

# Report of the Canadian Neurological Society Manpower Survey 2012

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**ABSTRACT: Background:** The Canadian Neurological Society commissioned a manpower survey in 2012 to assess Canadian neurological manpower and resources. **Methods:** Surveys were sent electronically to all Canadian neurologists with available email addresses. Responses were analysed for effects of physician gender, age, geographic location (eastern or western Canada) or type of practice (academic, community). Questions focused on work patterns, neurologic conditions treated, access to or performance of procedures, and service and manpower issues. **Results:** A total of 694 of 854 neurologists in Canada were surveyed and 219 (32%) responded. Respondents were 70% male with mean age of 50 years. Neurologists worked an average of 57 hours/week and saw a mean of 40 patients per week. There were significant differences in number of patients seen, types of practice, and areas of neurological specialization between community and academic neurologists. Fifty percent of neurologists report shortages of neurologists in their community, particularly of general adult neurologists. Wait times for neurological services exceeded international standards for consultations and also were longer than Canadian averages for other specialists. More community (18%) than academic (5%) neurologists planned to retire within the next 5 years. **Conclusions:** The demand for neurological services continues to outstrip resources despite the increased number of neurologists. Impending retirement of community neurologists will exacerbate manpower issues unless adequate numbers of trainees choose general neurologic practice in the community as a career.

**RÉSUMÉ: Rapport de l'enquête de la Société canadienne de neurologie sur la main-d'œuvre en 2012. Contexte:** La Société canadienne de neurologie a mené une enquête sur la main-d'œuvre en 2012 afin de déterminer quels sont les effectifs et les ressources en neurologie au Canada. **Méthode:** Une enquête a été effectuée par courriel auprès de tous les neurologues canadiens dont l'adresse courriel était disponible. Les réponses ont été analysées afin d'examiner les effets du sexe, de l'âge, du lieu géographique (région de l'est ou de l'ouest du Canada) et du type de pratique (en milieu universitaire ou communautaire). Les questions ciblaient l'organisation du travail, les maladies neurologiques prises en charge, l'accès à des examens ou à des interventions ou leur exécution et les problèmes de service et de main-d'œuvre. **Résultats:** L'enquête a été effectuée au Canada auprès de 854 neurologues et 694 y ont répondu. Soixante-dix pour cent étaient des hommes et l'âge moyen des répondants était de 50 ans. Les neurologues travaillaient en moyenne 57 heures et voyaient en moyenne 40 patients par semaine. Il existait des différences significatives dans le nombre de patients qu'ils voyaient, les types de pratique et les domaines de spécialisation en neurologie entre les neurologues du milieu universitaire et ceux du milieu communautaire. Cinquante pour cent des neurologues rapportaient qu'il existait une pénurie de neurologues dans leur milieu, particulièrement de neurologues généralistes traitant des adultes. Le temps d'attente pour être vu par un neurologue dépassait les normes internationales pour les consultations et était également plus long que la moyenne canadienne dans les autres spécialités. Un plus grand nombre de neurologues exerçant dans la communauté (18%) que dans le milieu universitaire (5%) prévoyaient prendre leur retraite dans les 5 prochaines années. **Conclusions:** La demande de services en neurologie continue de dépasser les ressources malgré l'augmentation du nombre de neurologues. La retraite prochaine de neurologues exerçant dans la communauté aggravera les problèmes de main-d'œuvre, à moins qu'un nombre adéquat de résidents ne choisisse comme carrière la pratique de la neurologie générale en milieu communautaire.

**Keywords:** Neurological Practice, Neurology – Adult, Neurology – General, Residency Training

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In 2002, the Canadian Neurological Society (CNS) commissioned a survey of Canadian neurologists to assess demographics, distribution, speciality interests, working conditions, job satisfaction, and future plans.<sup>1</sup> Since that time, there has been a further evolution of the medical environment. The Canadian population has grown and is also aging, with a concomitant expectation of increasing need for care of stroke, neurodegenerative, and other conditions that become more frequent with advancing age.<sup>2</sup> Advances in neurologic research have also produced new effective treatments in many fields, including movement disorders, epilepsy, and multiple sclerosis, which may intensify the service demands in those fields. Whether the current or future

complement of Canadian neurologists remains adequate to service these evolving needs of the Canadian population is an important question. To address this issue, in 2012, the CNS commissioned

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another survey to reassess Canadian neurological physician resources and to obtain additional information on future physician resource requirements.

## METHODS

With the help of the Canadian Collaborative Centre for Physician Resources, a survey instrument for neurologists was developed. Questions included demographics, patient care settings, population served, workload, areas of practice, identified demand and shortages, wait times, etc.

In 2012, there were 854 neurologists in Canada according to the CMA Masterfile January 2012.<sup>3</sup> Because of privacy legislation emails from provincial medical associations, provincial licencing bodies, the Royal College of Physicians and Surgeons of Canada, Collège des médecins du Québec, or the Canadian Medical Association were not available. Through the membership lists of the Canadian Neurological Society and publically available email addresses, we were able to obtain email addresses for 685 neurologists (80.2%). An email invitation containing a linkage to an online voluntary survey posted at Fluidsurveys was sent to these neurologists by Canadian Collaborative Centre for Physician Resources on May 9, 2012. Identification numbers were assigned to each neurologist to track responses. Electronic reminders were sent to nonresponders on May 16 and May 28, 2012. The survey closed June 5, 2012. Responses from those who identified themselves as completely retired, trainees, or no longer practicing in a medical field were not included. The data were analysed for all neurologists and comparisons were made based on gender, geographic region, type of practice, and age group. Eastern Canada comprised Ontario and east and Western Canada included Manitoba and west. Type of practice was either academic- or community-based practice. Age groups were younger than 45 years and 45 years or older. The number of responses for further subdividing the groups was not felt to be sufficient for statistical validity with the type of tests applied (i.e.  $n < 30$ ). Results were analysed using SPSS. Unpaired *t*-test and one-way analysis of variance were used to determine whether there were any significant differences between the means of independent groups and Pearson chi-square tests were used to evaluate between-group differences in the proportions from two independent groups. We considered *p* value less than 0.05 to be significant. Results were analysed using SPSS.

