

# Demographics, Interests, and Quality of Life of Canadian Neurosurgery Residents

*Christian Iorio-Morin, Syed Uzair Ahmed, Mark Bigder, Ayoub Dakson, Cameron Elliott, Daipayan Guha, Michelle Kameda-Smith, Pascal Lavergne, Serge Makarenko, Michael S. Taccone, Michael K. Tso, Bill Wang, Alexander Winkler-Schwartz, David Fortin on behalf of the Canadian Neurosurgery Research Collaborative*

**ABSTRACT: Background:** Neurosurgical residents face a unique combination of challenges, including long duty hours, technically challenging cases, and uncertain employment prospects. We sought to assess the demographics, interests, career goals, self-rated happiness, and overall well-being of Canadian neurosurgery residents. **Methods:** A cross-sectional survey was developed and sent through the Canadian Neurosurgery Research Collaborative to every resident enrolled in a Canadian neurosurgery program as of April 1, 2016. **Results:** We analyzed 76 completed surveys of 146 eligible residents (52% response rate). The median age was 29 years, with 76% of respondents being males. The most popular subspecialties of interest for fellowship were spine, oncology, and open vascular neurosurgery. The most frequent self-reported number of worked hours per week was the 80- to 89-hour range. The majority of respondents reported a high level of happiness as well as stress. Sense of accomplishment and fatigue were reported as average to high and overall quality of life was low for 19%, average for 49%, and high for 32%. Satisfaction with work-life balance was average for 44% of respondents and was the only tested domain in which significant dissatisfaction was identified (18%). Overall, respondents were highly satisfied with their choice of specialty, choice of program, surgical exposure, and work environment; however, intimidation was reported in 36% of respondents and depression by 17%. **Conclusions:** Despite a challenging residency and high workload, the majority of Canadian neurosurgery residents are happy and satisfied with their choice of specialty and program. However, work-life balance, employability, resident intimidation, and depression were identified as areas of active concern.

**RÉSUMÉ: Caractéristiques sociodémographiques, intérêts et qualité de vie des médecins résidents en neurochirurgie au Canada. Contexte:** Les médecins résidents en neurochirurgie font face à une combinaison unique de défis, notamment de longues heures de travail, des cas complexes sur le plan technique et des perspectives d'emploi incertaines. Nous avons ainsi cherché à évaluer leurs caractéristiques sociodémographiques, leurs intérêts, leurs objectifs de carrière, leur degré de satisfaction personnelle ainsi que leur bien-être général. **Méthodes:** Nous avons élaboré une enquête transversale qui, par l'entremise du *Canadian Neurosurgery Research Collaborative*, a été par la suite envoyée à chaque médecin résident inscrit, en date du 1<sup>er</sup> avril 2016, à un programme canadien de neurochirurgie. **Résultats:** Sur un total de 146 médecins résidents admissibles, nous avons reçu et analysé 76 formulaires d'enquête remplis, ce qui représente un taux de réponse de 52 %. L'âge médian des répondants était de 29 ans ; 76 % d'entre eux étaient de sexe masculin. Parmi les sous-spécialités les plus populaires dans le cadre d'une activité de recherche ultérieure, mentionnons celles portant sur la colonne vertébrale, l'oncologie et la neurochirurgie vasculaire ouverte. La plupart des répondants ont par ailleurs indiqué avoir travaillé entre 80 et 89 heures par semaine. La majorité d'entre eux ont aussi fait état d'un degré élevé de satisfaction personnelle et de stress ; de plus, tant leur sentiment de réussite que leur fatigue ont été évalués comme moyens à élevés. Quant à leur qualité de vie en général, 19 % des médecins résidents ont affirmé qu'elle était faible ; 49 %, qu'elle était moyenne ; et 32 %, qu'elle était élevée. En outre, 44 % ont considéré que leur niveau de satisfaction en matière de conciliation travail-vie personnelle était moyen. Ce dernier aspect est d'ailleurs le seul dont l'évaluation nous a permis d'identifier une insatisfaction notable, soit 18 %. De façon générale, on peut dire que les répondants se sont dits très satisfaits de leur choix de spécialité et de programme, de leur fréquence passée à observer des interventions chirurgicales et de leur environnement de travail. Toutefois, 36 % d'entre eux ont rapporté avoir été victimes d'intimidation tandis que 17 % ont affirmé avoir éprouvé des symptômes de dépression. **Conclusions:** Bien que les programmes de résidence en

