BMJ Open Sport & Exercise Medicine

Under-representation of women is alive and well in sport and exercise medicine: what it looks like and what we can do about it

Nash Anderson ,[1] Diana Gai Robinson ,[2,3] Evert Verhagen ,[4] Kristina Fagher ,[5] Pascal Edouard ,[6,7] Daniel Rojas-Valverde ,[8] Osman Hassan Ahmed ,[9,10,11] Moa Jederström ,[12] Laila Usacka ,[13] Justine Benoit-Piau ,[14] Candy Giselle Foelix ,[15] Carole Akinyi Okoth ,[16,17,18,19,20] Nefeli Tsiouti ,[21,22] Trine Moholdt ,[23,24] Larissa Pinheiro ,[25] Sharief Hendricks ,[26,27] Blair Hamilton ,[28] Rina Magnani ,[29] Marelise Badenhorst ,[30] Daniel L Belavy [31]

To cite: Anderson N, Robinson DG, Verhagen E, *et al*. Under-representation of women is alive and well in sport and exercise medicine: what it looks like and what we can do about it. *BMJ Open Sport & Exercise Medicine* 2023;**9**:e001606. doi:10.1136/bmjsem-2023-001606

Accepted 27 March 2023

For numbered affiliations see end of article.

Correspondence to
Dr Nash Anderson;
nash.anderson@gmail.com

INTRODUCTION

Despite constituting approximately 50% of the population, women specifically are under-represented in sport and exercise medicine (SEM) and they often experience a negative bias. Our authorship group has recognised this issue based on evidence from recent studies, personal experiences and the experiences of the wider SEM community. We understand that this is a complex issue. Through this editorial, we aim to briefly highlight the issue of insufficient representation of women in SEM, discuss some of the impacts of this inadequate inclusion and other negative aspects experienced and suggest steps that we can all take to address female under-representation to improve the field of SEM

FEMALE UNDER-REPRESENTATION IN SEM

Sex and gender bias in SEM settings are evident in multiple ways. Systematic reviews demonstrated that female athletes are under-represented in sports and exercise research.[1 2] International Olympic Committee consensus statements identified the need for increased representation and inclusion of authors from different genders, ethnicities, skill sets and levels of experience.[3] Female first and last authorship on scientific publications is less than 25%,[4 5] they hold less than 25% of leadership roles in editorial boards in sports sciences, and they are also under-represented in leadership in primary care sport medicine.[6 7] Women account for less than 20% of team doctors in both collegiate and professional sports, with the highest percentage (31%) in the Women's National Basketball Association.[8] At conferences, all-male conference panels and keynote speakers are still common.[9 10]

HOW DOES IT AFFECT THE FIELD, AND WHAT OTHER ADVERSE CONSEQUENCES DO WOMEN IN SEM FACE?

Under-representation of female participants, clinicians and researchers in SEM can have detrimental effects for the field and women within it.

Knowledge gaps

Although female athletes constitute approximately 50% of the population, there are distinct knowledge gaps in areas such as sport performance, cardiovascular health, musculoskeletal health, postpartum physiology and lactation research.[11] It is crucial to foster diversity in both participant cohorts and research teams.[12] This includes designing experimental studies with female-specific physiological considerations and creating evidence-based exercise-related guidelines tailored for sportswomen.[13] There is also a need for separate analyses to account for different causal mechanisms for injuries or health issues in men and women. Sex-specific exercise training recommendations can help improve adherence and physiological responses in clinical populations.[14] However, women remain under-enrolled in both recreational and performance sports research, mirroring the under-representation of women across health and disease states.[15]

Addressing this issue is vital to support performance and safe sport for women.