## RESULTS

### Demographics

Of the 685 neurologists who received an email invitation to complete the survey, 219 (32%) responded. This provided an overall accuracy of  $\pm 6.6\%$ , 19 times of 20 for the survey. Sixty-seven percent of the 219 neurologists were male and 29% were female (4% did not identify their gender). The mean age was 50 years (Table 1), which was younger than the 51 years reported by the 2002 CNS survey and the 52.7 years by the CMA Masterfile in 2012.<sup>1,4</sup> This may be due to fewer responses from neurologists  $\geq 65$  years of age, who represented only 11% of our sample but comprised nearly 20% of neurologists in January 2012 (Table 1).<sup>4</sup> Eighty-five percent of respondents were in full-time medical practice, 7% were part-time or semiretired, 2% in locums tenens

**Table 1: Age distribution of Canadian neurologists**

Years	Survey N = 219	CMA Master File <sup>4</sup> N = 854
<35	6.4%	5.9%
35-44	32.9%	24.7%
45-54	23.7%	24.5%
55-64	22.4%	24.2%
65+	11.0%	19.7%
DK/NR	3.7%	1.1%
Mean	50 years	52.7 years

DK/NR = do not know/no response.

positions, and 5% in a medically related field or other nonclinical situation; 0.5% were on a leave of absence or sabbatical.

The main work settings for neurologists were an academic health sciences centre (AHSC) (58%), private office or clinic (25%), non-AHSC teaching hospital (5%), community hospital (4%), and university (3%). Less than 1% of neurologists had an emergency department, nursing home, other hospital, or a research unit as their main work setting. A total of 74% of neurologists had a faculty appointment and 72% had a formal hospital appointment. Neurologists who practiced community-based patient care (community neurologists) were significantly less likely to have a faculty appointment (50% vs 89%) or a formal hospital appointment (59% vs 81%) than neurologists who practiced academic-based patient care (academic neurologists). Younger neurologists (45 years of age or younger) were significantly less likely to work in a private office or clinic than older neurologists (16% vs 34%). Many neurologists had more than one work setting so that, overall, 73% of neurologists spend at least part of their time in an AHSC, 47% in a university, 33.3% in a private office or clinic, 19% in a community hospital, 15% in a research unit, 12% in an emergency department, and 8% in non-AHSC teaching hospital.

Most neurologists practiced in larger centres (Table 2). Only 4% practiced in communities of fewer than 100,000 people and 14% in centres of 100,000-250,000, whereas 46% practiced in centres of 1 million or more. Community neurologists were more likely to practice in smaller centres. Fifty percent of community neurologists practiced in centres with fewer than 500,000, whereas 59% of academic neurologists practiced in centres of 1 million or more. Only 28% of community neurologists practiced in centres of 1 million or more. Neurologists in western Canada were more likely to practice in a larger centre.

### Work Patterns

Excluding on-call activities, neurologists worked an average of 56.5 hours/week (Table 3). This is unchanged from the 2002 survey (56.1 hours), but less than the 62.5 hours reported for neurologists in the 2013 National Physician Survey.<sup>5</sup> Community neurologists spent significantly more time in direct patient care (39 hours) than academic neurologists (25 hours). Academic neurologists spent 12 hours/week in research and 3 hours in administration, whereas community neurologists reported 2 hours/week in research and 1 hour/week in administration. Academic and community neurologists did not differ in time spent

**Table 2: Community size**

	Eastern vs Western Canada		Academic- vs community-based neurologists		All N = 219
	East* N = 135	West* N = 75	Academic N = 134	Community N = 80	
<100,000	3.7%	2.7%	0%	10.0%	3.7%
100,000-244,999	16.3%	10.7%	8.2%†	22.5%†	13.7%
250,000-499,999	17.8%	12.0%	14.9%	17.5%	15.5%
500,000-999,999	14.1%	21.3%	13.4%	21.3%	16.0%
1,000,000+	43.7%	50.7%	58.2%†	27.5%†	45.7%
DK/NR	4.4%	2.7%	5.2%	1.3%	5.5%

DK/NR = do not know/no response.

\*Eastern versus Western Canada was significantly different.

†Academic versus community was significantly different.

on continuing medical education and practice management. Neurologists in Western Canada worked significantly more hours than neurologists in Eastern Canada (59 vs 55 hours). There was no significant difference in the hours worked between male and female neurologists.

Although the number of new patients per week did not differ between male and female neurologists, academic neurologists saw fewer new patients per week than community neurologists (11 vs 23) (Table 4). Younger neurologists saw significantly fewer new patients than older neurologists (14 vs 19), possibly because fewer younger neurologists worked in a private office or clinic (16% vs 34%) and they were more likely to work in an academic health sciences centre (66% vs 53%). Academic neurologists were more likely to see patients in follow-up (65% of total patient visits vs 55%), even though community neurologists saw more returning patients overall (20 vs 29 patients). Neurologists in Eastern Canada saw significantly more returning patients than those in the west (27 vs 18).

