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Assessing the Quality of Recruitment Information on Skull Base Surgical Fellowship Program Websites.

Permalink

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Journal

Seminars in Neurosurgery, 85(Suppl 2)

ISSN

2193-6331

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Publication Date

2024-10-01

DOI

10.1055/a-2181-6813

Peer reviewed

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Accepted Manuscript online: 2023-09-26 Article published online: 2023-11-03

Assessing the Quality of Recruitment Information on Skull Base Surgical Fellowship Program Websites

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J Neurol Surg B Skull Base 2024;85(Suppl S2):e16–e27.

Abstract

Introduction The American Association of Neurological Surgeons (AANS), North American Skull Base Society (NASBS), American Rhinologic Society (ARS), and American Neurotology Society (ANS) fellowship directories are important information repositories for skull base surgical fellowship programs. However, there is limited research on the amount and depth of information available through these resources. The objective of the present study is to assess Web site accessibility and information availability for individual fellowship programs listed within the AANS, NASBS, ARS, and ANS fellowship directories.

Methods Lists of all accredited skull base surgical programs were obtained from the AANS and NASBS fellowship directories. Duplications in listed programs were removed, and systematic queries via an online search engine were conducted to identify fellowship Web sites. From each available Web site, information pertaining to 24 different variables was collected and organized into two categories—recruitment and education. Differences in the availability of information on recruitment and education were then compared across Web sites and contextualized relative to other surgical specialties.

Results After excluding duplicates, 113 fellowship programs were identified, of which 99 (87.6%) had accessible Web sites. Of the 48 listed by the NASBS, direct Web site links were available for 33 (68.8%), email contacts were accessible for 32 (66.7%), and phone numbers were listed for 6 (12.5%). Of the 39 programs listed by the AANS, none included Web site links, 38 (97.4%) provided an email contact, and 39 (100%) listed a departmental contact telephone number. All 28 (100%) programs listed by the ANS provided a phone and email contact in addition to a Web site link to each institutional Web site. Of the 33 programs listed by the ARS, 29 (88%) had a departmental contact

Keywords
- training
- surgical training
- neurosurgery
- ENT
- otorhinolaryngology-head and neck
- skull base
- fellowship
- recruitment
- Web site
- NASBS

received
August 2, 2023
accepted
September 22, 2023
accepted manuscript online
September 26, 2023
article published online
November 3, 2023

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Georg Thieme Verlag KG,
Rüdigerstraße 14,
70469 Stuttgart, Germany

DOI https://doi.org/10.1055/a-2181-6813.
ISSN 2193-6331.

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telephone number, 31 (94%) had an email contact available, and 4 (12%) had a program Web site link directly available from the database Web site. Of the 99 total programs, fellowship Web sites displayed an average of 5.46 (42.0%) of the 13 recruitment features and 4.80 (42.6%) of the 11 education features. Programs in the geographic Northeast were significantly less likely to present information pertaining to recruitment ($p = 0.023$). Furthermore, programs in geographic Northeast and West were significantly less likely to present information focused on surgical training and/or education ($p = 0.006$).

Conclusion Although many skull base fellowship programs have maintained comprehensive program Web sites, certain critical aspects remain deficient, and some programs provide little to no information. Providing more detailed information about programs can prove mutually beneficial for fellowship program directors and candidates.

Introduction

Web-based resources have increasingly become the default resource for candidates seeking information regarding medical residency programs and post-residency fellowships.[1,2] The importance of web-based materials and the reliance upon web-based resources have become particularly prominent across many professions since the onset of the coronavirus disease 2019 (COVID-19) global health crisis when in-person information sessions were eliminated due to public health concerns.[2] Quality online materials are, therefore, an increasingly important resource and means of helping programs attract applicants. On the other side of the recruitment process, these resources are also helpful to applicants seeking to identify programs best aligned with their motivations, career aspirations, and interests. Outdated or absent resources could lead applicants to develop an incorrect and potentially misleading impression of a program. Alternatively, errant information could impart an unfavorable impression of programs upon applicants and dissuade them from pursuing training at a program that might have otherwise been a great fit.