From the Division of Neurosurgery (CI-M, DF), Université de Sherbrooke, Sherbrooke, Quebec; Division of Neurosurgery (SUA), University of Saskatchewan, Saskatoon, Saskatchewan; Division of Neurosurgery (MB), University of Manitoba, Winnipeg, Manitoba; Division of Neurosurgery (AD), University of Dalhousie, Halifax, Nova Scotia; Division of Neurosurgery (CE), University of Alberta, Edmonton, Alberta; Division of Neurosurgery (DG), University of Toronto, Toronto, Ontario; Division of Neurosurgery (MK-S), McMaster University, Hamilton, Ontario; Division of Neurosurgery (PL), Université Laval, Quebec City, Quebec; Division of Neurosurgery (SM), University of British Columbia, Vancouver, British Columbia; Division of Neurosurgery (MST), University of Ottawa, Ottawa, Ontario; Division of Neurosurgery (MKT), Calgary University, Calgary, Alberta; Division of Neurosurgery (BW), University of Western Ontario, London, Ontario; Division of Neurosurgery (AW-S), McGill University, Montreal, Quebec.

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Correspondence to: Christian Iorio-Morin, Division of Neurosurgery, Centre Hospitalier Universitaire de Sherbrooke, 3001, 12e Avenue Nord, Sherbrooke, QC, Canada, J1H 5N4. Email: christian.iorio-morin@usherbrooke.ca.

neurochirurgie soient exigeants et comportent un volume de travail important, la majorité des médecins résidents du Canada se disent heureux et satisfaits de leur choix de spécialité et de programme. Cela dit, la conciliation travail-vie personnelle, l'employabilité, l'intimidation et la dépression ont été identifiées comme des sujets de grande préoccupation.

**Keywords:** fellowship, happiness, quality of life, satisfaction, Workload

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Neurosurgery is a highly competitive residency, with few positions available to many applicants.<sup>1</sup> Despite the nearly universal high motivation, impressive academic record, and good medical school ranking of accepted trainees, programs have historically been plagued with a 43% attrition rate.<sup>2,3</sup> Among the potential risk factors identified were dissatisfaction with lifestyle,<sup>2</sup> female gender,<sup>4</sup> and attitude of senior residents and staff.<sup>3</sup> As admissions in Canadian programs were increased to compensate an anticipated shortage in the workforce,<sup>5</sup> neurosurgery itself became much more subspecialized,<sup>6</sup> challenging the adequacy of surgical exposure for each trainee.<sup>7</sup> In the end, workforce shortage never materialized and, combined with the decision of the American Board of Neurological Surgeons to stop recognizing Canadian residency training, graduates recently found themselves worrying about unemployment.<sup>8,9</sup>

Neurosurgery residents therefore face a unique combination of challenges including a high-workload, high-stakes specialty following a 6-year long residency with uncertain employment prospects. To identify characteristics of such individuals, we performed a cross-sectional survey of Canadian neurosurgery residents and fellows assessing three domains: demographics, interests and career goals, as well as happiness and well-being.

## METHODS

### Study Population

All neurosurgery residents or fellows enrolled in a Canadian postgraduate program as of April 1, 2016, were eligible for participation. Residents who had been accepted at but had not yet started their neurosurgical residency program were excluded from the study. Potential respondents were identified through the Canadian Neurosurgery Research Collaborative (CNRC), which includes a local resident representative at 12 of the 14 neurosurgery programs in Canada.<sup>10</sup> Potential respondents from the remaining institutions were reached through a contact with one of the institution's residents. The study took the form of an online survey to be completed at the participant's convenience within 8 weeks of study start.

### Survey Development

A 40-question online survey was developed by the first author. The survey specifically explored three domains: (1) demographics, (2) interests and career goals, and (3) happiness and well-being. A meeting of the CNRC members was held to assess face and content validity. The survey was improved and the final version approved by all authors. The distributed survey is available as Supplementary Material 1.

Most questions consisted of either multiple choice questions or five-level Likert scales. Overall quality of life and satisfaction

with choice of specialty and work-life balanced were specifically assessed in this way to match reports from other specialties.<sup>11-15</sup> Responses to Likert questions were condensed to three levels for the analysis (i.e. "strongly agree" and "agree" grouped together and "strongly disagree" and "disagree" grouped together).

