Gender bias in sports medicine: an international assessment of sports medicine physicians' perceptions of their interactions with athletes, coaches, athletic trainers and other physicians

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ABSTRACT

Objectives To evaluate the difference between female and male sports medicine physicians regarding disrespectful attitudes and sexual harassment perceived from athletes, coaches, physicians, athletic trainers (ATs) and organisations/administrations.

Methods and study design anonymous survey was distributed to sports medicine physicians practicing in 51 countries. χ^2 analysis was used to detect differences between female and male sports medicine physicians and logistic regression analysis was used to determine the independent variables that affect disrespectful attitudes and sexual harassment from sports participants.

Results 1193 sports medicine physicians (31.9% female) participated from 51 countries. The survey revealed that female physicians, compared with male physicians, perceive significantly more disrespect or have their judgement questioned more by the following categories: male and female athletes, male and female coaches, female physicians with more years of experience, male physicians (regardless of years of experience), male and female ATs and organisation/administrations (all $p<0.05$). The only category where the frequency of disrespect was perceived equally by male and female physicians was during their interactions with female physicians who have the same or lesser years of experience. Female sports medicine physicians noted more sexual harassment than male physicians during interactions with male athletes, coaches, ATs and physicians (all $p<0.001$). In the logistic regression, gender was a related factor for perceiving disrespect, especially from male coaches (OR=2.01) and physicians with more years of experience (OR=2.18).

Conclusions Female sports medicine physicians around the world experience disrespectful attitudes, questioning of their judgement and are sexually harassed significantly more often than male counterparts.

WHAT ARE THE NEW FINDINGS?

⇒ Gender bias exists in sports medicine and female sports medicine physicians in many countries perceive disrespectful attitudes and questioning of their judgement greater than their male colleagues.
⇒ Female sports medicine physicians are sexually harassed by male sports participants and sports organisations significantly more than their male counterparts.
⇒ Future work should explore opportunities to eliminate bias in order to create an environment for all sports medicine physicians to thrive.

HOW MIGHT IT IMPACT ON CLINICAL PRACTICE IN THE FUTURE?

⇒ More awareness of disrespect and harassment towards female sports medicine physicians should support the creation of mechanisms such as education and reporting to change the environment at the organisational level.
⇒ Importantly, male sports medicine physicians can use this information to advocate on the behalf of women to promote gender equity, with the goal of eliminating discrimination and bias in the workplace.

INTRODUCTION

In 1979, the United Nations adopted the 'Convention on the Elimination of all Forms of Discrimination against Women'. This landmark document sought to curtail discriminatory practices against women in the rapidly growing female workforce around the world.[1] The convention has obvious applications to the growing number of female medical students and physicians across the globe.[2] However, 'gender equality,' defined by the World Health Organization in 2002 as the 'absence of discrimination on the basis of a person's sex in opportunities, the allocation of resources and benefits, or access to services,' remains elusive in many, if not most, countries. For example, entrance exam scores at some medical schools in Japan were manipulated so that men are more easily admitted.[3 4] In the USA, male physicians' salaries are higher than women's, and women in academic medicine are less likely to be promoted or addressed by their professional titles.[5–8] Although the number of female physicians is on the rise, a study in the USA reported that only 41% of female sports medicine physicians reported they have achieved their career goals and only 60.5% agreed they were compensated at a rate commensurate with their peers.[9] Most importantly, female physicians still face a considerable degree of discrimination in comparison to their male counterparts.[10]

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Sports medicine operates in a unique environment. Physicians are required to communicate not only with athletes, but also with coaches, athletic trainers (ATs) and other professionals that surround the athletes. Although the athletic world is populated by athletes representing both genders, sport is traditionally male dominant. For example, male sports tend to be better funded and have greater resources at all levels and compensated at a higher rate than female sports, highlighted in 2019 by USA Women's soccer gender discrimination lawsuit.[11] In addition, the Olympics only added women's triple jump, hammer throw, pole vault and steeplechase in the past 25 years, while the male versions of these sports have been contested prior to that.[12] This male dominance in sports carries over into the field of sports medicine and in fact, there are far fewer female than male sports medicine physicians serving as head team physicians in colleges in the United States National Collegiate Athletic Association.[13]

The purpose of this study is to evaluate discriminatory attitudes and sexual harassment perceived by female sports medicine physicians as compared with their male counterparts in their interactions with athletes, coaches, other physicians and ATs in multiple countries and investigate the causative factors that are related to disrespectful attitudes and sexual harassment. Although gender influence in sport medicine careers have been reported, there has not been a study on gender bias in sports medicine evaluating the effect of primary specialty and country of origin with international participants nor in specialties other than family medicine.[14]

METHODS

Participants

A cross-sectional study was performed by means of an online survey that was disseminated to sports medicine physicians practicing in 51 different countries via sports medicine organisations and private social media groups. For those countries that do not have their own sports medicine organisations, the link of the survey was distributed via sports medicine physicians working at a national sport federation. Survey responses from non-physician personnel employed by sports medicine organisations were disregarded. We also excluded all responses that did not specify a physician's gender. As long as the above criteria was met, participants that skipped questions were still included in the overall analysis.

Survey

In this anonymous survey, physicians were asked for demographic information of the subjects since previous studies have reported that personal background of an individual has an effect on his or her mindset regarding gender bias and the questions: 'how often have you felt disrespected or had your judgement questioned by the following?' and 'how often have you been sexually harassed by the following?' by different groups they encounter during the course of their job. The responses were 'every day, few times a week, few times a month, few times a year and never'.

The groups were as follows.