Currently, online resources regarding specific programs can be gathered from several resources, including program-hosted sites, the North American Skull Base Society's (NASBS) Skull Base Fellowship Registry, the American Association of Neurological Surgeons' (AANS) Fellowship Training Program Directory, the American Rhinologic Society (ARS) Fellowship Program Listing, and the American Neurotology Society Fellowship Program list. The AANS, NASBS, ANS, and ARS lists are intended to provide basic details and contact information for each program listed. In contrast, program-specific sites can be far more expansive and often provide information on program operative volume, number of cases performed by type, faculty profiles, and call requirements, among other pertinent details.

Although previous analyses have been conducted regarding fellowship Web site quality for other medical specialties, including orthopaedic surgery,[3] vascular surgery,[4] interventional radiology,[5] pain medicine,[6] and functional neurosurgery,[2] no prior study has evaluated the quality, accessibility, or availability of online information for skull base fellowship programs. Therefore, the objective of this study is to evaluate all currently accessible information pertaining to existing skull base fellowship information repositories (-NASBS/AANS/ARS/ANS) and to evaluate the extent of information available on program-specific Web sites.

Materials and Methods

Data Sources and Inclusion Criteria

The AANS (https://www.aans.org/en/Trainees/Academic-Fellowship-Directory), NASBS

(https://www.nasbs.org/fellowship-match-programs/), ARS (https://www.american-rhinologic.org/rhinology_fellowship), and ANS (https://www.americanneurotologysociety.com/neurotology-fellowship-program-information) independently maintain lists of skull base fellowship programs, which were treated as the definitive lists of current skull base fellowships. Information made available on these Web sites and provided by the official fellowship program Web sites were the only sources of information assessed in the present study. Of note, the Society of Neurological Surgeons (SNS) now lists programs accredited via the Committee on Advanced Subspecialty Training, but as this excludes nonaccredited fellowships, we did not include the SNS site in our analysis.[7] The NASBS provides a table of programs that includes institution name, fellowship title, fellowship type ["neurosurgical" or otorhinolaryngology/ENT subtypes ("rhinology/endonasal," "neurotology," "head and neck oncology," "plastic and reconstructive")], location, and fellowship administrator contact name. For each fellowship program title listed on the NASBS Web site, there is an embedded hyperlink leading to a distinct NASBS page that provides additional details about the corresponding program. Often, the individual program page listed on the NASBS Web site also contains a hyperlink to the official Web site of the program's host institution, providing applicants with additional information on the fellowship program. The AANS fellowship directory also provides institution name,

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location, fellowship focus, program director name, email contact, and phone contact. However, it does not provide separate links to the official fellowship program web pages. The ANS provides a PDF document listing ACGME-accredited neurotology fellowship programs and directors, which includes program name, program director name, director email, program length, type, and a link to the official institution Web site. On the main ANS webpage, there is also an alphabetized list of program names with embedded hyperlinks to the specific program Web site (or alternatively, to a PDF or Word document with specific, detailed program information). The ARS, in a similar manner to the NASBS, presents a list of fellowship program institutions with accompanying hyperlinks that lead to distinct ARS pages providing additional details on each specific program; we found the information available on this webpage to be more in-depth than that provided by its NASBS Web site correlate. As such, although direct links to the official Web site of the program's host institution were less frequently provided, the ARS webpage provided direct access to comprehensive information more frequently than the NASBS fellowship program page.

For each program listed by the four databases, an additional search was conducted through a commercially available web browser using the institution name along with the program title or using "skull base surgery fellowship" if the program title was not specified. In situations where multiple programs were listed under the same institution, as was the case for Cleveland Clinic (Ohio and Florida locations) for example, the search query included the program location as well. If the initial search yielded no results for the specified program, the name of the program's main contact person was also included in the query.

Next, results from the web query were cross-checked with the information and links provided by the NASBS, ARS, and ANS Web sites. Each source was assessed for authenticity and association with the fellowship institution. If there were any discrepancies between the web browser and provided links, we referred to both results for information extraction. As the AANS did not provide any links to fellowship Web sites, web browser results were used as the sole source for information extraction for programs listed in the AANS fellowship directory. We extracted information from both the society Web site and the corresponding program Web site when both informational sources for the same fellowship program were available. If the web search returned an official institution-linked PDF document with fellowship details, we treated that document as if it were an official Web site.

Accessibility

Of note, for the purpose of the present study, the search and analysis were performed prior to the recent addition of the skull base fellowship application repository to the NASBS Web site. We contextualize our findings as they relate to this recent development in the discussion section of the present study. Ultimately, the AANS, NASBS, ARS, and ANS skull base fellowship databases were evaluated according to the comprehensiveness of their unique databases, measured as the number of advertised programs listed and the accuracy of the list.

