

Opinion and Special Article: The Need for Specialized Training in Women's Neurology

Sara C. LaHue, MD,* Stephanie Paolini, MD,* Janet F.R. Waters, MD, MBA, and Mary A. O'Neal, MD

Neurology® 2023;100:38-42. doi:10.1212/WNL.0000000000201451

Correspondence

Dr. LaHue
sara.lahue@ucsf.edu

Abstract

Women's Neurology is an emerging subspecialty that focuses on neurologic disorders across a woman's lifetime. This new domain recognizes that both health and disease are directly affected by hormonal and reproductive changes throughout the life span. This field includes neurologic diseases with a higher prevalence in women and diseases that require specialized management during pregnancy, postpartum period, lactation, and menopause. A survey was sent to US neurology residency program directors to understand the state of training in the area. Their responses highlighted an urgent need for additional education in this field for neurology residents. In this study, we discuss the educational gaps in this area, the clinical benefits of a women's neurology discipline, and the instructional gaps in this area and provide practical recommendations for training programs in women's neurology using 2 innovative fellowship programs.

*These authors contributed equally to this work as cofirst authors.

From the Department of Neurology (S.C.L.), University of California San Francisco; Department of Neurology (S.C.L.), Weill Institute for Neurosciences, University of California San Francisco; Department of Neurology (S.P.), University of South Carolina School of Medicine, Columbia; Department of Neurology (J.F.R.W.), University of Pittsburgh Medical Center, PA; and Department of Neurology (M.A.O.N.), Brigham and Women's Hospital, Boston, MA.

Go to [Neurology.org/N](https://www.neurology.org/N) for full disclosures. Funding information and disclosures deemed relevant by the authors, if any, are provided at the end of the article.

Glossary

ACGME = Accreditation Council for Graduate Medical Education.

An Overview of Women's Neurology

Women's Neurology is an emerging subspecialty that focuses on neurologic disorders across a woman's lifetime.¹ Key periods span pregnancy, postpartum period, and menopause and considerations regarding family planning, fertility, bone health, and the use of hormonal contraception, replacement therapy, or assisted reproductive technology, which all require a different management approach in patients with neurologic disease. Neurologists have recognized important obstetric and sex-specific considerations in clinical practice for many years.² Yet, there remain clear gaps in the educational opportunities for neurology residents who care for these populations and for neurologists who want further expertise in this area following residency.

The care of women with neurologic disorders during the peripartum period requires prompt specialized care coordination and management.³ Cisgender, transgender, and nonbinary patients may all require obstetrical neurologic care. Neurologists who care for patients during pregnancy face a wide array of clinical concerns including drug safety and metabolism,⁴ the effect of pregnancy on neurologic disease activity or trajectory,⁵ the safety of anesthetic and delivery modes,⁶ and how the underlying neurologic disease may increase risk of pregnancy complications.³ Peripartum neurologic care spans outpatient and inpatient environments and may require coordination across disciplines for a safe pregnancy, labor, and delivery. The peripartum period is also associated with an increased risk of several neurologic emergencies, including eclampsia and stroke.⁷ The number of pregnant patients is expected to grow with an increased rate of pregnancy among older women, who also have a greater risk of peripartum neurologic complications.⁸ Expertise in the complex management of these disorders is paramount for ensuring best outcomes for both the mother and baby.

In this study, we describe gaps in neurology residency education and the opportunities for novel educational initiatives focused on women's neurology. We also discuss why subspecialists cannot completely fill this gap and how training in general neurology on sex-informed and gender-informed neurologic care can provide the needed expertise, which we highlight using practical models of 2 existing women's neurology fellowship programs.

Defining the Gap in Neurology Residency Training

A survey was sent in 2019 to all US neurology residency program directors to understand their perception of how well

their residents were educated in caring for women with neurologic disease (Table). This survey was used as a surrogate measure to query program directors to discover whether they felt a training gap existed; the number of lectures focused on a particular area was one measure of the perceived importance of that topic. The University of California, San Francisco Institutional Review Board, approved this survey (19-27502), and written informed consent was obtained from all respondents. Of the 85 program directors who began the survey, 25 of them (35%) completed the survey. They were collectively responsible for training 704 neurology residents.

Only 44% of the residency program directors felt that their residents were adequately prepared to care for pregnant women with neurologic diseases. In the year prior to the survey, 28% of the programs had no lectures focused on the care of women with neurologic illness. Furthermore, 56% of the residency program directors identified this as an area where residents were not adequately trained. The defined barriers to incorporating such didactics were lack of time, lack of expertise, and/or a lack of educational materials. Both a directed residency curriculum with educational materials to support core competencies and fellowship training would address these limitations. While lectures capture only a minute portion of the learning that occurs in residency, even in programs with an abundance of obstetric consults, dedicated faculty, and highly motivated residents, residency program directors acknowledged that there is room for improvement in this arena.