- Male and female athletes.
- Male and female coaches.
- Male and female physicians who had been in practice longer than the participant.
- Male and female physicians who had been in practice the same or less time than the participant.
- Male and female ATs.
- Organisation/administration personnel such as team managers or athletic directors.

Participants answered the frequency of experiencing disrespect or having their judgement questioned and having been sexually harassed. Choosing any option other than 'never' was considered a positive response. The survey was distributed from August to December 2020 and was translated into Arabic, Chinese, Dutch, English, French, German, Japanese, Korean, Norwegian, Spanish and Thai.

Statistical analysis

All data were analysed using the Stata V.16.1 (Stata Corporation, Texas, USA). Fisher's exact tests were used to detect differences between female and male sports medicine physicians and continuous data were compared using the Welch's t-test. A probability (p) value of <0.05 was considered significant. To investigate the related factors of receiving disrespectful attitudes and sexual harassment, binary logistic regression was used to determine the related variables. Age, gender, region where medical practice was conducted and residency training were included in the model. Male was set as the base level for gender and Europe as the base level for region since the gender gap there is the lowest according to the World Economic Forum, which not only focuses on income but also on political empowerment, educational attainment, health and survival, etc.[15] Family medicine was the base level for residency training, since we speculated that the majority would be sports medicine physicians trained in family medicine. We also performed logistic regression analysis on both genders separately. ORs and associated 95% CIs were calculated to determine the strength of the model. In addition, since the responses were on a frequency scale, ordinal regression analysis was performed and the results are listed in the online supplemental material.

Patient and public involvement

The survey was reviewed by select sports medicine physicians prior to finalising the questions to assure clarity of content.

RESULTS

A total of 1250 responses were received from 51 countries, and among them, we excluded those that did not specify their gender (N=11) and those determined not to be licensed medical doctors (N=46). Thus, a total of 1193 sports medicine physicians were qualified for analysis. The percentages of women and men were 31.9% (380/1193) and 68.1% (813/1193), respectively, and the average age of female physicians (40.1±9.3) was lower than that of male counterparts (48.3±11.5) significantly ($p<0.01$). The majority of the participants were from North America (36.0%) and Asia (33.8%), and participant characteristics are listed in table 1. For the primary residency training, 43.7% of female sports medicine physicians trained in family medicine and 47.7% of male sports medicine physicians trained in orthopaedics.

According to our findings, female sports medicine physicians experience disrespect or have had their judgement questioned more than their male counterparts when encountering male athletes, male coaches, male physicians regardless of years of experience, male ATs, sports organisation/administration (all $p<0.001$), female athletes ($p=0.015$), female coaches ($p=0.018$), female physicians with more years of experience ($p<0.001$) and female ATs ($p=0.006$). Also, female physicians report being sexually harassed significantly more than their male counterparts by male sports participants and sports organisation/administration (all $p<0.001$). The OR was high, particularly in male physicians with more years of practice. Results of the percentage of both male and female sports medicine physicians

Table 1 Characteristics of the participants

	Female N (%)	Male N (%)	P value
Practice region			**<0.001**
Africa	17 (4.5)	18 (2.2)	
Asia	48 (12.6)	355 (43.7)	
Europe	91 (24.0)	186 (22.9)	
North America	215 (56.6)	214 (26.3)	
Oceania	3 (0.8)	4 (0.5)	
South America	6 (1.6)	33 (4.1)	
Multiple	0 (0.0)	3 (0.4)	
Total	380 (100)	813 (100)	
Primary residency training			**<0.001**
Emergency medicine	17 (4.5)	21 (2.6)	
Family medicine	166 (43.7)	199 (24.5)	
Internal medicine	17 (4.5)	43 (5.3)	
Orthopaedics	55 (14.5)	388 (47.7)	
Paediatrics	28 (7.4)	15 (1.9)	
PM&R	59 (15.5)	68 (8.4)	
Sports medicine	28 (7.4)	41 (5.0)	
Other	10 (2.6)	38 (3.2)	
Age (years)	40.1±9.3	48.3±11.5	**<0.001**

Bold values denote statistical significance at the p < 0.05 level.
PM&R, physical medicine and rehabilitation.

having perceived disrespect or their judgement questioned and sexually harassed are listed in table 2. Details of the responses on both male and female sports medicine physicians are listed in figure 1.

Results of the logistic regression analysis on perceiving disrespectful attitudes or having their judgement questioned are shown in table 3 (both genders combined) and table 4 (both genders separately). Additionally, the results of the logistic regression analysis on having been sexually harassed are listed in table 5 (both genders combined) and table 6 (both genders separately).

Being a female sports medicine physician was a related factor for experiencing disrespect or having their judgments questioned by male coaches (OR=2.01, 95% CI (1.48 to 2.74), p<0.001), male physicians in practice longer than themselves (OR=2.18, 95% CI (1.58 to 3.01), p<0.001), male physicians in practice the same or less time than themselves (OR=2.10, 95% CI (1.58 to 2.80), p<0.001), male ATs (OR=1.55, 95% CI (1.16 to 2.07), p=0.003), and organisations/administrations (OR=1.41, 95% CI (1.06 to 1.88), p=0.019).

Age was a related factor for receiving disrespectful attitudes from both male and female physicians in practice longer and when the analysis was done separately, the results showed that younger female sports medicine physicians were more likely to receive disrespectful attitudes from female physicians in practice longer (OR=0.97, 95% CI (0.95 to 1.00), p=0.043). Moreover, male sports medicine physicians were more likely to receive disrespectful attitudes from both male (OR=0.96, 95% CI (0.95 to 0.97), p<0.001) and female (OR=0.96, 95% CI (0.94 to 0.97), p<0.001) physicians in practice longer.