### Survey Administration

All Canadian residents and fellows received an invitation to participate in the study and a link to the survey website. A general e-mail reminder was sent after 2 and 4 weeks. After 6 weeks, nonrespondents were contacted directly by their local CNRC representative to encourage participation. Response collection was stopped after 8 weeks.

### Statistical Analysis

As per the guidelines of the American Association for Public Opinion Research, surveys were considered completed if more than 80% of the questions were answered.<sup>16</sup> Only completed surveys were included in the analysis.

Survey answers are presented using frequency tables with the number of respondents to each answer and valid percentages. Continuous variables are reported using the median and range. The independence of categorical variables was assessed using the chi-square test. All statistical analyses were performed in IBM SPSS Statistics, version 24.0.0.0 (IBM, Armonk, NY). Figures were produced using Prism 6.0 (GraphPad Software Inc., La Jolla, CA) and Adobe Illustrator CS6, version 16.0.4 (Adobe Systems, San Jose, CA).

### Ethics, Consent, and Permissions

This study was approved by the Research Ethics Board of the Centre Hospitalier Universitaire de Sherbrooke and by the CNRC steering committee. Consent to publish anonymized, aggregated data was obtained as part of the general consent for study participation.

## RESULTS

### Survey Response Rate

A total of 146 residents and 25 fellows were identified as potentially eligible for study participation by CNRC representatives. We received surveys from 77 (53%) residents and four (16%) fellows. Given the poor response rate among fellows, we decided to exclude them from the analysis and focus exclusively on residents. One resident survey was incomplete and was excluded (Figure 1), leading to a final analysis of 76 completed resident surveys (52% response rate). Response rate varied between programs, ranging from 0% to 83%. All provinces and residency training levels were proportionally represented.

**Table 1: Demographics of survey respondents (Canadian neurosurgery residents and fellows)**

	n
Sex	
Female	19 (25%)
Male	57 (75%)
Median age (range)	29 (24-37)
Level	
PGY-1	12 (16%)
PGY-2	11 (14%)
PGY-3	16 (21%)
PGY-4	16 (21%)
PGY-5	12 (16%)
PGY-6	9 (12%)
Marital status	
Married	29 (38%)
Common law	18 (24%)
Single	29 (38%)
Children	
No children	54 (71%)
1	15 (20%)
2	6 (8%)
3	1 (1%)

PGY = postgraduate year.

### Demographics

The demographics of respondents are presented in Table 1. Briefly, 75% were male, 38% were married, and 71% had no children. The median age was 29 years. During their respective

**Table 2: Residency matching statistics**

	n (%)
Was neurosurgery your first choice of specialty when you applied in CaRMS?	
Yes	69 (96)
No	3 (4)
How did you rank your residency program among the other neurosurgery programs when you applied in CaRMS?	
First choice	54 (75)
Second choice	14 (20)
Third choice	3 (4)
Fourth + choice	1 (1)
Prior research experience	
No research experience	8 (11)
Summer research project	51 (67)
BSc	28 (37)
MSc	11 (15)
PhD	3 (4)

CaRMS = Canadian Resident Matching Service.

Canadian Resident Matching Service application, neurosurgery was the first choice of specialty for 96% of respondents, and 75% were matched to their first-ranked neurosurgical program (Table 2). Most respondents had some research experience before beginning residency, but their prior research exposure was not associated with a higher chance of matching in their first choice of program (73.4% vs 87.5% for residents with or without prior research experience, respectively; Pearson chi-square (3) = .911,  $p = 0.823$ ).

### Interests and Career Planning

Following residency training, 86% indicated that they plan to complete a fellowship (Table 3), with the most popular subspecialties being spine, oncology, and open vascular neurosurgery (Figure 2). The United States was the most popular anticipated site for fellowship training. Seventy-five percent of respondents stated they plan to incorporate research as part of their practice, with 57% planning to pursue advanced research training (masters of science or doctorate) during residency. The majority of respondents (80%) would endeavor to practice in an academic institution, with 59% ideally practicing in Canada. Twenty-five percent were unsure in which country they would like to practice and only 37% felt confident in finding a job. Interestingly, a nonstatistically significant trend was observed in which pursuing an additional research degree was associated with a lack of confidence in finding a job (28% vs 52% feeling confident among the respondents planning vs not planning an additional degree, Pearson chi-square (2) = 5.843,  $p = 0.054$ ).

