

FEMALE REPRESENTATION IN ORTHOPAEDIC SURGERY AND PRIMARY CARE SPORTS MEDICINE SUBSPECIALTIES: WHERE WE WERE, WHERE WE ARE, AND WHERE WE ARE GOING

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Since the United States' first woman began medical school less than two centuries ago, medicine has become increasingly gender diverse. Women now make up the current majority of medical students and are predominant in fields such as pediatrics, obstetrics and gynecology, child and adolescent psychiatry and neonatal-perinatal medicine. Despite this progress, representation of women in many medical subspecialties, such as orthopaedic surgery sports medicine and primary care sports medicine is still consistent with historic origins of gender inequality. In 2018, women made up only 5.3% of orthopaedic surgeons and 12.1% of orthopaedic surgery sports medicine residents and fellows. Similarly, data from 2019 suggests 27.2% of family medicine sports medicine physicians are women. The lack of female representation in positions of leadership within these subspecialties highlights further inequalities. Through current initiatives to provide early exposure and mentorship to prospective residency applicants, there have been small advances in diversifying these fields. However, these advances have been largely inadequate for women of minority and marginalized groups. Adequate female representation is paramount to gain the benefits field diversification presents, including accessible representation, provider advocacy, prioritization of women's health, mentorship, and diverse thought and innovation. By simultaneously analyzing the historic barriers facing women in operative and nonoperative fields of sports medicine and the benefits of gender diversity for patient care, we can recommend actions necessary in promoting gender diversity moving forward.

INTRODUCTION

The topic of gender disparity has captured the interest of many fields given the emphasis on creating more equitable work environments. In medicine, the Association of American Medical Colleges (AAMC) approved the Increasing Women's Leadership in Academic Medicine Project Committee Report in 1966. At the committee's initiation, it was acknowledged that the number of women entering medical school resulted in the misconception that gender equality in all fields of

medicine had been reached.¹ The medical field at large is slowly working to resolve its historical gender disparity, noting female predominance in fields such as pediatrics (63.4%), obstetrics and gynecology (58.9%), child and adolescent psychiatry (54%) and neonatal-perinatal medicine (52.8%). Although the current majority of medical students are female, many specialties and subspecialties of medicine still face such disparity.²⁻⁴ The field of orthopaedic surgery has the most notable discrepancy in gender diversity and is

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improving at a rate slower than that of any other medical speciality.⁵ In 2018, women made up only 5.3% of orthopaedic surgeons, demonstrating the least gender diversity of any field in medicine.^{5,6} Additionally, only 12.1% of orthopaedic surgery sports medicine residents/fellows are women according to the Accreditation Council for Graduate Medical Education.⁶ The field of sports medicine sees further disparity in primary care sports medicine, with 27.2% of family medicine sports medicine physicians being women as of 2019.⁷ These disparities are even greater for women belonging to other minority groups.⁵

Furthermore, distinct actions must be taken to enhance the field's leadership diversity. As explained by Brown et al., the number of women represented in orthopaedic surgery and sports medicine leadership roles still does not accurately reflect the number of women entering the field.⁸ Additional barriers in leadership have become increasingly more evident, not only in research, but in positions of academia, at conference panels and educational exhibits, and in niche positions of practice, such as collegiate and professional team physician roles.⁸⁻¹⁰

Representation of women in orthopaedic surgery and primary care sports medicine (OSSM and PCSM, respectively) is critical, as it is across all domains in the medical field. In congruence with diverse patient populations, patients need accessible representation and advocacy in physicians, including the treatment of the female athlete. Furthermore, increasing female representation allows for diverse thought and innovation, as demonstrated by Day et al., who found that companies with increased diversity earned more revenue from products and services, which increased even further when women held >20% of the leadership positions.⁵ Additionally, it was found that Fortune 500 companies that included females on the board had better performance.⁵ Recruitment of women into the field and positions of leadership promotes a cyclical phenomenon. Female leadership creates opportunities for further diversification, mentorship and prominent role models, while highlighting the value an institution places on diversity to future physicians.

To understand the barriers facing female representation in the field of OSSM and PCSM, it is necessary to gain awareness of both its historical and present state. With a foundation of where we

were and where we are now, we can most effectively delineate the best next steps to steer the field toward gender equity and direct where we are going.

