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NEUROLOGY IN CANADA: HISTORY OF THE CANADIAN NEUROLOGICAL SOCIETY

In the 19th and early 20th century, Canadian physicians interested in neurology focused on this area as part of their broader clinical practices. The most renowned was William Osler, often called Canada's first neurologist because one-third of his writing was devoted to neurology. Until the mid-20th century, most Canadian neurologists trained at the National Hospital, Queen Square, London, and in Paris. The majority returned to academic centers and after World War II every Canadian medical school and major center had consultant neurologists.

In 1947, Wilder Penfield at the Montreal Neurological Institute organized a meeting of Canadian neurologists and neurosurgeons that initiated the Canadian Neurological Society. A guiding precept was to bring neurologists, neurosurgeons, neuropathologists, and other clinicians focused on the nervous system together to exchange papers at a single conference. Subsequently, specialty associations of neurosurgeons, neurophysiologists, pediatric neurologists, and clinical neurophysiologists developed and, together with neurologists, became the Canadian Congress of Neurological Sciences. This became the Canadian Neurological Sciences Federation (CNSF) in 2006.

The CNSF is a legally constituted confederation of the Canadian Neurological Society, Canadian Neurosurgery Society, Canadian Association of Child Neurologists, and Canadian Society of Clinical Neurophysiologists. Organizations of neuroscience nurses, technologists, neuroscientists, and physiatrists are CNSF Associates, and 10 other related organizations focusing on neurologic diseases are CNSF Affiliates.

The principal CNSF mission is to enhance prevention, diagnosis, and management of nervous system disorders through professional development and advocacy. The CNSF promotes professional development by its annual Congress, which includes accredited continuing education courses, and publication of the *Canadian*

Journal of Neurological Sciences. CNSF advocacy is channeled through Neurological Health Charities Canada.

Neurologic disease in Canada. In 2007, the CNSF sponsored a study by the Canadian Institute for Health Information (CIHI) on the *Burden of Neurological Diseases, Disorders and Injuries in Canada*.¹ Total cost of 11 of the most common neurologic conditions was \$8.8 billion, representing nearly 3% of direct and 9% of indirect health care costs. Neurologic conditions accounted for 10%–20% of hospital admissions, patient days in acute care, and inpatient rehabilitation, as well as disability-adjusted life-years.

The neurologic needs of the aging Canadian population will accelerate in coming years, as the life expectancy for Canadians has increased to 81 years (84.1, women; 78.2, men) and continues to rise.

Neurology training in Canada. During the last half century, most neurologists began their training in Canada, followed by a fellowship abroad. Initially fellowships were mostly at the National Hospital, Queen Square, in London, or in France. After 1965, this shifted mainly to the United States, and more recently to Canadian centers.

Before World War II, neurology training programs were located in a few centers, such as McGill and University of Toronto. Subsequently, training programs expanded to most Canadian medical schools. Since 1969, all training must be in university centers accredited by the Royal College of Physicians and Surgeons of Canada (RCPSC), which also oversees the examination of candidates for specialty certification. Provincial governments regulate the number of residency positions and provide funding for all residents. There are 16 adult and 10 child neurology training programs. The RCPSC certifies 27–30 neurologists per year. The RCPSC is also responsible for a Maintenance of Certification program requiring all specialists to earn a minimum number of continuing education credits each year. The program involves a rigorous accreditation process for providers of Continued Professional Development.

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Go to Neurology.org for full disclosures. Funding information and disclosures deemed relevant by the authors, if any, are provided at the end of the article.

Collaborative research and educational programs. The small number of medical schools in Canada (17), and centralization of many services in major centers, encourages collaborative research and education among centers. For example, the Canadian Network of Multiple Sclerosis Centers was able to enroll over 30,000 people in a genetic study. In addition, networks of clinicians and researchers dealing with multiple sclerosis, stroke, and Parkinson disease are well-established.

Canada's role in international e-learning. Canada has a pivotal role in distance education through leadership in International Videoconference Behavioral Neurology Rounds that has involved American, Argentinian, Brazilian, Canadian, Chilean, Cuban, Israeli, Jordanian, Palestinian, Russian, South African, Spanish, and Swiss (WHO) sites. Since 2009, Canada has led the Neurology International Residents Videoconferencing Exchange (NIRVE) involving resident presentations from Brazilian, Canadian, Jordanian, and Russian centers. At the national level, Canada launched National Videoconference Neurology Grand Rounds in 2011 with participation of neurology training centers across the country.