On-call responsibilities also varied significantly (Table 5). Neurologists in Eastern Canada were less likely to be on call than neurologists in the west (75% vs 83%) and worked fewer on-call hours. Differences were more marked between academic and community neurologists: 84% of academic, but only 68% of community, neurologists had on-call duties. However, community neurologists with on-call duties reported significantly more on-call hours per month (113 hours) than academic neurologists (75 hours). In addition, only 33% of community neurologists had a resident working with them always or most of the time, compared with 83% of academic neurologists. Thirty-nine percent of community neurologists and 1% of academic neurologists never had residents. On the other hand, academic neurologists were more likely to be on-call for continuous 24-hour periods than community neurologists (62% vs 43%). Among neurologists who were on-call for 24 hours, 98% were required to provide direct patient care immediately after being on-call.

**Table 3: Mean work hours of neurologists**

	Eastern vs Western Canada		Academic- vs community-based neurologists		Male vs female		All N = 219
	East N = 135	West N = 75	Academic N = 134	Community N = 80	Male N = 146	Female N = 63	
Direct patient care:							
No teaching, hours	2 1.1	19.3	12.7*	33.3*	21.5	18.0	20.6
With teaching, hours	9.5	9.2	12.0*	5.7*	9.4	9.6	9.5
Teaching/education no patient care, hours	2.9	2.9	3.8*	1.5*	3.2	2.2	2.9
Indirect patient care, hours	5.3	6.8	5.2*	7.1*	5.5	7.1	5.9
Health facility committees, hours	0.9	1.3	1.3*	0.6*	1.0	1.0	1.0
Administration, hours	2.4	2.2	2.9*	1.3*	2.3	2.4	2.3
Research, hours	7.0	10.7	12.0*	2.3*	7.5	8.9	8.2
Managing practice, hours	1.6	1.6	1.5	1.6	1.7	1.4	1.6
CME, hours	2.8	3.3	2.9	3.1	3.0	3.0	3.0
Other, hours	1.1	2.0	1.6	1.4	1.7	1.0	1.5
Total hours worked	54.5†	59.4†	55.9	57.8	56.8	54.8	56.5

CME = continuing medical education.

\*Academic versus community was significantly different.

†Eastern versus Western Canada was significantly different.

**Table 4: Numbers of patients seen per week**

	Academic- vs community-based neurologists		Eastern vs Western Canada		Males vs females		Ages ≤45 vs ages >45 years		All N = 219
	Academic N = 134	Community N = 80	East N = 135	West N = 75	Male N = 146	Female N = 63	Age ≤45 N = 93	Age >45 N = 118	
New patients:									
<5	23.9%*	5.0%*	17.8%	16.0%	15.1%	22.2%	23.7%†	11.9%†	16.4%
5-9	38.8%*	13.8%*	30.4%	28.0%	30.1%	28.6%	32.3%	26.3%	28.8%
10-14	12.7%	11.3%	10.4%	14.7%	11.6%	12.7%	9.7%	14.4%	11.9%
15-19	8.2%	16.3%	10.4%	13.3%	10.3%	12.7%	12.9%	9.3%	11.0%
20-24	3.0%*	20.0%*	8.1%	9.3%	9.6%	7.9%	5.4%	12.7%	9.1%
≥25	6.7%*	33.8%*	18.5%	14.7%	20.5%	9.5%	12.9%	21.2%	16.9%
DK/NR	6.7%	0%	4.4%	4.0%	2.7%	6.3%	3.2%	4.2%	5.9%
Mean	10.9*	23.0*	15.7	15.4	16.5	13.5	13.7†	17.5†	15.8
Returning patients									
≤5	11.9%	5.0%	8.9%	10.7%	8.9%	11.1%	7.5%	11.0%	9.1%
6-10	17.9%	13.8%	17.0%	14.7%	13.7%	20.6%	17.2%	14.4%	16.0%
11-15	16.4%	13.8%	11.1%‡	24.0%‡	17.8%	11.1%	15.1%	16.1%	15.1%
16-20	14.9%	11.3%	8.9%	20.0%	11.6%	20.6%	16.1%	12.7%	13.7%
21-24	8.2%	7.5%	7.4%	8.0%	9.6%	4.8%	8.6%	7.6%	7.8%
≥25	23.9%	48.8%	42.2%‡	18.7%‡	35.6%	25.4%	32.3%	33.9%	32.4%
DK/NR	6.7%	0%	4.4%	4.0%	2.7%	6.3%	3.2%	4.2%	5.9%
Mean	20.2	28.7	26.6‡	18.3‡	23.9	21.7	22.7	23.8	23.5

DK/NR = do not know/no response.

\*Academic versus community was significantly different.

†Age ≤45 years versus age >45 years was significantly different.

‡Eastern versus Western Canada was significantly different.

## Neurologic Conditions

Almost 70% of community neurologists reported general adult neurology as their major area of practice followed by a small number reporting stroke, movement disorders, and multiple sclerosis (Table 6). Academic neurologists were more evenly distributed, with neuromuscular disorders, movement disorders, behavioural neurology, general adult neurology, and stroke being most frequent. Critical care, sleep disorders, and pain were the least common areas of practice for all. Community neurologists were less likely to have completed formal fellowship/subspecialty training than academic neurologists (61% vs 74%). They also had practiced longer, with 35% having practiced for more than 25 years compared with 18% of academic neurologists.

The five most common conditions (Table 7) seen by neurologists in their practices were migraine, Parkinson disease, epilepsy, stroke, and neuropathy. Community neurologists saw more patients with migraine, other headaches, multiple sclerosis, and Parkinson disease than academic neurologists, whereas academic neurologists saw more patients with seizures, motor neuron disease, vascular dementia, other dementias, and psychogenic disorders.

## Procedures and Their Access

Electroencephalograms (EEGs) were performed or reported by 37% of all neurologists, usually in a hospital clinic or laboratory.