HISTORY OF FEMALE REPRESENTATION IN ORTHOPAEDIC SURGERY AND PRIMARY CARE SPORTS MEDICINE: WHERE WE'VE BEEN AND WHERE WE ARE

The Origin of Women in Medicine

One of the earliest known contributions to medicine by a woman was by Metradora, a female Greek physician whose authorship of *On the Diseases and Cures of Women* marked the first medical text written by a woman.¹¹ Despite early contributions to medicine by women, it was not until the mid-1800s when women were permitted to attend United States medical schools.^{11,12}

Representation of Women in Orthopaedic Surgery Sports Medicine and Primary Care Sports Medicine Clinical Care

Dr. Ruth Jackson, born in Scranton, Iowa, is known as the first practicing female orthopedist in the United States. She graduated from Baylor College of Medicine in 1928 where she was one of four women in her class of 164 students.⁵ Since that time, orthopaedic surgery has demonstrated the slowest increase towards gender parity compared to other medical fields.⁵ From 1981-2001, 0.6% of individuals matching into orthopaedic surgery residency were female.⁵ In 2007, only 3.6% of active orthopaedic surgeons were women.¹³ Despite consistently being the least gender diverse specialty in medicine, recent years have seen additional growth, with women making up 14% of orthopedic surgery residents and 6.5% of AAOS members.⁵ Women in the subspecialty of OSSM currently make up 12.1% of residents and fellows.^{6,14}

Similarly, PCSM faces substantial gender disparity, although not as severe as that seen in orthopaedic surgery. In 2019, AAMC reported that only 27.2% of active practicing sports medicine physicians were women.⁷ However, the field of sports medicine is growing faster than any other specialty.⁴ Since 2014 the AAMC's Physician Specialty Data reports a 55.3% increase in sports medicine physicians.⁴ Although gender disparity in the field is lessening as a whole, women remain concentrated in certain specialties and less visible in

others, further highlighting the need to diminish existing disparity.⁴

Leadership

The apparent gender disparity in the fields of OSSM and PCSM is further deepened in various positions of leadership. Prior to 2019, only two female orthopaedic surgeons have held academic orthopaedic program chair positions in the United States.⁸ The American Academy of Orthopaedic Surgeons (AAOS) has had 89 presidents since their initiation in 1931, of which only one has been a woman, Kristy Weber, who became the first and only woman to be president for the AAOS in 2019.¹⁵

Similar gender disparity trends are seen in leadership roles in the field of sports medicine. To our knowledge, the first female president of the American Orthopaedic Society of Sports Medicine was not until 41 years after the society's inaugural president and has been the only female to hold the position since.¹⁶ The American Medical Society for Sports Medicine (AMSSM) elected their first female president, Dr. Deborah Squire, in 1999-2000; however, only 5 out of the 27 presidents have been female since the society was first established 30 years ago.¹⁷

Research

This trend of gender disparity is also heavily apparent in the field's research sector. In a series of seven year intervals following 1987, proportions of practicing male and female orthopaedic surgeons were analyzed and the overall percentage of women as first author was lower than the ratio of men to women in the field.⁸ The Journal of Arthroscopy, similar to other orthopaedic surgery and sports medicine journals, improved from 2.8% women as first author in 1986 to 15.7% in 2016.¹⁸ First author female publications in the subspecialty of sports medicine were found to be greater than all other subspecialties of orthopaedics except for pediatrics.¹⁹ Although improvements in gender differences are being made, the number of women represented as authors in orthopaedic surgery research still does not parallel the number of women entering the field. Therefore, it is necessary to decrease biases such as those described by the Matilda effect, a bias that undervalues the works and accomplishments of women in science compared to their male counterparts. This can be done by highlighting female researchers and emphasizing opportunities for females and

underrepresented minorities in the field, and by analyzing and critiquing current review processes.^{8,20,21} This would also foster an environment for more female clinician-researchers.