Table 1 Recruitment ($n = 13$) and education ($n = 11$) variables chosen for analysis of skull base neurosurgery fellowship Web sites

Recruitment	Education
Program description	Rotation schedule
Contact information	On-call schedule
Current fellow list	Didactic schedule
Salary information	Research opportunities
Work hours	Research requirements
Interview dates	Operative experience
Graduate information	Facility description
Selection/evaluation criteria	Faculty publications
City information	Faculty list availability
Program size information	Fellowship publication list availability
Meal allowance information	Fellowship conference presentation availability
Debt management information	
Enrollment/application information	

Web Site Analysis

Each Web site was evaluated by two independent reviewers (H.S. and E.T.). For each recruitment and education variable assessed, outcomes were recorded as the presence or absence of the variable being assessed (►**Table 1**).[2–6]

Web Site Recruitment and Education

The analysis of each Web site included two aspects: the availability of information relevant to recruiting potential candidates and the comprehensiveness of the information describing each fellowship's operative and educational experience (pedagogical/training value). Based on the methodology of previous analyses of residency and fellowship Web site data, 13 recruitment variables (►**Fig. 1**) and 11 educational variables (►**Fig. 2**) were selected. The percentage of recruitment variables ($n/13$) and educational variables ($n/11$) on each Web site was recorded and calculated. When a variable that was not immediately available on the official program page was available via a direct link on the program page to a specific program including that variable, that variable was counted.

Program Comparison

Skull base neurosurgery fellowship programs were categorized based on geographic location, program size, and ranking. Geographic location was determined based on the U.S. region (West, Midwest, South, Northeast), or international.[8] The number of available skull base fellowship positions and faculty neurosurgeons was used to determine program size. Faculty size was separated into programs with 1–5 versus $\geq$6 faculty. Program ranking was determined based on the 2023 U.S. News & World Report rankings of the top

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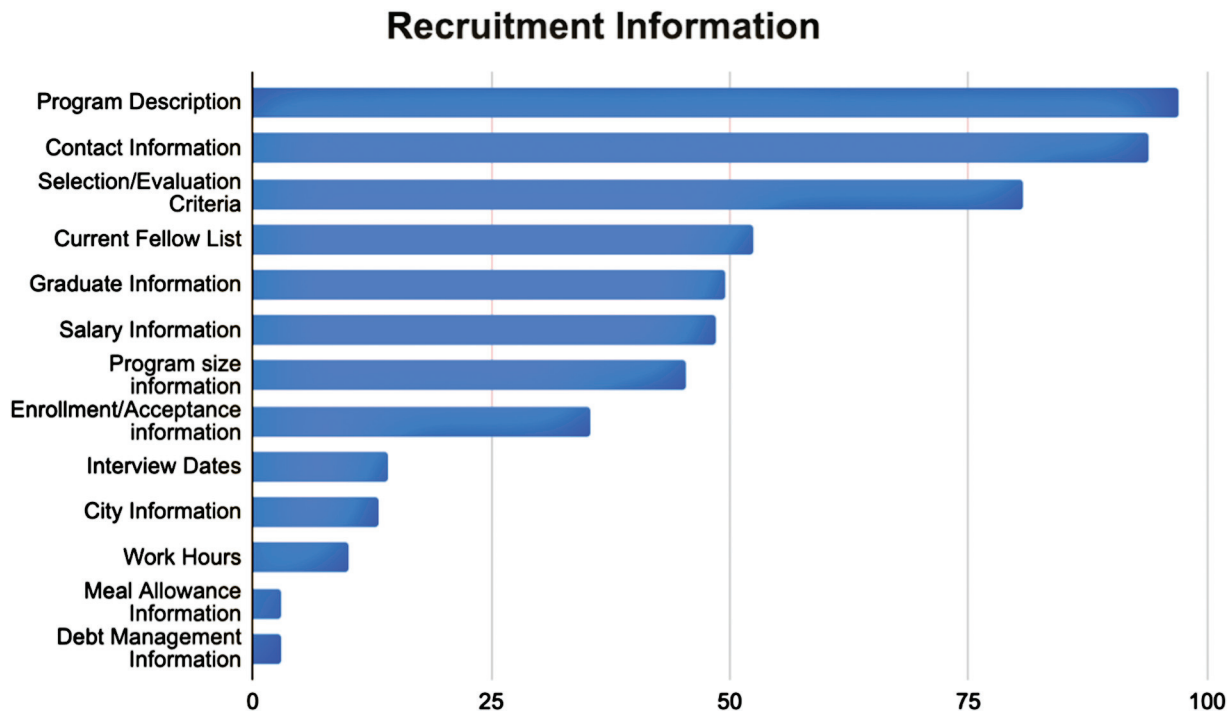