Eighty-six percent of neurologists reported that EEG was available in their community. Electromyograms (EMGs) were performed or reported by 43% of neurologists, and available in 84% of communities. Wait times for EMGs were longer than for EEGs (Tables 9, 10). One-third of all neurologists performed botulinum toxin injections. Somatosensory evoked potentials were performed or reported by 16% of neurologists. Community neurologists were more likely to perform EMG, somatosensory evoked potentials, and botulinum toxin injections than academic neurologists. Eleven percent of neurologists performed nerve blocks and sleep studies were carried out by only 5%. Neuroimaging studies such as computed tomography (CT), magnetic resonance imaging (MRI), carotid Doppler scans, transcranial magnetic stimulation, and interventional radiology were least likely to be performed or reported by neurologists (less than 5% each).

CT and MRI scans were available in 86% of neurologists' communities. Wait times depended on the urgency of the test and were much longer for MRI than CT. Ultrasound (85%) and angiography (77%) were available in most communities, but positron emission tomography was more accessible for academic neurologists (57%) than community neurologists (33%), as was interventional neuroradiology (78% vs 59%) (Tables 8, 9, 10).

Academic neurologists had greater access than community neurologists to neurosurgery (82% vs 59%), functional

**Table 5: On-call duties**

	Eastern vs Western Canada		Academic- vs community-based neurologists		All N = 219
	East N = 135	West N = 75	Academic N = 134	Community N = 80	
Call duties:					
Yes	74.8%*	82.7%*	84.3%†	67.5%†	76.3%
No	20.7%*	13.1%*	9.0%†	32.5%†	17.8%
DK/NR	4.4%	4.0%	6.7%	0%	5.9%
Mean on call hours/month <sup>‡</sup>	91.6* (range, 4-400)	80.3* (range, 4-400)	75.1† (range, 4-400)	113.2† (range, 12-360)	87.2 (range, 4-400)
Direct patient care on call hours/month <sup>‡</sup>	32.9	31.6	28.5†	41.2†	32.5
With resident on call <sup>‡</sup>					
Always	37.6%	32.3%	45.1%†	16.7%†	35.9%
Most of the time	29.7%	33.9%	38.1%†	16.7%†	31.1%
Occasionally	15.8%	22.6%	14.2%	25.9%	18.0%
Never	15.8%	9.7%	0.9%†	38.9%†	13.2%
DK/NR	1.0%	1.6%	1.8%	1.9%	1.8%
On call for 24 hours direct patient care <sup>‡</sup>	51.5%	61.3%	61.9%†	42.6%†	55.7%
Direct patient care after 24 hr on call <sup>§</sup>	100%	94.7%	98.6%	95.7%	97.8%

DK/NR = do not know/no response.

\*Eastern versus Western Canada was significantly different.

†Academic versus community was significantly different.

‡Only includes those with on-call duties.

§Only includes those on call for 24 hours.

neurosurgery (63% vs 25%), epilepsy surgery (71% vs 30%), and neuropsychological testing (77 vs 48%). Neuropsychological testing had one of the longest expected wait times, with

less than 25% of neurologists expecting availability within 3 months and less than 50% availability within 6 months (Tables 8, 9, 10).

**Table 6: Major area of practice**

	Eastern vs Western Canada		Academic- vs community-based neurologists		Male vs female		All N = 219
	East N = 135	West N = 75	Academic N = 134	Community N = 80	Male N = 146	Female N = 63	
General adult neurology	30.4%	37.3%	10.4%*	68.8%*	34.2%	25.4%	32.0%
Neuromuscular	10.4%	10.7%	14.9%*	2.5%*	9.6%	12.7%	10.0%
Movement disorders	11.1%	4.0%	10.4%	5.0%	8.2%	9.5%	8.2%
Stroke	8.1%	5.3%	9.0%	6.3%	8.9%	4.8%	7.8%
Pediatric neurology	8.9%	4.0%	9.7%	3.8%	4.1%	15.9%	7.3%
Behavioural neurology	6.7%	6.7%	10.4%	0%	7.5%	4.8%	6.4%
Multiple sclerosis	4.4%	6.7%	6.7%	3.8%	4.8%	7.9%	5.5%
Epilepsy	5.2%	5.3%	7.5%*	1.3%*	6.2%	3.2%	5.0%
Neuro-ophthalmology	1.5%	5.3%	3.0%	2.5%	3.4%	1.6%	2.7%
Headache	2.2%	2.7%	3.0%	1.3%	2.7%	1.6%	2.3%
Neuro-oncology	1.5%	4.0%	3.0%	1.3%	2.1%	3.2%	2.3%
Critical care	2.2%	0%	1.5%	1.3%	1.4%	1.6%	1.4%
Pain	0.7%	1.3%	0.7%	1.3%	1.4%	0.0%	0.9%
Sleep disorders	0.7%	0%	0.7%	0%	0.7%	0.0%	0.5%
Other	0%	1.3%	0%	1.3%	0.7%	0.0%	0.5%
DK/NS‡	5.9%	5.3%	9.0%	0%	4.1%	7.9%	7.3%

DK/NR = do not know/no response.

\*Academic versus community was significantly different.