PCSM, like OSSM, is also subject to a strong male dominance in the research sector. American Journal of Sports Medicine (AJSM) improved from 4.7% female first authors in 1986 to 19.3% in 2016.¹⁸ Percentage of female first authors in sports medicine journals showed significant increases between 2006 and 2017 but was still less than 20%.¹⁸

Sports Team Coverage

OSSM physicians represented 3.33% of NBA, 45.45% of WNBA, 10% of MLB, and 3.13% of NFL team physicians. In "Power Five" conferences, the percent of female OSSM physicians on athlete care teams made up 7.14% of SEC teams, 8.33% of ACC teams, 30.77% of BIG-10 teams, 0% of BIG 12 teams, and 50% of PAC-12 teams.¹⁰ As recently as 2020, O'Reilly demonstrated that females made up 18.1% of all team physicians and 7.7% of all orthopaedic surgeons among collegiate athletics. Likewise, females made up 6.7% of all team physicians and 6.3% of orthopaedic surgeons team physicians among professional athletics.²² Underrepresentation in sports medicine as compared to other subspecialties may lend itself to the broader sports culture. Individuals like Dr. Robin West, the only female physician acting as both the head team physician for professional football and baseball teams, is trail blazing the path to a more inclusive, representative and accessible leadership in sports.²³

Likewise, PCSM team physicians are largely male. In a study conducted by Pana et al., 42 females and 102 males completed a survey that highlighted gender differences in the field of PCSM. This survey indicated that males were more likely to cover the training room at all levels except at the Division I level, where males and females covered the training room equally.²⁴ Additionally, males had a higher likelihood of covering all types of sporting events.²⁴ High school training rooms are dominated by male primary care sports medicine physicians (39%) compared to female (10%).²⁴ Likewise, the majority of sports medicine physicians covering football games are male at 75%.²⁴

Perceptions

To understand why women are less likely to enter the field of sports medicine, women's

perceptions regarding residency matriculation must be analyzed. Studies have shown that early exposure to a field has a positive association with the number of women that apply.²⁵⁻²⁷ Additionally, for women applying to male-dominated fields such as orthopaedic surgery, same-gender mentorship was important, although not always easily accessible.^{25,26} Specifically in orthopaedic surgery, the most common reasons as to why women might not choose orthopaedics included perceived inability to have a good work/life balance (78%), the perception that too much physical strength is needed (74%) and lack of strong mentorship in medical school or earlier (69%).²⁶ Women applying to orthopaedic programs also felt that illegal interview questions, such as family planning questions, highlighted the clear gender bias in the field.²⁵

Although there are no existing studies done on perceptions of applicants applying to sports medicine, a study by Pana et al. explored gender influences on sports medicine career opportunities, practice choices and job satisfaction. In this study, women expressed that their gender negatively influenced their involvement with covering men's sports.²⁴ When asked "to what extent are you satisfied with your current career opportunities as a Sports Medicine Physician," twice as many women were unsatisfied with their career opportunities compared to men.²⁴ When asked about factors affecting career opportunities, there was a significant difference in how men and women answered regarding gender, with women reporting both positive and negative effects of gender on career opportunities, and males mainly reporting indifferent or positive effects of their gender on career opportunities.²⁴

Representation of Women in Sports

Increased female representation in the medical field was not an isolated phenomenon, as it paralleled the growth of women in many traditionally underrepresented fields, including sports. The first Olympic games, held in 1896, excluded women from participating.²⁸ This ended in 1900, where Charlotte Cooper and Margaret Ives Abbott competed in women's tennis, golf, and croquet events.²⁸ Another monumental moment for gender equity was the passing of Title IX by US Congress in 1972.²⁸ Title IX allowed women and men an equal opportunity to participate in sports in both public schools and colleges.²⁸ Then in 1991, the

International Olympic Committee (IOC) mandated that any new sport added to the Olympic program would include events for both men and women to promote the growth of female participation in the Olympics.²⁸ The 2010 Winter Olympics in Vancouver furthered representation, with a female-to-male competitor ratio of 5 to 7.²⁸ At the 2020 Olympic games, 49% of competitors were female, the closest the modern Olympics have ever come to gender parity.²⁹

SHATTERING GLASS CEILINGS: WHERE ARE WE GOING

Addressing Barriers to Orthopaedic Surgery and Primary Care Sports Medicine Specialties