Fig. 1 Recruitment information stratified by number of programs providing information related to each category listed on the *y*-axis.

Neurosurgery/Neurology or Ear/Nose/Throat (Otorhinolaryngology) programs.

Statistical Analysis

Data were collected using Microsoft Excel (Microsoft Corporation, Redmond, Washington, United States) and analyzed using R statistical software version 3.3.2 (The R Foundation, Vienna, Austria). The mean percentages of available education and recruitment Web site content by category were compared among groups with a Kruskal–Wallis test. Post-hoc Wilcoxon signed rank test was used to construct pairwise differences and confidence intervals where applicable. The threshold for statistical significance was $p < 0.05$ with all tests being two-sided.

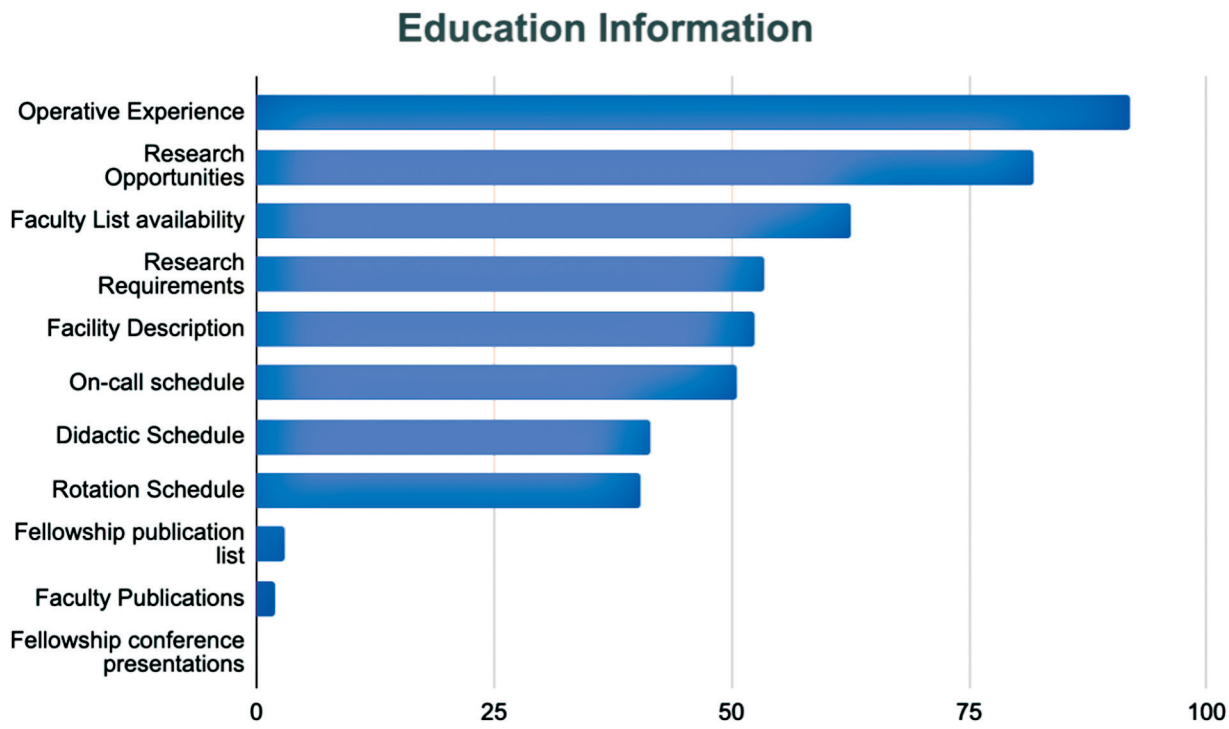

Fig. 2 Education information stratified by number of programs providing information related to each category listed on the *y*-axis.