**Table 7: Five most common conditions seen in practice, % of neurologists selecting condition**

Condition	Academic n = 134	Community n = 80	All n = 219
Migraine	50.7*	67.5*	56.2
Parkinson disease	20.9*	61.3*	35.2
Stroke	31.3	37.5	32.9
Epilepsy	29.1	35.0	31.1
Neuropathy	23.1	36.3	27.9
Seizure	30.6*	21.3*	26.9
Vertigo/dizziness	20.9	32.5	24.7
Other headaches	13.4*	32.5%	20.1
Multiple sclerosis	15.7*	27.5*	19.6
Radiculopathy	16.4	20.0	17.4
Alzheimer disease	14.9	17.5	15.5
Pain	14.9	13.8	14.2
Psychogenic disorder	20.1*	2.5*	13.7
Transient ischemic attacks	12.7	15.0	13.2
Other movement disorders	13.4	10.0	11.9
Tremour	11.9	11.3	11.4
Head injury	9.7%	6.3	8.2
Vascular dementia	11.9*	2.5*	8.2
Motor neuron diseases	11.9*	1.3*	7.8
Other dementias	10.4*	1.3*	6.8
Brain tumour	5.2	3.8	4.6
Sleep disorders	2.2	2.5	2.3
Other	20.9*	8.8*	16.0

\*Academic versus community was significantly different.

### Service and Manpower

As expected, wait times for outpatient neurological consultation varied by the urgency of the referral. Office emergencies were seen in 1 day or less by 48% of neurologists and within 1 week by 92%. For urgent consultations, 63% of neurologists reported wait times of 1 week or less and 20% reported wait times of longer than 2 weeks. For nonurgent consultations, the mean wait time was 24.1 weeks. Only 23% of neurologists reported nonurgent wait times of 2 months or less; 21% reported wait times of 2 to 3 months, 28% of 3 to 6 months, and 28% of more than 6 months.

Half of all neurologists thought there were too few neurologists in their community. In particular, community neurologists were more likely than academic neurologists to identify this need (63% vs 43%). Neurologists in Western Canada were significantly less likely than those in the east to identify a need for more neurologists (36% vs 56%).

In terms of subspecialties, additional general adult neurologists were ranked an immediate priority by 56% of community neurologists and 35% of academic neurologists, and only 15% of all neurologists did not think more adult general neurologists were needed (Table 11). Additional stroke neurologists were rated an immediate priority by 33% of all neurologists and additional epileptologists by 23%, whereas neuromuscular (8%), neuro-otology (7%), and sleep disorder neurologists (6%) were least

likely to be rated a recruitment priority. When asked to project needs over the next 5 years, general adult neurologists were ranked as a priority by 51%, followed by stroke neurologists (33%) and epileptologists (25%). Additional neuro-otology (4%) and sleep disorder (6%) neurologists were rated lowest as a 5-year priority.

Although almost 50% of neurologists believed that additional neurologists were required, far fewer believed that additional positions would be approved by authorities. General adult neurology positions were thought most likely to be approved and neuro-ophthalmology positions least likely (8% vs 2%).

Regarding changing practice in the next 2 or 5 years, almost half (46%) of academic neurologists and one-third (34%) of community neurologists said they were not planning any changes. In general, within the next 2 to 5 years, more community neurologists than academic neurologists planned to reduce activity, with 28% planning to reduce weekly work hours, 20% on-call hours, 24% the scope of practice, and 21% their clinic hours. Four percent of neurologists (3% community, 5% academic) planned to retire within 2 years, 10% (18% community, 5% academic) plan to retire within 5 years, and 14% (21% community, 10% academic) plan to retire in 6 to 10 years. More neurologists in Western (18%) than Eastern Canada (5%) were planning to retire within 5 years. If these percentages were applied to the total number of neurologists in Canada in 2012, they indicate that 32 neurologists planned to retire within 2 years, 82 within 5 years, and 121 within 6-10 years.

When asked "which factors are increasing the demands for their time at work," the most frequent responses were management of patients with chronic diseases/conditions (69%), complexity of patient caseload (68%), administrative workload/paperwork (60%), increasing patient expectations (54%), and aging patient population (50%). Surprisingly, more academic than community neurologists cited lack of availability of other local health care professionals (28% vs 19%), whereas more community than academic neurologists cited medical liability concerns (21% vs 5%) and requirement for demonstrating maintenance of competence (23% vs 11%).

When asked to identify "the most frustrating problems in their practice" (Table 12), half of neurologists cited increasing administrative workload/paperwork, and about one-third each cited a lack of chronic care beds and increasing patient expectations. One-quarter each chose lack of available diagnostic tests, lack of accessible patient electronic records, imaging and laboratory tests, lack of availability of other local health professionals, and increasing complexity of patient caseload.

### DISCUSSION

Our survey shows that although neurologists' numbers continue to increase and the mean hours of practice has not declined, the demand for neurological services as manifested by wait times has also increased. The proportion of female neurologists has increased, but there was no significant difference in work hours or patient load between males and females. There were significant differences in number of patients seen, types of practice and areas of neurological specialization, and access to specialized services between community and academic neurologists. Access to timely diagnostic imaging, particularly MRI scans, remains a problem. Fifty percent of neurologists report shortages of neurologists in

**Table 8: Services available to neurologists in their community of practice**

	Academic- vs community-based neurologists		Eastern vs Western Canada		All N = 219
	Academic N = 134	Community N = 80	East* N = 135	West* N = 75	
CT	84.3%	93.8%	88.9%	85.3%	86.3%
MRI	84.3%	93.8%	88.9%	85.3%	86.3%
PET	56.7%†	32.5%†	43.7%	52.0%	46.6%
EEG	84.3%	92.5%	88.1%	85.3%	85.8%
EMG	83.6%†	88.8%†	85.2%	85.3%	84.0%
Ultrasound	83.6%	92.5%	88.1%	84.0%	85.4%
Angiography	82.1%†	72.5%†	77.8%	78.7%	77.2%
Neurosurgery	82.1%†	58.8%†	71.9%	73.3%	71.1%
Interventional neuroradiology	77.6%†	53.8%†	65.9%	70.7%	67.1%
Epilepsy surgery	70.9%†	30.0%†	51.9%	61.3%	54.3%
Neuropsychological testing	76.9%*	47.5%†	63.7%	68.0%	64.8%
Functional neurosurgery	62.7%†	25.0%†	46.7%	50.7%	47.5%
DK/NS	15.7%	5.0%	10.4%	14.7%	13.2%

CT = computed tomography; DK/NR = do not know/no response; EEG = electroencephalogram; EMG = electromyogram; MRI = magnetic resonance imaging; PET = positron emission tomography.

