






Brief Communication

Assessment of Neurology Residency Program Websites across North America during COVID-19

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ABSTRACT: With virtual interviews for residency applications, residency program websites have become increasingly important resources for applicants. We evaluated the comprehensiveness of US and Canadian neurology residency program website, comparing this to published rankings of the best neurology and neurosurgery hospitals (for US programs) and number of residency positions (for US and Canadian programs). US program websites were found to be largely more comprehensive than Canadian websites, more extensive websites were associated with better program rankings and fewer residency seats in the US, and US regional differences in comprehensiveness were present. We recommend standardized guidelines to increase website comprehensiveness across programs.

RÉSUMÉ : Évaluation des sites Web des programmes nord-américains de résidence en neurologie pendant la pandémie de COVID-19.

En plus des entretiens virtuels pour les demandes d'admission à des programmes de résidence, les sites Web de ces mêmes programmes sont devenus des ressources de plus en plus importantes pour les candidats. Nous avons ainsi cherché à évaluer l'exhaustivité de ces sites dans le cas des programmes de résidence en neurologie offerts aux États-Unis et au Canada, et ce, en les comparant aux classements publiés des meilleurs hôpitaux de neurologie et de neurochirurgie (pour les programmes américains) et au nombre de places de résidence (pour les programmes américains et canadiens). À noter que les sites Web des programmes américains se sont révélés largement plus complets que les sites Web canadiens, les sites Web davantage exhaustifs étant associés à un meilleur classement des programmes et à moins de places offertes en résidence aux États-Unis. En matière d'exhaustivité, précisons en outre que des différences régionales américaines ont été constatées. En fin de compte, nous recommandons l'adoption de lignes directrices normalisées afin d'accroître l'exhaustivité des sites Web des différents programmes.

Keywords: Neurology; website; residency; medical education

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Over the past two decades, the use of residency websites has steadily increased. Websites serve as a major resource for applicants to learn about different programs and shape their decision to apply. According to surveys conducted among applicants in the 2020–2021 residency match process for Canadian neurology and American plastic surgery programs, program websites were used by 87% of applicants.^{1,2}

Studies of residency program website comprehensiveness and utility have shown applicants valuing website content such as faculty and resident profiles, research opportunities, and curriculum descriptions.³ While gaps in the website content of American neurology programs have been identified in the pre-pandemic era,⁴ there have been no investigations regarding how program websites have been affected by COVID-19 nor how American and Canadian program websites differ. With limited access to visiting electives

due to COVID-19, program websites are expected to play a more significant role in applicant decision-making.

While neurology residency programs have increased social media presence as a response to the pandemic, it is unclear how websites have evolved to adapt.⁵ We evaluated the quality and comprehensiveness of neurology residency program websites across North America in the setting of COVID-19 and compared American and Canadian program websites to provide insight into how programs can optimize website content to tailor to applicant needs.

A list of adult neurology programs accredited by the Accreditation Council for Graduate Medical Education (ACGME) in the continental United States (US) and by the Royal College of Physicians and Surgeons in Canada was generated through the Fellowship and Residency Electronic Interactive

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Table 1: Evaluation criteria and proportion fulfilled by adult neurology residency program websites in the United States (US) (N = 171^a) and Canada (N = 16)

Evaluation criteria by domain	Proportion (%) of US programs fulfilling criterion	Proportion (%) of Canadian programs fulfilling criterion
Recruitment		
Program contact email address	91.2	93.8
Mailing address	62.6	93.8
Selection criteria	82.5	56.3
Application process	72.5	43.8
Application dates	69.0	25.0
Electronic application service	91.8	81.3
International applicant information	79.5	43.8
Program description	97.7	100
Program director name	94.7	93.8
Program director photo	85.4	50.0
Department chair name	55.6	43.8
Department chair photo	49.1	43.8
Faculty		
Faculty listing	86.0	50.0
Photo	79.5	50.0
Educational background	62.6	43.8
Research interests	32.7	43.8
Research publications	33.3	31.3
Awards	24.0	31.3
Residents		
List of current residents	86.5	37.5
Resident year status	84.8	37.5
Individual or group photo	84.2	43.8
Education and research		
Curriculum	84.2	100
Rotation schedule	84.2	43.8
Research opportunities	75.4	62.5
Grant opportunities	11.1	12.5
Journal club	71.3	56.3
Meeting/conference opportunities	82.5	31.3
Fellowship/subspecialty information	59.6	25.0

