Consensus Competencies for Postgraduate Fellowship Training in Global Neurology

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Abstract

Background and Objectives

Use a modified Delphi approach to develop competencies for neurologists completing ≥1 year of advanced global neurology training.

Methods

An expert panel of 19 United States–based neurologists involved in global health was recruited from the American Academy of Neurology Global Health Section and the American Neurological Association International Outreach Committee. An extensive list of global health competencies was generated from review of global health curricula and adapted for global neurology training. Using a modified Delphi method, United States–based neurologists participated in 3 rounds of voting on a survey with potential competencies rated on a 4-point Likert scale. A final group discussion was held to reach consensus. Proposed competencies were then subjected to a formal review from a group of 7 neurologists from low- and middle-income countries (LMICs) with experience working with neurology trainees from high-income countries (HICs) who commented on potential gaps, feasibility, and local implementation challenges of the proposed competencies. This feedback was used to modify and finalize competencies.

Results

Three rounds of surveys, a conference call with United States–based experts, and a semi-structured questionnaire and focus group discussion with LMIC experts were used to discuss and reach consensus on the final competencies. This resulted in a competency framework consisting of 47 competencies across 8 domains: (1) cultural context, social determinants of health and access to care; (2) clinical and teaching skills and neurologic medical knowledge; (3) team-based practice; (4) developing global neurology partnerships; (5) ethics; (6) approach to clinical care; (7) community neurologic health; (8) health care systems and multinational health care organizations.

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Glossary

AAN = American Academy of Neurology; **ANA** = American Neurological Association; **HIC** = high-income country; **LMIC** = low- and middle-income country.

Discussion

These proposed competencies can serve as a foundation on which future global neurology training programs can be built and trainees evaluated. It may also serve as a model for global health training programs in other medical specialties as well as a framework to expand the number of neurologists from HICs trained in global neurology.

Interest in global health and the globalization of American academic medicine has increased substantially among recent generations of health care trainees.[1] In the last 35 years, the number of medical students in the United States who spent time working internationally has risen from 6% to 29%.[2] While most of the global health electives have predominantly focused on primary care, obstetrics, and infectious diseases, interest in global neurology experiences is also increasing. The growing recognition of the burden of neurologic disease in low- and middle-income countries (LMICs) has been accompanied by increasing interest in and demand for global neurology experience among neurology postgraduate trainees in the United States. A survey of US and Canadian neurology residency program directors revealed that 93% would make time available for residents to participate in international electives if funding was available.[3] Global neurology is also increasingly recognized as a viable career path among United States–based neurologists in academic medicine[4-6] as reflected by the formation of a Global Health Section of the American Academy of Neurology (AAN) in 2011, which currently includes 611 members,[7] and the American Neurological Association (ANA) International Outreach Committee.[8]

In spite of growing interest, models for training neurologists in high-income countries (HICs) interested in pursuing a career in global neurology have not been well- delineated. A recent study of global health competencies in all medical training programs in the United Kingdom failed to reveal a single neurology-related global health competency in any program,[9] and a survey of neurology trainees in Europe demonstrated insufficient opportunities for global health training.[10] Some educators have attempted to incorporate aspects of global neurologic care in LMICs into standard curricula for postgraduate neurology training in the United States.[11-13] These attempts have generally been comprised of either global health courses within a curriculum without travel or short-term international trips tailored to medical students and neurology residents. Given the growing interest in integrating opportunities for global health training in neurology residencies and the emergence of recognized global neurology training programs,[7,14-16] a formal training curriculum is needed to ensure all trainees receive adequate, ethical, and appropriate training. However, competencies designed specifically for neurologists in HICs wishing to complete an extended (≥1 year) fellowship in global neurology have not been previously explored.

