

Visibility and representation of women in multiple sclerosis research

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Abstract

Objective

To establish the gender distribution of multiple sclerosis (MS) researchers across high-impact neurologic publications, MS-specific journals, and the European Committee for Treatment and Research in MS (ECTRIMS).

Methods

Journal editorial boards and contents were retrieved online to assess first-named and senior authors. Published tables of contents for each journal from 2017 were reviewed. Congrex, the ECTRIMS organizers, were contacted and speaker names were obtained from online abstracts to assess visible opinion leaders.

Results

A total of 2,080 articles were analyzed across 4 general neurology journals, and 452 across 2 MS journals. Overall, 36% of general neurology articles had a female first name author and 25% had a female senior author. In MS-specific journals, 44% of first authors and 35% of senior authors were female, with similar proportions of unique authors. There is limited female representation on the ECTRIMS executive board, but reasonable balance on Council. Almost 50% of attendees in 2017 were female, but only 35% of invited speakers.

Conclusions

There is substantial female drop-off between junior and senior research level across multiple areas. Strategies to support gender balance are urgently required, including developing mentorship schemes, ensuring gender balance in conferences, and thorough examination of the barriers facing female academics with direct challenges to address unconscious bias.

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From Blizard Institute (A.T., M.M., G.G.) and Preventive Neurology Unit, Wolfson Institute of Preventive Medicine (C.C., G.G., R.D.), Queen Mary University London; Department of Neurology (M.M., G.G., R.D.), Royal London Hospital, Whitechapel, London; Independent Journalist (R.H.), London; and Department of Neurology (J.P.), John Radcliffe Hospital, Oxford, UK.

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Glossary

AAN = American Academy of Neurology; ECTRIMS = European Committee for Treatment and Research in MS; MS = multiple sclerosis; MSARD = *Multiple Sclerosis and Related Disorders*; MSJ = *Multiple Sclerosis Journal*.

There is increasing awareness of gender imbalance in academic medicine, which is also seen in neurology and neuroscience research. It has previously been suggested that while there is little to no imbalance at the early career stage, a decreasing proportion of women are found as seniority increases. Data published by the American Academy of Neurology (AAN) indicate that neurology has one of the highest gender pay gaps across medical specialties, with women earning on average \$37,000 less than men per annum. In 2014, only 11% of departmental chairs in neurology in the United States were female.¹ Similar figures have been reported in the United Kingdom, where only 27% of neurology consultants are female,² one of the lowest proportions across medical specialties.

There have been a number of AAN schemes aimed at increasing the visibility of women within neurology that have aimed to correct this imbalance. The AAN has developed a gender disparity task force, which has made a number of recommendations. The Women Leading in Neurology scheme, which focuses on upskilling potential future female leaders in the field, is one result of this; however, these programs will take some years to come to fruition. Additional mentoring schemes for female researchers are increasing in popularity at local and national levels, and a letter in the *Annals of Neurology* highlights a number of ways in which the current gender imbalance can start to be addressed going forward.³

While it could be argued that opportunities for female neurologists are greater than they ever have been, the persisting gender imbalance, especially in academic neurology, remains of concern. It has been contended that increasing diversity within academia has positive effects such as widening focus and increasing the plurality of research outputs.⁴ In the case of neurologic illness, it can be argued that this breadth is desperately needed given the huge variety of unanswered research questions.

One disease within neurology where it could be argued that the gender disparity is of particular importance is multiple sclerosis (MS). MS is a disease that affects more women than men, with a gender ratio approaching 3:1, yet the gender ratios and visibility of female MS researchers has not been scrutinized. Without a clear statement of the magnitude of the problem, the neurology community cannot start to work towards improving this disparity.

An important source of role models for junior researchers is visible women chairing and participating in sessions at

academic conferences, as it can sometimes be difficult to establish gender from scientific publications. While there may be practical difficulties with conference attendance due to family or other commitments, the approximately equal gender mix of conference attendees demonstrates that this is not the sole cause of lack of balanced panels. However, diversity (or lack of it) at a senior level and as in key opinion leaders on panels becomes clear at conferences. The overwhelming majority of MS researchers will attend the annual European Committee for Treatment and Research in MS (ECTRIMS); hence this conference was selected as a key site for analysis.

