

# Describing the women of orthopaedic surgery

demographics, biometrics, and their path to practice

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## Aims

The purpose of this survey study was to examine the demographic and lifestyle factors of women currently in orthopaedic surgery.

## Methods

An electronic survey was conducted of practising female orthopaedic surgeons based in the USA through both the Ruth Jackson Society and the online Facebook group “Women of Orthopaedics”.

## Results

The majority of surveyed female orthopaedic surgeons reported being married (76.4%; 285/373) and having children (67.6%; 252/373). In all, 66.5% (247/373) were collegiate athletes; 82.0% (306/373) reported having no female orthopaedic surgeon mentors in undergraduate and medical school. Their mean height is 65.8 inches and average weight is 147.3 lbs.

## Conclusion

The majority of female orthopaedic surgeons did not have female mentorship during their training. Additionally, biometrically, their build is similar to that of the average American woman.

## Take home message

- Most practising female orthopaedic surgeons are married with children.
- The majority of practising female orthopaedic surgeons were collegiate athletes.
- Most practising female orthopaedic surgeons had no female orthopaedic mentor in undergraduate and medical education.

## Introduction

Although women currently account for more than half of the medical students in the USA, in 2018, only 7.6% of the American Academy of Orthopaedic Surgeons (AAOS) members were women.<sup>1</sup> Additionally, women account for a smaller proportion (17.8%)

of full-time orthopaedic surgery faculty at American medical schools than all other medical specialties.<sup>2</sup>

Despite the positive aspects of a career in orthopaedic surgery, perceptions of how women fit into the speciality may adversely affect a student’s decision to enter the field.<sup>3</sup> These perceptions can be shaped by their sense of belonging, as well as the availability of and experiences with women orthopaedic mentors. For example, there have been conceptions that many women are “too small” or “too weak” to be orthopaedic surgeons;<sup>4,5</sup> or, anecdotally, that all female orthopaedic surgeons are former collegiate athletes. Others have suggested that orthopaedic surgeons were perceived as

unable to have good work-life integration.<sup>5</sup> Such thoughts could adversely effect the perception of this field by women in medical training while choosing a career path. In order to address these potential misconceptions, it is important to accurately delineate demographic and lifestyle factors of women who have chosen to pursue orthopaedic surgery. A clearer understanding of the current typical female orthopaedist, or even the full spectrum of women in orthopaedics, may help future female students with medical speciality decisions and create a more diverse field of physicians who can better serve their patients. Additionally, an understanding of these factors may help to dispel misconceptions about female orthopaedists and cure modifiable factors affecting students during their training.

Investigations regarding the demographic details and lifestyle decisions of women in orthopaedic surgery are limited in the current literature. Therefore, we asked the following research questions: 1) what are the anthropomorphic descriptors of female orthopaedists?; 2) what type of professional and personal lifestyle choices do women in orthopaedics tend to make?; and 3) do female orthopaedic surgeons have female orthopaedic mentors throughout their medical journey? If so, at what point of their journey?

We hypothesized that female orthopaedic surgeons would resemble the average American woman with regard to biometrics, as would their clinical practice and family lifestyle decisions. Additionally, we hypothesized that there would be a lack of female orthopaedic mentorship, especially during the earlier stages of medical training (medical school).

## Methods

### Subjects and procedures

An 18-question online Qualtrics (Qualtrics, USA) survey was created. Questions were designed by two Ruth Jackson Orthopaedic Society (RJOS) and Women of Orthopaedics (WoO) Facebook group-member female orthopaedic surgeons to ascertain biometrics, demographics, family lifestyle choices, and practice patterns. The 2018 American Academic of Orthopaedic Surgeons (AAOS) Census was used as the reference regarding certain demographic data, to allow comparison. Additional questions regarding biometrics and mentorship were developed based upon discussion with peers, and literature review on the topic of women in medicine and surgery. Pilot surveys were completed and critiqued by five surgeons. Exclusion criteria included any responses from male surgeons or incomplete survey responses. Included in the solicitation materials for each group was a request for individuals to only complete the survey once, even if they were members of both groups.