Following previously defined definitions of competency and competency-based medical education,[17,18,19] a panel of United States–based neurologists with extensive experience in global neurology education was convened to develop competencies intended for use in postgraduate global neurology training programs for trainees from HICs. These were subsequently critically reviewed and edited by a group of neurologists based in LMICs with experience working with neurology trainees from HICs, and the final comprehensive list of agreed on competencies is presented here.

Methods

A panel of United States–based neurologists with experience in global neurology in LMICs (Table 1) was selected from the AAN Global Health Section and the ANA International Outreach Committee to participate in a modified Delphi method to generate consensus competencies. A modified Delphi method was used given its strengths in achieving consensus among a group of experts, especially when participants are separated by physical distance.[20] The stages for the Delphi method include identifying a research problem, selecting experts, developing a questionnaire, conducting anonymous iterative questionnaire rounds, collecting individual and group feedback between rounds, and summarizing the findings. While the classic Delphi and modified Delphi methods are similar with regard to procedure and intent, participants never meet or have direct interaction in the classic Delphi approach.

An initial list of broad global health competencies was generated by the principal investigators (N.S. and D.R.S.) by reviewing the literature for both neurology-based competencies and general global health competencies.[9,21,22,23-29] All domains and competencies identified in the literature review were compiled in a comprehensive list which constituted the initial survey sent to participants. Of note, individual competencies identified by literature review were modified to be specific to neurology. For example, the competency, "Describe how globalization contributes to the spread of communicable and chronic disease," was modified to, "Describe how globalization contributes to the spread of communicable and chronic neurologic disease." In addition, both individual competencies and proposed domains were modifiable during the subsequent Delphi process. The initial survey was

Table 1 Diversity and Expertise of United States–Based Expert Participants

Participant	Affiliations/partnerships with non-US academic and/or clinical entities	Area of expertise	Foreign graduate	Countries lived/worked	Duration of international partnerships
Nicoline Schiess, MD, MPH	Perdana University Graduate School of Medicine (Malaysia), UAE University	NINI	Hungary	Haiti, India, Malaysia, Zambia, UAE, the United Kingdom	11+ y
Violet Kulo, EdD, MS	N/A	Curriculum development, medical education	Kenya	Kenya	5 y
Pria Anand, MD	N/A	NINI, inpatient neurology	No	Guinea, Colombia	1 y
David R. Bearden, MD, MSCE	University of Zambia	Neuroinfectious disease, neurogenetics	No	Botswana, Zambia	10+ y
Aaron Berkowitz, MD, PhD	Partners In Health, Doctors Without Borders	Global neurology, neurology education	No	Haiti, Malawi, Vietnam, Navajo Nation	10 y
Gretchen L. Birbeck, MD, MPH	University of Zambia, University Teaching Hospitals Children's Hospital, Chikankata Hospital, Zambia, Blantyre Malaria Project	Tropical neurology, epilepsy, health services	No	Zambia, Malawi, England	14 y
Anna Cervantes-Arslanian, MD	N/A	Neuroinfectious disease, NCCU, stroke	No	USA, Mexico	N/A
Felicia C. Chow, MD, MAS	N/A	Neuroinfectious disease, health disparities	No	Peru, China, Uganda, Kenya, Nigeria	2+ y
Michelle Kvalsund, DO, MS	University of Zambia School of Medicine, Lusaka	Neurophysiology, neuromuscular	No	Brazil, Zambia	12 y
Farrah J. Mateen, MD, PhD	N/A	NINI, epidemiology of vulnerable populations	Canada	Bhutan, Guinea, Tanzania, Jordan, Lao PDR, Lebanon, Timor-Leste, Bangladesh	~5 y
Ana-Claire Meyer, MD	N/A	NINI	No	Kenya	~5 y
Cumara B. O'Carroll, MD, MPH	Mbarara University of Science and Technology, Mbarara, Uganda	Vascular neurology	No	Uganda, Malawi, Suriname, Nicaragua, Panama, St. Lucia	13+ y
Archana A. Patel, MD, MPH	University of Zambia School of Medicine, Centre Hospitalier Universitaire de Kigali	Epilepsy, global child neurology education	No	Zambia, Rwanda, Tanzania	>10 y
Michael N. Rubenstein, MD	Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania	General neurology, neurology education	No	Tanzania, Mali	12 y