Workplace challenges

Harassment at the workplace can lead to unhealthy work environments, mental health challenges and poor job satisfaction for female practitioners.[14] This may contribute to women leaving their positions early or seeking work in other areas. Moreover, the workload and work culture may differ for female and male clinicians and researchers. Higher suicide mortality rates are observed among female physicians compared with male physicians.[16] Work stressors have been identified as a risk factor for suicide among female physicians.[17] Female sportmedicine physicians experience disrespect and have their judgement questioned more often than male sport medicine physicians. They have also reported experiencing sexual harassment.[18]

Reduced sports participation

Encouraging sports participation and actively striving to keep all children and adolescents, irrespective of their sex or gender, engaged in sports is crucial for promoting health throughout life.[19] Sports dropout is a major

Table 1 Strategies and actions for promoting diversity and inclusivity in sport and exercise medicine and academia

Strategies	Actions
Build a culture of awareness, excellence and inclusivity	Embrace diverse views and diverse people, leading to better research and outcomes. Addressing gender bias through open discussions. Educate faculties on the impact of gender bias.[23] Open and candid discussions about gender bias can help shift the focus to evaluating the quality of work conducted in science and medicine, rather than focusing on the practitioner's gender. This may create solutions to address bias rather than perpetuating it through silence.
	Improve gender representation and work–life balance in academia
	Ensure equal representation of male and female research participants.[23]
	Provide secure, long-term employment opportunities for early-career academics, and ensure that they have access to equal parental leave, support for dual-career relationships, part-time work options, and affordable, high-quality childcare. Additionally, consider organising family-friendly conferences that can accommodate attendees with caregiving responsibilities.24
	Diversify the applicant pool through initiatives such as training search committees.[23]
	Support and promote professional growth through mentoring, networking and development opportunities, particularly for women faculty.[23]
	Promote a healthy work–life balance by discouraging a culture of 24/7 work and encouraging employees to prioritise their well-being.[24]
	Foster a problem-solving environment in which colleagues can support each other and work as a team, increasing motivation, efficiency and health.[24]
Promote female inclusion in sports medicine	Provide diversity and inclusion training for athletes, coaches and other staff.[25] Provide career coaching, mentorship and opportunities for growth as practitioners and in leadership positions.
	Hold leaders accountable for driving business practices and clinics that improve diversity.
	Encourage diversity and inclusion in leadership positions within sports medicine organisations and address gender bias in hiring and promotion practices.[25]
	Implement intentional allyship strategies to address speaker gender inequity.[25]
	Conduct further research through an intersectional lens to examine factors leading to over-representation of white men in SEM[25]
Enhance female inclusion in research, publications, and conferences	Consider diversity at all stages of research and publication, including among author groups and peer reviewers.[25]
	Reflect on the reasons behind the gender disparity in acceptance rates of scientific work, and explore the possibility of implementing gender-blind review processes.[24]
	Ensure diversity at sport and exercise medicine conferences, increasing the representation of women and gender diverse people as speakers and attendees.[26]
Recognise the benefits of greater diversity	Acknowledge that greater diversity benefits both clinicians and patients, bringing different qualities, skills and experience to the table.[25] Female providers are preferred by female athletes for sexual health problems and by both male and female athletes for psychosocial health issues.[27] Female physicians have lower mortality rates for their patients.[28]
Enhance the use of enabling technology	Promote the empowerment of women through information and communications technology.[29]
Distribute work equally	Ensure that work is distributed equally across genders. Do not overload women.[24]
Implement anonymous reporting platforms and expert commentary to address bias in SEM settings	Initiatives like #SpeakUpOrtho provide a platform for anonymously sharing experiences of microaggressions, bullying, harassment, discrimination and retaliation. Expert commentary can help prevent the perpetuation of these behaviours.[30]

SEM, sport and exercise medicine.

concern among specifically female adolescents. Role models may play a role in ameliorating this.[20 21]

ADDRESSING FEMALE UNDER-REPRESENTATION

At peak sport medicine bodies, academic researchers and training institutions, there are a number of ways we can address female under-representation and its consequences. In table 1, we describe the following strategies: (a) build a culture of awareness, excellence and inclusivity, (b) promote female inclusion in sport medicine, (c) enhance female inclusion in research, publications and conferences, (d) recognise the benefits of greater diversity, (e) enhance the use of enabling technology, (f) distribute work equally, (g) implement anonymous reporting platforms and expert commentary to address bias in SEM settings. By incorporating these strategies, we can work towards creating a more diverse and inclusive environment in the field of sport medicine that benefits everyone involved.