Sports medicine physicians in Asia perceive less disrespect or had their judgments questioned less by male athletes (OR=0.56, 95% CI (0.38 to 0.81), p=0.002), female athletes (OR=0.57, 95% CI (0.39 to 0.85), p=0.006) and male coaches (OR=0.62, 95% CI (0.42 to 0.90), p=0.013) compared with European

Table 2 Percentage of sports medicine physicians who felt disrespected or had their judgement questioned

Have felt disrespected or their judgement questioned by the following (total responses)	Female N (%, 95% CI)	Male N (%, 95% CI)	P value
Male athletes (1153)	233 (63.8, 58.7 to 68.8)	377 (47.8, 44.3 to 51.4)	**<0.001**
Female athletes (1143)	176 (48.2, 43.0 to 53.5)	315 (40.5, 37.0 to 44.0)	**0.015**
Male coaches (1137)	259 (72.4, 67.4 to 76.9)	374 (48.0, 44.5 to 51.6)	**<0.001**
Female coaches (1134)	154 (42.8, 37.6 to 48.1)	273 (35.3, 31.9 to 38.8)	**0.018**
Male physicians in practice longer (1112)	274 (76.8, 72.0 to 81.0)	388 (51.4, 47.8 to 55.0)	**<0.001**
Male physicians in practice the same or less (1144)	218 (60.1, 54.8 to 65.1)	305 (39.1, 35.6 to 42.6)	**<0.001**
Female physicians in practice longer (1137)	175 (48.3, 43.1 to 53.6)	266 (34.3, 31.0 to 37.8)	**<0.001**
Female physicians in practice the same or less (1132)	102 (28.3, 23.7 to 33.3)	219 (28.4, 25.2 to 31.7)	1.000
Male athletic trainer (1136)	185 (51.4, 46.1 to 56.7)	271 (34.9, 31.6 to 38.4)	**<0.001**
Female athletic trainer (1128)	126 (35.3, 30.1 to 40.5)	209 (27.1, 24.0 to 30.4)	**0.006**
Organisation/administration (1137)	190 (53.1, 47.8 to 58.3)	323 (41.5, 38.0 to 45.0)	**<0.001**
Sexually harassed by the following (total responses)	**Female N (%, 95% CI)**	**Male N (%, 95% CI)**	**P value**
Male athletes (1151)	67 (18.4, 14.6 to 22.8)	12 (1.5, 0.8 to 2.6)	**<0.001**
Female athletes (1152)	8 (2.2, 1.0 to 4.3)	33 (4.2, 2.9 to 5.8)	0.122
Male coaches (1148)	49 (13.6, 10.2 to 17.5)	10 (1.3, 0.6 to 2.3)	**<0.001**
Female coaches (1145)	3 (0.8, 0.2 to 2.4)	19 (2.4, 1.5 to 3.8)	0.102
Male physicians in practice longer (1150)	108 (29.9, 25.2 to 34.9)	15 (1.9, 1.1 to 3.1)	**<0.001**
Male physicians in practice the same or less (1150)	54 (14.9, 11.4 to 19.0)	12 (1.5, 0.8 to 2.6)	**<0.001**
Female physicians in practice longer (1149)	6 (1.7, 0.6 to 3.6)	16 (2.0, 1.2 to 3.3)	0.818
Female physicians in practice the same or less (1147)	5 (1.4, 0.5 to 3.2)	22 (2.8, 1.8 to 4.2)	0.207
Male athletic trainer (1144)	29 (8.1, 5.5 to 11.5)	13 (1.7, 0.9 to 2.8)	**<0.001**
Female athletic trainer (1143)	3 (0.8, 0.2 to 2.4)	18 (2.3, 1.4 to 3.6)	0.100
Organisation/administration (1146)	42 (11.6, 8.5 to 15.4)	13 (1.7, 0.9 to 2.8)	**<0.001**

Bold values denote statistical significance at the p < 0.05 level.

Figure 1 (A) Details of the responses of 'how often have you felt disrespected or had your judgement questioned by the following?' on both male and female sports medicine physicians. (B) Details of the responses of 'how often have you been sexually harassed by the following' on both male and female sports medicine physicians.

physicians. As for male sports medicine physicians, those based in Asia experienced less disrespectful attitudes from male athletes (OR=0.52, 95% CI (0.34 to 0.81), p=0.003), female athletes (OR=0.53, 95% CI (0.34 to 0.84), p=0.007), male coaches (OR=0.58, 95% CI (0.37 to 0.89), p=0.014), female physicians in practice longer (OR=0.61, 95% CI (0.38 to 0.98), p=0.040), and male ATs (OR=0.60, 95% CI (0.38 to 0.94), p=0.026) compared with European sports medicine physicians. Sports medicine physicians based in Africa experienced more disrespected or had their judgments questioned by male coaches (OR=2.42, 95% CI (1.01 to 5.79), p=0.048), female coaches (OR=6.24, 95% CI (2.63 to 14.84), p<0.001), male physicians in practice longer than themselves (OR=3.96, 95% CI (1.51 to 10.39), p=0.005), female physicians in practice longer than themselves (OR=2.64, 95% CI (1.19 to 5.85), p=0.017), female physicians in practice the same or less time than themselves (OR=2.59, 95% CI (1.20 to 5.60), p=0.015), male ATs (OR=3.31, 95% CI (1.48 to 7.41), p=0.004), female ATs (OR=3.46, 95% CI (1.59 to 7.51), p=0.002) and organisations/administrations (OR=2.34, 95% CI (1.08 to 5.10), p=0.032) compared with European physicians. This trend was higher when the analysis was performed only on female sports medicine physicians. Female North American physicians frequently perceived disrespect or had their judgments questioned by male athletes (OR=2.76, 95% CI (1.40 to 5.46), p=0.004), male physicians in practice longer than themselves (OR=4.55, 95% CI (2.02 to 10.29), p<0.001), male ATs (OR=2.18, 95% CI (1.11 to 4.30), p=0.024) and female ATs (OR=2.44, 95% CI (1.13 to 5.27), p=0.023), in comparison to European physicians.