Aims

We set out to establish the gender distribution of MS researchers at ECTRIMS, in MS-specific journals, and across high-impact neurologic publications. In order to establish the variation by career stage, we assessed both first and senior authors, and visible opinion leaders at the ECTRIMS conference.

Given the recent *Lancet* series on gender bias, with reported results of author gender,⁵ the decision was taken not to analyze articles published in *Lancet Neurology*. In general, first author names are cited in presentations and references, whereas last authors are taken to be the senior author on the publication. By focusing on first and last authors in 4 major neurologic research publications (*Annals of Neurology*, *JAMA Neurology*, *Brain*, and *Neurology*[®]) as well as MS-specific journals (*Multiple Sclerosis Journal* [MSJ] and *Multiple Sclerosis and Related Disorders* [MSARD]), we set out to look at the visible researchers. In addition, by manually searching for online biographies, we again examined visibility of the gender of authors.

Methods

Journal editorial boards (accessed December 10, 2018) and contents were retrieved online. Published tables of contents for each journal were searched for 2017 (as of August 2018), and first and senior (last) author names and institutions recorded for all published articles and letters. In order to assess any change over time, the 2008 published table of contents for MSJ was reviewed.

Article title and type were recorded. As the predominant article type contributing to career development is original research, we also examined gender distribution within authors of this article type. Articles identified by journal classification as “original research” were used, whereas other classes of

articles such as editorials, reviews, and letters were not included. One author (R.D.) then reviewed all article titles and abstracts where required, and determined whether original research articles in neuroscience journals were related to MS.

The proportion of articles with female vs male first and last author were calculated blind to author name (i.e., per article analysis), and a second analysis was performed where unique author names only were used for analysis (i.e., per author analysis). Where articles had a single author only, this author was counted within the first author analysis.

Congrex, the organizer of ECTRIMS, was contacted to obtain the gender breakdown of conference attendees and faculty; speaker names and abstract reviewers were obtained from online records. The 2018 faculty was obtained via the preliminary program, and session types were established according to the program.

Gender of researchers was determined using online biographies. Initial searches were performed by researcher name; results were then cross-referenced according to institution. Where name search did not result in a biography from which gender could be ascertained, additional searches were used with additional terms including institution name or “neurology” as an additional search term. Where the gender of an individual author could not reliably be ascertained from the results of the searches above, this was recorded.

Results

Gender visibility in general neurology journals

Authorship in different general neurology and neurologic research journals is summarized in tables 1 and 2.

Across the 4 journals examined, 2,080 articles were examined in total. Of these, 1,988 articles had first authors where the

gender was identifiable. In total, 1,264 (64%) articles had a male first author and 724 (36%) had a female first author. Of 872 articles defined as original research, 480 (55%) had male first authors and 392 (45%) had female first authors. There were 57 MS-related original research articles, of which in only one could the first author gender not be ascertained; 30 (54%) first authors were male and 27 (46%) were female. In total, 1,860 unique first authors were identified across 2,080 articles, in 1,772 of whom it was possible to identify the gender. Of these, 1,102 (62%) were male and 670 (38%) were female.

When examining the gender of senior (final) authors, 253 articles with a single author were excluded. The gender of 39 senior authors could not be identified, leaving 1,788 articles for analysis.

We determined that overall 1,332 (75%) senior authors were male and 446 (25%) were female. Of 904 original research articles (after 16 were excluded due to single author and gender not ascertained), 665 (74%) had male senior authors and 239 (26%) female senior authors. The senior author gender was ascertained in all 56 MS-related original research articles; 40 (71%) were male and 16 (29%) female.

Women hold only 28% (49/175) of editorial board positions of the 4 leading general neurology journals examined.

Gender visibility in MS-related journals

There are 2 main PubMed indexed MS-related journals: *MSJ* and *MSARD*. Students and early career researchers in MS will often review many research articles in these journals during their career. The results from MS-specific journals are summarized in table 3.