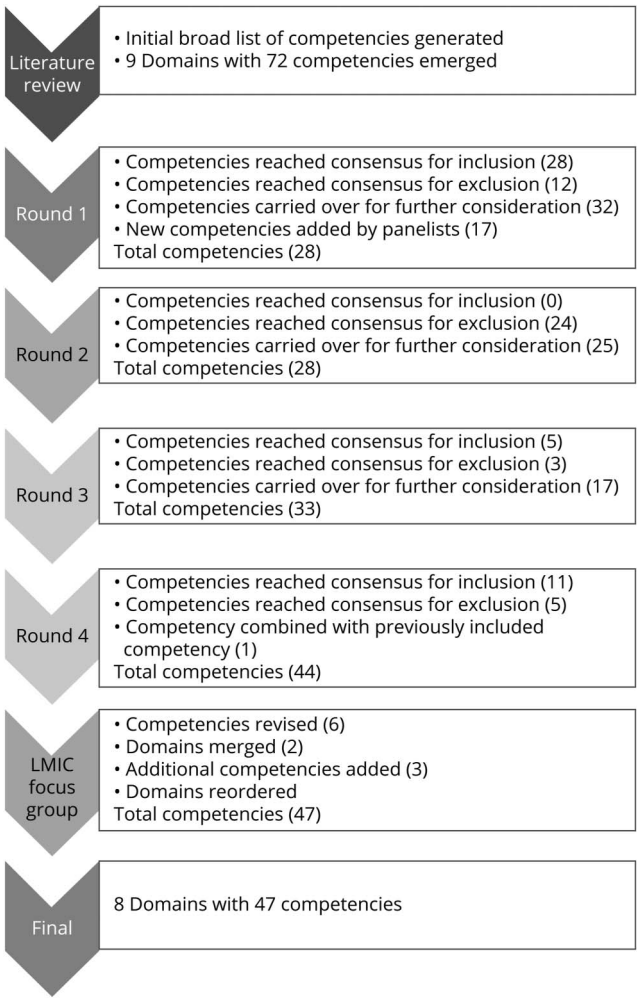
Continued

Table 1 Diversity and Expertise of United States–Based Expert Participants *(continued)*

Participant	Affiliations/partnerships with non-US academic and/or clinical entities	Area of expertise	Foreign graduate	Countries lived/worked	Duration of international partnerships
Omar K. Siddiqi, MD, MPH	University of Zambia School of Medicine	Neuroinfectious diseases, epilepsy	No	Zambia	11+ y
Serena Spudich, MD, MA	Chulalongkorn University, Thai Red Cross AIDS Research Centre	Neuroinfectious diseases, research training	No	Thailand	12 y
Sean A. Tackett, MD, MPH	Visiting Associate Professor Universiti Malaya	Curriculum development, medical education	No	China, Malaysia, Oman, Saudi Arabia, Taiwan, UAE, Vietnam	3–4 mo
Kiran T. Thakur, MD	None directly, affiliations through neuroID fellows	Neuroinfectious diseases	No	Malawi, Bangladesh, Malaysia, India	1.5 y
Nirali Vora, MD	University Teaching Hospital of Kigali, Kwame Nkrumah University of Science and Technology; University of Zimbabwe	Vascular neurology, medical education	No	India, Zimbabwe, Ghana, Rwanda	8 y
Joseph Zunt, MD, MPH	Multiple universities and institutes across Peru	Neuroinfectious diseases, research training	No	Peru	26 y
Deanna Saylor, MD, MHS	University Teaching Hospital, Lusaka, Zambia	Neuroinfectious disease, global neurology, international neurology training	No	Kenya, Uganda, Zambia	12 y

Abbreviations: N/A = not available; NCCU = neurocritical care unit; NINI = neuroimmunology and neuroinfectious diseases, UAE = United Arab Emirates.