More Pipeline Programs

Understanding the barriers impacting women's decisions to pursue sports medicine careers can motivate policy changes and educational development, including pipeline programs, early exposure, mentorship and scholarships in order to improve diversity.³⁰ Programs emphasizing these suggestions have been shown to increase female and underrepresented minority interest in the field (**Table 1**).²⁵ The Perry Initiative was named after Dr. Jacqueline Perry, one of the first female orthopaedic surgeons. The program prioritizes hands-on experiences, mentorship opportunities and educational endeavors. A study involving the Perry Initiative's Medical Student Outreach Program has demonstrated its efficacy, showing a match rate of program alumni double that of females currently in orthopaedic surgery residency.^{5,31,32} Similarly, Nth Dimensions exists as a pipeline program aiming to increase representation of women and underrepresented minorities in orthopaedic surgery through activities, mentorship and additional resources.³³ In a retrospective observational cohort study, medical students involved in the Nth Dimensions Summer Internship program demonstrated a 75% retention rate of applying to procedure-based specialties and a 72.3% match rate.³⁴ The J. Robert Gladden Orthopaedic Society, Ruth Jackson Orthopaedic Society (RJOS), and The B.O.N.E.S. Initiative are additional programs which have all demonstrated success in enhancing the field's gender representation.^{30,35-37} Similarly, pipeline programs have been established for primary care, including the Family Medicine Student Track (FaMeS) program at Boston University, which has

demonstrated significant outcomes in increasing primary care interest and applicants.³⁸ Although we are unaware of any pipeline program solely established for the subspecialty of sports medicine reported in the literature, many programs mentioned have sports medicine educational components and sports medicine faculty/mentors actively increasing awareness around this subspecialty.

Address Gender Bias

Despite these programs' successes and contributions to advancing field diversity, more

efforts should be made to address the trends in gender representation. Other barriers requiring attention include gender discrimination and implicit and explicit gender bias. Nearly 20% of female orthopaedic surgeons report experiencing discrimination during their fellowship application, with 40% facing questions regarding marriage, pregnancy or maternity leave during their fellowship interview.^{25,39,40} Pay bias is another prevalent issue, with a 2008 cross-sectional survey of PCSM's reporting the average annual income

Table 1. Pipeline Programs Addressing Barriers to Orthopaedic Surgery and Primary Care Sports Medicine Specialties

Program	About	More Information
The Perry Initiative	The Perry Initiative is committed to inspiring young women to be leaders in the fields of orthopaedic surgery and engineering, two fields in which women are drastically under-represented. Both of these fields require extensive education and we specifically target women in high school and medical school, two critical junctures along the career pathway.	https://perryinitiative.org/
Nth Dimensions	Nth Dimensions was founded in 2004 by orthopaedic surgeons working collaboratively with academic institutions, community surgeons, and industry to address the dearth of women and underrepresented minorities (URMs) in orthopaedic surgery. The overarching goal of Nth Dimensions is to address and eliminate healthcare disparities for all communities. The primary mission is to provide resources, expertise, and experience, through developing and implementing strategic pipeline initiatives.	https://www.nthdimensions.org/
The J. Robert Gladden Orthopaedic Society	The mission of the J. Robert Gladden Orthopaedic Society (JRGOS) is to increase diversity within the orthopaedic profession and promote the highest quality musculoskeletal care for all people.	https://www.gladdensociety.org/

Ruth Jackson
Orthopaedic
Society (RJOS)

The mission of RJOS is to promote professional development of women of all backgrounds to succeed in orthopaedic surgery throughout all stages of their careers.

<http://www.rjos.org/>

The B.O.N.E.S.
Initiative

Now in its third year, the B.O.N.E.S (Bringing Orthopedics to New England Students of Medicine) Initiative is a half-day event hosted by the women of the Harvard Combined Orthopaedic Residency Program that provides networking opportunities, inspiration and hands-on experience with orthopaedics for female medical students from all around New England.

<https://www.brighamandwomensfaulkner.org/about-bwfh/news/bones-initiative-seeks-to-inspire-young-women-to-pursue-careers-in-orthopaedic-surgery>

Family Medicine
Student Track
(FaMeS)

A "pipeline" program targeted at entering first-year students that incorporates curricular, extracurricular, summer, and career-planning elements.