In regard to residency training, compared with those with family medicine training, sports medicine physicians trained in orthopaedics have perceived less disrespect or have had their judgments questioned less by female athletes (OR=0.58, 95% CI (0.38 to 0.90), p=0.014) and female coaches (OR=0.47, 95% CI (0.30, 0.74), p=0.001). However, while as a whole orthopaedic surgeons experienced less disrespectful attitudes from certain

Table 3 Results of logistic regression analysis on having felt disrespected or their judgement questioned (both genders combined)

	OR	95% CI	P value
Male athletes			
Region (Ref: Europe)			
Asia	0.56	0.38 to 0.81	0.002
North America	1.67	1.14 to 2.43	0.008
Residency training (Ref: family medicine)			
Internal medicine	0.53	0.29 to 0.96	0.037
Emergency medicine	0.45	0.22 to 0.90	0.024
Female athletes			
Region (Ref: Europe)			
Asia	0.57	0.39 to 0.85	0.006
North America	1.48	1.02 to 2.15	0.039
Residency training (Ref: family medicine)			
Orthopaedics	0.58	0.38 to 0.90	0.014
Male coaches			
Gender (Ref: male)			
Female	2.01	1.48 to 2.74	<0.001
Region (Ref: Europe)			
Africa	2.42	1.01 to 5.79	0.048
Asia	0.62	0.42 to 0.90	0.013
Residency training (Ref: family medicine)			
PM&R	0.52	0.32 to 0.83	0.007
Emergency medicine	0.29	0.14 to 0.60	0.001
Female coaches			
Region (Ref: Europe)			
Africa	6.24	2.63 to 14.84	<0.001
North America	1.61	1.09 to 2.36	0.017
Residency training (Ref: family medicine)			
Orthopaedics	0.47	0.30 to 0.74	0.001
Emergency medicine	0.36	0.16 to 0.82	0.014
Male physicians in practice longer			
Gender (Ref: male)			
Female	2.18	1.58 to 3.01	<0.001
Age	0.97	0.95 to 0.98	<0.001
Region (Ref: Europe)			
Africa	3.96	1.51 to 10.39	0.005
North America	2.29	1.48 to 3.52	<0.001
Oceania	0.06	0.01 to 0.59	0.016
Residency training (Ref: family medicine)			
Sports medicine	2.15	1.04 to 4.41	0.038
Male physicians in practice the same or less			
Gender (Ref: male)			
Female	2.10	1.58 to 2.80	<0.001
Female physicians in practice longer			
Age	0.96	(0.95 to 0.97	<0.001
Region (Ref: Europe)			
Africa	2.64	1.19 to 5.85	0.017
Female physicians in practice the same or less			
Region (Ref: Europe)			
Africa	2.59	1.20 to 5.60	0.015
Male athletic trainers			
Gender (Ref: male)			
Female	1.55	1.16 to 2.07	0.003
Region (Ref: Europe)			
Africa	3.31	1.48 to 7.41	0.004
Female athletic trainers			
Region (Ref: Europe)			
Africa	3.46	1.59 to 7.51	0.002
South America	2.17	1.02 to 4.60	0.044
Residency training (Ref: family medicine)			
Internal medicine	0.45	0.22 to 0.94	0.033
Organisations/administrations			
Gender (Ref: male)			
Female	1.41	1.06 to 1.88	0.019
Region (Ref: Europe)			
Africa	2.34	1.08 to 5.10	0.032
Residency training (Ref: family medicine)			
PM&R	0.56	0.35 to 0.88	0.012

PM&R, physical medicine and rehabilitation.

categories, females in orthopaedics experienced disrespectful attitudes from male physicians in practice longer at a higher rate than those is family medicine (OR=4.36, 95% CI (1.51 to 12.58), p=0.006). Sports medicine physicians trained in emergency medicine also experienced less disrespect or have had their judgments questioned less by male athletes (OR=0.45, 95% CI (0.22 to 0.90), p=0.024) male coaches (OR=0.29, 95% CI (0.14 to 0.60), p=0.001) and female coaches (OR=0.36, 95% CI (0.16 to 0.82), p=0.014) compared with family medicine trained sports medicine physicians.

Results of the logistic regression analysis on sexual harassment revealed that, compared with male sports medicine physicians, female counterparts have been sexually harassed more by male athletes (OR=12.42, 95% CI (6.14 to 25.11), p<0.001), male coaches (OR=9.95, 95% CI (4.58 to 21.62), p<0.001), male physicians in practice longer (OR=27.47, 95% CI (14.33 to 52.65), p<0.001), male physicians in practice same or less time (OR=13.77, 95% CI (6.54 to 28.99), p<0.001), male ATs (OR=5.40, 95% CI (2.46 to 11.85), p<0.001) and organisations/administrations (OR=7.31, 95% CI (3.50 to 15.27), p<0.001). Younger age was also a related factor of being sexually harassed by male athletes (OR=0.96, 95% CI (0.93 to 0.99), p=0.021) and female coaches (OR=0.95, 95% CI (0.90 to 0.99), p=0.027). Also, younger male sports medicine physicians were more likely to be sexually harassed than older male sports medicine physicians.