Portugal is an example of a country that has achieved parity between men and women in research, with women representing 50% of published researchers.[22] Women are highly represented among first authors, indicating greater equality and representation for early-career researchers. Unlike other comparable nations, women researchers in Portugal are likely to continue publishing over time and remain engaged in research.

It is important that we acknowledge the under-representation and work to break the cycle of gender bias through role models. The lack of female role models in SEM can perpetuate the cycle of gender bias. Breaking this cycle is essential to ensure that future generations do not perceive gender bias as normal and continue to pass it down to new practitioners joining the field. In the future, gender equity should be normal.

CONCLUSION

Like many disciplines, there is an evident under-representation of women and potential negative bias in SEM, research and occupations at all levels. There are great benefits to achieving gender equity in SEM. We believe that we can ensure that the brightest minds from all backgrounds can contribute to the advancement of science and enhance not only the sports medicine community but also society at large by acknowledging and addressing this under-representation.

RECOMMENDED RESOURCES

- Follow the hashtag #WomenInSTEM
- See BJSM blog August 2022 https://blogs.bmj.com/bjsm/2022/08/22/gender-bias-in-sports-medicine/

Author affiliations
[1]Tuggeranong Chiropractic Centre, Fadden, Australian Capital Territory, Australia
[2]Sydney Sportsmed Specialists, Sydney, New South Wales, Australia
[3]School of Medicine, Notre Dame University, Sydney, New South Wales, Australia
[4]Amsterdam Collaboration on Health & Safety in Sports, Department of Public and Occupational Health, Amsterdam Movement Sciences, Amsterdam UMC, University Medical Centers – Vrije Universiteit Amsterdam, Amsterdam, The Netherlands
[5]Rehabilitation Medicine Research Group, Department of Health Sciences, Lund University, Lund, Sweden
[6]Department of Clinical and Exercise Physiology, Sports Medicine Unit, University Hospital of Saint-Etienne, Faculty of Medicine, Saint-Etienne, France
[7]Université Jean Monnet Saint-Etienne, Lyon 1, Université Savoie Mont-Blanc, Inter-university Laboratory of Human Movement Biology (EA 7424), Saint-Etienne, France
[8]Sport Injury Clinic (Rehab&Readapt), Human Movement Sciences and Quality of Life School (CIEMHCAVI), National University of Costa Rica, Heredia, Costa Rica
[9]Physiotherapy Department, University Hospitals Dorset NHS Foundation Trust, Poole, UK
[10]The Football Association, Burton-Upon-Trent, UK
[11]School of Sport, Health and Exercise Science, University of Portsmouth, Portsmouth, UK
[12]Athletics Research Center (ARC), Department of Health, Medicine and Caring Sciences (HMV), Linköping University, Linkoping, Sweden
[13]Faculty of Medicine, University of Latvia, Riga, Latvia
[14]School of Rehabilitation, Faculty of Health Medicine and Science, Université de Sherbrooke, Sherbrooke, Quebec, Canada
[15]Child of this Culture Foundation, Orlando, Florida, USA
[16]National Spinal Injury Referral Hospital, Nairobi, Kenya
[17]Ministry of Health, Narobi, Kenya
[18]Medical Commission, Nairobi, Kenya
[19]National Olympic Committee of Kenya, Nairobi, Kenya
[20]Kenya Hockey Union, Nairobi, Kenya
[21]Project Breakalign, Nicosia, Cyprus
[22]School of Medicine, European University Cyprus, Engomi, Cyprus
[23]Department of Circulation and Medical Imaging, Norweigan University of Science and Technology, Trondheim, Norway
[24]Women's Clinic, St. Olavs Hospital, Trondheim, Norway
[25]Department of Physical Therapy, School of Physical Education, Physical Therapy and Occupational Therapy, Rehabilitation Sciences Graduate Program. Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil
[26]Department of Human Biology, Division of Exercise Science and Sports Medicine, Lifestyle and Sport (HPALS) Research Centre, Faculty of Health Sciences, University of Cape Town, Rondebosch, South Africa
[27]Institute for Sport, Physical Activity and Leisure, Leeds Beckett University Carnegie School of Sport, Leeds, UK
[28]Centre for Stress and Age Related Disease, University of Brighton, Brighton, UK
[29]School of Physical Education and Physical Therapy, State University of Goiás, Goiânia, GO, Brazil
[30]Sports Performance Research Institute New Zealand (SPRINZ), Auckland University of Technology, Auckland, New Zealand
[31]Hochschule für Gesundheit, Germany; Department of Applied Health Sciences, Gesundheitscampus 6-8, Bochum, Germany