Figure Summary of the Process and Results of Each Round Required for Achieving Consensus on the Global Neurology Curriculum



reviewed by medical education experts (V.K. and S.A.T.) with specific attention to ensure the wording and formatting was consistent with standards of the Accreditation Council of Graduate Medical Education. The finalized initial survey consisted of 72 competencies across 9 domains.

The survey was sent through email to expert panelists who were asked to rate each competency based on appropriateness for inclusion among a list of essential competencies for global neurology fellowship training using a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). In the first survey round only, each item also included an open response option to provide comments or suggest wording changes to existing competencies, and participants were also able to propose their own competencies for inclusion. Surveys were administered using Qualtrics (Provo, UT), and questionnaire responses were anonymous to ensure all responses carried equal weight.

Mean scores were calculated for each competency, and all qualitative feedback and new competencies proposed by participants were summarized. A revised survey was sent to the group including all competencies that did not reach consensus criteria in the first round as well as competencies with proposed word changes and newly proposed competencies. After responses were collated, a third survey was sent that included only competencies that had not reached consensus during the second round. Finally, a conference call was used in the fourth round to discuss and come to consensus on remaining competencies.

Consensus competencies then underwent formal review by a group of neurologists from LMICs with experience working with neurologists based in HICs (Table 2) to provide feedback on potential gaps, feasibility, relevance, and local challenges in implementation of the competencies. LMIC experts reviewed the competencies, completed a semistructured questionnaire regarding inappropriate and missing competencies, and then participated in a focus group discussion to further identify relevance, high-priority and low-priority competencies, and finalize new competencies for inclusion in the final list.

Data Analysis

Average ratings for each competency were calculated. Based on previously published methods,[20] panelists reached consensus to automatically include competencies with a mean rating of >3.5 and exclude competencies with a mean rating of ≤3.0. Competencies with a mean rating between 3.01 and 3.50 were included in the subsequent survey round for further consideration and voting.

Standard Protocol Approvals and Participant Consents

Consent acknowledgment was included at the beginning of the expert survey (United States–based experts) and structured questionnaire (LMIC experts). The Johns Hopkins University School of Medicine Institutional Review Board approved this study with a waiver of written informed consent. Anonymized data not published within this article will be made available by request from any qualified investigator.

Results

Invitations to participate were sent to 23 United States–based global neurology experts. Two did not respond, and 1 declined to participate. Of the 20 experts who agreed to participate, 1 did not respond to any surveys and was excluded. Nineteen panelists completed the round 1 survey, 18 panelists completed the round 2 survey, and 19 panelists completed the round 3 survey. Fourteen panelists participated in the conference call in round 4, and the remaining 5 provided feedback through email and agreed on the final competencies. Figure summarizes the process and results of each round, and Tables 3 and 4 display a list of the resulting 47 competencies divided over 8 domains. eAppendix 1 (links.lww.com/WNL/C726) contains the detailed analysis and consensus for each round for competencies and domains.

The main reasons cited by panelists for excluding certain competencies included competencies being too broad, too