Research funding. Neuroscience research funding comes from many sources, although primarily the Canadian Institute of Health Research (CIHR), with an annual budget of over \$1 billion. Unlike the NIH, CIHR funds only extramural research. Neuroscience research accounts for about 28% of CIHR funding. Other important sources for operating support include agencies related to neurologic diseases such as multiple sclerosis, heart disease and stroke, Parkinson disease, and Alzheimer disease. Infrastructure support for major equipment and renovations comes from the Canada Foundation for Innovation. Clinical trials are primarily supported by industry, and sometimes through collaborative studies cosponsored by CIHR.

Support for principal investigators comes from universities, except in the case of industry support. However, the Canada Research Chairs, funded by the federal government, supports faculty across all disciplines, with 2,000 chairs across the country, among which neuroscience is well-represented. Some provinces have programs to support investigators relatively early in their careers. The relative lack of stable salary support has aggravated the difficulty that Canada, like many other countries, has encountered in producing significant numbers of clinician–scientists. Some universities and provinces have attempted to address this problem by introducing academic practice plans.

Neurologists and clinical practice. In Canada, there are approximately 38,000 family physicians and 35,000 specialists, of which 854 are neurologists, with 28%

being women. Most are in high population areas of Ontario, Quebec, Alberta, and British Columbia. There are a maximum of 26 neurologists in each of the other 6 provinces and none in the 3 territories of Northern Canada. Approximately 44% of neurologists are over age 54 years and 20% are over age 64. Thus a significant proportion of neurologists are close to retirement age.²

Many neurologists in academic centers have multiple roles and only part of their time involves clinical practice. In 2002, 31%–49% of neurologists across the 10 provinces worked in an academic setting, 76% having subspecialty interests.³

Canada has a publicly funded health care system with coverage for all citizens and freedom of choice of physician regardless of income. Fee-for-service billing is simplified, with electronic billing for all services to the provincial government and a single payment received. There is minimal paperwork, a simplified coding system, and minimal time and overhead for the neurologist.⁴

Challenges for the future. The Canadian health care system must find ways to maintain the values and principles of the system while improving efficiencies and managing costs. Health care is a provincial and territorial responsibility, and since each jurisdiction has different economic pressures, responses could be less consistent and uniform in the future. Even in a health care system available to all, the access may be uneven for many rural or marginalized populations.

Almost half of the neurologists currently practicing in Canada are over age 50, with many at or beyond normal retirement age; the current numbers of residents in training will not meet the increasing needs. The aging population will bring increasing requirements for neurologic services. Waiting lists for consultations and procedures require innovative approaches and the involvement of other health care professionals. There must be a greater commitment to multidisciplinary care for chronic neurologic illnesses.

Innovative approaches will be needed to deal with a future with increased costs and demands but insufficient numbers of neurologists. Linkages and collaboration with other health professionals to provide care are essential. Canada's leadership in telehealth will be important in dealing with education, consultation, and support.

STUDY FUNDING

No targeted funding reported.

DISCLOSURE

T.J. Murray is a Scientific Advisor to the Canadian Multiple Sclerosis Monitoring System supported by the Canadian Institute for Health Information; is a Scientific Advisor on the National Population Study of Neurological Conditions; has received honoraria and travel support for lectures at conferences by Biogen Idec and Serono; and is President of the Robert Pope Foundation. G. Bray receives a stipend from the Canadian Neurological Sciences Federation. M. Freedman received funding for expenses as a delegate

from the Canadian Neurological Society to the Council of Delegates of the World Congress of Neurology; has received honoraria from Novartis Pharmaceuticals Canada for advisory board consulting and Bristol Myers Squibb for attending a consultancy meeting; received financial support for a Behavioral Neurology fellow from Eli Lilly Canada; is listed on a provisional patent related to methods and kits for differential diagnosis of Alzheimer's disease vs frontotemporal dementia using blood biomarkers and may be listed on the planned patent application; receives grant funding from the Canadian Institutes of Health Research and the Parkinson Society of Canada; has received grant funding from the Alzheimer Society of Canada, Lundbeck Canada, and the Canadian Institutes of Health Research; and receives support from the Saul A. Silverman Family Foundation as a Canada International Scientific Exchange Program and Morris Kerzner Memorial Fund. A.J. Stoessl's work is supported by the Canadian Institutes of Health Research, the Michael J. Fox Foundation, the Pacific Alzheimer Research Foundation, and the Canada Research Chairs program. He has served on advisory boards or committees (unpaid) for Canada Research Chairs, the Movement Disorders Society, the Parkinson Study Group, and World Federation of Neurology Association for Parkinsonism & Related Disorders; has received speaker fees from Abbott, Medscape, and Teva; and has

served as a consultant for Biogen Idec, Bioscape Imaging, Medgenesis, and Ono Pharma. Go to Neurology.org for full disclosures.

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Neurology[®]

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Neurology 2013;80;406-408

DOI 10.1212/WNL.0b013e31827f0788

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