DISCUSSION

This is the first study to investigate the perception of disrespectful attitudes and being sexually harassed by sports participations in male and female sports medicine physicians in multiple countries. Our results indicated that, female physicians are frequently on the receiving end of disrespectful attitudes and having their judgement questioned more significantly than their male counterparts, especially by male sports participants, which was consistent with a previous study on academic medicine.[6] Also, χ^2 analysis revealed that female physicians have been sexually harassed significantly more than male counterparts especially from male physicians with more experience. Moreover, when adjusted by logistic regression, gender of the sports medicine physician was a significant factor for having judgement questioned by male athletes, male coaches, male physicians and male ATs.

Logistic regression analysis showed that for interactions with certain members of the sports medicine realm, the gender of the sports medicine physician did not influence them potentially perceiving disrespect. This was during interactions with female

Table 4 Results of logistic regression analysis on having felt disrespected or their judgement questioned (both genders separately)

Female sports medicine physicians	OR	95% CI	P value
Male athletes			
Region (Ref: Europe)			
Africa	4.21	1.06 to 16.63	0.040
North America	2.76	1.40 to 5.46	0.004
Female athletes			
NA	NA	NA	NA
Male coaches			
Residency training (Ref: family medicine)			
PM & R	0.38	0.18 to 0.80	0.011
Female coaches			
Region (Ref: Europe)			
Africa	7.48	1.86 to 30.04	0.005
Male physicians in practice longer			
Region (Ref: Europe)			
Africa	6.92	1.34 to 35.74	0.021
North America	4.55	2.02 to 10.29	<0.001
Residency training (Ref: family medicine)			
Orthopaedics	4.36	1.51 to 12.58	0.006
Male physicians in practice the same or less			
Residency training (Ref: family medicine			
PM & R	0.47	0.24 to 0.92	0.027
Female physicians in practice longer			
Age	0.97	0.95 to 1.00	0.043
Region (Ref: Europe)			
Africa	3.35	1.01 to 11.13	0.048
Female physicians in practice the same or less			
Region (Ref: Europe)			
Africa	3.65	1.07 to 12.41	0.039
Male athletic trainers			
Region (Ref: Europe)			
Africa	12.11	2.48 to 59.25	0.002
North America	2.18	1.11 to 4.30	0.024
Female athletic trainers			
Region (Ref: Europe)			
Africa	7.16	2.02 to 25.47	0.002
North America	2.44	1.13 to 5.27	0.023
Organisations/administrations			
Age	1.03	1.00 to 1.05	0.046
Residency training (Ref: family medicine)			
PM&R	0.47	0.24 to 0.94	0.033
Male sports medicine physicians			
Male athletes			
Age	0.99	0.97 to 1.00	0.038
Region (Ref: Europe)			
Asia	0.52	0.34 to 0.81	0.003
Residency training (Ref: family medicine)			
Emergency medicine	0.27	0.10 to 0.76	0.013
Female athletes			
Region (Ref: Europe)			
Asia	0.53	0.34 to 0.84	0.007
Residency training (Ref: family medicine)			
Orthopaedics	0.51	0.30 to 0.86	0.011
Emergency medicine	0.23	0.08 to 0.67	0.007
Male coaches			
Region (Ref: Europe)			
Asia	0.58	0.37 to 0.89	0.014
Residency training (Ref: family medicine)			
Emergency medicine	0.22	0.07 to 0.64	0.006
Sports medicine	3.24	1.26 to 8.34	0.015
Female coaches			
Region (Ref: Europe)			
Africa	5.64	1.76 to 18.05	0.004
North America	1.78	1.11 to 2.88	0.018
Residency training (Ref: family medicine)			
Orthopaedics	0.48	0.28 to 0.82	0.007
Emergency medicine	0.23	0.07 to 0.74	0.014
Male physicians in practice longer			
Age	0.96	0.95 to 0.97	<0.001
Region (Ref: Europe)			
North America	1.82	1.09 to 3.06	0.023
South America	2.76	1.11 to 6.85	0.029
Residency training (Ref: family medicine)			
Sports medicine	2.98	1.18 to 7.51	0.021
Male physicians in practice the same or less			
Region (Ref: Europe)			
Africa	3.12	1.07 to 9.07	0.037
Female physicians in practice longer			
Age	0.96	0.94 to 0.97	<0.001
Region (Ref: Europe)			
Asia	0.61	0.38 to 0.98	0.040
Female physicians in practice the same or less			
NA	NA	NA	NA
Male athletic trainers			
Region (Ref: Europe)			
Asia	0.60	0.38 to 0.94	0.026
Residency training (Ref: family medicine)			
Emergency medicine	0.24	0.07 to 0.88	0.031
Sports medicine	2.55	1.08 to 6.00	0.032
Female athletic trainers			
Residency training (Ref: family medicine)			
Emergency medicine	0.19	0.04 to 0.86	0.031
Organisations/administrations			
Residency training (Ref: family medicine)			
Sports medicine	2.88	1.20 to 6.91	0.018

PM&R, physical medicine and rehabilitation.

athletes, female physicians and female coaches, and this could be explained again by females in general having less gender stereotypes and studies have shown males in general tend not to recognise gender stereotypes.[16] One positive finding was that male and female physicians did not differ in perceiving disrespect from male athletes. While the power dynamic between physicians and athletes could be playing a role, it could also be possible that gender bias is less common in younger individuals due to improved attitudes on gender in society over time as athletes tend to be younger than coaches and other physicians.