\*Eastern vs Western Canada was significantly different for complete question.

†Academic versus community was significantly different.

their community, particularly of general adult neurologists. Wait times for neurological services exceeded international standards for consultations and also were longer than Canadian averages for other specialists. More community (18%) than academic (5%) neurologists planned to retire within the next 5 years.

### The Neurologic Workforce: Comparisons With 2002

Our 30:70 ratio of female:male neurologists is similar to the proportions of males (72.8%) and females (26.9%) from the CMA Masterfile 2012.<sup>3</sup> In the 2002 survey, only 14% were female.<sup>1</sup> Other data confirm that the proportion of female neurologists has steadily increased from only 12% of neurologists older than age 65 to 41% of those ages 35 to 44 years; since 2009, the proportion of male to female neurology trainees has been approximately equal.<sup>6,7</sup> The increase in the number of female physicians has

given rise to concerns that more physicians will be required because of the perception that females are more likely to take time off, work part-time, and see fewer patients. However, we found no significant differences between males and females in the numbers working part-time, the numbers of patients seen, the numbers of hours worked, or the likelihood of being on call (Tables 3 and 4).

Responding neurologists worked an average of 56 hours/week and spent an average of 30 hours in direct patient care. In 2002, the figures were very similar (56.1 hours/week and 31.6 hours/week, respectively). However, there has been a decline in the number of new patients seen. In 2002, academic neurologists saw an average of 15 new consultations and community neurologists 30 new consultations per week. In 2012, the number of new patients seen had declined by one-third. It is not clear whether this reflects spending more time per patient possibly because of more complex

**Table 9: Wait times for urgent tests: % of neurologists reporting availability within time period**

N = 219	Same day	Next day	<1 week	<1 months	<3 months	<6 months	<1 year	Not available	DK/NR
CT	40.6	8.2	30.1	8.2	1.4	0.5	0	0	11.0
MRI	14.6	12.8	26.	23.3	7.8	2.7	0.9	0	11.0
Carotid Doppler	18.3	18.3	29.2	13.7	3.2	0	0	1.8	15.5
EEG	16.0	8.2	33.8	23.3	5.0	1.4	0	0	12.3
EMG	4.6	7.8	28.8%	33.8	10.0	1.8	0	0.9	12.3
PET	0	0.5	11.0	21.5	8.2	1.8	1.8	36.1	19.2
Angiography	14.2	7.8	31.5	17.4	4.1	0.5	0	8.2%	16.4
Interventional neuroradiology	18.7	10.5	19.6	13.2	5.0	0	0	15.1	17.8

CT = computed tomography; DK/NR = do not know/no response; EEG = electroencephalogram; EMG = electromyogram; MRI = magnetic resonance imaging; PET = positron emission tomography.

**Table 10: Wait times for routine tests: % of neurologists reporting availability within time period**

N = 219	<1 week	<1 month	<3 months	<6 months	<1 year	>1 year	Not available	DK/NR
CT	15.1	42.9	26.0	3.7	1.4	0	0	11.0
MRI	1.8	9.1	24.2	30.1	19.6	4.1	0	11.0
Carotid Doppler	15.1	40.6	20.1	4.1	1.8	0.5	1.8	16.0
EEG	10.5	36.5	31.1	7.3	1.8	0	0	12.8
EMG	4.2	16.9	36.1	18.3	8.2	2.3	0.5	13.7
PET	1.4	7.3	24.7	6.8	4.6	0.5	35.6	19.2
Angiography	6.4	31.1	29.7	3.7	0.9	0	9.1	19.2
Interventional neuroradiology	5.5	23.3	27.9	5.5	1.8	0	16.0	20.1
Neuropsychological testing	1.4	3.2	17.8	19.6	13.2	12.3	18.3	14.2

CT = computed tomography; DK/NR = do not know/no response; EEG = electroencephalogram; EMG = electromyogram; MRI = magnetic resonance imaging; PET = positron emission tomography.

\*Academic versus community was significantly different.

new patients or whether neurologists in 2012 were spending more time seeing returning patients than in 2002 as the number of returning patients seen per week was not reported in 2002.

In our survey, three of the four most common answers to the question “what factors are increasing the demands for their time at work” were patient-related: management of patients with chronic diseases/conditions cited by almost 70%, followed closely by complexity of patient caseload and increased patient expectations. All of these would be expected to increase the time required for each patient.

In both the 2002 and 2012 surveys, academic neurologists see fewer patients than community neurologists. This naturally reflects that academic neurologists often have other responsibilities, such as research and teaching. However, the difference may be an over-estimation because academic neurologists are more likely to have

hospital appointments, and care of inpatients may not be well-captured in our data. We did not specifically ask about visits to inpatients on hospital wards, and these visits may not have been included in the numbers of new and returning patients. Another aspect not captured by the data is that academic neurologists are often subspecialists to whom more complex patients are referred. Last, the direct patient care by academic neurologists often involves teaching of students and residents, which increases time demands and decreases the number of patients seen.