### Workload

The most frequent self-reported number of worked hours per week (including calls) was the 80- to 89-hour range, with 21% stating they typically worked more than 100 hours per week (Figure 3). This workload was deemed reasonable by 58% and too much by 41% of respondents. The median number of days on call per month was 7 (range, 0-12), with most feeling this number was reasonable (66%) or too high (34%).

### Happiness and Well-Being

Happiness and well-being measures are presented in Table 4. Overall, the majority of respondents reported both a high level of happiness as well as stress. Sense of accomplishment and fatigue were reported as average to high. Overall quality of life was low for 18%, average for 49%, and high for 33%. Satisfaction with work-life balance was average for 46% of respondents and was the only tested domain in which significant dissatisfaction was identified (17%). Overall, respondents were highly satisfied with their choice of specialty, choice of program, surgical exposure, and work ambiance.

Of note, 35% of respondents reported having been victim of intimidation during residency. Depression was experienced by 17%, and 4% considered suicide. Intimidation was statistically significantly associated with depression (Pearson chi-square (4) = 19.107,  $p = 0.001$ ).

## DISCUSSION

### Demographics and Career Planning

The demographics of Canadian neurosurgery residents was remarkably similar to that of their American<sup>17</sup> and European<sup>18</sup> colleagues, with an average age of 30 years, the majority being

**Table 3: Career planning**

	n	Yes	Neutral/unsure	No
Median expected length of residency (excluding fellowship) in years (range)	6.5 (6-10)			
Reason for extension of residency (%)				
No planned extension	31 (41)			
Additional degree/research	43 (57)			
Repeat rotations	2 (3)			
Personal reasons	3 (4)			
Health reasons	0 (0)			
Have you completed or are you pursuing an additional degree (excluding fellowship) during your residency? (%)				
No	30 (39)			
MBA	1 (1)			
MSc	24 (32)			
PhD	19 (25)			
Other	2 (3)			
Would you like to complete a fellowship? (%)		65 (86)	10 (13)	1 (1)
Where would-you like to complete your fellowship? (%)				
Canada	12 (16)			
United States	52 (69)			
Europe	3 (4)			
Other	1 (1)			
Unsure	8 (10)			
Would you like to incorporate research as part of your practice? (%)		56 (75)	13 (17)	6 (8)
Would you like to work in an academic institution? (%)		60 (80)	12 (16)	3 (4)
Would you like to work in a community hospital? (%)		8 (11)	36 (49)	30 (40)
Where would-you like to practice? (%)				
Canada	45 (59)			
United States	6 (8)			
Europe	0 (0)			
Other	6 (8)			
Unsure	19 (25)			
Are you confident in finding a job? (%)		28 (37)	23 (31)	24 (32)

male (75% of Canadians vs 79% of Americans vs 76% of Europeans), married (38% of Canadians vs 51% of Americans), and without children (71% of Canadians vs 68% of Americans). The interest in subspecialty training was significant and appears grossly proportional to the current Canadian staff positions, with spine, oncology, and vascular being the most represented. This contrasts with a survey conducted in 1996 in which the majority of practicing neurosurgeon worked as general neurosurgeons in academic centers<sup>5</sup> and further confirms the trend toward a subspecialization within the field.<sup>6</sup>

### Workload

With regard to work hours, 69% of Canadian residents reported working more than 80 hours/week, compared with 6% of Europeans,<sup>19</sup> in whom the European Working Time Directive 2003/88/EC theoretically limits work hours to 48 per week.

Recent data were not available for the American programs, although a survey performed 1 year after the 2011 introduction of American work hour restrictions reported that 36% of neurosurgery residents violated the 80-hour regulation on an occasional or regular basis.<sup>17</sup>

The issue of work hour regulation is controversial. Proponents argue that an excessive workload negatively affects residents' physical and mental health and are associated with increased complications and unfavorable patient outcomes.<sup>20-22</sup> Opponents stress that imposing work hour restrictions impedes continuity of care by increasing the number of caregivers, limits surgical exposure, and decreases resident performance with a detrimental effect on patient safety and resident employability.<sup>23,24</sup>