Twitter Nash Anderson @Sportmednews, Diana Gai Robinson @dianarobdoc, Evert Verhagen @evertverhagen, Kristina Fagher @KristinaFagher, Pascal Edouard @PascalEdouard42, Moa Jederström @MJederstrom, Laila Usacka @kailalailap, Candy Giselle Foelix @candygfoelix, Carole Akinyi Okoth @Carole0683, Nefeli Tsiouti @ProjeBreakalign, @Bgirlsmash, Trine Moholdt @trinemoholdt, Sharief Hendricks @Sharief_H, Blair Hamilton @BlairH_PhD, Rina Magnani @rinoca_ and Daniel L Belavy @belavyprof

Contributors NA and DLB are credited with creating the first draft of this paper. All other authors contributed to the development and refinement of the manuscript. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work. Sonia Cheng and Ana Morais Azevedo provided feedback on this paper.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Disclaimer

Competing interests NA, DLB, DGR are senior editorial board members, KF, PE, DR-V, OHA, MJ, LU, JB-P, CGF, CO, NT, TM, LSPP, SH, BH, RM, MB are associate editors, and EV is the editor-in-chief of BMJ Open Sports & Exercise Medicine.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Commissioned; internally peer reviewed.

ORCID iDs
Nash Anderson http://orcid.org/0000-0002-1786-8805
Diana Gai Robinson http://orcid.org/0000-0002-2627-2309
Evert Verhagen http://orcid.org/0000-0001-9227-8234
Kristina Fagher http://orcid.org/0000-0002-9524-7553
Pascal Edouard http://orcid.org/0000-0003-1969-3612
Daniel Rojas-Valverde http://orcid.org/0000-0002-0717-8827
Osman Hassan Ahmed http://orcid.org/0000-0002-1439-0076
Moa Jederström http://orcid.org/0000-0003-0938-084X
Laila Usacka http://orcid.org/0000-0003-1688-5926
Justine Benoit-Piau http://orcid.org/0000-0001-9943-2978
Candy Giselle Foelix http://orcid.org/0009-0000-7590-9276
Carole Akinyi Okoth http://orcid.org/0009-0005-1187-4250
Nefeli Tsiouti http://orcid.org/0000-0003-0019-9622
Trine Moholdt http://orcid.org/0000-0003-1024-8088
Larissa Pinheiro http://orcid.org/0000-0001-5927-2893
Sharief Hendricks http://orcid.org/0000-0002-3416-6266
Blair Hamilton http://orcid.org/0000-0001-7412-1188
Rina Magnani http://orcid.org/0000-0002-5492-5119
Marelise Badenhorst http://orcid.org/0000-0001-8443-9173
Daniel L Belavy http://orcid.org/0000-0002-9307-832X