Prior to circulation, exemption was sought and granted for this study from the lead author's (ECG) Institutional Review Board (IRB). The opening 'question' of the survey was a statement of informed consent, explaining the purposes of the study, use of the data, disclosing the IRB exemption, and providing contact information for any questions or concerns. Only after providing this consent were the survey questions revealed and data collected.

An online link to the survey was distributed to practising female orthopaedic surgeons of the RJOS (n = 392) via emailed electronic link and to the WoO Facebook group (n = 1,605 current total members). RJOS is the oldest

women's orthopaedic surgery organization in the USA. While not all women practising or training for orthopaedics are RJOS members, roughly 42% of female AAOS fellows belong to the RJOS.<sup>5</sup> The WoO Facebook group serves as a forum for women in orthopaedics to discuss current deidentified medical cases, share advice, and provide resources to support individuals at all career stages. Inclusion in the WoO Facebook group is not limited to practising female orthopaedic surgeons, and the number of practising female orthopaedic surgeons in the group is not known.

### Statistical analysis

All statistics and data analysis were performed using SPSS v. 28.0 (IBM, USA).

## Results

A total of 415 responses from the two groups were received. Incomplete surveys (n = 40) and men who responded to the survey (n = 2) were excluded, leaving 373 participants in our final analysis. The mean responding female orthopaedic surgeon was age 42 years. The average height was 65.8 inches tall, ranging from 4 feet 11 inches to 6 feet 3 inches. The median and mode datapoints were both 5 feet 6 inches. There were six surgeons 5 feet or shorter, and 11 surgeons 6 feet or taller. (Table I). Most respondents were white (305/373; 82%) or Asian (34/373; 9%) (Table II). Multiracial and African-American physicians accounted for 3.8% (14/373) and 2.9% (11/373) of respondents, respectively. A minority of the sampled physicians identified as Hispanic/Latina (6/373; 1.6%) or 'other' (3/373; 0.8%).

There were no Native American female orthopaedic physicians within our sample.

Regarding personal lifestyle choices, three-quarters of the participants were married (76.4%). Approximately 10.5% of respondents (n = 39) had been previously divorced, and 67.6% of respondents (n = 252) had children (Table III). Of the physicians that had children, each physician had, on average, two children. Additionally, 44 respondents had three children, 13 had four children, and one had six children. Female orthopaedists specializing in arthroplasty and paediatric orthopaedics had, on average, the most children (2.40 and 2.07 children, respectively), while those specializing in orthopaedic oncology had the least number of children (1.80 children). Two respondents noted that they had stepchildren, and four respondents were pregnant at the time of the survey.

The majority of the female orthopaedic surgeon survey respondents completed a biology/pre-medical degree (n = 253; 60.4%). Social sciences (n = 43; 10.3%), arts/humanities (n = 35; 8.4%), engineering/math (n = 34; 8.1%), and foreign language (n = 17; 4.1%) were the next most popular majors (Table IV). The remaining survey respondents completed 'other' majors (n = 37; 8.8%), such as athletic training, physical therapy, and kinesiology.

Regarding prior competitive sports participation, 66.5% of respondents (247 of 373) participated in collegiate athletics at a Division I, II, or III level. Respondents competed in a diverse array of sports, including alpine skiing, basketball, crew (rowing), cross-country running, diving, fencing, field hockey, figure skating, golf, gymnastics, horseback riding, ice hockey, lacrosse, rugby, tennis, track and field, soccer, softball,

**Table I.** Biometrics.

Characteristic	Value
Mean height, inches (SD, range)	65.8 (2.8, 59.0 to 75.0)
Mean weight, lbs (SD, range)	147.3 (27.2, 96.0 to 275.0)
Mean age, yrs (SD, range)	42.3 (8.4, 29.0 to 70.0)

SD, standard deviation.

**Table III.** Family and relationships.

Characteristic	Number of participants (%)
<b>Marital status</b>	
Currently married	285 (76.4)
Not currently married	88 (23.6)
<b>Previously divorced?</b>	
Yes	39 (10.5)
No	334 (89.5)
<b>Children</b>	
Has children	252 (67.6)
Does not have children	121 (32.4)

swimming, volleyball, and water polo. After completion of their undergraduate education, 159 (42.6%) of these future surgeons took time off to work (135 participants; 36.2%) or to take classes (24 participants; 6.4%).