A study in Switzerland pointed out that implementing gender sensitive teaching during medical school training might limit gender bias[17]; and this effect was confirmed in a study on faculty attitudes as well.[18] If this is true, there is a possibility to reduce gender bias through formal education, which would need to involve multiple groups within sports medicine rather than only targeting the physicians. As per region, in general, sports medicine physicians practicing in North America and Africa perceived

Table 5 Results of logistic regression on having sexually harassed (both genders combined)

Male athletes	OR	95% CI	P value
Gender (Ref: male)			
Female	12.42	6.14 to 25.11	<0.001
Age	0.96	0.93 to 0.99	0.021
Region (Ref: Europe)			
Africa	7.65	2.42 to 24.19	0.001
Asia	2.76	1.01 to 7.56	0.048
Oceania	127.40	7.05 to 2301.59	0.001
South America	7.60	1.29 to 44.79	0.025
Female athletes			
Gender (Ref: male)			
Female	0.41	0.17 to 0.97	0.043
Region (Ref: Europe)			
Africa	4.18	1.30 to 13.46	0.016
Oceania	80.84	6.10 to 1072.17	0.001
South America	4.75	1.25 to 18.02	0.022
Male coaches			
Gender (Ref: male)			
Female	9.95	4.58 to 21.62	<0.001
Region (Ref: Europe)			
Africa	7.89	2.34 to 26.66	0.001
Oceania	53.60	4.65 to 617.19	0.001
South America	6.47	1.07 to 39.16	0.042
Female coaches			
Age	0.95	0.90 to 0.99	0.027
Male physicians in practice longer			
Gender (Ref: male)			
Female	27.47	14.33 to 52.65	<0.001
Residency training (Ref: family medicine)			
Pediatrcs	0.13	0.03 to 0.55	0.006
Male physicians in practice the same or less			
Gender (Ref: male)			
Female	13.77	6.54 to 28.99	<0.001
Region (Ref: Europe)			
South America	4.68	1.08 to 20.16	0.039
Female physicians in practice longer			
NA	NA	NA	NA
Female physicians in practice the same or less			
Region (Ref: Europe)			
Africa	6.40	1.22 to 33.52	0.028
Male athletic trainers			
Gender (Ref: male)			
Female	5.40	2.46 to 11.85	<0.001
Female athletic trainers			
NA	NA	NA	NA
Organisations/administrations			
Gender (Ref: male)			
Female	7.31	3.50 to 15.27	<0.001
Region (Ref: Europe)			
Africa	11.51	3.27 to 40.53	<0.001
Oceania	35.78	4.08 to 313.38	0.001
Residency training (Ref: family medicine)			
Orthopaedics	0.25	0.07 to 0.83	0.023

Table 6 Results of logistic regression on having sexually harassed (both genders separately)

Female sports medicine physicians	OR	95% CI	P value
Male athletes			
Region (Ref: Europe)			
Africa	7.54	2.12 to 26.78	0.002
Female athletes			
NA	NA	NA	NA
Male coaches			
Region (Ref: Europe)			
Africa	6.55	1.74 to 24.67	0.005
Female coaches			
NA	NA	NA	NA
Male physicians in practice longer			
Residency training (Ref: family medicine)			
Orthopaedics	2.70	1.10 to 6.63	0.030
Pediatrcs	0.12	0.03 to 0.54	0.006
Male physicians in practice the same or less			
NA	NA	NA	NA
Female physicians in practice longer			
Age	1.11	1.01 to 1.21	0.024
Female physicians in practice the same or less			
NA	NA	NA	NA
Male athletic trainers			
NA	NA	NA	NA
Female athletic trainers			
NA	NA	NA	NA
Organisations/administrations			
Age	1.05	1.01 to 1.09	0.008
Region (Ref: Europe)			
Africa	8.94	1.83 to 43.73	0.007
Male sports medicine physicians			
Male athletes			
Age	0.92	0.85 to 0.99	0.023
Residency training (Ref: family medicine)			
Orthopaedics	0.04	0.00 to 0.43	0.007
Female athletes			
Region (Ref: Europe)			
Africa	5.73	1.43 to 23.03	0.014
South America	6.13	1.46to 25.79	0.013
Male coaches			
Age	0.88	0.81 to 0.96	0.006
Residency training (Ref: family medicine)			
Orthopaedics	0.04	0.00 to 0.65	0.023
Female coaches			
Age	0.94	0.89 to 0.99	0.019
Region (Ref: Europe)			
Africa	7.13	1.07 to 47.65	0.043
Male physicians in practice longer			
Age	0.93	0.87 to 0.99	0.023
Male physicians in practice the same or less			
Region (Ref: Europe)			
North America	0.04	0.00 to 0.73	0.030
Residency training (Ref: family medicine)			
Orthopaedics	0.09	0.01 to 0.83	0.034
Female physicians in practice longer			
Region (Ref: Europe)			
Africa	10.12	1.03 to 99.56	0.047
Female physicians in practice the same or less			
Region (Ref: Europe)			

Continued

Table 6 Continued

Female sports medicine physicians	OR	95% CI	P value
Africa	10.24	1.55 to 67.76	0.016
Male athletic trainers			
Age	0.92	0.86 to 0.99	0.019
Region (Ref: Europe)			
Asia	17.81	1.44 to 220.33	0.025
South America	71.71	3.62 to 1419.55	0.005
Residency training (Ref: family medicine)			
Orthopaedics	0.10	0.01 to 0.99	0.049
Female athletic trainers			
Age	0.94	0.89 to 0.99	0.022
Organisations/administrations			
Age	0.93	0.87 to 1.00	0.038
Region (Ref: Europe)			
Africa	19.92	1.67 to 237.06	0.018
Asia	11.27	1.01 to 126.05	0.049

disrespectful attitudes and have had their judgments questioned more than European physicians, but physicians in Asia experienced less. It is difficult to say whether these differences reflect true regional differences or if physicians in North America and Africa have a keener awareness of gender bias and pay more attention to how they are treated. Compared with other regions, studies on gender bias in Asia are limited and physicians from this region may have a higher tolerance for or lower awareness of gender bias creating underreporting.[19–25] We also need to take into account that the majority of the Asian doctors are from Japan, which has a high gender gap.[15] As to Africa, since the majority of the Africans were from South Africa, which is a country with a low gender gap according to world economic information, it is speculated that sports medicine physicians in Africa who answered the survey were sensitive to the topic.[15] However, since the respondents in Oceania and Africa were small in this research, further investigation is required.