REFERENCES

1 Sanderson K. How sports science is neglecting female athletes. *Nature* 14, 2022. 10.1038/d41586-022-04460-3 Available: URL: https://www.nature.com/articles/d41586-022-04460-3
2 Mondini Trissino da Lodi C, Landini MP, Asunis E, *et al*. Women have tendons… and tendinopathy: gender bias is A "gender void" in sports medicine with A lack of women data on patellar tendinopathy-A systematic review. *Sports Med Open* 2022;8:74. 10.1186/s40798-022-00455-6 Available: https://sportsmedicine-open.springeropen.com/articles/10.1186/s40798-022-00455-6
3 Fortington LV, Badenhorst M, Bolling C, *et al*. Are we levelling the playing field? A qualitative case study of the awareness, uptake and relevance of the IOC consensus statements in two countries. *Br J Sports Med* 2023. 10.1136/bjsports-2022-105984 Available: https://bjsm.bmj.com/content/early/2023/01/31/bjsports-2022-105984
4 Martínez-Rosales E, Hernández-Martínez A, Sola-Rodríguez S, *et al*. Representation of women in sport sciences research, publications, and editorial leadership positions: are we moving forward? *J Sci Med Sport* 2021;24:1093–7. 10.1016/j.jsams.2021.04.010 Available: URL: https://www.sciencedirect.com/science/article/pii/S1440244021001067
5 Cowan SM, Kemp JL, Ardern CL, *et al*. Sport and exercise medicine/physiotherapy publishing has a gender/sex equity problem: we need action now! [Internet]. *Br J Sports Med* 2023;57:401–7. 10.1136/bjsports-2022-106055 Available: https://bjsm.bmj.com/content/early/2023/01/11/bjsports-2022-106055
6 Mattson LM, Rosario-Concepcion RA, Hurdle MFB, *et al*. Gender diversity in primary care sports medicine leadership. *Curr Sports Med Rep* 2022;21:303–8. 10.1249/JSR.0000000000000979 Available: https://pubmed.ncbi.nlm.nih.gov/35946849/
7 Memon AR, Ahmed I, Ghaffar N, *et al*. Where are female editors from low-income and middle-income countries? A comprehensive assessment of gender, geographical distribution and country's income group of editorial boards of top-ranked rehabilitation and sports science journals. *Br J Sports Med* 2022;56:458–68. 10.1136/bjsports-2021-105042 Available: https://bjsm.bmj.com/content/56/8/458
8 O'Reilly OC, Day MA, Cates WT, *et al*. Female team physician representation in professional and collegiate athletics [online]. *Am J Sports Med* 2020;48:739–43. 10.1177/0363546519897039 Available: https://pubmed.ncbi.nlm.nih.gov/31922898/
9 Crossley KM, Litzy K, Whittaker JL. See, hear and empower women: it is time to walk the walk to eliminate manels in sport and exercise medicine/physiotherapy [Internet]. *Br J Sports Med* 2023;57:251–2. 10.1136/bjsports-2022-106030 Available: https://bjsm.bmj.com/content/57/5/251
10 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 [Internet]. *Br J Sports Med* 2018;52:1287–9. 10.1136/bjsports-2018-099084 Available: https://bjsm.bmj.com/content/52/20/1287
11 Emmonds S, Heyward O, Jones B. The challenge of applying and undertaking research in female sport - sports medicine - open [internet]. springeropen. springer international publishing. 2019. Available: https://sportsmedicine-open.springeropen.com/articles/10.1186/s40798-019-0224-x
12 Elsevier. *3 reasons gender diversity is crucial to science. elsevier connect*. 2018. Available: https://www.elsevier.com/connect/3-reasons-gender-diversity-is-crucial-to-science
13 Elliott-Sale KJ, Minahan CL, Jonge X, *et al*. Methodological considerations for studies in sport and exercise science with women as participants: A working guide for standards of practice for research on women - sports medicine [internet]. springerlink. springer international publishing. 2021. Available: https://link.springer.com/article/10.1007/s40279-021-01435-8
14 Batz-Babarich C, Tay L, Kuykendall L, *et al*. A meta-analysis of gender differences in subjective well-being… [internet]. A meta-analysis of gender differences in subjective well-being: estimating effect sizes and associations with gender inequality. 2018. 10.1177/0956797618774796 Available: https://journals.sagepub.com/doi/abs/10.1177/0956797618774796?journalCode=pssa