Practice location among respondents who listed their current practice location was quite evenly spread across the South (84 surgeons), West (82 surgeons), Midwest (73 surgeons), and Northeast (67 surgeons) of the USA. One physician is a travelling doctor, four are practising out of country, and three are no longer practising. Of note, in our sample, 59 participants did not specify their current practice location. The majority (304 of 370; 82.1%) of practising respondents are currently practising in an urban setting, while the remainder (66 of 370; 17.9%) are in a rural setting. Additionally, the most prevalent practice types are “academic practice (salary from academic institution)” (116 participants; 31.1%), “hospital/medical centre (salary from hospital/medical centre)” (80 participants; 21.4%), and “private practice – orthopaedic group” (75 participants; 20.1%) (Figure 1).

Most respondents (319 of 373; 85.5%) have completed a fellowship and are considered “specialists within orthopaedic surgery” (Table V). The remaining respondents are either orthopaedic generalists (16 of 373; 4.3%) or orthopaedic generalists with an area of speciality interest (38 of 373; 10.2%). The most popular areas of specialization were hand (25.7%), paediatric orthopaedics (21.7%), sports medicine (19.6%), and trauma (11.0%). Approximately 20% of respondents noted having more than one area of specialization.

During their medical careers, only seven respondents had a female orthopaedic mentor during college and 60 respondents had a female orthopaedic mentor during medical school (Figure 2). Of the remaining 306 respondents, 128 had

**Table II.** Ethnography.

Race	Number of participants (%)
White	305 (81.8)
Asian	34 (9.1)
Multiracial	14 (3.8)
African-American	11 (2.9)
Hispanic/Latina	6 (1.6)
Other	3 (0.8)
Native American	0 (0)
Total	373

**Table IV.** College majors.

Major	Number of participants (%)
Arts/Humanities	35 (8.4)
Biology/Pre-medical	253 (60.4)
Engineering/Maths	34 (8.1)
Foreign language	17 (4.1)
Social sciences	43 (10.3)
Other	37 (8.8)
Total	419

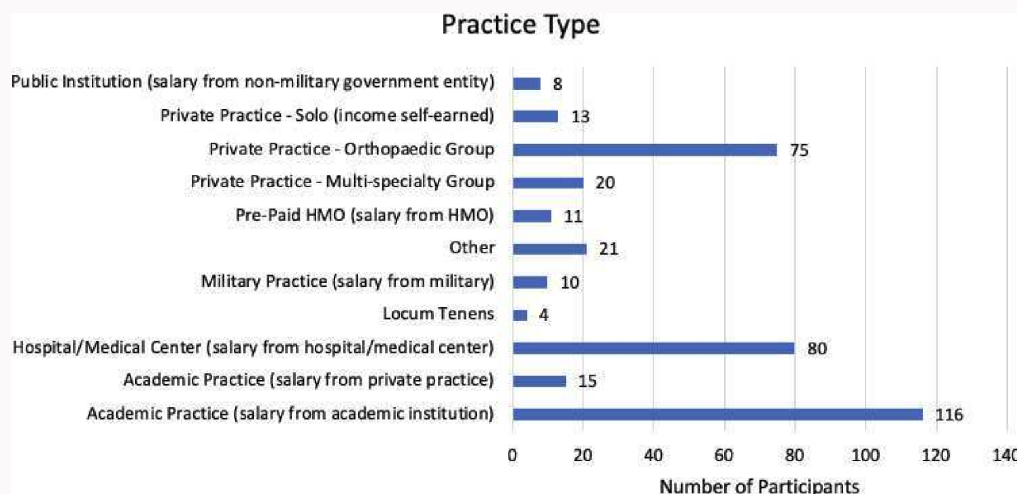
a female orthopaedic mentor during residency, 44 had one during fellowship, and 17 had one in practice. Thus, roughly one-third (117 of 373) of respondents have never had a female orthopaedic mentor during training.

