



Future Directions for Global Clinical Neurosurgical Training: Challenges and Opportunities

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■ **OBJECTIVE:** Expanded access to training opportunities is necessary to address 5 million essential neurosurgical cases not performed annually, nearly all in low- and middle-income countries. To target this critical neurosurgical workforce issue and advance positive collaborations, a summit (Global Neurosurgery 2019: A Practical Symposium) was designed to assemble stakeholders in global neurosurgical clinical education to discuss innovative platforms for clinical neurosurgery fellowships.

■ **METHODS:** The Global Neurosurgery Education Summit was held in November 2021, with 30 presentations from directors and trainees in existing global neurosurgical clinical fellowships. Presenters were selected based on chain referral sampling from suggestions made primarily from young neurosurgeons in low- and middle-income countries. Presentations focused on the perspectives of hosts, local champions, and trainees on clinical global neurosurgery fellowships and virtual learning resources. This conference sought to identify factors for success in overcoming barriers

to improving access, equity, throughput, and quality of clinical global neurosurgery fellowships. A preconference survey was disseminated to attendees.

■ **RESULTS:** Presentations included in-country training courses, twinning programs, provision of surgical laboratories and resources, existing virtual educational resources, and virtual teaching technologies, with reference to their applicability to hybrid training fellowships. Virtual learning resources developed during the coronavirus disease 2019 pandemic and high-fidelity surgical simulators were presented, some for the first time to this audience.

■ **CONCLUSIONS:** The summit provided a forum for discussion of challenges and opportunities for developing a collaborative consortium capable of designing a pilot program for efficient, sustainable, accessible, and affordable clinical neurosurgery fellowship models for the future.

Key words

- Global health
- Global neurosurgery
- Global surgery
- International development
- Public health

Abbreviations and Acronyms

AANS: American Association of Neurological Surgeons
CNS: Congress of Neurological Surgeons
COVID-19: Coronavirus disease 2019
DGNN: Duke Global Neurosurgery and Neurology
FIENS: Foundation for International Education in Neurological Surgery
HIC: High-income country
LMIC: Low- and middle-income country
NED: Neurosurgery, Education and Development
PGSSC: Program in Global Surgery and Social Change
TBI: Traumatic brain injury

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Citation: World Neurosurg. (2022) 166:e404-e418.
<https://doi.org/10.1016/j.wneu.2022.07.030>

Journal homepage: www.journals.elsevier.com/world-neurosurgery

Available online: www.sciencedirect.com

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INTRODUCTION

The era of only the best for the few and nothing for the many is drawing to a close.

Dr. Halfdan Mahler, Third Director-General,
World Health Organization, 1980

The need for global attention to and investment in surgery was articulated by Halfdan Mahler, the Director-General of the World Health Organization, as early as 1980.¹ Thirty-five years later, in 2015, the groundbreaking report by the Lancet Commission on Global Surgery highlighted the lack of access to surgical care that 5 billion individuals worldwide face.^{2,3} Later that year, the 68th World Health Assembly passed World Health Assembly Resolution 68.15 on strengthening emergency and essential surgical care and anesthesia as a component of global health.³ Global neurosurgery arose at the intersection of neurosurgery and public health to address the global burden of neurosurgical disease.^{4,5} Approximately 5 million emergency and essential neurosurgical cases are not performed annually, all in low- and middle-income countries (LMICs), because of a global deficit of >23,000 neurosurgeons.⁶ The lack of neurosurgical personnel results in unnecessary morbidity and mortality, representing a critical global public health concern.

Previously, medical missions were the predominant model of addressing the global burden of neurosurgical disease.⁷ However, missions have been criticized for their short-term focus, lack of emphasis on local capacity building, and inconsistent post-operative follow-up.⁷ The term medical neocolonialism has been used to describe these aspects of well-intentioned but often harmful efforts. More recently, sustainable programmatic collaborations have been endorsed as a better method to increase local neurosurgical capacity for both short-term and long-term neurosurgical patient care.^{8,9} These programs may be clinical, nonclinical, or a combination of the two. Clinical programs have been developed that focus on supporting training in the host LMIC or designate opportunities for advanced clinical training in high-income countries (HICs). Global educational platforms have expanded as simulators and digital connectors have become more widely used.^{10,11} Given the wide array of established and emerging clinical training opportunities, Weill Cornell Medical College in association with George Washington University School of Medicine and Health Sciences convened the “Global Neurosurgery 2019: A Practical Symposium” summit with leaders in global neurosurgery along with junior faculty and residents to centralize resources, converge parallel global neurosurgery efforts, and identify areas of need to advance training and care in LMICs.¹²

Although progress has been made in the arena of global neurosurgical education and training, access to sustained neurosurgical training opportunities has been identified as a substantial barrier. This article outlines the proceedings and preliminary recommendations the virtual “Global Neurosurgery Education Summit 2021: Developing the Clinical Fellowship Models of the Future” on November 19, 2021. The summit focused on neurotrauma and spina bifida given the previously described importance of these conditions in LMICs.¹³⁻¹⁸ The goal of this conference was to present an overview of global neurosurgical fellowships

worldwide; discuss innovative and novel virtual learning resources; and use the gathering as a forum to discuss challenges, opportunities, and strategies for clinical training in neurosurgery in the postpandemic era.

METHODS

Agenda

The conference consisted of 30 presentations from international experts in neurosurgical training, virtual platforms, and virtual educational tools. Programs for clinical training in neurosurgery as well as opportunities for virtual access development were detailed. The target audience was health care providers with an interest in improving neurosurgical care in LMICs. The conference was conducted with an understanding of the bidirectional nature of international learning and the usefulness of global forums in disseminating innovative educational models. The vision of this conference was to serve as a collaborative consortium for accelerating global progress in specific, high-need areas of clinical neurosurgical training through global clinical neurosurgical fellowships. The meeting also served as a conduit for the presentation of innovative, high-fidelity virtual training opportunities for trainees and faculty to aid in the design of supplements to traditional global neurosurgery clinical fellowships.

The faculty were selected by global chain referral sampling, with particular emphasis placed on securing participants recommended by trainees and medical students in LMICs, who would be the most likely participants in future clinical training programs. Presentations were specifically designed to include perspectives of both host institutions and local champions. Countries represented arose from 5 continents and included Canada, Colombia, Ethiopia, Haiti, Nepal, Nigeria, Saudi Arabia, South Africa, Spain, Tanzania, Uganda, United Kingdom, United States, and Vietnam (Figure 1). Several programs were multinational and/or varied in participant country of origin from year to year. When possible, host and local champions were encouraged to make presentations on the same program to provide a 360° view of the training.

This educational summit was open to all who desired to register and was advertised through the mailing lists of the sponsoring universities, Seattle Science Foundation, and social media sites. The conference was accredited for a maximum 10.5 hours of American Medical Association PRA Category 1 Continuing Medical Education Credit. To keep the course accessible to all and account for the cost of Continuing Medical Education Credits, a reduced \$25 registration fee was charged, with a request that participants who were able select the \$50 or \$100 registration option do so. Registration fees were waived entirely for participants from LMICs.

