy physical workloads, and long work weeks [26,27]. Musculoskeletal disorders have also been found to be exacerbated by pregnancy in orthopaedists [28]. Policies surrounding call during pregnancy and reasonable maternity leave could mitigate some of these risks and should be a professional norm. Also, while there have been historical concerns about exposure to radiation and cement in the operating room, we did not find this to be a major concern for the nonarthroplasty group in their decision making. Recent studies have shown excellent protection using standard lead and likely little to no risk from cement exposure during pregnancy [29–32].

One strategy for increasing women in arthroplasty is to focus on capturing women residents who considered arthroplasty, but ultimately chose something else. Nearly 40% of our nonarthroplasty respondents considered arthroplasty to some degree and 8.7% considered it "strongly." The top 3 dissuaders for this group were concerns about a "boy's club" or culture, concerns about the physicality, and a lack of mentors.

The powerful influence of mentorship in orthopaedics has been written about extensively [2,3,33–35]. We found a lack of mentors to be one of the most important overall dissuaders in addition to being important specifically to the group that considered arthroplasty. While women can certainly be positively influenced by men mentors, there is evidence that finding a mentor of similar gender and race can be important to mentees [2,3,9,33]. Our study found that 72.4% of the respondents had no women arthroplasty attendings at their current institution. Improving access to women mentors is a complex issue—given the paucity of women available to do this it can place a major burden on those who are willing. This time demand, coupled with work–life balance concerns discussed above, may contribute to lower research productivity for women surgeons and further exacerbate the retention and promotion of women in academic medicine [9,16,36–38]. Groups such as the Women in Arthroplasty (WIA) committee of AAHKS (American Association of Hip and Knee Surgeons) provide one solution to this problem as a small number of women can simultaneously reach many trainees at national meetings. While sessions at large meetings cannot replace one-on-one mentorship, it can increase access to this scarce commodity and provide trainees who have diverse perspectives and surgical tips.

Concerns about physical strength have been shown to be a deterrent for medical students considering orthopaedics [2,3,39]. Arthroplasty is one of the most physically demanding subspecialties with high rates of workplace injuries and upper-extremity overuse disorders [28,40]. In this study, we found that the arthroplasty group was not very concerned with the physicality of surgery compared to other factors. In the group that considered arthroplasty, but chose something else concerns about the physicality of surgery ranked among the most important dissuaders.

Some of these concerns may be well-founded and addressing them could improve recruitment. Cohen-Rosenblum et al. found that 68% of women arthroplasty surgeons had experienced work-related musculoskeletal injuries with the forearm/wrist/hand most often affected [28]. Similar studies that included men found comparable overall injury rates, but relatively higher rates of shoulder injuries [40]. As women surgeons often have smaller hands, the use and/or creation of smaller and lighter instruments may decrease upper extremity injuries and should be investigated [28,41]. In our study, we found that almost half (46%) of the arthroplasty group was currently using or planning to use a device to assist with the physically demanding tasks of broaching and/or cup impacting. There has been an increased focus among surgeons, regardless of gender, on the musculoskeletal demands of surgery and strategies to improve surgeon longevity [28,40]. Technological advances such as these may alleviate some concerns about physicality and should be highlighted in residency training environments.

One final major dissuader in the nonarthroplasty group was the perception of a "boy's club" or culture. These concerns should lessen as the subspecialty becomes more diverse, but this change is happening too slowly to be a solution in itself. Other potential strategies for combating this include early exposure to the subspecialty and early encouragement from faculty. Highlighting women in subspecialty conferences and in printed/electronic materials may also shift perceptions.

There is no question that the field of arthroplasty would benefit from more women surgeons. Women undergo higher rates of orthopaedic procedures, including arthroplasty, than men [3,12]. Across specialties, surgeons who are women have lower mortality rates than their men colleagues and arthroplasty surgeons who are women have similar complication rates to men [5,12]. Some patients prefer women providers and gender diversity leads to better patient outcomes and satisfaction [3,14,42]. Ultimately, diversity promotes innovation and allows for the best patient care possible.

Limitations

This study has several potential limitations. Due to the methods of distribution, a response rate could not be calculated. This study surveyed only a portion of women orthopaedists and as such the results could be influenced by sampling error. By using fellowship choice as an indicator of subspecialty, we did not capture generalists who perform a substantial number of arthroplasties. Prior literature was used to guide the creation of questions, but the survey was still undoubtedly biased by our own cultural norms, assumptions, and personal experiences. Despite our best intentions, the asking or wordings of certain questions may have reinforced stereotypes. We surveyed arthroplasty surgeons at multiple stages of their careers and 59.8% of our respondents were attending surgeons. Our results may not accurately reflect current perceptions of trainees given this range. Despite these limitations, this work provides useful information to help drive change in the field of total joint arthroplasty.

Conclusions

The decision to pursue a subspecialty is multifactorial. In this study, we attempted to better understand what motivates women surgeons to choose arthroplasty and what concerns they have about the field. We also looked at dissuaders for women who chose other subspecialties. Important motivators were enjoyment of surgeries and the patient population. Major areas of concern, namely work–life balance and pregnancy have been shown to be problematic for women surgeons and may be amplified in arthroplasty. We offer some possible solutions for addressing the identified concerns for both groups. It is encouraging that nearly 40% of the women surveyed considered arthroplasty and we are hopeful that we can attract more women to our subspecialty.

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