(Continued)

Table 1: (Continued)

Evaluation criteria by domain	Proportion (%) of US programs fulfilling criterion	Proportion (%) of Canadian programs fulfilling criterion
Teaching		
Grand round conferences	78.9	75.0
Educational resources	9.9	31.3
Research requirement	31.0	62.5
Benefits		
Salary	61.4	0
Insurance plans	60.2	0
Vacation policy	59.6	0
Advertised paid parental leave	43.3	87.5
Community and environment		
Wellness resources	36.3	6.3
Hospital	86.0	75.0
Neighborhood	47.4	37.5
Local attractions	51.5	31.3
Community events	28.7	31.3

^aThree of 174 US neurology residency programs had inaccessible websites.

Database and Canadian Resident Matching Service (CaRMS) website, respectively. Data on the number of postgraduate year 1 (PGY1) positions offered in 2022 were collected through Residency Explorer and CaRMS for American and Canadian programs, respectively. The 2022 US News & World Report's best neurology and neurosurgery hospitals list was used to rank US programs. Due to the absence of a ranking system for Canadian neurology divisions/departments, program rank, and website were not compared for Canada. Two reviewers (CT, WW) extracted data independently and in duplicate from websites in August 2022. Any discrepancies were resolved through consensus and discussion with a senior author (FK).

Adapted from validated studies, an assessment tool for components required in an extensive program website was created.^{6,7} A 40-item point system was used to assess residency program websites consisting of the following domains: recruitment, faculty, residents, education and research, teaching, benefits, and community and environment (Table 1). A point was assigned for each criterion fulfilled either on the official program website or on webpages and documents linked to the official website. Details for criteria fulfillment and its application are summarized in the Supplementary methods.

To assess regional differences, US and Canadian programs were stratified based on the geographical subdivision system used by the National Geographic Society and Government of Canada, respectively. The US was grouped into five regions: Midwest, Northeast, Southeast, Southwest, and West. Canada was stratified into four regions: Atlantic, Central, Prairies, and West.

Data for fulfilled criteria were summarized by mean and standard deviation of scores, stratified by criteria domain and country. Distribution of program websites by degree of