Table 2 Diversity and Expertise of LMIC-Based Expert Participants

Participant	Affiliations with institutions outside of your primary institution	Area of expertise	Clinical/research experience outside of current country of residency	Experience working with students, trainees, clinicians, and/or researchers from high-income countries	Cumulative time working with students, trainees, and/or colleagues from high-income countries
Phillip Chan, MBChB, PhD	N/A	Neuroinfectious disease	Hong Kong, China	Thailand	7 y
Lorraine Chishimba, MBChB, MMED Neurology	N/A	Movement disorders	N/A	The United States, the United Kingdom	4 y
Isabel Elicer, MD	N/A	Neuroinfectious disease	Mount Sinai Hospital, New York City; University Teaching Hospital, Lusaka	The United States	>1 y
Agnès Fleury, MD, PhD	N/A	Neuroinfectious disease, neuroimmunology	Neurologist training in Paris, France; Népal, El Salvador	France	10+ y
Aarti Kinikar, MBChB, MD, MRCP	Maharashtra University of Health Sciences, Nashik, India; Lata Mangeshkar Medical College and Research Institute, Nagpur, India; Johns Hopkins University, Baltimore, MA	Infectious diseases including neuro infections Medical education: undergraduate and postgraduate—pediatrics Pediatric and neonatal nutrition	Johns Hopkins University, USA; Thailand; MRC-UK: UCL London; Stellenbosch University, South Africa; University College, Uganda; Emory University, USA; Columbia University, USA; Kirby Institute, Australia	The United States, the United Kingdom, Australia	25 y
Amir A. Mbonde, MBChB, MMED	Mayo Clinic Arizona	General neurology, global neurology	3.5 y spent in the United States	The United States, the United Kingdom	7 y
Adesola Ogunniyi, MBChB	Indiana University, Indianapolis and Northwestern University, Chicago	Neuroepidemiology neurodegenerative diseases	Yes	The United States	30 y

Abbreviations: LMIC = low- and middle-income country; N/A = not available.

Table 3 Global Neurology Competencies Reaching Consensus in the First 4 Domains: "Cultural Context, Social Determinants of Health, and Access to Care;" "Clinical and Teaching Skills and Neurologic Medical Knowledge;" "Team-Based Practice;" and "Developing Global Neurology Partnerships"

Cultural context, social determinants of health, and access to care
Discuss the similarities and differences between health care disparity, health disparity, and healthy equity.
List major social, economic, and environmental determinants of neurologic health and their impact on access to and quality of care for neurologic diseases in the local setting as well as their impact on health disparities in your home country.
Describe how globalization, including travel and trade, impacts neurologic disorders.
Discuss how economics and politics impact individual and community neurologic health at a local, national, regional, and global level.
Identify local cultural practices, languages, values, perceptions of stigma, and professional dynamics unique to the local setting that influence communication and health care decision-making, including the use of translators and interpreters.
Describe how cultural context, including stigma and discrimination, influences perceptions of neurologic health and disease.
Define the terms immigrant, asylee, and refugee and articulate barriers to neurologic health care in the local setting for these and other vulnerable populations.
Employ knowledge of environmental (including climate change), social, and economic determinants of health to advocate for strategies that tackle neurologic health inequalities and improve neurologic health.
Demonstrate respect for the unique cultures, values, and roles of patients and family members in global health settings and within immigrant, refugee, and other vulnerable populations.
Clinical and teaching skills and neurologic medical knowledge
Clinical and teaching skills
Obtains an empathetic, comprehensive, and relevant history of neurologic illness pertinent to the local environment and local epidemiology.
Performs a comprehensive review of systems pertinent to the nervous system and the local context.
Obtains a travel history relevant to the nervous system and the local context (e.g., endemic infections, wildlife contacts, etc.).
Obtains a social history relevant to the nervous system and the local context.
Obtains a family history relevant to neurologic disease and the local context.
Obtains exposure information (ill contacts, pets, and vaccination history) relevant to neurologic disorders and the local context.
Interpret diagnostic findings in the context of neurologic disorders prevalent in the local setting.
Recognizes indications for advanced imaging and other diagnostic studies that are relevant in their local setting based on relative availability and cost-effectiveness of these diagnostic tests compared with their diagnostic yield in an individual patient.
Demonstrate flexibility and ability to adapt clinical, teaching, and neurology-specific skills and practice to a resource-constrained setting, including how to efficiently use human resources and diagnostic tests and how to function and teach well in a clinical setting without any of these.
Understands cultural variations in the acceptance of neurodiagnostic tests (e.g., lumbar puncture) across different populations and can explain informed consent, including risks and benefits of lumbar puncture, in a locally relevant manner.
Neurologic medical knowledge
List the neurologic diseases most prevalent in different world regions with an emphasis on describing the local epidemiology of neurologic diseases in one's local setting.
Give examples of outbreaks of neurologic disorders and challenges in their recognition and management.
Describe major causes of neurologic morbidity and mortality globally and how disease risk varies with geography, socioeconomic status, and race.
Compare and contrast the presentation, management, and outcomes of common neurologic diseases, such as epilepsy, stroke, and meningitis, in one's home setting to the local settings in which one practices and how management of neurocritical illnesses is undertaken when intensive care units are not available.
Demonstrate familiarity with tropical diseases, neurologic infections, neurogenetic disorders, and psychiatric illnesses in the local setting.
Team-based practice
Exhibit interprofessional values and communication skills that demonstrate respect for, and awareness of, the unique cultures, values, roles/responsibilities, and expertise represented by other professionals, local providers, and groups that work in global health.
Develop understanding and awareness of the neurology health care workforce crisis in the developing world, movement of health care workers in the neurology workforce, the factors that contribute to this, and strategies to address this problem.