The national program requirements from the Accreditation Council for Graduate Medical Education (ACGME) include caring for patients with neurologic disorders "across the life span," but do not specifically require experience in treating pregnant and postpartum patients.⁹ Caring for women with neurologic disease is an important residency competency and warrants explicit attention. However, new educational initiatives require significant resources, including time and content expertise, which are not always available. There are several ways to incorporate women's neurology education and assessment into graduate medical education depending on the program. These include self-study using published resources,^{3,10} formal residency didactics, and attending national conferences. Patient examples cared for in outpatient and inpatient settings can be highlighted in clinical conferences. A curriculum could be created on a national level through the American Academy of Neurology and be available to all residency programs. Furthermore, incorporating women's neurology into an ACGME Neurology Residency Milestone would emphasize the importance of the issue.

Table Survey Questions Administered to US Neurology Residency Program Directors on the Availability of Educational Opportunities on the Care of Women With Neurologic Disorders (N = 25)

| Survey question | Total responders, N (%) |
|---|-------------------------|
| At your institution, do Neurology and Obstetrics and Gynecology services share the same campus (within a 7-min walk)? | |
| Yes | 21 (84) |
| This past academic year, was there at least 1 lecture exclusively focused on the care of women with neurologic disease? | |
| Yes | 17 (68) |
| This past academic year, was there at least 1 lecture given by a subspecialist on the care of women with neurologic disease within that subspecialty (e.g., headache, epilepsy, and multiple sclerosis)? | |
| Yes | 19 (76) |
| This past academic year, did a Neurology Grand Rounds specifically focus on the care of women with neurologic disease? | |
| Yes | 10 (40) |
| Do you feel that your residents are adequately prepared to care for pregnant women with neurologic disease on graduation? | |
| Yes | 11 (44) |
| Needs Improvement | 9 (36) |
| No | 5 (20) |
| Are there plans to increase educational opportunities dedicated to the care of women with neurologic disease in the next academic year? | |
| Yes | 13 (52) |
| What barriers exist that make it difficult to implement education on these topics? | |
| Lack of time | 16 (64) |
| Lack of expertise | 10 (40) |
| Lack of educational materials | 9 (36) |

Women's Neurology Fellowship—A Novel Training Approach

National organizations have called for the consideration of social determinants of health, life span approaches, and cultural considerations in women's health to optimize the clinical care of women. Fellowship training specific to women's health is a trend seen in other areas of medicine, such as in internal medicine (e.g., cardio-obstetrics¹¹) and psychiatry (e.g., reproductive psychiatry¹²). This nuanced training makes personalized sex-specific and gender-specific care attainable. There is a similar need for training neurologists to become experts in the care of women with neurologic diseases, especially during the peripartum period, which can be aimed at providing general neurologists with this expertise.

The goal of a fellowship program in women's neurology is to focus on issues specific to women with neurologic disease. Training emphasizes sex differences in neurologic disorders during all stages of women's lives through multidisciplinary models of care. This fellowship may attract medical students to neurology interested in women's health who might have instead chosen internal medicine or obstetrics. It also provides an

area of expertise to aid academic promotion for general neurologists through education leadership and primary research. Indeed, such expertise is key to advancing research involving pregnant patients, who are often excluded from studies, which in turn results in lack of data in the management and outcomes of many neurologic disorders during pregnancy.¹³ Training in sex-informed patient care benefits patients, neurology departments, and the field of neurology at large.

Many subspecialties have areas of expertise in women's health, including those specializing in epilepsy, headache, stroke, and multiple sclerosis.³ However, not all topics fall into these domains, so general neurologists with expertise in women's neurology who can coordinate care across several disciplines are also needed. The general neurology expert would act as a crucial hub connecting subspecialists and contribute to a team care model.

Women's Neurology Fellowship Program Models

The University of Pittsburgh began a 2-year Women's Neurology fellowship training program in 2016. The women's

neurology fellow works at Magee Women's Hospital where more than 11,000 deliveries occur annually. The first fellowship year may be spent in an accredited program in clinical neurophysiology or epilepsy to address the need for expertise in peripartum epilepsy management. The second year begins with immersion into obstetrics where the fellow rotates with the antepartum maternal fetal medicine, high-risk obstetrical services, and obstetrical anesthesia services. The fellow consults on inpatient obstetrical patients with neurologic disorders and follows up peripartum patients in several outpatient subspecialty clinics.