In *MSJ*, a total of 259 articles and letters were reviewed. Of these, 45 had a single author. It was not possible to ascertain the gender of 14 first authors and 2 final authors. Of the 245 first author genders ascertained, 131 (54%) were male and

Table 1 First authorship and gender in neurology journals

	<i>Neurology</i> ®	<i>Brain</i>	<i>JAMA Neurology</i>	<i>Annals of Neurology</i>	Total
Total number of articles	1,159	374	307	240	2,080
Unable to ascertain gender	29	32	13	18	92
Overall F/total (% F)	431/1,130 (38.1)	118/342 (34.5)	87/294 (29.5)	88/222 (29.6)	724/1988 (36)
Original research articles F/total (% F)	232/462 (50.2)	68/271 (25.1)	46/121 (38)	46/118 (39)	392/872 (45)
MS original research F/total (% F)	21/32 (65.6)	1/9 (11.1)	2/7 (28.6)	3/9 (33.3)	27/57 (47)
Editorials F/total (% F)	38/139 (27.3)	0/12 (0)	12/57 (21)	1/8 (12.5)	51/216 (24)
Clinical scientific notes F/total (% F)	14/51 (27.5)				
Resident and fellow section F/total (% F)	53/153 (34.6)				
Unique authors F/total (% F)	389/988 (39.4)	116/305 (38)	79/263 (30)	86/207 (41.5)	670/1772 (38)

Abbreviation: MS = multiple sclerosis.

Table 2 Senior authorship and gender in neurology journals

	<i>Neurology</i> ®	<i>Brain</i>	<i>JAMA Neurology</i>	<i>Annals of Neurology</i>	Total
Total number of articles	1,159	374	307	240	2,080
Single author	132	50	51	20	253
Unable to ascertain gender	20	5	9	5	39
Overall F/total (% F)	266/1,007 (26.4)	81/319 (25.4)	63/247 (25.5)	36/205 (17.6)	446/1778 (25)
Original research articles F/total (% F)	138/462 (29.8)	51/189 (26.9)	34/127 (26.7)	16/126 (12.6)	239/904 (26)
MS original research F/total (% F)	12/33 (36.3)	4/9 (44.4)	0/7 (0)	0/7 (0)	16/55 (29)
Editorials F/total (% F)	34/118 (28.8)	0 (all single author)	7/23 (30.4)	1/4 (25)	42/145 (29)
Clinical scientific notes F/total (% F)	9/44 (20.4)				
Resident and fellow section F/total (% F)	39/146 (26.7)				
Unique authors F/total (% F)	234/859 (27.2)	72/292 (27.7)	57/229 (24.9)	36/212 (12.9)	399/1,595 (25)

Abbreviation: MS = multiple sclerosis.

114 (46%) were female. We found 59/114 (52%) of first authors on research articles were male. Of 219 individual first authors in *MSJ* in 2017, 118 were male (56%) and 101 (44%) were female.

Of the 212 *MSJ* articles and letters where it was possible to identify the gender of the senior author, 141 (67%) were male and 71 (33%) female. The proportions were similar for original research articles, with 78/124 (63%) senior authors identified as male and 46/124 (37%) female. Other article types are summarized in table 3. Of 179 unique senior authors, 117 (65%) were male and 62 (35%) were female.

In *MSARD*, 40% (63/156) first authors and 37% (65/174) of senior authors were female. When looking at original research articles in *MSARD*, 46% (40/87) of first authors and 39%

(40/102) of senior authors were female. Other article types are summarized in table 3.

Women hold only 33% (26/79) of editorial board positions of the *MS* journals examined.