Survey

Participants and presenters were asked to complete a preconference survey to stimulate thought and discussion about the design of future clinical neurosurgical fellowships (Supplementary Material). In particular, participants were asked to consider the merits of flipped classroom (also known as reverse classroom) didactic learning for trainees, surgical simulators, essential

components, and duration of hands-on skills that should continue to be taught in the current in-person model, and the merits of hands-on training in HICs versus LMICs. The flipped classroom is an instructional strategy and type of blended learning that aims to increase student engagement and learning by having students complete readings at their home and work on problem-solving during class.¹⁹

Structure

The conference consisted of 3 sessions (Figure 2). Session I “Review of Existing Global Neurosurgery Educational Programs” contained part 1 as “Host Institution/Participant Perspectives” and part 2 as “LMIC Local Champion Perspectives”. Session II “Components of Pilot Global Neurosurgery Fellowships of the Future,” included part 1 as “Virtual Learning Resources” and part 2 as “Hands-on Surgical Fellowships, Current Opportunities, and Experiences.” Within the first 2 sessions, each presentation was 10 minutes with an additional 5 minutes for question-and-answer and discussion. Session 3 involved the generation of a consensus statement for pilot curricula on neurotrauma and spina bifida. The summit focused on these topics because these conditions tend to be the areas of greatest need within pediatric neurosurgery within LMIC contexts.¹³⁻¹⁸

RESULTS

Preconference Survey

A total of 115 individuals registered for the symposium, including 47 physicians, 42 residents/fellows, 10 medical students/Ph.D. candidates, 6 nurses/physician assistants, and 10 other. Only some respondents listed their country of origin (Tables 1 and 2). Eighty-five individuals (74.6%) responded to the preconference survey.

Of respondents, 61 (72.0%), 60 (71.0%), and 58 (68.2%) agreed or strongly agreed that using large virtual components may represent an effective means of delivering clinical, brain trauma, and pediatric global neurosurgery hybrid fellowships training, respectively. Seventy-one individuals (84.0%) agreed or strongly agreed that such learning can be accomplished using a flipped classroom model. Respondents indicated that elements of targeted global curricula that can be accomplished effectively in the virtual sessions include the studying of surgical cases ($n = 70$; 82.4%), learning of anatomy and physiology ($n = 66$; 77.6%), complication avoidance and management ($n = 66$; 77.6%), and essential steps of surgical procedures ($n = 66$; 77.6%). Video modules ($n = 75$; 88.2%) and smart glasses ($n = 51/85$; 60.0%) were rated as potentially useful in teaching surgical management.

Most topics and subtopics suggested in the survey to design brain neurotrauma and pediatric neurosurgery pilot curricula were considered to be essential. The leading neurotrauma topics included critical care management and monitoring of patients with brain trauma ($n = 80$; 94.1%), brain trauma imaging ($n = 79$; 92.9%), and assessment and management of patients with brain trauma ($n = 79$; 92.9%). For pediatric neurosurgery, congenital malformation ($n = 79$; 92.9%), spinal bifida ($n = 79$; 92.9%), and hydrocephalus ($n = 77$; 90.6%) were reported as the most important topics. Essential subtopics within hydrocephalus and spina bifida included myelomeningocele ($n = 76$; 89.4%) and postinfectious hydrocephalus management ($n = 75$; 88.2%).

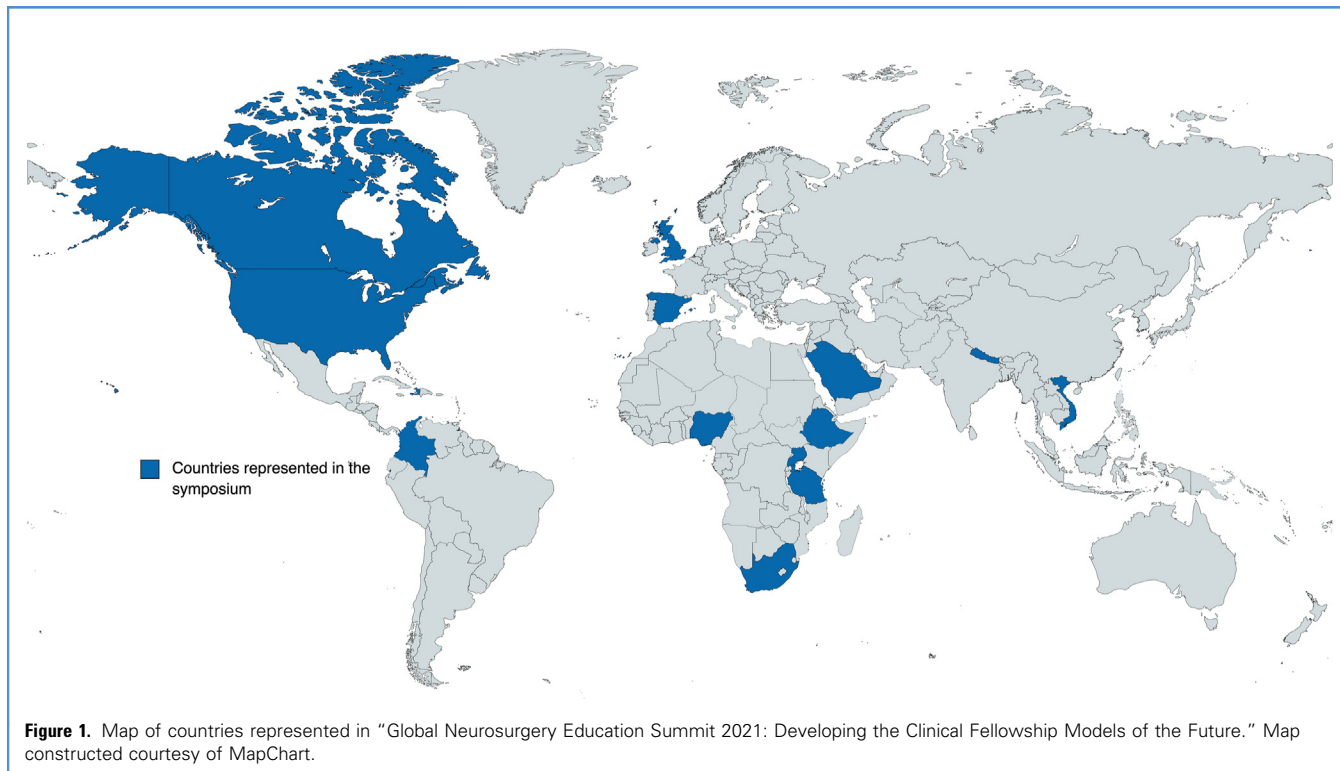
Respondents most recommended that the length of the virtual portion of the hybrid fellowship be either 11–12 weeks ($n = 25/77$; 32.5%) or 21–24 weeks ($n = 22/77$; 28.6%), assuming 1 hour per week of classroom didactics. The suggested length by respondents for the practical portion of the fellowship was most often 12 weeks ($n = 31/77$; 40.3%), whereas 41 (53.2%) reported that a length of 2–8 weeks was ideal. A suggested list of essential hands-on elements included neuroanatomy, surgical laboratories and cadavers, and surgical experience in the operating room. The suggested number of participating fellows was between 5 and 10 fellows for 37/77 of respondents (48.1%). To ensure the effective evaluation of fellows and fellowships programs, respondents indicated quantitative didactic measures ($n = 66$; 77.8%) and qualitative technical measures ($n = 57$; 67.1%) were necessary. Quantitative subtopics deemed essential by most respondents were Global Neuro module tests ($n = 55$; 64.7%), certification by a local or regional board ($n = 50$; 58.8%), and a final course examination ($n = 49$; 57.6%). Qualitative subtopics deemed essential by the majority were feedback from program directors ($n = 50$; 58.8%) and other fellows ($n = 45$; 52.9%).