Unfortunately, the field of medicine is far from gender diverse according to both our results and previous studies.[26 27] Gender diversity is important not only to reduce disparities but also for a better medical outcome and in fact, Greenwood *et al* reported that patient–physician gender concordance was a related factor for mortality rate and female patients treated by male physicians had a higher mortality rate.[28 29] Needless to say, a diverse environment is important for equity and sports medicine societies should not only focus on increasing the number of female sports medicine physicians but also to increase awareness of the implicit gender bias in sports medicine and take deliberate actions such as changing policies and systems to combat discrimination and harassment.[30] Since educational intervention was effective to reduce gender bias in academic medicine, future education could include how women perceive disrespectful attitudes or have their judgments questioned and education on sexual harassment to bring awareness could be the first step.[18] Moreover, according to this study, it has been demonstrated that female sports medicine physicians experience disrespectful attitudes, having their judgements questioned and sexually harassed more than their male counterparts and thus not being treated the same way as male counterparts. Both male and female sports medicine physicians should be aware of this fact.

Gender was a related factor for getting sexually harassed and female sports medicine physicians were being sexually harassed by all categories of male sports participants evaluated in our study (coaches, athletes, physicians, ATs) as well as organisations/administrations more than male sports medicine physicians. It should be noted that female sports medicine physicians reported that they are most frequently sexually harassed by male physicians in practice longer than them, and since it has been demonstrated that female physicians during residency and fellowship were harassed more than those already in practice meaning that younger women tend to be the victims which indirectly matches our results.[31] Also, since women and men have been reported to have different perception of gender bias, there is a possibility that female respondents were more sensitive to the topic.[16 32] Furthermore, since experiencing disrespectful attitudes from female sports medicine physicians were significantly different by region, it is conjectured that cultural background has an influence.[32]

There are several limitations to this study. First of all, the survey asked 'what is your gender' with options listed as 'male' and 'female'. These are actually categories of sex rather than gender but we referred to it as gender in the paper since the question stem asked for gender. It should also be recognised that gender is not a binary category and future studies should consider capturing physicians who identify as a category other than 'man' or 'woman'.[33 34] Residency training differs by region and the percentage between surgical versus non-surgical sports medicine physicians in each country should be considered since gender bias in the field of surgery has been reported anecdotally to be an issue for quite some time.[35] Furthermore, the physicians in Oceania had low reach, which made the 95% CI values extremely large indicating a sparse data bias, leading to some regions being heavily represented by a single country. Since not all the questions were required to be answered, there could have been selection bias due to non-responses, and the sample may not be representative of the study population. In addition, since we were not able to reach out to all sports medicine organisations including countries that do not have one, measurement bias exists, and the survey-based design is also susceptible to recall bias. Also, even though the survey is anonymous, under-reporting of sexual harassment and abuse is possible due to fear of stigma.[36–38]

Finally, since the majority of responses were from white sports medicine physicians, we consider that we have obtained a limited scope on gender bias attitudes from non-white sports medicine physicians and future studies should seek wider diversity in sports medicine physician participation.

Despite the increasing number of female physicians, our study indicated that female sports medicine physicians perceive that they are still not being treated the same way as male counterparts by sports participants. If female sports medicine physicians continue to feel disrespected and have their judgement questioned more than their male counterparts, this could lead to more stress, lower satisfaction in female sports medicine physicians' work and burnout.

Sports Medicine societies should have a diversity and inclusion policy, as well as robust bullying, harassment and discrimination policies and reporting mechanisms. Annual data should also be collected on these across sport to ensure organisations move toward gender equality and safer work environments for physicians of all genders, races, ethnicities and sexual orientations.

CONCLUSIONS

Gender bias does exist in the field of sports medicine and female sports medicine physicians around the world perceive significantly more disrespectful attitudes, have their judgement questioned and are sexually harassed more than their male counterparts. Future work should explore opportunities to eliminate gender bias to make it a better, safer, more inclusive and fairer world for all athletes, teams, organisations and their sports physicians. Change will take time, and at times be

difficult, but must be championed and lead from the top by all sports medicine physicians in leadership positions across sporting organisations.