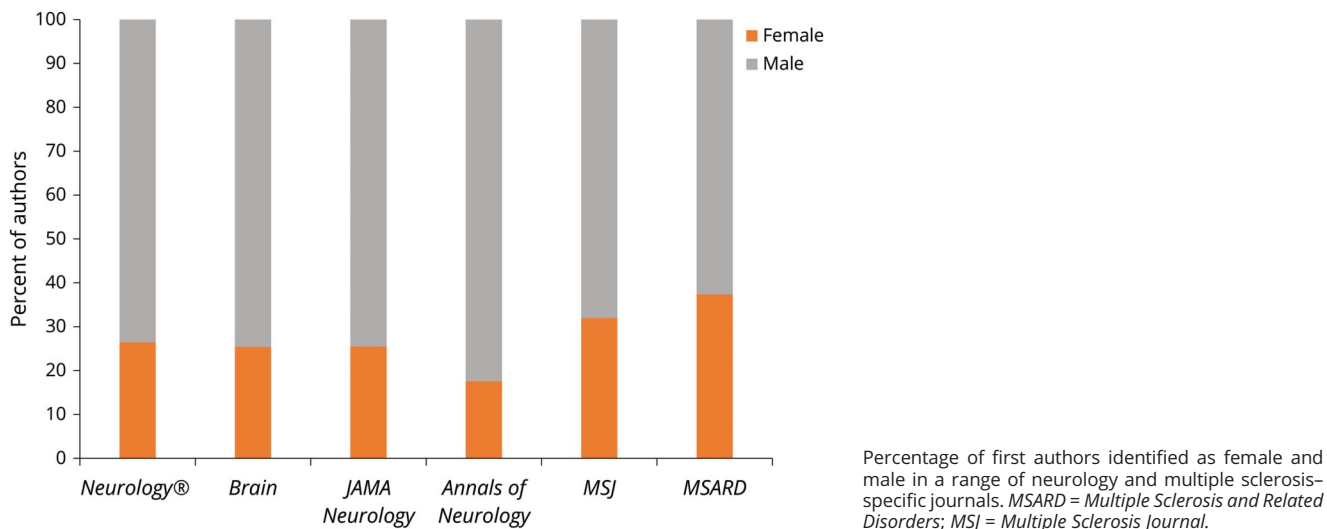
Figure 1, A and B, shows authorship of research articles by gender.

Data from *MSJ* in 2008 demonstrate that there has been a slow change in gender distribution of first and senior authors. Of the 148 research articles in *MSJ* in 2008, 53/113 (40%) first authors were female; 99 (76%) senior authors were male and 32 (24%) female (figure 2). It was not possible to obtain gender of 15 first authors, 12 senior authors, and there were 5 single authored articles.

Table 3 Authorship in multiple sclerosis-related journals

	<i>Multiple Sclerosis Journal</i> : first author	<i>Multiple Sclerosis and Related Disorders</i> : first author	<i>Multiple Sclerosis Journal</i> : senior author	<i>Multiple Sclerosis and Related Disorders</i> : senior author	First author overall	Senior author overall
Total number of articles	259	193	259	193	452	452
Single author	NA	NA	45	6	NA	51
Unable to ascertain gender	14	37	2	13	51	15
Overall F/total (% F)	114/245 (46.5)	63/156 (40.4)	71/222 (33.5)	65/174 (37.4)	177/401 (44.1)	136/386 (35)
Original research articles F/total (% F)	55/114 (48.2)	40/87 (46.0)	46/124 (37.1)	40/102 (39.2)	95/201 (47.3)	86/226 (38)
Editorials F/total (% F)	3/13 (23.1)	3/8 (37.5)	2/11 (18.2)	5/9 (55.6)	6/21 (28.6)	7/20 (35)
Unique authors F/total (% F)	101/219 (46.1)	59/139 (42.4)	62/179 (34.6)	57/156 (36.5)	160/358 (44.7)	119/245 (36)