Most respondents preferred that faculty trainers from HICs travel to LMICs for both brain trauma ($n = 41/77$; 53.3%) and pediatric myelomeningocele/hydrocephalus ($n = 44/75$; 58.7%) fellowships over fellows from LMICs traveling to HICs. Respondents pointed out the necessity of conducting surgery within local resource limitations, whereas others highlighted the opportunity for bidirectional exchange. Prominent early stakeholders/participants in the process included medical/surgical/neurosurgical specialty boards ($n = 72/77$; 93.5%), organizations that currently have fellowships ($n = 71/77$; 92.2%), department chairpersons ($n = 56$; 72.7%), and ministries of health ($n = 54$; 70.1%).

Presentation Summaries

Session I, Part 1: Host Institution/Participant Perspectives

- Tanzania/Muhimbili Orthopedic Institute (Weill Cornell Medicine): Neurosurgery training center established in 2013 that includes annual visits, remote training, exchange visit programs, and quality improvement to train Tanzanian neurosurgeons.^{12,20,21} The Weill Cornell Medicine team has sought to expand neurosurgical training through a compendium of in-person and virtual training opportunities and has seen marked growth in Tanzanian neurosurgical capacity over its long-running program. The program is included in the College of Surgeons of East, Central and Southern Africa regional resident complementary training package.
- Nepal (NeoSpine): Nepal Spine Foundation collaborates with the Department of Neurosurgery at Tribhuvan University Teaching Hospital to teach residents and faculty in the management of spinal trauma, tumors, congenital deformities, infections, and acquired degenerative conditions. These on-site spine surgery workshops have occurred yearly for more than a decade. In addition, the Foundation organizes monthly virtual conferences to train Nepalese spine surgeons in spine techniques, representing a measure for continued, longitudinal engagement between on-site courses. The benefit of the virtual teaching conferences has been reported.²²
- International Outreach Committee (American Association of Neurological Surgeons [AANS]): The purpose of this committee



is to assist in expanding access to membership and educational resources to non-North American trainees and neurosurgeons. One initiative has been the AANS International Visiting Surgeon Fellowship, which is a traveling observational fellowship offered to 2 neurosurgeons annually. The AANS also offers a symposium with international speakers at the AANS Annual Scientific Meeting, along with an opportunity for neurosurgeons and residents outside North America to attend.

- Uganda (Duke University): Duke Global Neurosurgery and Neurology (DGNN) works in partnership with Mulago Hospital/ Makerere University College of Health Sciences since 2007 and established a twinning program with Mulago and Mbarara Hospitals to increase neurosurgical capacity.²³⁻²⁵ DGNN conducts educational and training sessions with Ugandan neurosurgeons and trainees and actively collaborates on research initiatives aimed at understanding the burden of neurosurgical disease and developing strategies to address neurosurgical disease. DGNN is also actively working on establishing a program to enable a continual flow of neurosurgical supplies to Ugandan hospitals. Duke has established with local leaders 2 neurosurgical training programs with 8 graduates and 12 more in the training program, with a goal of 50 neurosurgeons in Uganda, an increase from 5 when the program started in 2009.
- Vietnam (University of Alabama, Birmingham): This is a pediatric neurosurgical collaboration with several children's hospitals aimed at improving the care of conditions such as hydrocephalus, epilepsy, neuro-oncology, craniofacial

conditions, and cerebrovascular conditions.¹¹ This collaboration uses in-country training with at least biannual visits, as well as out-of-country training in which Vietnamese partners travel to Birmingham for 2–3 months per year. Ongoing and continual support includes conferences and remote surgical mentorship. This collaboration has pioneered the implementation of virtual interactive presence technologies for neurosurgical training.

- Program in Global Surgery and Social Change (PGSSC, Harvard University): The Global Neurosurgery Initiative of the PGSSC focuses on research, advocacy, and policy in global neurosurgery and pediatric neurosurgical training at CURE Hospital in Uganda.^{6,26} The PGSSC operates through a team of unfunded research fellows, who are medical school graduates, and research associates, who are medical students, to map and develop solutions to the neurosurgical burden of disease in LMICs through strengthening of health systems. The PGSSC team functions through an arrangement of in-person and virtual meetings. Recent fellows have originated from LMICs and have completed their fellowships remotely. The PGSSC also organizes a recurring webinar series to provide accessible global neurosurgery education.
- Foundation for International Education in Neurological Surgery (FIENS). Founded in 1969, FIENS is an organization of partnerships dedicated to addressing global neurosurgical need through bidirectional education in the country of need, leading to a self-sustaining program of care, with a mission of service