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Results

Accessibility of Information

The NASBS Web site listed the most fellowship programs at 48, while the AANS Web site listed 39 fellowship programs, the ARS listed 33 fellowship programs, and the ANS listed 28 fellowship programs. Following removal of duplicates listed across two or more society Web sites, 113 unique fellowship programs remained.

For the 48 results listed on the NASBS repository, the NASBS Web site provided individual links for each program that led to a page with further information on the specific fellowship. Contact information for every program was listed. On the linked program-specific pages, training and testing requirements, length of program, number of fellows accepted annually, night and weekend call requirements, number of skull base versus non-skull base cases, research opportunities, and logistical application information were provided. Web site links to the institutional program Web site were linked on these NASBS program-specific pages for 15 of the 48 programs (►**Table 2**). For one program, an external link to the program's page was provided but it was found to be nonfunctional.

The AANS Web site provided email contacts for 38 out of 39 programs, and phone number contacts for all 39 (►**Table 2**). No individual Web site links were provided. The ANS provided 28 results in the form of a PDF and embedded hyperlinks on their main webpage. For all but one result, the specific institutional program Web site was provided. One institution's link was to their main institutional homepage, rather than to their program's fellowship-specific Web site. Furthermore, one Web site link was found to be nonfunctional. Contact information was listed for every program in the form of the program director name and email in the main compiled PDF list. Phone number contacts were provided in all embedded link documents and webpages. The ARS provided a list of 37 rhinology fellowship programs, 35 of which mentioned skull base surgery in their program descriptions on the linked program-specific ARS pages. One program was designed specifically for international fellows and removed from consideration. One institution listed both their 1- and 2-year tracks separately, which are considered here as a singular fellowship program. The program-specific ARS pages also included information such as specific rotations included within the training, call schedules, case logs, appointment requirements, and research opportunities, though this varied by institution. Web site links to the institutional program Web site were linked on the ARS-specific pages for 4 out of 33 results (►**Table 2**).

Of note, the listed contact information differed between the four databases for most programs listed on both repositories. The NASBS Web site most often provided contact information for the fellowship coordinator (nonphysician administrator), while the AANS and ANS Web sites usually provided the contact information for the fellowship director (faculty skull base surgeon). The ARS also listed the fellowship director's contact information, though in several cases multiple contacts were listed.

In total, of the 113 individual programs identified, 99 (87.6%) program Web sites were accessible via web browser query. All subsequent analyses were conducted using these 99 confirmed program sources.

Fellowship Recruitment

A total of 13 different features were evaluated within the recruitment quality domain for all program Web sites. Across the 99 program Web sites, there were, on average, roughly 5.46 (42.0%) of the 13 components (►**Table 3**). The most frequently presented recruitment features were program description (96.97%), contact information (93.94%), selection/evaluation criteria (80.81%), current fellow list (52.53%), and graduate information (49.49%). Meal allowance information (3.03%) and debt management information (3.03%) were rarely included on any online resources for individual programs.

Fellowship Education

Eleven different features were evaluated within the education category of fellowship program Web site information availability (►**Table 3**). Program Web sites featured, on average, approximately 4.79 (43.62%) of 11 possible information categories. The most often presented features were operative experience (91.92%), research opportunities (81.82%), faculty list (62.63%), research requirements (53.54%), and facility description (52.53%). Fellowship publications (3.03%) and faculty publications (2.02%) were rarely included, and no program resource displayed information related to fellowship conference presentations.

In summation, the top five skull base fellowships (►**Table 4**) in terms of fellowship program Web site information quality and availability according to cumulative score were: (1) Mayo Clinic Neurologic Surgery and (2) Otorhinolaryngology, (3) University of Toronto Otorhinolaryngology, (4) University of British Columbia Otorhinolaryngology,

Table 2 Breakdown by Web site links provided

Characteristic	NASBS	AANS	ANS	ARS
Skull base surgical fellowships listed	48	39	28	33
Phone number contact available	6	39	0	29
Email contact available	32	38	28	31
Web site link available	33	0	28	4

Abbreviations: AANS, American Association of Neurological Surgeons; ANS, American Neurotology Society; ARS, American Rhinologic Society; NASBS North American Skull Base Society.