The 1-year Women's Neurology Fellowship program at Massachusetts General and Brigham and Women's Hospitals began in 2018. This predominantly outpatient fellowship focuses on the management of sex-specific neurologic issues across the life span. This is accomplished by a core set of longitudinal ambulatory clinics in several subspecialties with expert preceptorship. This clinic experience is supplemented by 2 months of electives including women's mental health, obstetrical anesthesia, maternal fetal medicine, urogynecology, and genetic counseling.

These 2 fellowships are distinct in organization but unified in overall educational goals. The University of Pittsburgh's fellowship is focused on peripartum neurologic care, training neurologists to provide expertise at centers lacking subspecialists. By contrast, the Massachusetts General and Brigham and Women's Hospitals fellowship takes a broad approach to sex-based concerns across a woman's life span, providing an academic tract for general neurologists to pursue interests in women's health. Both programs provide protected time and mentorship for educational and research pursuits. The goals of these fellowships are to train general neurologists to be experts in women's neurology and serve to coordinate neurologic care with subspecialists both within neurology and other health care providers because many of these women have complex needs.

Future Directions

A greater emphasis on caring for women with neurologic disorders in neurology graduate medical education is imperative for maximizing health outcomes for these complex patients. Neurologists trained in women's neurology offer a unique skill set to become leaders in the field through creating innovative interdisciplinary clinics, new educational initiatives for trainees, and advancing research. Postgraduate training offers unique opportunities for both provider and patient satisfaction. As fellows matriculate from these programs, it will be important to measure how their expertise enhances resident education at their local institutions. Clinical outcomes and patient satisfaction when cared for by women's neurology specialists must be measured. Changes in the number and type of patient referrals at institutions that provide such expertise should be

assessed. We anticipate that trainees will choose a career path in women's neurology and this will become a crucial part of academic neurology departments across the country.

Acknowledgment

The authors acknowledge the unwavering support of Dr. John Engstrom, Neurology Residency Program Director at the University of California, San Francisco. S.C. LaHue acknowledges generous support by the National Institute on Aging (R03AG074035), Larry L. Hillblom Foundation (A137420), the UCSF Claude D. Pepper Older Americans Independence Center funded by National Institute on Aging (P30 AG044281), and the Bakar Aging Research Institute.

Study Funding

The authors report no targeted funding.

Disclosure

S.C. LaHue receives royalties from Oxford University Press. S. Paolini reports no disclosures relevant to the manuscript. M.A. O'Neal acts as a consultant for Crico Malpractice insurance carrier and Best Docs and receives royalties from UpToDate, Oxford, and Springer publishing companies. J.F.R. Waters reports no disclosures relevant to the manuscript. Go to Neurology.org/N for full disclosures.

Publication History

Received by *Neurology* February 17, 2022. Accepted in final form September 8, 2022. Submitted and externally peer reviewed. The handling editor was Roy E. Strowd, III, MD, MEd, MS.

Appendix Authors

| Name | Location | Contribution |
|-----------------------------------|--|---|
| Sara C. LaHue, MD | University of California San Francisco, Department of Neurology, San Francisco; Weill Institute for Neurosciences, Department of Neurology, University of California San Francisco | Drafting/revision of the article for content, including medical writing for content; major role in the acquisition of data; study concept or design; and analysis or interpretation of data |
| Stephanie Paolini, MD | University of South Carolina School of Medicine, Department of Neurology, Columbia | Drafting/revision of the article for content, including medical writing for content |
| Janet F.R. Waters, MD, MBA | University of Pittsburgh Medical Center, Department of Neurology | Drafting/revision of the article for content, including medical writing for content; study concept or design |
| Mary A. O'Neal, MD | Brigham and Women's Hospital, Department of Neurology, Boston, MA | Drafting/revision of the article for content, including medical writing for content; study concept or design |