Weill Cornell Medicine		New York-Presbyterian	
Global Neurosurgery Education Summit 2021			
<i>Developing the Fellowship Models of the Future</i>			
Friday, November 19, 2021			
Presented by Weill Cornell Medical College			
In association with George Washington University School of Medicine and Health Sciences			
Virtual Live Stream Via Zoom			
Course Co-Directors:			
Caitlin Hoffman, MD, and Roger Härtl, MD, Weill Cornell Medical College			
Gail Rosseau, MD, George Washington University			
Agenda			
6:45am	Welcome and Introductions	Caitlin Hoffman, MD Roger Härtl, MD Gail Rosseau, MD	
SESSION I Review of Existing Global Neurosurgery Educational Programs			
Part 1: Host Institution/Participant Perspectives			
7:00 am	Tanzania/MOI (Weill Cornell Medicine)	Roger Härtl, MD	
7:15am	Nepal (NeoSpine)	Richard Wolms, MD	
7:30 am	International Outreach Committee (AANS)	Kenan Arnautovic, MD	
7:45 am	Uganda (Duke University)	Michael Haglund, MD, and Anthony Fuller, MD	
8:00 am	Vietnam (University of Alabama, Birmingham)	Brandon Roque, MD	
8:15 am	PGSSC (Harvard University)	Kee Park, MD, Ahmed Negida, MBCh and Radzi Hamzah, MD, MPH	
8:30 am	Clack Fellowship (FIENS)	Robert Dempsey, MD	
8:45 am	Bassett Fellowship (FIENS)	David Sandberg, MD	
9:00 am	Tanzania/Zanzibar (NED Foundation)	Jose Piquer, MD	
9:15 am	Colombia (Meditech Foundation)	Andrés Rubiano, MD	
9:30 am	Haiti (University of Miami)	John Ragheb, MD	
9:45 am	International Division (CHS)	Martina Stippeler, MD	
10:00 am	Barcelona Program (EANS)	Jesus LaFuente, MD	
10:15 am	Middle East (Arnold Palmer Hospital)	Samer Elbabaa, MD	
10:30 am	NIHR Global Health (United Kingdom)	Peter Hutchinson, MD, Angelos Kolias, MD, and Dylan Griswold, MD	
10:45am	Seattle Science Foundation	Rod J. Osoukian, MD	
11:00am	Neuro Kids	Michael Dewan, MD	
11:10am	Fogarty Program (NIH)	Rebecca Reynolds, MD	
11:20am	Break		
Part 2: LMIC Local Champion Perspectives			
11:35 am	Tanzania/MOI Experience	Hamisi Shabani, MD	
11:50 am	Experiences from West Africa	Raji Mahmud MD	
12:05 pm	Ethiopia/Black Lion Experience	Kibruysfaw Zewdie, MD	
12:20 pm	Haiti Experience	Ernest J. Barthélemy, MD, MPH, MA	
12:35 pm	South Africa Experience	Graham Fieggen, MD	
SESSION II Components of Pilot Global Neurosurgery Fellowships of the Future			
Part 1: Virtual Learning Resources			
1:00 pm	Project ECHO	Elizabeth Donner, MD	
1:15 pm	Ohana One Pilot Study	Marchelle Sellers, MBA	
1:30pm	Case Report: Smart Glasses	Fabian Sommer, MD	
1:40 pm	AD Trauma NA Experience	Chitra Subramaniam, MD	
1:55 pm	Global Neuro	Jamie Ullman, MD & Gregory Hawryluk, MD	
2:10 pm	Intersurgeon	James Johnston, MD	
PART 2: Hands-on Surgical Fellowships, Current Opportunities and Experiences			
2:25 pm	Toronto SickKids	Abhaya Kulkarni, MD	
2:40 pm	Evaluation Surveys for Non-Faculty Attendees		
2:50 pm	Break for Faculty/Adjourn for Non-Faculty Attendees		
SESSION III Consensus Statement			
Focus for Pilot Curricula: Trauma and Spina Bifida			
3:00 pm	Group discussion on presented material and development of a consensus statement on pilot global fellowship programs in Trauma and Pediatrics		
6:00 pm	Closing Remarks / Evaluation Surveys for Faculty / Adjourn		

Figure 2. Program agenda.

through education. FIENS establishes curricula, certification, and virtual and hands-on learning and provides funding for boot camps and postgraduate support for the establishment of trainees in their country of need.

- Clack Fellowship (FIENS): This fellowship supports neurosurgical trainees in LMICs in completing their neurosurgical training at a local or regional training center.^{27,28} In this way, trainees may learn critical knowledge and skills within local resource limitations to become competent

neurosurgeons who practice in their home country. This fellowship seeks to address the global burden of neurosurgical disease through education and support trainees who must pay tuition for neurosurgical residency training.

- Bassett Fellowship (FIENS): This fellowship supports neurosurgical trainees in LMICs or recent graduates in obtaining 3 months of specialized training at an established neurosurgical service.^{27,28} The purpose of this fellowship is to allow neurosurgeons or trainees to hone specialized skills that they can share and apply in their home country. A special emphasis is the learning of both surgical skills and also the educational skills necessary to maintain a training program in one's home country. These fellowships were limited because of the coronavirus disease 2019 (COVID-19) pandemic but have since resumed, with greater discussion on the role of amplifying access through virtual sessions.
- Tanzania/Zanzibar (NED [Neurosurgery, Education and Development] Foundation): This organization seeks to address the most prevalent pediatric neurosurgical diseases within local challenges through patient care, reinforcement of weekly academic activities, and coordination of international surgical camps.²⁹⁻³¹ Initiatives include mobile training courses in endoscopic third ventriculostomy for hydrocephalus; development of the first neurosurgery program in Zanzibar at Mnazi Mmoja Hospital; and conduction of seminars, hands-on courses, and supervised operative experiences. The NED Foundation also evolved the neurosurgical program at Mnazi Mmoja Hospital into a nonprofit neurosurgical institute providing free care to all patients.
- Colombia (Meditech Foundation): This organization is focused on expanding medical education and research capacity in trauma, emergency, and critical care. Many of its initiatives have focused on neurotrauma. Some initiatives have been the establishment of traumatic brain injury (TBI) guidelines with the Colombian Ministry of Health and the development of stratified protocols for TBI care. The International Global Neurotrauma Fellowship in partnership with Barrow Neurological Institute at Phoenix Children's Hospital and the University of Cambridge is intended to augment neurotrauma training for LMIC neurosurgeons. This fellowship is a combined clinical and research fellowship designed to increase proficiency in treating cranial and spinal neurotrauma and designing and executing research projects to improve neurotrauma outcomes and care delivery. A new specific global neurosurgery 1-year fellowship has been developed supported by Universidad del Valle in Cali, Colombia, with the aim of supporting the capacity development for young neurosurgeons of the Central American and Caribbean Region. The program started in June 2022.
- Haiti (University of Miami): This partnership through Project Medishare aims to increase access to neurosurgical care through the provision of surgery and training of Haitian neurosurgeons.³²⁻³⁴ The Hospital Bernard-Meys/Project Medishare has become the main hospital in Port-au-Prince and has

Table 1. Registrants by Category

Category	Total Number Registered	Number Adding Country	High-Income Country, n (%)	Low- and Middle-Income Country, n (%)
Physicians	47	16	8 (50.0)	8 (50.0)
Residents and fellows	42	23	6 (26.1)	17 (73.9)
Medical students	10	4	2 (50.0)	2 (50.0)
Nurses/physician assistants	6	3	1 (33.3)	2 (66.6)
Other	10	4	2 (50.0)	2 (50.0)

provided a unique opportunity for basic neurosurgical training. A formalized training curriculum aligned with Accreditation Council for Graduate Medical Education International goals has been established to provide a sustainable solution to the neurosurgical disease burden in Haiti.