Figure 1 Proportion of first authors identified as female across journals



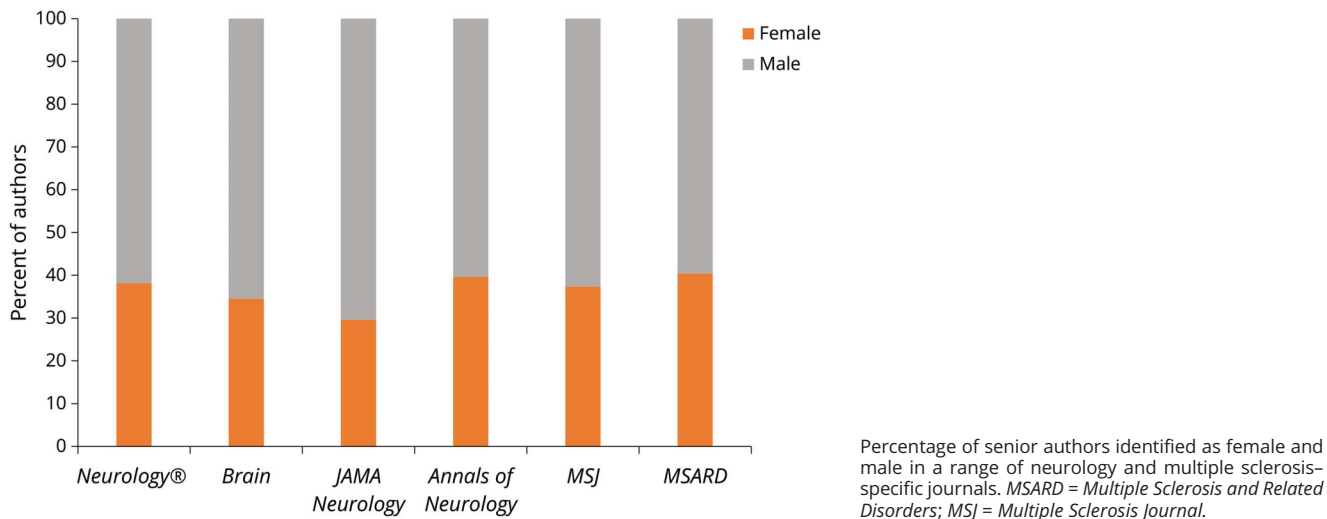
Visibility of female neurologists and researchers at ECTRIMS

There is limited female representation at a senior level on the ECTRIMS Executive Committee, with only 2 female members out of 7 (website accessed November 27, 2018) and only one female president in the last 5 years (2014). There is a better gender balance in the ECTRIMS council (29/70 [41%] members are women). Of the 9 countries with 3 representatives on ECTRIMS council, 3 have exclusively male representation (Sweden, United Kingdom, and Switzerland), and none have exclusively female representation. Only 56/181 (31%) of the invited speakers in 2017, and 32% in 2016, were female. Notably, 48% of 7,514 participants who provided gender at registration for ECTRIMS 2017 were female.

At ECTRIMS 2018, 69/195 (35%) invited speakers, 50% of chairs of Young Investigator sessions, and 44% of chairs of Scientific/Free Communications sessions were female. Women were particularly underrepresented in the satellite symposia, the overwhelming majority of which are organized by pharmaceutical companies, chairing 1/12 sessions and filling 11/40 panel positions. Only 20 out of 100 (20%) members of the 2018 abstract review panel were female.

In keeping with our findings from the published literature, 7/11 (64%) of those presenting in 2017 Young Investigators sessions were female, indicating no gender imbalance at early career researcher stage. There is no gender imbalance in those awarded ECTRIMS fellowships, who are typically at

Figure 2 Proportion of senior authors identified as female across journals



a relatively early career stage. Overall, 54% of current and previous ECTRIMS fellows are female, and 75% of post-doctoral research fellowships are held by women. However, the imbalance at a more senior level persists, with only 13/50 (26%) named female supervisors.

Discussion

Our data demonstrate considerable female dropoff between junior and senior research level in MS, mirroring the wider scientific community. This exists across multiple areas, including visibility at conferences, journal article authorship, and editorial boards, with potential implications for both research priorities and delivering MS care. The data are striking in their consistency. Strategies to support gender balance at senior level are urgently required, including developing mentorship schemes, ensuring gender balance of prominent sessions in conferences, and thorough examination of the barriers facing female academics in the MS field with direct challenges to address unconscious bias. It has been suggested that the increasing use of technologies to facilitate virtual conferences or networking without the need to travel could overcome some of the barriers to participation; however, these technologies are not sufficient or appropriate to be used in isolation and may potentiate the asymmetry—a conscious effort and programs are required.

We have made the assumption that the convention is for last authors to hold senior positions, but we were unable to confirm this. This may differ for case response or editorials, and so efforts were made to mitigate against this by studying original research articles separately, where this assumption is widely made, and would be the expected norm. While it could be argued that we did not correctly ascertain the gender of researchers correctly in all cases, by triangulating our search strategy across name, research area (neurology), and institution, it is conceivable that this occurred. In addition, assigning gender to individuals on the basis of online biographies may be seen as inherently flawed. However, by using this technique we are examining the visible gender, which is in many ways the best way to study this diversity.