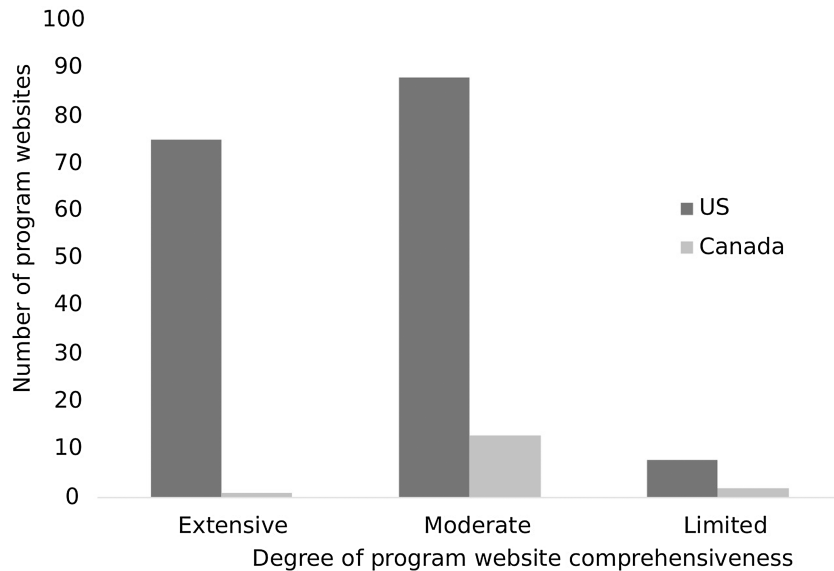


Figure 1: Distribution of US and Canadian neurology residency program websites by degree of comprehensiveness. The degree of website comprehensiveness is based on the number of evaluation criteria fulfilled (refer to Table 1 for the criteria list). Extensive = 28–40, moderate = 14–27, limited = 0–13 criteria fulfilled. Of US neurology residency program websites, 75, 88, and 8 websites were comprehensive to an extensive, moderate, and limited degree, respectively. Of Canadian neurology residency program websites, 1, 13, and 2 websites were comprehensive to an extensive, moderate, and limited degree, respectively.

comprehensiveness is summarized in Figure 1. For the US, national program rank and number of PGY1 positions were evaluated as singular predictors of total website score using simple linear regression. If significant, predictors were evaluated using multivariable regression to assess collinearity. The predictiveness of domain sub-scores for program rank was assessed by multivariable linear regression. For Canada, the number of PGY1 seats and total website score were assessed using simple linear regression. Regional subgroup analysis for total website score evaluation was conducted with the Kruskal-Wallis test with post hoc pairwise comparison using false detection rate for continuity correction. Pairwise comparison of total score and domain sub-scores between American and Canadian programs was performed with the Mann-Whitney U test. $p < 0.05$ was considered statistically significant. Analyses were completed in RStudio 2022.02.0 + 443.

We identified 174 US and 16 Canadian adult neurology residency programs. Three of 174 ACGME-accredited neurology programs had inaccessible websites and were excluded. Proportion of fulfilled criteria and website evaluation scores are summarized in Tables 1 and 2, respectively. US programs had higher website scores than Canadian programs in total score ($p = 0.002$) and the domains of faculty ($p = 0.003$), residents ($p < 0.0001$), education and research ($p = 0.0005$), benefits ($p < 0.0001$), and community and environment ($p < 0.0001$). Canadian programs had higher website scores in the teaching domain than US programs ($p = 0.002$).

Among US programs, total website score was positively associated with program ranking ($p = 0.002$). The domain sub-score for education and research was positively associated with program rank ($p = 0.0002$), when adjusted for other domain contributions. Among all North American programs, there was an inverse association between total website score and number of PGY1 seats ($p < 0.0001$). This difference remained significant only in the US context, even when adjusted for program ranking ($p = 0.04$). In regional analysis, Canadian regions did not exhibit any difference in domain sub-scores ($p > 0.05$). Within the US, the Southwest had higher faculty domain sub-scores compared to the Midwest, Southeast, and West individually (all $p = 0.007$). The US Midwest had higher education and research domain sub-scores than the Southwest ($p = 0.02$).

Our study reveals variability in content extensiveness between American and Canadian neurology residency program websites. While Canadian program websites had more comprehensive content in teaching, US program websites were more extensive in faculty, resident, education and research, benefits, and community and environment content. In US programs, higher website total scores and education and research domain sub-scores were associated with better rankings. Among US programs, higher website scores correlated with fewer PGY1 seats. Across US regions, the Southwest had higher faculty domain sub-scores than the Midwest, Southeast, and West, while the Midwest had higher education and research sub-scores than the Southwest.

Prior studies have shown that applicants value faculty, resident, research, and curriculum information across specialties.^{7,8} This may explain why we found that websites provided more comprehensive information in these domains. As in-person electives were suspended during COVID-19, websites may have been curated to inform more about community, environment, and benefits, that would have been otherwise learned in-person. Further, differences between Canadian and US program websites may be attributed to differences in program values. For instance, all Canadian neurology residency programs have academic half-days, highlighting the importance of resident teaching in Canada.⁹ Higher education sub-scores of Canadian programs (all university-based) compared to those of the US (70% university-based)⁴ are consistent with the proposal that university-based programs have higher quality curriculum than community-based programs.¹⁰ However, further study is warranted.