References

1. O'Neal MA. A review of women's neurology. *Am J Med.* 2018;131:735-744.
2. Harden CL, Hopp J, Ting TY, et al. Practice parameter update: management issues for women with epilepsy: focus on pregnancy (an evidence-based review): obstetrical complications and change in seizure frequency: report of the Quality Standards Subcommittee and Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology and American Epilepsy Society. *Neurology.* 2009;73(2):126-132.
3. Klein A, O'Neal MA, Scifres C, Waters J, Waters JH. *Neurological Illness in Pregnancy: Principles and Practice*: John Wiley & Sons, Ltd; 2015.
4. LaHue SC, Anderson A, Krysko KM, et al. Transfer of monoclonal antibodies into breastmilk in neurologic and non-neurologic diseases. *Neurol Neuroimmunol Neuroinflamm.* 2020;7(4):e769. [ncbi.nlm.nih.gov/pubmed/32461351](https://pubmed.ncbi.nlm.nih.gov/pubmed/32461351).
5. Bove R, Alwan S, Friedman JM, et al. Management of multiple sclerosis during pregnancy and the reproductive years: a systematic review. *Obstet Gynecol.* 2014;124(6):1157-1168.
6. Waters JFR, O'Neal MA, Pilato M, Waters S, Larkin JC, Waters JH. Management of anesthesia and delivery in women with chiari I malformations. *Obstet Gynecol.* 2018;132(5):1180-1184.
7. Swartz RH, Cayley ML, Foley N, et al. The incidence of pregnancy-related stroke: a systematic review and meta-analysis. *Int J Stroke.* 2017;12(7):687-697.
8. Ananth CV, Keyes KM, Wapner RJ. Pre-eclampsia rates in the United States, 1980-2010: age-period-cohort analysis. *BMJ.* 2013;347:f6564.
9. Accreditation Council for Graduate Medical Education. Residency review committees—neurology program requirements [online]. Accessed May 12, 2022. [acgme.org](https://www.acgme.org).
10. O'Neal MA. Obstetric and gynecologic disorders and the nervous system. *Continuum (Minneapolis, Minn).* 2020;26(3):611-631.
11. Girmius A, Meng ML. Cardio-obstetrics: a review for the cardiac anesthesiologist. *J Cardiothorac Vasc Anesth.* 2021;35(12):3483-3488.
12. Nagle-Yang S, Miller L, Osborne LM. Reproductive psychiatry fellowship training: identification and characterization of current programs. *Acad Psychiatry.* 2018;42(2):202-206.
13. LaHue SC, Gelfand AA, Bove RM. Navigating monoclonal antibody use in breastfeeding women: do no harm or do little good? *Neurology.* 2019;93(15):668-672.

Subspecialty Alerts by E-mail!


Customize your online journal experience by signing up for e-mail alerts related to your subspecialty or area of interest. Access this free service by clicking on the “My Alerts” link on the home page. An extensive list of subspecialties, methods, and study design choices will be available for you to choose from—allowing you priority alerts to cutting-edge research in your field!

Infographics Available on Select Articles

Infographics are an exciting feature available across the *Neurology*[®] journals, providing an engaging and convenient way to understand the information presented in select articles. All infographics are created by a team of scientific writers and illustrators and undergo a rigorous review process involving input and feedback from the author and *Neurology* editors. View a selection of infographics at: [Neurology.org/Infographics](https://www.neurology.org/Infographics)

Visit the *Neurology*[®] Website at [Neurology.org/N](https://www.neurology.org/N)

- More article-based content on home pages
- Streamlined menus and navigation
- Enhanced blog sections for specialty areas
- Same experience on desktop, tablet, and mobile devices
- Improved article reading experience; links more evident (pdf, analytics, social media)

 Find *Neurology*[®] on Facebook: <http://tinyurl.com/neurologyfan>

 Follow *Neurology*[®] on Twitter: <https://twitter.com/GreenJournal>

Neurology[®]

Opinion and Special Article: The Need for Specialized Training in Women's Neurology

Sara C. LaHue, Stephanie Paolini, Janet F.R. Waters, et al.

Neurology 2023;100;38-42 Published Online before print September 30, 2022

DOI 10.1212/WNL.0000000000201451

This information is current as of September 30, 2022

| | |
|---|---|
| Updated Information & Services | including high resolution figures, can be found at: http://n.neurology.org/content/100/1/38.full |
| References | This article cites 11 articles, 4 of which you can access for free at: http://n.neurology.org/content/100/1/38.full#ref-list-1 |
| Subspecialty Collections | This article, along with others on similar topics, appears in the following collection(s): Models of care http://n.neurology.org/cgi/collection/models_of_care Other Education http://n.neurology.org/cgi/collection/other_education |
| Permissions & Licensing | Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: http://www.neurology.org/about/about_the_journal#permissions |
| Reprints | Information about ordering reprints can be found online: http://n.neurology.org/subscribers/advertise |

Neurology® is the official journal of the American Academy of Neurology. Published continuously since 1951, it is now a weekly with 48 issues per year. Copyright © 2022 American Academy of Neurology. All rights reserved. Print ISSN: 0028-3878. Online ISSN: 1526-632X.