Continued

Table 3 Global Neurology Competencies Reaching Consensus in the First 4 Domains: "Cultural Context, Social Determinants of Health, and Access to Care;" "Clinical and Teaching Skills and Neurologic Medical Knowledge;" "Team-Based Practice;" and "Developing Global Neurology Partnerships" *(continued)*

Demonstrate a commitment to capacity building in the local context through bidirectional knowledge sharing through mentoring and teaching.
Explain the importance of respect, bidirectional exchange, and capacity strengthening in the practice of global neurology and outline potential pitfalls related to the development of global neurology partnerships.
Developing global neurology partnerships
Describe best practices for assuring program sustainability.
Demonstrate diplomacy and build trust with community partners.
Demonstrate leadership skills, including participatory communication skills, adaptability, team management, flexibility, self-awareness, and positivity that support collaborative practice and team effectiveness.
List major organizations funding global neurology programs (e.g., research, education, and/or clinical) and describe pathways to achieve support.
Demonstrates a willingness and ability to learn from local providers and communities.

basic (i.e., ideally should have been achieved during neurology residency), not specific to global health, not teachable, or not measurable.

LMIC experts noted competencies were highly relevant to their settings overall and rated the most important competency domains/subdomains as clinical skills and cultural context,

Table 4 Global Neurology Competencies Reaching Consensus in the Last 4 Domains: "Ethics," "Approach to Clinical Care," "Community Neurologic Health," and "Health Care Systems and Multinational Health Care Organizations"

Ethics
Demonstrate understanding of and ability to resolve common ethical issues and challenges that arise when working within diverse economic, political, and cultural contexts and when working with vulnerable populations and in low-resource settings to address global neurology issues.
Demonstrate an awareness of and respect for local and national codes of ethics relevant to one's working environment (e.g., variations in brain death policies, approaches to palliative care, attitudes toward withdrawing care, health care decision-making practices, appropriate disclosure of health information, goals of care, definition of quality of life, etc.).
Apply the fundamental principles of international standards (e.g., Declaration of Helsinki) for the protection of human subjects in diverse cultural settings.
Respect the rights and equal value of all people without discrimination.
Discuss historical contexts relevant to the local setting which may alter how neurologic health, health care delivery, international medical providers, and international research projects may be viewed by local partners, patients, governments, and other relevant stakeholders. These may include colonization, postcolonial and neocolonial realities, and prior ethical violations.
Explain the principles of responsible conduct of research and collaborative practice as they pertain to a global health setting.
Approach to clinical care
Discuss limitations in skills, knowledge and abilities and challenges of adapting care practices, and knowledge from one's home to one's local setting.
Apply social justice and human rights principles in addressing neurologic global health problems.
Implement strategies to engage marginalized and vulnerable populations in making decisions that affect their neurologic health and well-being.
Community neurologic health
Locate, appraise, and interpret available data (e.g., public health surveillance data, vital statistics, registries, surveys, electronic health records, and health plan claims data) to understand the neurologic health status of populations. (This might include navigation and collaboration with local ministries of health, local institutional review boards, and knowledge of local guidelines.)
Health care systems and multinational health care organizations
Describe how different care delivery systems influence access to neurologic care, content of care, patient participation, empowerment, and health care expenditure.
Discuss the role, organizational structure, and limitations of the World Health Organization as it pertains to neurology. Discuss additional organizations and how they influence neurologic policy and/or practice in your area of interest.
List insurance mechanisms, levels of care, and resources in the health care system and community that are commonly available to facilitate the clinical care and recovery of patients with neurologic disorders in the local setting in which you are practicing.
Describe how research funding priorities and mechanisms can influence neurologic research.