## Discussion

### Demographics and biometrics

The purpose of this study was to examine the demographics, lifestyle choices, practice patterns, and experiences of women in orthopaedics throughout their medical journeys to depict the current workforce more accurately and examine existing myths regarding the ‘typical female’ that chooses a career in orthopaedic surgery. The average respondent in our study was younger (aged 42 years) than the average practising orthopaedic surgeon in the USA (aged 52 years), as reported by the AAOS in their 2018 Census.<sup>6</sup> Additionally, our average female orthopaedist was slightly taller (65.8 inches) and weighed less (147.3 pounds) than the average American woman (63.5 inches, 170.8 lbs);<sup>7</sup> 81.7% (305 of 373 reporting height) of our respondents were taller than the average American woman. However, the range data show that women of all sizes, even those who might be viewed as ‘too small’, can be orthopaedic surgeons.

The ethnography of the female orthopaedic surgeons in our sample were similar to that described in the 2018 AAOS Census,<sup>6</sup> where 79.10% of responding female orthopaedic surgeons were white, 9.05% were Asian and African-American, and Hispanic/Latina, multi-racial, Native American, and “other” combined to make up the remaining 11.85%.



**Fig. 1** Current practice types reported by respondents. HMO, health maintenance organization.

**Table V.** Specialization.

Level of specialization	Number of participants (%)
Orthopaedic generalist	16 (4.30)
Orthopaedic generalist with an area of speciality interest	38 (10.20)
Specialist within orthopaedic surgery	319 (85.50)
<b>Area of specialization</b>	
Arthroplasty	30 (8.00)
Foot/Ankle	35 (9.40)
Hand	96 (25.70)
Orthopaedic oncology	16 (4.30)
Paediatric orthopaedics	81 (21.70)
Shoulder/Elbow	30 (8.00)
Spine (adult)	12 (3.20)
Spine (paediatric)	8 (2.10)
Sports medicine	73 (19.60)
Trauma	41 (11.00)
No area of specialization	16 (4.30)
Other	15 (4.00)
<b>Number of areas of specialization</b>	
One	294 (78.80)
Two or more	73 (19.60)
Three or more	5 (1.30)
Four or more	1 (0.30)

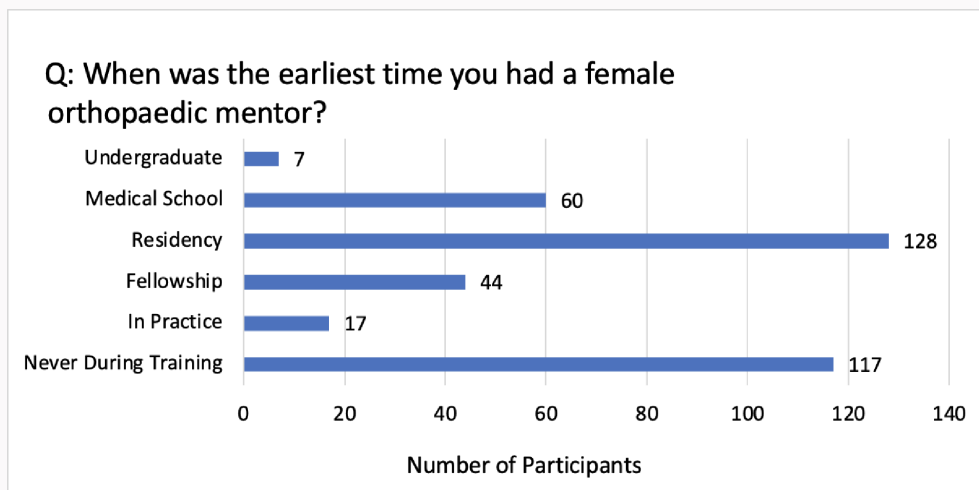
This distribution is also similar to that observed in a 2012 study on diversity in orthopaedics by Daniels and DiGiovanni.<sup>8</sup> Irrespective of sex, they reported that white participants made up the majority of clinical academic faculty (85.9%), followed by Asians/Pacific Islanders (7.8%), African-Americans (3.1%),

and Hispanics (2.3%). Native Americans/Alaskan Natives made up the smallest portion of orthopaedic surgeons (0.2%).<sup>8</sup>