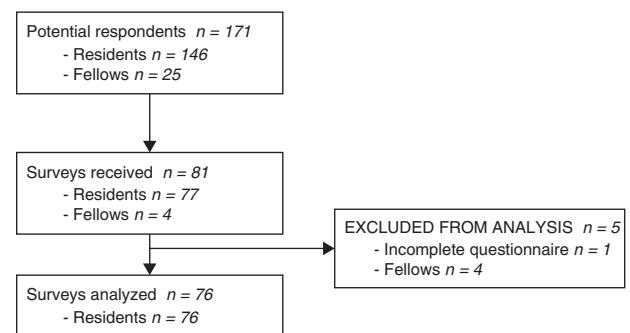
In our survey, although the majority of respondents felt that their workload was reasonable, a significant proportion of respondents (42.5%) disagreed. Work-life balance was the only consistent source of dissatisfaction (17% of respondents) among our cohort,

**Table 4: Wellbeing, quality of life, and satisfaction with residency**

	n (%)	High	Average	Low
How would you rate your level of...				
Happiness		45 (59)	28 (37)	3 (4)
Stress		40 (53)	30 (39)	6 (8)
Sense of accomplishment		37 (49)	33 (43)	6 (8)
Anxiety		22 (29)	32 (43)	21 (28)
Fatigue		37 (50)	31 (41)	7 (9)
Workload		50 (66)	24 (31)	2 (3)
Quality of life		25 (33)	37 (49)	14 (18)
How would you rate your satisfaction with...				
Choice of specialty		70 (92)	5 (7)	1 (1)
Choice of program		67 (88)	8 (11)	1 (1)
Surgical exposure		67 (88)	8 (11)	1 (1)
Work ambiance		52 (68)	18 (24)	6 (8)
Work-life balance		28 (37)	35 (46)	13 (17)
What is your level of confidence in...				
Successfully completing residency		70 (92)	6 (8)	0 (0)
Becoming a competent neurosurgeon		70 (92)	6 (8)	0 (0)
Have you been victim of intimidation during residency?				
Yes	27 (35)			
No	44 (58)			
Decline to answer	5 (7)			
Have you suffered depression during residency?				
Yes	13 (17)			
No	57 (75)			
Decline to answer	6 (8)			
Have you considered suicide during residency?				
Yes	3 (4)			
No	72 (93)			
Decline to answer	2 (3)			

with a rate comparable to that reported for practicing US neurosurgeons (14%).<sup>25</sup> Although less dramatic than the 32% and 38.9% reported for American and Canadian general surgery residents, respectively,<sup>26,27</sup> dissatisfaction with work-life balance was higher than the 8.8% national average for residents across specialties.<sup>28</sup> This phenomenon is not new. Indeed, an analysis of attrition in Canadian neurosurgery residency programs revealed a total attrition rate of 42.6% in the years 1980 through 1992, with 65% of the affected residents voluntarily withdrawing from training mostly for lifestyle reasons.<sup>2</sup> Moreover, a 2015 survey reported a 56% rate of burnout among American practicing neurosurgeons.<sup>29</sup> Although data for neurosurgery residents are not available, a rate of 51.5% was reported for American internal medicine residents in 2011<sup>14</sup> and 58% for general surgery residents in 2004.<sup>30</sup> Burnout was not directly assessed in our survey, although no respondent reported extending his or her residency for health reasons. It would be surprising, however, that burnout was nonexistent in neurosurgery, and this may reflect a response bias to the survey. We did, however, collect anecdotal evidence that research rotations are sometimes

used to give residents “a break” from the workload of on-service rotations. Strategically placed research could perhaps represent a coping mechanism in the face of a demanding residency while also fulfilling academic objectives.

**Figure 1: Flow diagram of survey respondents.**

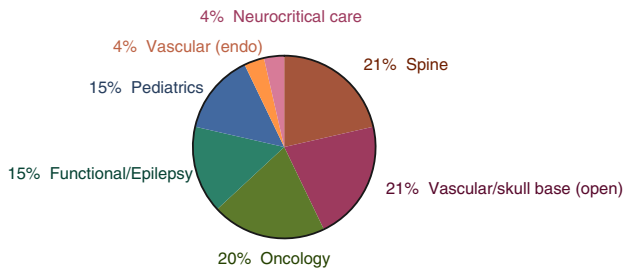


Figure 2: First choice of fellowship.