social determinants of health and access to care, team-based practice, and developing global neurology partnerships. As a result, competency domains are listed in this order to reflect their relative perceived importance. Policy-focused competencies were believed to be least relevant overall but, nevertheless, were still deemed important. Based on input from the LMIC experts, wording changes were made to 6 competencies and an additional 3 competencies were added, 1 each to the following domains: clinical and teaching skills and neurologic and medical knowledge, team-based practice, and health care systems and multinational health care organizations.

Furthermore, during the focus group, the LMIC neurologists emphasized empathy, ethical behavior, respect, the ability to adapt medical knowledge and skills to local resources, and understanding sociocultural aspects of the country as key aspects of actualizing the competencies, with "respect" and "bidirectional exchange" being particularly important. It was noted that many times, LMIC investigators have experienced international collaborators "coming, taking, and leaving" rather than collaborating and building together. Other elements such as sustainability, capacity building, and an emphasis on cost-effective practice were also noted as crucial to maintaining the longevity of programs. Cultural context, including the stigma of neurologic disorders, and the need for an intentional focus on advocacy were identified as crucial areas for neurologists working in LMIC settings.

Discussion

This modified Delphi process resulted in 47 competencies regarded as essential for neurologists from HICs pursuing training in global neurology. Formal competency-based global health curricula have become an accepted standard in global health training,[24,30] albeit with varying models and outcomes.[31,32] Accepted formal competencies that are observable, measurable,[17,18] and appropriately structured to reflect specific educational outcomes agreed on by neurologists from HICs and LMIC partners with experience in this area may result in trainees feeling more comfortable enrolling in global neurology training programs. In addition, appropriate competencies may engender greater support for global neurology activities at the administrative and financial levels of academic neurology departments.

The Delphi method has been used previously to develop a consensus fellowship curriculum.[20] Using the combined expertise of US-based global neurologists and LMIC-based neurologists with experience collaborating with and/or training neurologists from HICs has resulted in this set of extensive, well-researched proposed competencies for US-based neurologists or neurologists trained in other HICs pursuing postgraduate training in global neurology.[33-35] Our consensus curriculum was reviewed by neurologist colleagues in LMICs and adjusted to reflect their comments on the content and perceived importance of each competency domain.

Challenges to implementing, monitoring, and evaluating this postgraduate competency framework[36] include possible mismatch of existing competencies with patient or population needs, lack of international teamwork and collaboration, a scarcity of medical institutions in LMICs, and limited capacity of LMIC institutions to expand their educational opportunities to external trainees. Currently, the number of global neurology trainees is small, but adequate resources for development and implementation of programs and curricula exist in many countries. Implementation of the competency framework developed here would require several steps, including developing partnerships across geographic boundaries, identifying in-country resources (including available technology for neurodiagnostics and virtual training), and identifying in-country neurology mentors.[11] Consulting other global health programs, program directors, and curriculum experts for first-hand experiences and advice can be invaluable when implementing a new program in a new country, particularly when seeking the expertise and experience of in-country educators and clinicians.[33]