- International Committee of the Congress of Neurological Surgeons (CNS): The CNS seeks to support neurosurgeons globally

Table 2. Registrants by Country

Country	Income Classification	Number of Registrants
Bangladesh	LMIC	1
Belgium	HIC	1
Brazil	LMIC	1
Canada	HIC	1
Chile	HIC	1
Colombia	LMIC	1
Congo (Democratic Republic)	LMIC	2
Ethiopia	LMIC	1
Germany	HIC	1
Ghana	LMIC	1
Kenya	LMIC	5
Libya	LMIC	1
Malaysia	LMIC	1
Nigeria	LMIC	1
Philippines	LMIC	1
Singapore	HIC	1
Spain	HIC	1
Tanzania	LMIC	8
Tunisia	LMIC	1
Uganda	LMIC	2
United States	HIC	14
Zambia	LMIC	2

LMIC, low- and middle-income country; HIC, high-income country.

by partnering with other professional societies, such as the Japanese Congress of Neurological Surgeons, the Neurological Society of India, and the Sociedade Brasileira de Neurocirurgia, to organize scientific sessions with international guest speakers. The CNS has also made its library of online educational resources and educational events accessible to international neurosurgeons. In addition, internationally recognized neurosurgeons with ties to their local society and the CNS who attend committee meetings provide valuable input into how the CNS can serve these countries. The CNS Foundation with its philanthropic efforts is committed to education of international neurosurgeons in the form of tele-mentor programs, international visitor's programs, and international observership programs.

- Barcelona Program (European Association of Neurological Surgeons): These training courses open to residents from Europe and abroad to enhance theoretic knowledge and clinical management skills. These courses may serve as an important training opportunity for neurosurgeons and trainees in LMICs who lack access to local training courses, although the total cost of attendance is likely the largest barrier. One of the most important aspects in training neurosurgeons from LMICs is to have the facility of hands-on training available to them. For this purpose, we are involving local health authorities to obtain permission for participants to work in specific centers with full supervision in English so they can work as residents for 1 year. This strategy creates a worthwhile visit with a worthwhile training experience, feeling part of the team and making this experience unique, as no Western country allows LMIC surgeons to train as local trainees. The Catalan government together with an initiative with Kenya is working on a detailed program in which the trainee will be able to operate on patients in Barcelona within a pilot study, which might change the training paradigm for the future.
- Middle East (Palestine Children's Relief Fund, a U.S.-based nongovernmental organization): This program focuses on subspecialized pediatric and adult neurosurgical missions to different parts in the Middle East. This program also involves providing training opportunities to local LMIC neurosurgeons via hands-on workshops and clinical visits to neurosurgical departments in HICs.
- National Institute for Health Research Global Health (United Kingdom): This program funds high-quality applied health research, including neurotrauma, and training, such as

neurosurgical training, in LMICs. The neurotrauma group seeks to map TBI care; understand TBI care; generate and implement innovation in TBI; and measure and nurture research capacity with collaborators in South America, Africa, and Southeast Asia, as well as partner organizations. The group has worked on large-scale projects on outcomes studies and prevention of TBI in LMICs.

- **Seattle Science Foundation:** This nonprofit organization was created in 2006 and creates high-quality video modules from recognized experts. The program also includes on-site training with 3 fellowship positions in clinical complex spine and anatomic research and clinical and research opportunities for premedical and medical students. Didactic contents are accessible on the Web site and YouTube, free of charge and without a subscription. The Foundation has highlighted the usefulness of virtual education and is important to the global neurosurgery community given the need to expand the quantity and quality of the neurosurgical workforce.
- **NeuroKids:** This program is a mentor–trainee virtual-presence training platform that uses technology from Help Lightning (Help Lightning, Birmingham, Alabama, USA) and Ohana One to teach pediatric neurosurgical procedures. The hybrid model begins with short-term on-site in-person training. Subsequent training occurs via the virtual-presence platform over 12 months, throughout which assessments are administered to ensure adequate skills acquisition. Trainees become expert NeuroKids faculty themselves and go on to train other neurosurgeons. Didactic videos may be streamed, and individuals can record and review their own surgical procedures to identify areas for improvement. The organization was created during the COVID-19 pandemic to use remote learning to address the high burden of pediatric neurosurgical disease. Although barriers include interference with current practice/call, cost, and identifying international partners, Neuro Kids seeks to minimize these barriers by serving as a central platform to facilitate collaboration.
- **Fogarty Program (National Institutes of Health):** Funding opportunities include an on-the-ground global health research program. Predoctoral and postdoctoral trainees from the United States and LMICs can participate in a 1-year program of mentored global health research training at recognized research institutions or agencies in LMICs. Recently, neurosurgical residents from the United States have traveled to Zambia to study outcomes of pediatric hydrocephalus and spina bifida and Peru to examine neurosurgical capacity for TBI. DGNN has a collaborative effort with the neurologists in Uganda to address the stigmata and burden of epilepsy identification and treatment, opening the country's first epilepsy clinic in 2018.

Session I, Part 2: LMIC Local Champion Perspectives

- **Tanzania/Muhimbili Orthopedic Institute:** Tanzania has benefited from the presence of multiple different groups, including Madaktari Africa, Weill Cornell, NED Institute, and CURE International.^{12,20,21} These groups have established a sustainable partnership that involves frequent annual visits, remote training, exchange visit programs, and assessment of quality improvement. A nursing group called Pioneer in

Neuroscience Nursing in Tanzania was created to provide nurses with adequate neuroscience knowledge. The group uses American Association of Neuroscience nursing courses but is developing its own curriculum. The Tanzanian Government's Ministry of Health facilitated an increase in the number of intensive care unit beds for TBI from 8 to 32 and the acquisition of implants for spinal fracture treatment. Further efforts to improve sustainability are necessary.

- **Experiences from West Africa:** Factors responsible for disparity and underdevelopment of neurosurgical centers include national/regional instability, poverty, lack of political will, and lack of internal collaboration and synergy among African neurosurgeons. The number of neurosurgeons in Africa has dramatically increased, and new neurosurgical centers, including those with greater care acuity and private centers with improved equipment, have been built. However, training relies on private effort. Hybrid training fellowship opportunities may maintain local training and sustain ongoing local efforts in the context of travel restriction. Promoting a team-based training approach involving neuronurses and neuroanesthetists may also be helpful.
- **Ethiopia/Black Lion Experience:** Ethiopia has partnered with the University of Bergen Haukeland University Hospital and FIENS. The Chinese government recently built a neurosurgical hospital in Addis Ababa. Efforts to augment training have produced additional neurosurgeons and trainees with a resulting increase in capacity and improved outcomes. Further training will allow Ethiopia to meet the standard of 1 neurosurgeon for every 200,000 individuals suggested by the World Health Organization. Challenges include the overwhelming presence of low-level facilities, which prevent delivery of safe and adequate neurosurgical care, and the need for current partnerships to focus on supporting ongoing local efforts to scale up the workforce and expand neurosurgical facilities. Hawassa University is supported in its quest to become a surgical center of excellence by the Operation Giving Back Program of the American College of Surgeons. The recent hiring of 2 neurosurgeons may provide opportunities for collaborative growth of this as a multidisciplinary surgical program.
- **Haiti Experience:** The Society of Haitian Neuroscientists was recently established and provides weekly virtual educational services at the University of Mirebalais. The organization has partnered with Zanmi Lasante, a sister organization of Partners in Health and Haiti's largest health care provider apart from the government, to provide guidance in addressing neurosurgical needs, with the State University of Haiti to restructure the neuroscience curriculum, and the INFO-CHIR journal to introduce more neuroscience and neurosurgery content into publication. These comprehensive initiatives seek to advance neurosurgical care in the domains of clinical practice, education, and research and overcome a complex sociopolitical history and multiple natural disasters.
- **South Africa Experience:** South Africa's Society of Neurosurgeons of South Africa is active, and laboratories such as the University of Cape Town Neuroscience Institute Innovation Laboratory help with additional training and research. The