### Satisfaction and Quality of Life

Respondent's satisfaction with their program (88%) was higher than the 2013 national Canadian average across specialties (62%).<sup>28</sup> Neurosurgery residents' satisfaction in their choice of specialty (92%) was comparable to rates reported for practicing American neurosurgeons (95%)<sup>25</sup> and substantially higher than orthopedic residents (69%) and most surveys of attending surgeons from other surgical specialties including ear, nose, throat (ENT) (74%); obstetrics and gynecology (76%-89%); plastics (67%-80%); and vascular (36%).<sup>15</sup> This might be related to a higher sense of accomplishment amongst neurosurgery residents. Indeed, only 8% of our respondents reported having a low sense of accomplishment relative to 13% to 40% of obstetrics and gynecology residents and 21% to 55% of ENT residents.<sup>15</sup>

Quality of life was reported as low by 18% of respondents. This was similar to general surgery residents' 18%<sup>26</sup> and ENT surgeons' 20.9%<sup>31</sup> and higher than internal medicine residents' 14.5%.<sup>14</sup> Yet, only 4% of respondents reported being unhappy. This discrepancy between quality of life and happiness might seem contradictory. We believe it reflects the temporary nature of residency in which quality of life is sacrificed until training is complete, competency is demonstrated, and a job is found. This overarching goal likely sustains happiness despite challenging circumstances.<sup>32</sup>

### Intimidation

Intimidation is a longstanding problem in residency training and workplace environment in general. A recent literature review reported that 45% to 93% of residents experienced some form of inappropriate behavior during training<sup>33</sup>; "intimidation or bullying," when specifically named as such, was reported by 30.8% of

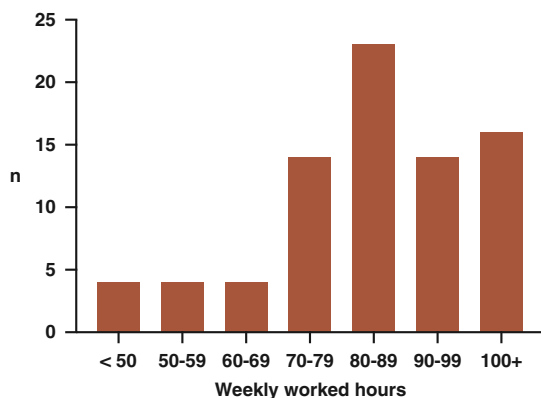


Figure 3: Self-reported worked hours in a typical week (including calls).

Canadian residents across specialties in 2013.<sup>28</sup> A total of 44.7% of family medicine residents who graduated between 2001 and 2005 from two Canadian programs reported having experienced intimidation or harassment during residency training,<sup>34</sup> and such behavior was reported by 16.7% of Canadian general surgery residents as a reason for considering leaving training.<sup>27</sup> With a rate of 35% in our survey, neurosurgical programs are clearly affected by this problem as well. The well-known association between intimidation and depression is further confirmed by our data and highlights the importance of proactively fighting this problem.

### Limitations

With a 52% response rate, our survey captured a sizeable sample of Canadian neurosurgery residents, and respondents were evenly distributed throughout training levels and provinces.

As an e-mail survey, our results do remain vulnerable to voluntary response bias. If, for example, residents with more time and energy proved more susceptible to answer, results could be skewed toward optimism. Concerns regarding respondents' anonymity could have further exacerbated this phenomenon because residents may have feared identification in small training programs with only one resident per year. Although participants were assured that only anonymous, aggregated data would be published, personal questions such as satisfaction with the program, intimidation, depression, and suicide could have acted as deterrents. On the other hand, the opposite could also be true and dissatisfaction might have motivated some residents to complete the survey.

### CONCLUSIONS

The average, prototypical neurosurgery resident is a 29-year-old single male with an interest in research. He works 80 to 89 hours per week with 7 nights on call per month, which he finds reasonable. Although he reports having a high level of stress and fatigue because of the high workload, he is generally happy and feels rewarded for his work. He is highly satisfied with his choice of specialty and considers a fellowship in spine, oncology, or open vascular surgery. He remains uncertain about his future employability.

### ACKNOWLEDGMENTS

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### DISCLOSURES

All authors declare having no conflict of interest.

### STATEMENT OF AUTHORSHIP

All authors contributed to the study design and implementation. CI-M collected the results, performed the statistical analysis, and drafted the manuscript. All authors critically revised the manuscript and approved the final version.

### SUPPLEMENTARY MATERIAL

To view the supplementary material for this article, please visit <https://doi.org/10.1017/cjn.2017.263>.

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