This study has clearly articulated goals for United States–based neurologists or neurologists from other HICs pursuing fellowship training of at least 1 year in global neurology. As such, a comprehensive list of competencies was developed that are likely unachievable for neurology postgraduate trainees or medical students who seek a short-term global neurology experience in an LMIC. The proposed competencies could, however, serve as a starting point for educators interested in developing competencies for short-term to medium-term global neurology experiences or further adapted to "milestones" for residents or students pursing such experiences. Thus, this more complete list of competencies could be prioritized and pared down to those appropriate for and achievable in an experience of shorter duration.

Furthermore, not every competency included in this list will be applicable to or appropriate to all LMIC settings in which a trainee may pursue global neurology training. We anticipate that individual programs will choose the most applicable competencies for their trainees and will likely not include all 47 competencies for every trainee in every program. Finally, given the limited number of neurologists who pursue formal global neurology training, a formal accreditation or board examination evaluating these competencies is unlikely, and adherence to these competencies will likely be undertaken and evaluated only at the individual program level. It is also important to recognize that the final list of global neurology competencies proposed here does not address the postgraduate neurology training needs in many LMIC settings. A comparative inspection of the vast difference in number of trained adult neurologists—4.75 per 100,000 people in HICs vs 0.13 per 100,000 in LMIC[37]—demonstrates the astounding lack of access to neurologic expertise that many patients with neurologic disorders encounter and the concomitant lack of neurology training programs[38] in the parts of the world that need them most. The consensus competencies presented here were developed for Unites States–based neurologists who have already completed neurology residency and, thus, have acquired a solid foundation of clinical knowledge and skills in

general neurology. As such, the proposed competencies are likely not appropriate in their current form to serve as curricula for neurology training programs developed in LMICs. However, 1 goal of HIC global neurology programs should be to provide training, networking, and capacity building in the local institutions in which they are working through strengthening and developing collaborations, sharing expertise, enhancing networking opportunities for local physicians and trainees, and building capacity at a local level. This can then be followed by other formal international exchange or research programs for health care workers from LMICs such as the Fulbright exchange program.[39] As such capacity develops, neurologists in LMICs would ideally be involved in reshaping these competencies which could then serve as a starting point to be adapted and incorporated into local curricula once appropriately contextualized.

Finally, while outside the scope of this study, we acknowledge the implementation challenges and local burden that are required to effectively develop and institute a global neurology training program in an LMIC setting. These considerations are certain to vary substantially from location to location and even from institution to institution within a given location. To begin to gain perspective on and address implementation issues that may be more widespread and generalizable between locations, we convened a panel of LMIC neurologists from across several world regions with experience working with neurologists from HICs. While we sought a broad representation of experts from around the world, not every world region was represented, nor was every potential content within represented world regions. However, context-specific considerations such as language proficiency, cultural competency training, compensation for partnering institutions and mentoring, as well as medicolegal practicalities, are essential components of any program—regardless of setting—that intends to implement and use the competencies defined herein. As such, strong international partnerships and open discussions between collaborators will be essential to considering and equitably implementing these competencies at any institution worldwide and should be undertaken before beginning a global neurology training program anywhere in the world.

While the field of global health neurology is still in its infancy, this proposed curriculum could serve as a starting platform and framework to help grow the number of young neurologists trained in global neurology and may also serve as a model for global health training programs in other medical specialties. The rapidly evolving dynamic of the global health community will virtually ensure that the proposed competencies will likely change over time as perceptions evolve within the field of global health. As such, these competencies should be seen as a starting point for programs training neurologists from HICs in global neurology and should be adapted as needed to the changes affecting the field of global health, such as increasing migration patterns, conflicts, and emergence and re-emergence of neurotropic pathogens.

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Appendix *(continued)*

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