Intriguingly, we found associations of website comprehensiveness with better program ranking and fewer PGY1 seats in the US. Comprehensive websites can foster trust and confidence in programs, attract larger and diverse applicant pools, and increase program visibility and recognition, all of which can lead to better rankings. Notably, US News & World Report's rankings largely rely on patient outcomes, independent of website content.¹¹ Furthermore, programs with fewer PGY1 seats may invest more in website content due to greater resource availability or emphasis placed on attracting qualified applicants. Regional differences in program websites may be attributed to elements such as demographics, culture, resource availability, and local competition.

Table 2: Evaluation scores of adult neurology residency program websites in the United States (US) (N = 171^a) and Canada (N = 16)

Evaluation criteria domain (maximum score)	Score of US Programs: mean (SD)	Score of Canadian Programs: mean (SD)
Recruitment (12)	9.2 (2.6)	7.7 (2.4)
Faculty (6)	3.1 (1.9)	2.5 (2.8)
Residents (3)	2.5 (1.1)	1.2 (1.5)
Education and research (7)	4.6 (1.7)	3.3 (1.1)
Teaching (3)	1.2 (0.8)	1.7 (1.1)
Benefits (4)	2.2 (1.5)	0.9 (0.3)
Community and environment (5)	2.5 (1.4)	1.8 (1.6)
Total ^b (40)	25.3 (6.6)	19.1 (6.2)

^aThree of 174 US neurology residency programs had inaccessible websites.

^bIncludes criteria from all domains. SD, standard deviation.

Ultimately, further investigation in these potentially bidirectional associations is needed.

Previously, a pre-pandemic study evaluating US neurology residency program websites found associations between comprehensiveness and program ranking, size, affiliation, and location.⁴ In contrast, our study examines program websites in the setting of COVID-19 when websites became increasingly significant due to restrictions to in-person experiences. While data were collected from February-April 2020 in the previous study,⁴ one-third of residency online resources were created after March 2020.¹² Consequently, our evaluation in 2022 captured almost 20 additional websites. Moreover, our study compares Canadian and US program websites and incorporates more extensive criteria, such as the community and environment, which may be crucial to applicants who have not visited the program location.

Our study adds to the literature by examining neurology program websites following the shift to a virtual platform due to COVID-19. Additionally, it is novel in comparing American and Canadian program websites. While we used validated scoring criteria from the literature,⁸ our assessment may have been subjective and excluded attributes crucial to applicants. As websites are constantly updated, we were unable to reflect changes over time with cross-sectional data. To alleviate this, we collected data near the start of residency applications to capture websites at their most comprehensive state. Within Canadian regional analysis, statistical accuracy and result interpretation were limited due to modest sample sizes. Moreover, it is important to note that US program rankings are influenced by factors beyond website comprehensiveness, such as hospital resources and staff training opportunities.

Our study highlights components emphasized by neurology residency training programs on their websites within the context of COVID-19 and underlines key differences between American and Canadian residency program websites. Based on our experience, we recommend the following as a minimum standard for a comprehensive program website: information regarding recruitment (e.g., program description, contact information), faculty and residents (e.g., name list, photos), education (e.g., curriculum, rotations), teaching (e.g., grand rounds, research requirement), benefits (e.g., salary, vacation/leave policies), and community/environment (e.g., hospital sites, local attractions). Future studies

in website design and interface could determine other aspects important to applicants. As interviews remain virtual, comprehensive program websites are vital in helping applicants make informed decisions and select the most suitable program.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/cjn.2023.266>.

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Competing interests. None.

IRB approval status. This study was exempt from institutional review board approval as the data was extracted in its entirety from publicly available resources. The dissemination of results will not identify any individual or generate new forms of identifiable information.

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