greatest challenge for local programs is adequate funding. Although contributions from international partners are welcome, the sustainability of local training would ideally depend on local funding. Suggestions for improvement center on strengthening local institutions, because the focus should be on the developing countries and not the international organizations providing help and preventing entrenched privilege in research collaboration with international partners.

Session II, Part 1: Virtual Learning Resources

- **Project ECHO:** This concept emphasizes the creation of a community of learning by connecting an interprofessional specialist team (hub) with community-based health care providers (spokes) to empower mini-specialists to lead local specialty care capacity in underserved communities. Educational sessions are delivered online to many countries and have discussed epilepsy. This project represents a scalable model for remotely training health care workers in LMICs to target the global burden of neurosurgical disease within local resource limitations.
- **Ohana One Pilot Study:** This group created a free network of mentor/mentee surgeons committed to training and sharing expertise virtually using Vuzix smart glasses (Vuzix, Corp., West Henrietta, New York, USA) and Help Lightning software. These technologies hold promise for transforming what was traditionally conceptualized as in-person training to virtual training opportunities and expanding the feasibility of clinical teaching and mentoring relationships across geographic distances.
- **Case Report: Smart glasses:** a preliminary study of Vuzix smart glasses and Help Lightning software showed limited visual resolution. However, virtual connectivity technologies such as smart glasses and Help Lightning, with some refinements, may be used to teach operative neuroanatomy and skills and coach trainees through a case worldwide.
- **AO Trauma North America Experience:** Nonprofit organization focused on trauma and musculoskeletal disorders teaching that offers lectures and hands-on interactive sessions in spine and trauma care. These educational opportunities have allowed proliferation of spina and trauma care worldwide and serve as an example of the wide reach of virtual education.
- **Global Neuro:** This association is involved in neurotrauma, neurovascular, and complex cranial access teaching, primarily through in-person didactics and online didactic materials in 10 different languages, that have been developed during the pandemic. This organization has an array of existing coursework, as well as the infrastructure and network to organize large-scale virtual courses. A training program in Venezuela for neurotrauma care is planned. An online diploma in neurotrauma care has been developed and has approximately 250 students (surgeons, intensivists, and residents) at worldwide level. In addition, short online courses for areas such as Latin America and Africa are under planning.
- **InterSurgeon:** This virtual platform was designed for developing collaborative partnerships between individuals and organizations within global surgery, as well as provision of relevant information, links to important resources, and technological tools.³⁵ InterSurgeon may serve as a useful mechanism for

connecting partners for global neurosurgery fellowships and increasing the accessibility of standard resources and augmented reality tools.

- **Toronto SickKids:** This fellowship program includes a 2–4 international fellows per year. Fellowships are funded from the hospital division, largely through surgical revenues, and stipends are commensurate with midlevel residents in Ontario. Fellows have originated from the United States, Europe, Middle East, Southeast Asia, Africa, and South America. This program represents a model of international fellowships that allows training in an HIC with a combination of operative experiences, clinics, lectures, and journal clubs. Challenges include the inability to judge skill and learning needs before arrival, licensing and visa issues, cultural differences in communication and values, and high expenses. Nonetheless, the program has created an international network of well-trained collegial fellows who have returned to their home countries to provide neurosurgical care.

Highlights of Round Table Discussion and Closing Thoughts

- The central concern of the discussion was the certification or assessment of individuals completing a global fellowship program. Both quantitative and qualitative measures were deemed important, but their relative weights and which quantitative and qualitative measures to use remain unclear.
- A related concern was the use of the term fellowship to describe nonformal or short programs given the limitations in assessing participants.
- Platforms that presented themselves as useful methods of implementing a global educational structure were highlighted. The role of contextual factors, such as working within local resource limitations and health systems, in designing hybrid fellowships was emphasized.
- Attendees agreed that virtual didactic sessions, including those focused on teaching neuroanatomy and pathophysiology and building an understanding of operative approaches, were feasible.
- Attendees emphasized the importance of a hands-on component to global neurosurgery fellowships to augment technical skills and provide in-the-moment operative mentorship.
- The distribution of virtual versus on-site and didactic versus hands-on training remained undecided and continues to be part of the ongoing discussion.
- Neurotrauma and pediatric hydrocephalus/spina bifida were agreed on as appropriate starting points for hybrid global neurosurgery fellowships.

Action Items for the Global Neurosurgical Community

- There was a consensus about the need to develop learning objectives and a core curriculum for hybrid global neurosurgery fellowships in neurotrauma and pediatric hydrocephalus/spina bifida.

- It was deemed important to establish a set of key metrics for evaluation.
- It was considered desirable to standardize the length and distribution of virtual versus on-site and didactic versus hands-on training.
- The need to attract and maintain all stakeholders' support for hybrid global neurosurgery fellowships was emphasized.
- It was deemed valuable to create a list of useful technologies and resources for hybrid global neurosurgery fellowships.

DISCUSSION

Increasing capacity for global neurosurgical clinical training is essential to address the shortage of neurosurgeons in LMICs. We present our findings from the “Global Neurosurgery Education Summit 2021: Developing Clinical Fellowship Models of the Future.” Experienced global neurosurgical educators, faculty, fellows, residents, and students provided their expertise and perspectives in the service of a productive discussion regarding the existing models of global neurosurgical training and future clinical global neurosurgery fellowships. This discussion provides insight into strategies that may be considered to mitigate the global burden of neurosurgical disease and to help close the surgeon gap.

