

Global Neurosurgery at the University of Toronto: Past and Present Efforts, and a Charter for the Future

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Email: Mojgan.Hodaie@uhn.ca Global neurosurgery at the University of Toronto dates back at least twenty years, when Dr. Ab Guha opened a new avenue of partnerships and concerted efforts to partner and strengthen neurosurgical power in sites where there is limited availability of neurosurgeons. Since then, this area of work and interest has permeated the careers of many of Toronto neurosurgeons—residents, fellows and faculty alike. This article explores the early involvement of Toronto in global neurosurgery, its contributions to the field, and a forecast for future developments.

1 | INTRODUCTION

Kenneth McKenzie arrived in Toronto in 1923, bringing with him the legacy of being the first neurosurgeon in Canada. Since then, Toronto has established itself as the hub of Canadian neurosurgery, in both volumes of cases, the strength of trainees, as well as research output (1). As one of the largest training programs in North America (2), Toronto has had ongoing international connections, chiefly through the fellowship programs within our division. However, to our recollection, the earliest instance in which Toronto demonstrated a concerted effort towards the formal work in global neurosurgery was through the persistent and continued efforts of Ab Guha (1957-2009), who amongst many philanthropic activities, establish the National Neuroscience Institute in Calcutta (India), his city of birth, as his goal. Since then, interest in global neurosurgery has remained strong within our division, with multiple continued and consistent collaboration areas. These include Mark Bernstein's travels within Africa and SouthEast Asia, expanding the reach of awake craniotomies; James Rutka's efforts to strengthen local surgeons throughout Ukraine; George Ibrahim's collaborations in Haiti to expand the surgical treatment of pediatric neurosurgical conditions; and MojganHodaie's work on structured curricula for neurosurgery residents. Simultaneously, Toronto neurosurgery has focused on encouraging fellows from low- and middle-income countries (LMIC's) to join our center, in many cases funded by the first Chair in International Neurosurgery (3).

As a result of these activities, several clinical fellows who trained in Toronto and returned to bring their expertise to their local sites must be highlighted, including Grace Mutango (pediatric neurosurgery, Uganda), Nilesh Mohan (neuro-oncology, Kenya), Claire Karakezi (neuro-oncology, Rwanda), SelfyOswari (Indonesia), and a substantial number of short-term visitors from a breadth of international sites.

The value that surgeons contribute with their efforts to advance global surgery has been formally recognized by the University of Toronto Department of Surgery, reflected in establishing a formal process of academic promotion based on contributions to the field of global surgery; this, together with educational activities such yearly Global Surgery Symposium and the Office of International Surgery, serves as critical support for surgeons who intend to become involved in this global work (4).

2 | TRAINING NEUROSURGEONS USING A VIRTUAL PLATFORM

The disproportionate shortage of surgical services in LMIC's (5,6) is often combined with limitations in the surgical training programs for residents. There are several reasons for this, including the observation that neurosurgery is often perceived a luxury specialty and thus overlooked despite the known expected economic consequences of delayed neurosurgical care (7,8). With an estimate of 0.03 neurosurgeons per 100,000 individuals in LMIC's (9), trained neurosurgeons tend to be extremely busy, which in turn influences the structure of neurosurgical training. While each site attempts to maximize the education of their own residents, it is our view that in addition to twinning visits and surgical collaboration, an important focus of global neurosurgery ought to be enhancing and strengthening neurosurgical training for residents. This is an investment into a new generation of neurosurgeons who, with greater knowledge and a broader skill set, will be well-positioned to take on greater challenges, expand their neurosurgical reach, and ultimately offer care to more patients.

This was the key motivating force behind the creation of the NEURONproject (Neurosurgery Education with Universal Reach ONline)(10), a collaborative approach which draws upon visit-based models as well as e-Learning to effectively facilitate global educational initiatives(11). NEURONproject utilizes open-source course management systems which allow the hosting of lecture-based modules and interactive case discussions. These courses recognize the enormous value of faculty participation, who interact with learners and provide feedback. This approach has been able to integrate modern surgical education, adapt to local needs, and foster independent growth within local neurosurgical programs: NEURONproject has been able to facilitate the education of neurosurgery residents in Cambodia, Ukraine, and Vietnam over the past 6 years. Using structured online education complemented by periodic site visits, this initiative has been able to establish a new, long-term avenue of local training, with the goal of improving neurosurgical care in LMICs.

3 | EXPECTATIONS FOR THE FUTURE OF GLOBAL NEUROSURGERY

Haglund and Fuller, in 2019, laid bare the future of global neurosurgery's maturation into an organized and unified discipline: the development of large-scale, multilateral and multinational health system-strengthening collaborations, paired with the efforts of colleagues in several related fields that facilitate and augment this work (12). The Toronto University impact on global neurosurgery must consider these principles as it charts the course of its future activities. Fortunately, there is now sufficient interest, both within global neurosurgery and other surgical subspecialties, to craft a strategy for tackling this important challenge.