### Neurologist Demand

Access to routine neurological consultations has deteriorated. In 2002, 55% of community neurologists and 41% of academic

**Table 11: Percentage of neurologists endorsing need as a priority for additional types of neurologists in their community**

Type of neurologist	Currently needed			Needed within 5 years		
	Academic	Community	All	Academic	Community	All
General adult neurology	35.1*	56.3*	42.5	44.8*	62.5*	50.7
Stroke	42.5*	20.1*	33.3	37.3*	27.5*	32.9
Epilepsy	26.1	17.5	22.8	30.6*	16.3*	24.7
Pediatric neurology	19.4	17.5	18.3	22.4	20.0	21.0
Movement disorders	23.1	16.3	20.5	23.9	17.5	21.0
Headache	24.6	13.8	20.1	25.4*	12.5*	20.1
Behavioural neurology	17.9	18.8	17.8	20.9	20.0	20.1
Pain	23.1	21.3	21.9	14.9	21.3	16.9
Multiple sclerosis	19.4	10.0	15.5	19.4	11.3	16.0
Neuro-oncology	17.2*	7.5%	13.2	17.9*	10.0*	14.6
Neuromuscular	6.7	8.8	7.8	13.0%	12.5%	13.2
Critical care	14.9	10.0	13.2	15.7*	7.5*	12.3
Neuro-ophthalmology	12.7	6.3	10.0	12.7	6.3	10.0
Sleep disorders	8.2	3.8	6.4	6.7	6.3	6.4
Neuro-ontology	7.5	7.5	7.3	2.2	6.3	3.7

DK/NR = do not know/no response.

\*Academic versus community was significantly different.



**Table 12: Most frustrating problems endorsed by neurologists**

	Academic- vs community-based neurologists		Eastern vs Western Canada		All N = 219
	Academic N = 134	Community N = 80	East* N = 135	West* N = 75	
Administrative workload/paperwork	51.5%	53.8%	54.8%	50.7%	51.6%
Lack of chronic care beds	44.8%†	27.5%†	38.5%	36.0%	37.4%
Increasing patient expectations	27.6%	40.0%	33.3%	29.3%	32.0%
Lack of available diagnostic tests	30.6%	23.8%	25.2%	33.3%	27.4%
Lack of accessible patient electronic records, imaging, and laboratory tests	25.4%	28.8%	25.9%	25.3%	26.0%
Lack of available other health care professionals	29.9%†	18.8%†	29.6%	20.0%	25.1%
Complexity of patient caseload	21.6%	30.0%	21.5%	29.3%	24.7%
Lack of available local/regional physician services in my speciality	23.9%	21.3%	27.4%	16.0%	22.4%
Management of patients with chronic diseases/conditions	20.1%	20.0%	18.5%	21.3%	19.6%
Lack of available local/regional physician services in other specialities	20.9%	15.0%	21.5%	14.7%	18.3%
Communication/social issues with patients	14.9%	18.8%	14.1%	18.7%	16.0%
Medical liability concerns	7.5%†	20.0%†	14.1%	9.3%	12.3%
Aging patient population	6.0%	13.8%	9.6%	5.3%	8.7%
Other	9.0%	13.8%	10.4%	10.7%	10.5%
None of the above	1.5%	6.3%	3.0%	4.0%	3.2%
DK/NS	10.4%	3.8%	6.7%	10.7%	9.6%

More than one response permitted; therefore, percentages do not total 100%.

DK/NR = do not know/no response.

\*Eastern vs Western Canada was significantly different for complete question.

†Academic versus community was significantly different.

neurologists could review a routine consultation within 8 weeks, whereas in 2012, only 21% of academic neurologists and 26% of community neurologists could do so.<sup>1</sup> The demand for neurological services is anticipated to grow because of the aging of the Canadian population, the increased number of neurological diseases for which there are effective treatments, and the lack of neurological expertise amongst family physicians and other specialists. Neither internal medicine specialists nor family physicians are required to do any neurology rotations as part of their residency training.

Wait times for all specialist consultation in Canada are longer than in many other countries. The Commonwealth Fund surveyed 11 developed countries in 2013, and Canada ranked lowest for access to specialists. Only 39% of Canadian referrals were seen within 4 weeks versus 80% of British and Swiss referrals. Twenty-nine percent of Canadian referrals waited more than 2 months compared with 3% of Dutch and Swiss referrals.<sup>8</sup> Within Canada, the Healthy Canadians 2012 report looked at patient-reported wait times for all specialist physicians and found that 45% waited less than 1 month, 38% waited 1 to 3 months, and 17% longer than 3 months.<sup>2</sup> This contrasts with our findings of mean wait times for routine neurologic consultation of 24 weeks. Wait times reported by the Edmonton North Primary Health care Network for all outpatient neurology referrals were a mean of 73 days in 2009 and increased to 97 days in 2011.<sup>9</sup> In southwest Ontario, between 2005 and 2010, the mean wait time for neurology consultations was almost 60 days. However, this was shorter than some other medical specialties, such as gastroenterology, dermatology, and rheumatology, where the wait times were longer than

80 days.<sup>10</sup> Both of these studies include all referrals regardless of urgency.