### Path to orthopaedic surgery

The undergraduate majors selected by our sample of female orthopaedic surgeons were similar to those reported in the 2020 Matriculating Student Questionnaire (MSQ) administered by the Association of American Medical Colleges (AAMC).<sup>9</sup> More specifically, the majority of students matriculating to medical school (58%) completed an undergraduate major pertaining to biological life sciences, similar to our study (67%, excluding those in "other"). Additionally, the percentage of overall medical school matriculants and survey respondents studying social sciences (8.9% AAMC vs 11.5% our study) and physical sciences and maths (10.8% AAMC vs 9.1% our study) were similar as well, suggesting that our sample of female orthopaedists have the same distribution of majors as overall medical school matriculants.

Our results suggest that previous participation in collegiate athletics at a Division I, II, or III level may be correlated with a woman choosing to pursue orthopaedic surgery. Though the relationship between college athletic participation and selecting orthopaedics as a speciality is not well understood,<sup>10</sup> there are a few possible explanations for the correlation seen in our study. A previous RIOS survey study showed that enjoyment of manual tasks was one of the most common reasons cited for choosing a career in orthopaedic surgery.<sup>5</sup> Because athletes are more likely to be accustomed to physically demanding activities and performing manual tasks, they may be more likely to pursue a career in a procedural field compared to non-athletes. Additionally, athletes may not be as deterred by the perceived physical strength required to work in orthopedics.<sup>11,12</sup> Although the majority of the respondents did indicate prior participation in athletics at the collegiate level, it is important to note that a substantial proportion (33.5%) of female orthopaedic surgeons were not college-level athletes.



**Fig. 2**  
The earliest time at which respondents had a female orthopaedic mentor.

### Path within orthopaedic surgery

Lifestyle choices of our sampled female orthopaedic surgeons were comparable to previous studies on women in orthopaedics.<sup>5,12</sup> Our study reports that 76% of respondents were married, while in Rodhe et al's<sup>5</sup> 2016 study, 75% of the surveyed orthopaedists were married (Table III). More respondents (68%) in our sample had children than those in that same study (52%). These results further demonstrate that many female orthopaedic surgeons have chosen to have families in addition to their careers. However, the challenges of pregnancy, parenthood, and fertility in orthopaedic surgery remain a critically important issue, as highlighted in Morgan et al's 2023 systematic review of this topic.<sup>13</sup>

In both Rodhe et al<sup>5</sup> and Biermann,<sup>11</sup> over one-third of female orthopaedic surgeons reported being in an academic model (Figure 1); in our study it was 31.1%. These findings are noteworthy as the 2018 AAOS Orthopaedic Practice in the USA (OPUS) Survey reported that 57% of members are in private practice, while only 18% are part of an academic practice.<sup>6</sup>

Compared to all orthopaedic surgeons in the 2018 AAOS Census,<sup>6</sup> the women in our cohort were more likely to be specialized – 86% in our study versus 60%. In the same census, across all surgeons, the most common primary speciality area was sports medicine (18.2%), followed by arthroplasty (14.4%) and hand surgery (11.6%). This differs from our findings, where hand surgery (25.7%), paediatric orthopaedics (21.7%), and sports medicine (19.6%) were the most common reported primary specialties in our female cohort.

### Mentorship

Though the number of women entering surgical fields has increased over the last few decades, the progress towards gender parity varies between surgical specialties. Of all primary surgical specialties, orthopaedic surgery has experienced the most limited improvement in gender diversity.<sup>4,14</sup> Female representation in orthopaedics departments as trainees or faculty remains low and, in some programmes, non-existent. In a survey of 76 orthopaedic surgery residency programmes in 2007, Nguyen et al<sup>14</sup> showed that 15 departments (20%) had no female faculty members, 74

departments (97%) had male residency programme directors, and all programmes had a male chairperson. At the time of this publication, there are currently nine female orthopaedic chairs. Compared to all other medical specialties, orthopaedic surgery has the lowest female representation (13%;  $p < 0.05$ ) in faculty and full-time professors (3.8%;  $p < 0.05$ ).<sup>15</sup> Additionally, the increases in the percentage of women in orthopaedics over the past few decades have been significantly lower than all other primary surgical fields.<sup>4</sup> Assuming the growth rate in proportion of women orthopaedic surgeons remains the same as that of the 2010 to 2019 period, it will take a projected 217 years for orthopaedic surgery to achieve gender parity with the overall medical profession.<sup>16</sup>