In addition to the traditional focus on sustainable capacity-building projects in LMIC's countries where neurosurgical care is most challenging to access, particularly regions of Africa and Southeast Asia (13,14), Canada's geographical distribution presents unique challenges to the equitable provision of neurosurgical care. The definition of global neurosurgery is expanding to include the advancement of access to neurosurgical care across regional divisions (15). Increasing recognition of the health outcome disparities faced in the Canadian North (the Yukon, Northwest Territories, and Nunavut) compared to the rest of the country (16) presents a novel target for globally minded neurosurgeons.

Canada's three Northern territories parallel many LMIC's scarcities of access to neurosurgical care: combined, they comprise approximately 110,000 Canadians living on 3,500,000 square kilometers of landmass and do not have any neurosurgeons (17). Nunavut's capital Iqaluit, for example, is inaccessible by road, and lies more than 2000 kilometers by air travel from the centers equipped to provide emergent neurosurgical care (e.g., Edmonton, Alberta; Winnipeg, Manitoba; and Ottawa, Ontario). The future of global neurosurgery in Canada must therefore include attention to the Canadian North. While prior experiences in other continents have taught us that there is no one-size-fits-all approach to global neurosurgery, these efforts may offer insights into the types of initiatives (such as the development of surgical outposts in remote Northern communities, or Federal incentives for neurosurgeons to work and build capacity there) likely to be successful in addressing Canadian disparities in neurosurgical care.

References

1. Lozano CS, Tam J, Kulkarni A v., Lozano AM. The academic productivity and impact of the University of Toronto Neurosurgery Program as assessed by manuscripts published and their number of citations. *Journal of Neurosurgery*. 2015;123(3):561-570. doi:10.3171/2014.12. JNS142553
2. Lee RP, Venable GT, Roberts ML, et al. Five-Year Institutional Bibliometric Profiles for 119 North American Neurosurgical Residency Programs: An Update. *World Neurosurgery*. 2016; 95:565-575. doi: 10.1016/j.wneu.2016.07.006
3. Wilkins-Barrick Chair | Toronto Neurosurgery. Accessed February 18, 2021. <https://www.torontoneurosurgery.com/wilkins-barrick-chair>
4. Department of Surgery. Accessed February 18, 2021. <https://surgery.utoronto.ca/>
5. Meara JG, Leather AJM, Hagander L, et al. Global Surgery 2030: Evidence and solutions for achieving health, welfare, and economic development. *The Lancet*. 2015;386(9993):569-624. doi:10.1016/S0140-6736(15)60160-X
6. Taira BR, Kelly McQueen KA, Burkle FM. Burden of surgical disease: Does the literature reflect the scope of the international crisis? *World Journal of Surgery*. 2009;33(5):893-898. doi:10.1007/s00268-009-9981-x
7. Ellegala DB, Simpson L, Emanuel Mayegga AMO, et al. Neurosurgical capacity building in the developing world through focused training. *Journal of Neurosurgery*. 2014;121(6):1526-1532. doi:10.3171/2014.7. JNS122153
8. Cadotte DW, Viswanathan A, Cadotte A, Bernstein M, Munie T, Freidberg SR. The consequence of delayed neurosurgical care at TikurAnbessa Hospital, Addis Ababa, Ethiopia. *World Neurosurgery*. 2010;73(4):270-275. doi: 10.1016/j.wneu.2010.02.017
9. Aarli JA, Dua T, Janca A, Muscetta A. Neurological Disorders: Public Health Challenges. World Health Organization. 2012.

10. NEURONproject – Neurosurgical Education with Universal Reach Online. Accessed February 18, 2021. <http://www.neuronproject.org/>
11. Liang KE, Bernstein I, Kato Y, Kawase T, Hodaie M. Enhancing neurosurgical education in low- and middle-income countries: Current methods and new advances. *Neurologia Medico-Chirurgica*. 2016;56(11):709-715. doi:10.2176/nmc.ra.2016-0092
12. Haglund MM, Fuller AT. Global neurosurgery: Innovators, strategies, and the way forward. *Journal of Neurosurgery*. 2019;131(4):993-999. doi:10.3171/2019.4.JNS181747
13. Dewan MC, Rattani A, Fieggen G, et al. Global neurosurgery: The current capacity and deficit in the provision of essential neurosurgical care. Executive summary of the global neurosurgery initiative at the program in global surgery and social change. *Journal of Neurosurgery*. 2019;130(4):1055-1064. doi:10.3171/2017.11.JNS171500
14. Park KB, Johnson WD, Dempsey RJ. Global Neurosurgery: The Unmet Need. *World Neurosurgery*. 2016; 88:32-35. doi: 10.1016/j.wneu.2015.12.048
15. Andrews RJ. What is in a Name? “Global Neurosurgery” in the 21st Century. *World Neurosurgery*. 2020; 143:336-338. doi: 10.1016/j.wneu.2020.07.233
16. Young TK, Chatwood S, Marchildon GP. Healthcare in Canada’s North: Are we getting value for money? *Healthcare Policy*. 2016;12(1):59-70. doi:10.12927/hcpol.2016.24776
17. Canadian Medical Association. Neurosurgery Profile.; 2019. Accessed February 18, 2021. <https://www.cma.ca/sites/default/files/2019-01/neurosurgery-e.pdf>