Opportunities

Particular areas of clinical need include the surgical treatment of cranial trauma and pediatric disorders of spina bifida and hydrocephalus. Approximately 69 million individuals worldwide experience a TBI,³⁶ and the pooled period prevalence of spina bifida is 43.6 per 100,000 individuals.³⁷ The incidence of congenital hydrocephalus ranges from 67.5 to 316.1 per 100,000 individuals.³⁸ For cranial trauma care, didactic training may include topics such as epidemiology, trauma care systems, pathophysiology, assessment, imaging, surgical management, critical care management and monitoring, complication avoidance, and advocacy. For spina bifida and hydrocephalus, didactic training may include topics such as neurologic examination of the newborn, infant, or child; normal and abnormal development of the nervous system; spina bifida identification and management; hydrocephalus identification and management; shunt and endoscopic third ventriculostomy techniques; and the importance of folate fortification. Technical training for these conditions includes practicing surgical skills and steps of the procedure, either on models, cadavers, or virtual simulators. The areas of neurotrauma and spina bifida care emphasize the benefit of bidirectional educational exchange within global neurosurgery. These areas represent an opportunity for HICs to learn from LMICs given the presumed large burden of these conditions in LMICs.^{36,39,40} However, the conditions or procedures perceived as most needed may vary based on the region and community. A recent study from a single center in southwest Nigeria showed that head injury was the most common presenting condition, whereas myelomeningocele was less common.⁴¹ Another study showed the importance of myelomeningocele care in Uganda.⁴²

Challenges

All interventions must be based on the needs of local communities. Although trauma craniotomy and myelomeningocele closure have been noted as pediatric neurosurgical bellwether procedures,¹⁸ capacity may exist in some countries and regions. Accordingly, efforts to address the burden of neurosurgical disease in LMICs must center LMIC perspectives. In addition, global neurosurgical clinical training has generally involved teaching by HIC faculty in LMICs or an apprenticeship model in which learners from LMICs travel to HICs for hands-on training. Although the former model allows context-appropriate didactic or surgical skills training, these initiatives are often short-term and are further affected by limited use of neurosurgery on the part of patients or limited resources on the part of hospitals. The latter model has been found to be deficient for multiple reasons. First, this practice contributes substantially to brain drain,⁴³ defeating the purpose of traveling to an HIC to obtain skills that can be applied in LMIC settings. Second, many diseases are more common in LMICs than HICs, reducing the trainee's exposure to an adequate operative volume for common conditions in their home country. Third, operative conditions and limited local resources in LMICs are different from those in HICs. LMIC neurosurgeons must learn to practice within the resources of their home environment to obtain optimal educational benefit. Given these factors, some experienced clinical global neurosurgery educators prefer the model in which HIC faculty travel to LMICs as the final hands-on portion of training programs if necessary. Other models exist. The FIENS model has HIC faculty travel to LMICs to help establish and maintain the training program and its graduates under the leadership of the LMICs. Some training programs are managed by HIC–LMIC codirectors, and teachers are fifty-fifty from both regions. Students are supported by local faculties while they are in the 2 contexts.

Hybrid Fellowships and Modules

It seems possible for a clinical global neurosurgery hybrid fellowship with a large virtual component to be an effective means of training. Clearly, in-person operative teaching cannot be replicated through virtual means. However, didactic topics that lend themselves well to online learning include operative anatomy and physiology, clinical case discussions, patient selection, patient education, and the use of essential equipment. The flipped classroom has been shown as an effective learning technique over virtual platforms, particularly for adult learners. During the conference, participants provided a robust discussion of flipped classrooms but could not reach a consensus on the appropriate cohort size, duration of didactic online learning, and methods to assure participation. In addition, aspects of operative teaching can occur remotely. Faculty may remotely narrate operative procedures that they or their students perform, with stop-action questioning and discussion regarding positioning, operative anatomy, next steps in the procedure, tools to use, critical operative considerations, and complication detection and management. Similarly, students may do the same to increase their understanding of the procedure or show their understanding. Mentoring not only happens in the operating room but also has tremendous potential

before and after the operating room for remote mentoring. Successful completion of the remote mentoring component of operative training would involve accurate description of patient selection, positioning, essential steps of surgical procedures, avoidance of intraoperative complications and awareness of potential sources, and postoperative management and surveillance on the part of students. The remote mentoring also could be longitudinal to help with ongoing patient selection and selection of surgical approaches. This foundation could then facilitate a more efficient and effective use of the hands-on segment of training. However, attendees did not arrive at a consensus as to what proportion of the fellowship should be virtual versus in-person. Moreover, although most attendees indicated that hybrid fellowships were feasible to some extent, some attendees indicated that only certain educational modules should be hybrid rather than more extensive in-person fellowships.

Limitations and Future Directions

Our consensus exercise has limitations. First, the LMIC perspectives provided in session I were fewer than those from HICs. This disparity occurred despite the virtual format of the conference and elimination of all financial barriers to participation. Some individuals may not have had the chance to participate because of a lack of Internet connection, technical difficulties, or time zone differences. As a result, our findings may underrepresent the perspectives of LMIC neurosurgeons and trainees. These challenges represent a limitation of hybrid fellowships as well. In general, there was substantial underrepresentation of low-income and lower middle-income countries with neurosurgical programs, particularly in Eastern Europe, South America, and Asia. Second, there was disagreement regarding the definition of a clinical global neurosurgery fellowship during session 3. Although we attempted to use a standardized definition, alternative conceptualizations of what constituted a fellowship contributed to a lack of consensus with respect to the organization of such an initiative as a field. Third, although the event was established due to advances in virtual education resulting from the COVID-19 pandemic and some presenters noted that the pandemic affected their work or that their organizations were established during the pandemic, we did not directly quantify the impact of the pandemic on the summit or global neurosurgery training. It is likely that responses in the precourse survey would have differed if this summit was conducted before the pandemic. In addition, it is important to consider future directions. Inevitably, all educational models evolve over time. The development of new hybrid models for neurosurgical clinical fellowships or global clinical modules would benefit from the participation of neurosurgical department chairs and residency program directors; accreditation boards of medical, surgical, and neurosurgical specializations; ministries of health; and ministries of education. The program structure, curricula, and syllabi will require participation from medical schools, professional associations, and nongovernmental organizations involved in sponsoring or administering neurosurgical clinical fellowships. It will be critical to systematically gather evidence through pilot programs to establish the efficacy and safety of these new hybrid clinical fellowships in different regions.

CONCLUSIONS

“Global Neurosurgery Education Summit 2021: Developing the Clinical Fellowship Models of the Future” brought together a diverse group of experienced global neurosurgical educators, faculty, fellows, residents, and students interested in accelerating progress in addressing the shortage of neurosurgeons in LMICs through examination of current and potential future models of clinical neurosurgical fellowships. Developed as a response to the limited availability of global fellowships, the program featured speakers selected based on the needs of neurosurgical trainees in LMICs. Presentations from hosts, local champions, and individuals with experience in virtual learning modalities, followed by open virtual discussions, raised awareness regarding the challenges and opportunities in current models of clinical neurosurgical training and suggested future collaborations on pilot projects for hybrid virtual modules on clinical operative training. Perhaps most importantly, this symposium suggested a pathway forward to advancing neurosurgical training in the areas of greatest need. We look forward to sharing in the continued momentum and progress of global neurosurgical clinical education. Standardization of the format of future global neurosurgery fellowships, allowing sufficient flexibility to adapt to new pedagogical techniques and technologies, represents an important opportunity for addressing the global burden of neurosurgical disease.