### Neurologist Supply

In Canada, between 2002 and 2014, the number of neurologists increased from 694 to 917, an increase of 32%.<sup>11</sup> The ratio of neurologists has increased from 2.2/100,000 population in 2002 to almost 2.6/100,000 population in 2014. For comparison, the United Kingdom has the fewest neurologists per capita in the Western world, with a rate of 1.1/100,000, but acute neurological services are rarely provided by British neurologists.<sup>12,13</sup> In 2004, the median number of neurologists in Europe was 4.8/100,000 population.<sup>14</sup> Our Canadian figure of 2.6/100,000 remains lower than that in the United States, where only seven states had fewer than 2.6 neurologists/100,000 population and the average density was 3.9/100,000 in 2009.<sup>15</sup> The American Academy of Neurology Workforce Task Force suggests that, in most states, demand for neurological services outstrips current supply and this demand will be significantly higher by 2025.<sup>16</sup>

Data on retirements are difficult to obtain. From the CMA Neurology Profile, 15 neurologists retired, as defined by giving up their licences, in the period 2010-2013.<sup>7</sup> This did not capture those who no longer practice but have not given up their licences. It did include two younger than the age of 45 who may have given up their licences temporarily. This is a rate of 0.6%/year or 3% in 5 years, which is less than the 10% who stated in our survey that they were planning to retire within 5 years. Other data from the

CMA suggest that stated plans to retire greatly overestimate the number of actual retirements.<sup>17</sup>

Community neurologists outnumber academic neurologists in planning retirement within the next 10 years. Most community neurologists focus on general adult neurology—the area of practice most frequently identified as an area of need in our survey. Neurological training programs will need to ensure that their programs include adequate exposure to general adult neurology and community practice so that there are enough graduates to replace retirees. Otherwise, access to neurological services will deteriorate further, particularly given the differences in the numbers of patients seen between academic and community neurologists.

How does the supply of new neurologists compare with the attrition rate? The total number of regular Ministry-funded neurology trainees in adult neurology programs has increased from approximately 100 in 2001 to 189 by 2009-2010 and to 236-240 between 2011 and 2014. In 2013-2014, 43 first-year residents (49% female, 51% male) entered training, and it was estimated that the number of trainees completing residency training ready to enter practice was 44.<sup>6</sup> The majority of these would have entered training in 2009-2010. From 2011 data, 82% of neurology residents completing training in 2011 were practicing in Canada in 2013.<sup>7</sup> These data suggest that, conservatively, at least 35 new neurologists will enter practice in Canada each year, or 175 over the next 5 years.

If the 10% (82 neurologists) who plan to retire over the next 5 years actually do so, this will mean an overreplacement of almost 100 neurologists. To date, neurologists entering practice have not had problems finding positions, but many other specialties have underemployed or unemployed graduates.<sup>18</sup> We have not observed the full impact of the increase in residency positions as the larger cohorts have not completed their training yet. Whether the demand exists for this increased supply depends on population growth, aging of the population, patient complexity and other factors increasing time required for patient care, new treatments for stroke and other diseases, and the lack of training in neurology of other physicians. If the demand exists, though, it will only be fulfilled if additional positions are approved and funded by provincial health departments. It is concerning that even though 50% of neurologists thought additional neurologists were needed in their community, less than 8% of neurologists in our survey thought that new positions would be approved by the relevant authorities. The success of new neurologists in obtaining positions will need to be carefully monitored in the future and the number of residency positions may need to be adjusted to avoid the oversupply problems seen in other specialties.

### Access to Neuroimaging

Despite recent efforts to reduce wait times for imaging procedures, especially MRI scans, many neurologists report unacceptable wait times. The Canadian Association of Radiologists has published national guidelines recommending the maximal wait times for CT and MRI tests. For urgent CT or MRI, the guidelines state that the test should be completed as soon as possible, but in some circumstances, depending on the medical judgement of the clinical team, a wait of up to 7 days may be acceptable. For routine tests, the maximum target interval is 60 days.<sup>19</sup> The majority of neurologists can access CT scans for

urgent and routine patients within these guidelines. However, MRI scans are more problematic, with only 54% of neurologists reporting having access meeting the guidelines for urgent patients. Routine MRIs are particularly difficult to obtain. We do not have information on access within 60 days specifically, but only 11% have access within 1 month, 35% within 1 to 3 months, and almost one-quarter report wait times of greater than 6 months. This suggests no improvement since 2002, when 70% of neurologists could not access routine MRIs within 10 weeks.<sup>1</sup>

### Limitations

Potential limitations of our study include the response rate of 32%, which was worse than the response rate of 54% in the 2002 CNS Manpower survey.<sup>1</sup> In part, this was due to new privacy legislation that prevented us from obtaining email addresses for all Canadian neurologists, though we did identify addresses for 82%, which is similar to the 88% (772/881) surveyed by the CMA in 2013.<sup>5</sup> Also, the use of email may mean that older neurologists are underrepresented in our study. Nevertheless, 32% is still a higher response rate and total number of responses (219) than other recent surveys of neurologists or physicians in general. The National Physicians Survey 2010 response rate for neurologists was 144/782 (18.9%) and in the 2013 National Physicians Survey, 118/772 (15.3%) responded.<sup>5</sup>

Our survey of access and wait times relied on the neurologists' report, with no method to check their accuracy. Similarly, the likelihood of approval of new neurological positions was based on opinion and not confirmed with authorities. The number of patients seen did not specifically ask about inpatient care, and so may underestimate total patient care, and also does not capture the complexity of patients or time required for consultation.

### CONCLUSION

Despite increased numbers of neurologists in Canada, wait times for neurological services continue to increase and are longer than the Canadian or international averages for specialist consultations. Access to neurological investigations is delayed particularly for MRI and neuropsychological testing. Although half of neurologists believe that additional neurologists are needed, the numbers of new trainees entering neurological training programs have increased substantially, and the ability of new neurologists to find positions will need to be monitored closely so that the supply does not outstrip available positions. Disproportionate numbers of community neurologists compared with academic neurologists plan to retire within the next 10 years. As the majority of community neurologists are general adult neurologists, neurological training programs will need to ensure that their trainees have adequate exposure to community practice and general adult neurology so that replacements are available.

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## DISCLOSURES

JB received honoraria and speakers fees from Serono and served on an advisory board and received a director's fee from Vycor Medical Co. SK, LW, LB, and TC have nothing to disclose.

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