<https://pubmed.ncbi.nlm.nih.gov/20063220/>

for men to be \$40,000 greater than their women counterparts.⁴¹ In the *MIT Science Policy Review*, Kong et al. recommends four steps for opposition of gender discrimination within institutions. These include investing in early education initiatives for increasing female representation, instituting stronger state and federal policies around gender discrimination, fostering workplace practices that promote diversity and developing better quantification and metrics for assessing gender discrimination to enact more meaningful policies.⁴²

More Female Leadership Positions

Lack of leadership opportunities have also been reported as a factor impacting field diversity.⁵ It is necessary that women adequately occupy all realms of leadership, including faculty positions, lead authors, conference speakers and board positions. Through intentional efforts, Thorborg et al. suggests equal female representation in leadership positions is possible, noting drastic increases in women speakers over the last 7 years of the International Federation of Sports Physical Therapy World Congress.⁴³

The AAMC's Increasing Women's Leadership Project Implementation Committee has also released recommendations for furthering female representation in academic medicine: "(1)

emphasize faculty diversity in departmental reviews, evaluating department chairs on their development of women faculty; (2) target women's professional development needs within the context of helping all faculty maximize their faculty appointments, including helping men become more effective mentors of women; (3) assess which institutional practices tend to favor men's over women's professional development, such as defining "academic success" as largely an independent act and rewarding unrestricted availability to work (i.e., neglect of personal life); (4) enhance the effectiveness of search committees to attract women candidates, including assessment of group process and of how candidates' qualifications are defined and evaluated; (5) financially support institutional Women in Medicine programs and the AAMC Women Liaison Officer and regularly monitor the representation of women at senior ranks."¹

The Female Athlete

Gender parity is crucial in optimizing clinical care in the field of sports medicine as increased diversity among health care professionals has shown to increase perspectives regarding patient care, innovativeness, patient satisfaction, accessibility and patient comfortability.⁵ This is

important as women's participation in sports is growing, making up 42.8% of high school athletes and 44% of NCAA athletes. However, only 4.1% of PCSM training programs have a track specific to women's health.^{44,45}

It is presumed that one third of female athletes will acquire a sports-related injury in a single season.⁴⁶ Additionally, females are more susceptible to certain musculoskeletal injuries such as bone stress injuries, patellofemoral pain syndrome, concussions, atraumatic multidirectional shoulder instability, femoroacetabular impingement and anterior cruciate ligament tears.^{47,48} There has been a substantial increase in these types of musculoskeletal injuries as female participation in sports has increased.^{47,48} As seen by the creation of nineteen women's sports medicine care programs throughout the country, the sports medicine field has begun to prioritize the health needs of the female athlete, often with female physicians playing vital leadership roles.⁴⁷

As mentioned, more female physicians are needed to meet the health needs of female athletes. Literature has demonstrated preference for female health care professionals in a variety of instances. In a systematic literature review, Chung et al. analyzed sports medicine provider gender preference among athletes with a mean age range of 14.7 to 21 years old and half being female. The review found that young athletes preferred same-gender providers when their care related to topics of sexual health or genitals and female providers for topics of behavioral or psychosocial health.⁴⁹ Specifically, regarding body image and disordered eating, female patients prefer a same-gender provider.⁴⁹ Additionally, when topics of sensitive nature were discussed, females had greater same-gender preference compared to males.⁴⁹ Similarly, a survey study showed that women had a greater preference for a physician of the same gender when health topics involved sex, birth control, acne, diet, relationships and psychiatric problems compared to their male counterparts.⁵⁰ Additionally, as explained by a questionnaire study examining preferences for orthopaedic surgeons, 90% of all patients demonstrating a gender preference preferred a female surgeon.⁵¹ Ultimately, enhanced physician accessibility can increase compliance, satisfaction and care, benefiting the health of the athlete: the ultimate goal of the field of sports medicine.

CONCLUSION

Although progress has been made in improving the field's historic gender disparity, there is still work to be done to achieve equal gender representation. This is crucial to optimize clinical care in the field of OSSM and PCSM. Additionally, female representation in both the field and its leadership positions are beneficial, as gender diversity cultivates representation, role models and mentorship opportunities. Making intentional steps to prioritize diversity further challenges institutions to consider their values and program culture. This is increasingly important as female sports participation continues to grow, demanding a more diverse physician body to enhance patient comfortability, accessibility and satisfaction.

Conflict of Interest Statement

The authors report no conflict of interest with the contents of this manuscript.

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