While the arguments for slower career progression and the “drop-off” of women in academic medicine are well-rehearsed,^{6,7} the dramatic difference between visibility of men and women in neurology and MS is proving slow to change. An increase in the proportion of female senior authors of approximately 10% in 10 years means that it will take another 20 years before equality is reached, if the current rate of change is maintained.

Clinical trial steering groups,⁸ pharmaceutical advisory boards, and journal editorial boards all have considerable roles in directing research and development direction, and yet female MS experts are overlooked in these influential areas. The

effect of any gender disparity in clinical or academic MS neurology is impossible to study; however, in a female preponderant disease, gender balance in clinical research leaders is important in influencing aspects of research and care delivery.

The current dearth of female leaders in academic neurology means that the lack of visibility of women in this field has become a self-fulfilling prophecy. Pharmaceutical companies are particularly guilty of overlooking women in both the clinical trial arena, as has been demonstrated previously,⁸ and as we have demonstrated at satellite symposia at ECTRIMS. New initiatives, such as International Women in MS, which has developed from a desire to foster a supportive and inspirational community for women working in the field of MS, are being developed.

Change cannot come from women alone—the entire MS field needs to engage with addressing inequity. Nothing is going to change regarding gender inequality unless men start to engage and actively promote women in their spheres of influence. Organizations, companies, and committees could quickly and easily contribute to rebalancing this issue by ensuring that women are equally represented; for example, by following the lead of the National Institute for Health Research UK, where 50% of institutional nominations for professorships are requested to be female. Unconscious bias, and an acceptance of the status quo, almost certainly plays a considerable role, and this is starting to be challenged.

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Appendix Authors

Name	Location	Role	Contribution
Alison Thomson	Blizard Institute, Queen Mary University London, UK	Author	Conceived the idea of the study, data collection analysis and interpretation, figure generation, manuscript drafting
Rachel Horne	Independent journalist, London, UK	Author	Contributed to study concept and design, critically reviewed manuscript
Christine Chung	Preventive Neurology Unit, Wolfson Institute of Preventive Medicine, Queen Mary University London, UK	Author	Major role in data acquisition

Appendix *(continued)*

Name	Location	Role	Contribution
Monica Marta	Blizard Institute, Queen Mary University London, Royal London Hospital, UK	Author	Contributed to study concept and design, critically reviewed manuscript
Gavin Giovannoni	Blizard Institute, Queen Mary University London, UK	Author	Contributed to study concept and design, critically reviewed manuscript
Jacqueline Palace	John Radcliffe Hospital Oxford, UK	Author	Contributed to study concept and design, critically reviewed manuscript
Ruth Dobson	Preventive Neurology Unit, Queen Mary University London, UK	Author	Conceived idea of the study, data collection and analysis, initial manuscript drafting, reviewed all comments, generated final manuscript

References

1. American Academy of Neurology. The gender gap in neurology. Available at: aan.com/tools-and-resources/practicing-neurologists-administrators/career-articles/the-gender-gap-in-neurology/. Accessed October 4, 2018.
2. Focus on physicians: 2017–18 census (UK consultants and higher specialty trainees). In: RCP London [Internet]. 2018. Available at: rcplondon.ac.uk/projects/outputs/focus-physicians-2017-18-census-uk-consultants-and-higher-specialty-trainees. Accessed October 4, 2018.
3. International Women in MS. Gender inequities in the multiple sclerosis community: a call for action. *Ann Neurol* 2018;84:958–959.
4. Nemeth CJ. Minority Influence Theory. IRLE Working Paper No. 218-10. 2010. Available at: irle.berkeley.edu/files/2010/Minority-Influence-Theory.pdf. Accessed October 4, 2018.
5. González-Alvarez J. Author gender in *The Lancet* journals. *Lancet* 2018;391:2601.
6. Nittrouer CL, Hebl MR, Ashburn-Nardo L, et al. Gender disparities in colloquium speakers at top universities. *Proc Natl Acad Sci USA* 2018;115:104–108.
7. A postdoc who persisted: academia needs to confront sexism. *Science* 2017;357:222.
8. Moneim J, Coles A, Giovannoni G, Horne R, Carr O. Women on multiple sclerosis clinical trial steering committees. *Ann Neurol* 2018;84:329–330.

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