The lack of female mentorship and female faculty members has been frequently cited as a potential cause for gender disparity in the orthopaedics speciality.<sup>8,17-20</sup> In our study, only 67 total respondents had a female orthopaedic mentor prior to their commitment to orthopaedic surgery, with minimal female orthopaedic mentorship reported during undergraduate education (seven respondents) or medical school (60 respondents) (Figure 2). The remaining 306 (82%) respondents did not have a female orthopaedic mentor prior to selecting an orthopaedic residency, and 117 respondents never had a female orthopaedic mentor during training. The presence of a role model of the same gender has been reported to be a much more important influence for women, compared to men, when choosing a career.<sup>21</sup> Thus, the lack of female orthopaedic mentorship provides a possible explanation for the ongoing gender inequality seen in orthopaedic surgery.

### Limitations

This study has several limitations. The survey was limited to members of the RJOS and the WoO Facebook group and, therefore, the experiences and opinions of these members may not be representative of all female orthopaedic surgeons. However, these are the largest open groups of women orthopaedic surgeons, and thus has the potential for internal diversity. Ideally, this study could be expanded to include all members of national orthopaedic organizations, such as the

American Academy of Orthopaedic Surgeons or the American Board of Orthopaedic Surgeons; however, both require interval review and permission, and of course include their own selection bias.

Additionally, the WoO Facebook group (n = 1,605) includes female orthopaedic residents, fellows, and attendings, but the exact number of each is uncertain. This makes it impossible to determine the rate of response among this group. While the invitations asked that each participant only complete the survey once, as it is an anonymous survey, we were not able to determine if there were duplicate responses. Additionally, because the survey was distributed only via electronic means, it is possible that this would bias the respondents to be younger and more 'tech-savvy'.

Future directions would include a broader study, investigating the demographics, biometrics, and career paths of all practising orthopaedists, with sub-analysis not only by sex, but also ethnicity and potentially other variables. Furthermore, a deeper understanding of the prevalence of any mentorship, whether from a male or female mentor, and its relationship to career choice and trajectory would be important, especially considering the still limited number of female orthopaedic surgeons to provide same-gender mentoring.

Finally, we believe that this initial study has been useful to investigate the truth behind some of the pre-existing notions regarding the 'typical' female orthopaedic surgeon, namely that she is sporty and must be tall. However, we recognize that these results also play into existing biases about physical characteristics, namely height and its relationship to perceived competence.<sup>21</sup> As this "height premium" has been studied in both men and women, its relationship to the demographics of orthopaedic surgeons should be considered in the future.

To the best of our knowledge, this is the largest study of female orthopaedic surgeons regarding their experiences throughout their medical journeys, as well as their professional and personal lifestyle choices. Additionally, it is the only study describing the biometrics of practising female orthopaedic surgeons. To better diversify the field of orthopaedic surgery, it is vital that young women understand that they too can wield a scalpel, just as they are. There is no minimum bench-press requirement, nor must they give up their dreams of having a family, in whatever form that takes. In fact, while the average female orthopaedist in our study was similar in both height and weight to the average American woman, women of all sizes do this job. There are women in all specialities of orthopaedic surgery, and within all practice environments. We hope that this evidence may help encourage young women doubtful of their potential place in orthopaedic surgery that their future presence is welcomed and supported by the diverse collection of women who have chosen this field before them.

Our data also support prior research suggesting that women orthopaedic surgeons may lack orthopaedic mentorship during the earlier, impressionable stages of their career (undergraduate and medical school). The lack of female orthopaedic mentorship has been cited as a potential explanation for the disparity of women in orthopaedic surgery, despite the increasing number of women in medical school. While further research is clearly needed, ideally, the findings of

this study will further motivate all orthopaedic surgeons, both women and men, to support young women considering our incredible field, such that the future is more representative of all of us.

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