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ACKNOWLEDGMENTS

The authors thank Roseann Henry and Tatiana Soto for their invaluable assistance in organizing the conference.

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commercial or financial relationships that could be construed as a potential conflict of interest.

Received 16 June 2022; accepted 6 July 2022

Citation: *World Neurosurg.* (2022) 166:e404-e418.

<https://doi.org/10.1016/j.wneu.2022.07.030>

Journal homepage: www.journals.elsevier.com/world-neurosurgery

Available online: www.sciencedirect.com

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Conflict of interest statement: The authors declare that the article content was composed in the absence of any

SUPPLEMENTARY MATERIAL

GLOBAL NEUROSURGERY EDUCATION SUMMIT 2021

Faculty Pre-Course Survey (this is the same survey for all four versions, faculty and attendee, pre and post course; only difference is that POST version will have the optional name/contact question)

Thank you for participating in this survey – your opinions will help direct discussion during the course and inform the follow-up research paper to be published in 2022.

PART I

How much do you agree with the following statements?

- It is possible for a **clinical global neurosurgery hybrid fellowship with a large virtual component** to be an effective means of training.
 - Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Strongly agree
- It is possible for a **brain trauma global neurosurgery hybrid fellowship with a large virtual component** to be an effective means of training.
 - Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Strongly agree
- It is possible for a **pediatric global neurosurgery hybrid fellowship focused on myelomeningocele repair and associated hydrocephalus with a large virtual component** to be an effective means of training.
 - Strongly disagree
 - Disagree
 - Neither agree nor disagree
 - Agree
 - Strongly agree
- The “**flipped classroom**” is an effective way for adults to learn remotely.

(A flipped or reverse classroom is an instructional strategy and a type of blended learning, which aims to increase student engagement and learning by having students complete readings at their home and work on live problem-solving during class time.)
 Ref 1 :[The Flipped Classroom – From Theory to Practice in Health Professional Education](#) Ref 2 :[Commentary: The Khan academy and the day-night flipped classroom](#)

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

PART II

- Do you consider these topics to be **essential didactic curricular elements for a brain neurotrauma fellowship**?
 - Y Brain trauma epidemiology
 - Y Trauma care systems
 - Y Brain trauma pathophysiology
 - Y Assessment and management of brain trauma patients
 - Y Brain trauma imaging
 - Y Surgical management of brain trauma patients
 - Y Critical care management and monitoring of brain trauma patients
 - Y Complication avoidance and management in brain trauma patients
 - Y Advocacy for brain-injured patients

Other [free text entry]
- Do you consider these topics to be **essential didactic curricular elements for a pediatric neurosurgery fellowship**?
 - Y Pediatric neurosurgery in the third world
 - Y Neurological examination of the newborn, infant, and child
 - Y Normal and abnormal development of the nervous system
 - Y Congenital intracranial malformations
 - Y Hydrocephalus
 - Y IVH and posthemorrhagic hydrocephalus
 - Y Post-infectious hydrocephalus
 - Y Congenital cysts
 - Y Treatment with shunts
 - Y Treatment with neuroendoscopy
 - Y Spina bifida
 - Y Embryogenesis of congenital spinal disorders
 - Y Spinal meningocele
 - Y Myelomeningocele
 - Y Spina bifida occulta

- Intraspinal congenital cysts
- Congenital vertebral anomalies

PART III

7. For the virtual portion of a hybrid fellowship program, **how many weeks** would the didactic portion require (assuming one hour a week of classroom didactics)? [choose one]
 - 6 weeks
 - 7–8 weeks
 - 9–10 weeks
 - 11–12 weeks
 - 13–14 weeks
 - 15–16 weeks
 - 17–20 weeks
 - 21–24 weeks
8. For the virtual portion of a hybrid fellowship program, **how many participants** would be the ideal number for the classroom didactic portion? [choose one]
 - 1 participating fellow
 - 2 participating fellows
9. What elements of learning can be accomplished effectively with **new online technologies**?
 - learning anatomy and physiology
 - observing procedures
 - studying cases
 - choice and use of essential equipment
 - complication avoidance and management
 - describing essential steps of surgical procedures
 - practice and performance of surgical procedures
10. Do you believe the following technologies are **useful in teaching surgical management**?
 - Video modules
 - “Smart glasses”
 - Other [free text]
11. What are the **essential hands-on elements** for these hybrid fellowships? [free text]
12. How much **time would be required for essential hands-on elements**? [choose one]
 - 2 weeks
 - 4 weeks
 - 6 weeks
 - 8 weeks
 - 10 weeks
 - 12 weeks
13. In a virtual hybrid fellowship, what is the minimum required **in-person clinical learning time**? [choose one]
 - 1 week
 - 2 weeks
 - 3 weeks
 - 4 weeks
 - 5 weeks
 - 6 weeks
 - 7 weeks
 - 8 weeks
 - 9 weeks
 - 10 weeks
 - 11 weeks
 - 12 weeks
14. What would the most effective model be for a **brain trauma fellowship**? [choose one]
 - Fellows from LMICs travel to HIC
 - Trainer from HIC travels to LMIC
15. What would the most effective model be for a **pediatric myelomeningocele/hydrocephalus fellowship**? [choose one]
 - a. Fellows from LMICs travel to HIC
 - b. Trainer from HIC travels to LMIC
16. Do you have any **comments** about the most effective models for these fellowships? [free text]
17. Which **individuals and organizations** should be early stakeholders and participants in this process? Y/N
 - Department chairpersons
 - Boards of medical, surgical, and neurosurgical specialization
 - Ministries of Health
 - Ministries of Education
 - Organizations that currently have fellowships, including AANS-CNS Pediatric Section, ISPN, FIENS, etc.
18. What **evidence** would it take to establish that these new fellowships are effective?
 - Quantitative didactic measure: evaluation of fellows/graduates
 - Weekly quizzes

- Y Global Neuro modules test for brain trauma
 - Y Final course exam
 - Y Certification by local or regional board
 - Y **Qualitative** technical measure
 - Y Test Flight
 - Y Feedback from other participants
 - Y Feedback from program directors
 - Y Feedback from home program
19. [optional on POST versions only] If you wish to participate in preparing the summary paper from this course, please provide the following information:
- a. First name/Last name

- b. Affiliation
- c. E-mail address

After pre-course SUBMIT, message will read
Thank you for taking the time to fill out this pre-course survey. We hope you will attend our entire symposium and participate in the development of the consensus statement. Those who participate in that session and fill out the post-course survey will be involved in the preparation of our summary paper, to be published in 2022.

After post-course SUBMIT, message will read
Thank you for taking the time to participate in developing a consensus statement and filling out this post-course survey. If you provided your contact information in the survey, we will be in touch to send you a draft of the paper.