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REFERENCES

1 Byrnes A, Bath E. Violence against Women, the Obligation of Due Diligence, and the Optional Protocol to the Convention on the Elimination of All Forms of Discrimination against Women--Recent Developments. *Human Rights Law Review* 2008;8:517–33.
2 Phillips SP, Austin EB. The feminization of medicine and population health. *JAMA* 2009;301:863–4.
3 McCurry J. Two more Japanese medical schools admit discriminating against women 2018. Available: https://www.theguardian.com/world/2018/dec/12/two-more-japanese-medical-schools-admit-discriminating-against-women
4 The Asahi Shimbun. Medical school sued for bias against female applicants, 2020. Available: https://www.asahi.com/ajw/articles/13822665
5 Jena AB, Olenski AR, Blumenthal DM. Sex differences in physician salary in US public medical schools. *JAMA Intern Med* 2016;176:1294–304.
6 Bickel J, Wara D, Atkinson BF, *et al*. Increasing women's leadership in academic medicine: report of the AAMC project implementation Committee. *Acad Med* 2002;77:1043–61.
7 Ness RB, Ukoli F, Hunt S, *et al*. Salary equity among male and female internists in Pennsylvania. *Ann Intern Med* 2000;133:104–10.
8 Files JA, Mayer AP, Ko MG, *et al*. Speaker introductions at internal medicine grand rounds: forms of address reveal gender bias. *J Womens Health* 2017;26:413–9.
9 Nicole G. Stern G, Barrett JR. Is there perceived gender disparity for women practicing sports medicine? *Adv Women Leadersh* 2013;33:48–51.
10 Adesoye T, Mangurian C, Choo EK, *et al*. Perceived discrimination experienced by physician mothers and desired workplace changes: a cross-sectional survey. *JAMA Intern Med* 2017;177:1033–6.
11 Archer A, Prange M. 'Equal play, equal pay': moral grounds for equal pay in football. *J Philos Sport* 2019;46:416–36.
12 World Athletics. Olympic Games, 2021. Available: https://www.worldathletics.org/records/by-category/olympic-games-records
13 Lewis C, Jin Y, Day C. Distribution of men and women among NCAA head team physicians, head athletic trainers, and assistant athletic trainers. *JAMA Intern Med* 2020;180:324–6.
14 Pana AL, McShane J. Gender influences on career opportunities, practice choices, and job satisfaction in a cohort of physicians with certification in sports medicine. *Clin J Sport Med* 2001;11:96–102.
15 The World Economic Forum. Global gender gap report, 2020. Available: https://www.weforum.org/reports/gender-gap-2020-report-100-years-pay-equality
16 Handley IM, Brown ER, Moss-Racusin CA, *et al*. Quality of evidence revealing subtle gender biases in science is in the eye of the beholder. *Proc Natl Acad Sci U S A* 2015;112:13201–6.
17 Rrustemi I, Locatelli I, Schwarz J, *et al*. Gender awareness among medical students in a Swiss university. *BMC Med Educ* 2020;20:156.
18 Girod S, Fassiotto M, Grewal D, *et al*. Reducing implicit gender leadership bias in academic medicine with an educational intervention. *Acad Med* 2016;91:1143–50.
19 Bekker S, Ahmed OH, Bakare U, *et al*. We need to talk about manels: the problem of implicit gender bias in sport and exercise medicine. *Br J Sports Med* 2018;52:1287–9.
20 Thorborg K, Krohn L, Bandholm T, *et al*. 'More walk and less talk': changing gender bias in sports medicine. *Br J Sports Med* 2020;54:1380–1.
21 Macchione AL, Sacco DF. The effect of workplace gender composition on investment interest in hypothetical companies. *Psychol Rep* 2021;332941211009134:00332941 2110091.
22 Kattapuram TM, Patel TY, Solberg AO. Gender parity does not equal gender equity: continued Sexism in medical literature. *Ann Surg* 2021;273:e164–5.
23 Nguyen A. Children have the fairest things to say: Young children's engagement with anti-bias picture books. *Early Child Educ J* 2021:1–17.
24 Arora A, Kaur Y, Dossa F, *et al*. Proportion of female speakers at academic medical conferences across multiple specialties and regions. *JAMA Netw Open* 2020;3:e2018127.
25 Choi S-H, Choi EY, Lee H. Comparison of job quality indices affecting work-life balance in South Korea according to employee gender. *Int J Environ Res Public Health* 2020;17. doi:10.3390/ijerph17134819. [Epub ahead of print: 04 07 2020].
26 Laurencin CT, Murray M. An American crisis: the lack of black men in medicine. *J Racial Ethn Health Disparities* 2017;4:317–21.
27 Togioka BM, Duvivier D, Young E. Diversity and Discrimination In Healthcare. In: *StatPearls*. Treasure Island (FL): StatPearls Publishing LLC, 2021.
28 Stanford FC. The importance of diversity and inclusion in the healthcare workforce. *J Natl Med Assoc* 2020;112:247–9.
29 Greenwood BN, Carnahan S, Huang L. Patient-Physician gender concordance and increased mortality among female heart attack patients. *Proc Natl Acad Sci U S A* 2018;115:8569–74.
30 Hui K, Sukhera J, Vigod S, *et al*. Recognizing and addressing implicit gender bias in medicine. *CMAJ* 2020;192:E1269–70.
31 Frank E, Brogan D, Schiffman M. Prevalence and correlates of harassment among US women physicians. *Arch Intern Med* 1998;158:352–8.
32 García-González J, Forcén P, Jimenez-Sanchez M. Men and women differ in their perception of gender bias in research institutions. *PLoS One* 2019;14:e0225763.
33 Broussard KA, Warner RH, Pope ARD. Too many boxes, or not enough? preferences for how we ask about gender in Cisgender, LGB, and Gender-Diverse samples. *Sex Roles* 2018;78:606–24.
34 Puckett JA, Brown NC, Dunn T, *et al*. Perspectives from transgender and gender diverse people on how to ask about gender. *LGBT Health* 2020;7:305–11.
35 Lim WH, Wong C, Jain SR, *et al*. The unspoken reality of gender bias in surgery: a qualitative systematic review. *PLoS One* 2021;16:e0246420.
36 Arhin ND, Nebhan CA, Clair WK. Patient harassment of medical trainees: reflections for a more inclusive future. *JAMA Oncol* 2022;8:516-517.
37 Jussen L, Lagro-Janssen T, Leenders J, *et al*. Underreported and unknown student harassment at the faculty of science. *PLoS One* 2019;14:e0215067.
38 Freedman-Weiss MR, Chiu AS, Heller DR, *et al*. Understanding the barriers to reporting sexual harassment in surgical training. *Ann Surg* 2020;271:608–13.