15 Zhu JW, Reed JL, Van Spall HGC. The underrepresentation of female athletes in sports research: considerations for cardiovascular health. *Eur Heart J* 2022;43:1609–11. 10.1093/eurheartj/ehab846 Available: https://doi.org/10.1093/eurheartj/ehab846
16 Duarte D, El-Hagrassy MM, Couto TCE, *et al*. Male and female physician suicidality: A systematic review and meta-analysis. *JAMA Psychiatry* 2020;77:587–97. 10.1001/jamapsychiatry.2020.0011 Available: https://jamanetwork.com/journals/jamapsychiatry/fullarticle/2762468
17 Fridner A, Frank E, Aasland OG, *et al*. Survey on recent suicidal ideation among female university hospital physicians in Sweden and Italy (the HOUPE study): Cross-sectional associations with work stressors [Internet]. Gender Medicine. Elsevier. 2009. Available: https://www.sciencedirect.com/science/article/abs/pii/S1550857909000394?via%3Dihub
18 Tsukahara Y, Novak M, Takei S, *et al*. Gender bias in sports medicine: an international assessment of sports medicine physicians' perceptions of their interactions with athletes, coaches, athletic trainers and other physicians [Internet]. *Br J Sports Med* 2022;56:961–9. 10.1136/bjsports-2021-104695 Available: https://pubmed.ncbi.nlm.nih.gov/35738877/
19 Lahti A. *Physical activity in childhood and adolescence. [doctoral thesis (compilation), department of clinical sciences, malmö]*. Lund University: Faculty of Medicine, 2019. Available: https://lup.lub.lu.se/search/files/70250861/avhandling_amanda_lahti.pdf
20 Wagnsson S, Gustafsson H, Libäck J, *et al*. Lessons learned from a multi-level intervention program to reduce Swedish female floorballers' dropout rate [Internet]. *Journal of Sport Psychology in Action* 2021;12:226–44. 10.1080/21520704.2020.1850576 Available: https://www.tandfonline.com/doi/full/10.1080/21520704.2020.1850576
21 Eliasson I, Johansson A. The disengagement process among young athletes when withdrawing from sport: a new research approach. *International Review for the Sociology of Sport* 2021;56:537–57. 10.1177/1012690219899614 Available: https://journals.sagepub.com/doi/full/10.1177/1012690219899614
22 Elsevier. Elsevier's reports on gender in research. elsevier connect. n.d. Available: https://www.elsevier.com/connect/gender-report
23 Casad BJ, Franks JE, Garasky CE, *et al*. Gender inequality in academia: problems and solutions for women faculty in stem. *J Neurosci Res* 2021;99:13–23. 10.1002/jnr.24631 Available: https://onlinelibrary.wiley.com/doi/full/10.1002/jnr.24631
24 Fagher K, Verhagen E. When women can be stars in sports, why is it so difficult in sports and exercise medicine research? [Internet]. *BMJ Open Sport Exerc Med* 2022;8:e001218. 10.1136/bmjsem-2021-001218 Available: https://bmjopensem.bmj.com/content/8/1/e001218
25 Hayes V, O Donovan J. Women in sports and exercise medicine: where are we now? [Internet]. *Br J Sports Med* 2023. 10.1136/bjsports-2022-106468 Available: https://bjsm.bmj.com/content/early/2023/02/22/bjsports-2022-106468
26 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. 10.1136/bjsports-2020-102966 Available: https://bjsm.bmj.com/content/54/23/1380

27 Chung JS, Merkel D, Carter CW, *et al*. Gender preferences of youth athletes for their sports medicine providers: a systematic review [Internet]. *Orthopaedic Journal of Sports Medicine* 2021;9(7_suppl3):2325967121S0010.
28 Yusuke Tsugawa MD. Outcomes of hospitalized medicare beneficiaries treated by male vs female physicians. *JAMA Intern Med* 2017. Available: https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2593255
29 Gender equality and women's empowerment [internet]. United Nations. United Nations [2022]. Available: https://www.un.org/sustainabledevelopment/gender-equality/ [Accessed 22 Mar 2023].
30 Gianakos AL, LaPorte DM, Mulcahey MK, *et al*. Dear program director: solutions for handling and preventing abusive behaviors during surgical residency training. *J Am Acad Orthop Surg* 2022;30:594–8. 10.5435/JAAOS-D-21-00630 Available: https://pubmed.ncbi.nlm.nih.gov/34889219/