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Table 3 Program Web site characteristics

Characteristic	No. of programs	Mean recruitment content on Web sites		Mean education content on Web sites	
Region			$p = 0.0228$		$p = 0.0055$
South	23	47.49 (13.45)		52.57 (16.21)	
Northeast	21	36.63 (17.86)		44.16 (21.28)	
Midwest	23	44.25 (21.16)		41.50 (19.92)	
West	23	35.12 (13.08)		35.97 (20.60)	
International	9	52.99 (20.51)		44.44 (22.93)	
Number of fellows			$p = 0.281$		$p = 0.381$
1	86	42.40 (17.49)		44.08 (19.50)	
2	9	42.74 (14.45)		43.43 (22.63)	
3	1	76.92		54.55	
Not listed	3	17.95 (11.75)		27.73 (39.63)	
Number of faculty			$p = 0.064$		$p = 0.456$
≤5	64	43.63 (16.04)		43.89 (19.87)	
>5	25	42.15 (21.43)		47.64 (20.38)	
Not listed	10	31.54 (16.40)		31.82 (20.66)	
Redirect to SF Match	50				

Table 4 Ranking of programs according to cumulative recruitment and education scores

Institution	Type	Total recruitment variables	Total education variables	Cumulative score	Neurosurgery US news ranking	ENT US news ranking
Mayo Clinic	Neurosurgical	13	7	20	6	N/A
Mayo Clinic	Neurotology	13	7	20	N/A	6
University of Toronto	Rhinology/endonasal	10	8	18	N/A	N/A
University of British Columbia	Rhinology/endonasal	10	6	16	N/A	N/A
University of Miami Miller School of Medicine	Rhinology/endonasal	10	6	16	N/A	N/A
Sydney ENT Clinic	Rhinology/endonasal	9	6	15	N/A	N/A
University of British Columbia	Neurotology	8	6	14	N/A	N/A
University of Texas Health Science Center at Houston	Rhinology/endonasal	8	6	14	N/A	N/A
Cleveland Clinic Florida	Neurosurgical	8	5	13	N/A	N/A
University of British Columbia	Neurosurgical	8	4	12	N/A	N/A
University of Texas Southwestern Medical Center Neurotology Fellowship	Neurotology	5	7	12	30	N/A
M.D. Anderson Cancer Center	Neurosurgical	6	5	11	N/A	N/A
Medical College of Georgia—Augusta University	Rhinology/endonasal	5	6	11	N/A	N/A
Cornell University/Columbia University/NewYork-Presbyterian	Rhinology/endonasal	3	7	10	N/A	13
Rutgers New Jersey	Rhinology/ endonasal	5	5	10	N/A	N/A
Thomas Jefferson University	Neurosurgical	5	5	10	43	N/A

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Table 4 (*Continued*)

Institution	Type	Total recruitment variables	Total education variables	Cumulative score	Neurosurgery US news ranking	ENT US news ranking
Cleveland Clinic	Neurosurgical	6	3	9	8	N/A
House Clinic	Neurosurgical	6	3	9	N/A	N/A
Lehigh Valley Health Network	Neurosurgical	3	6	9	N/A	N/A
Michigan Ear Institute	Neurotology	3	6	9	N/A	N/A
Oregon Health & Science University	Neurosurgical	6	3	9	32	N/A
University of Michigan	Head and neck oncology	3	6	9	N/A	20
University of Southern California	Neurotology	4	5	9	N/A	N/A
University of Wisconsin/Madison	Neurosurgical	4	5	9	N/A	N/A
Brigham and Women's Hospital	Neurosurgical	5	3	8	19	N/A
Rhinology and Skull Base Surgery Fellowship	Neurosurgical	4	4	8	45	N/A
University of Cincinnati	Neurotology	6	2	8	N/A	N/A
University of Colorado	Neurosurgical	4	4	8	N/A	N/A
University of South Florida	Neurosurgical	3	5	8	N/A	N/A
Case Western Reserve	Neurosurgical	5	2	7	39	N/A
New York Presbyterian/Cornell	Neurosurgical	3	4	7	3	N/A
Ohio State University	Neurosurgical	4	3	7	29	N/A
Pacific Neuroscience Institute & John Wayne Cancer Institute	Neurosurgical	4	3	7	N/A	N/A
The University of Kansas Medical Center	Rhinology/endonasal	3	4	7	N/A	27
University of Washington	Neurosurgical	5	2	7	N/A	N/A
University of Toronto	Neurosurgical	5	2	7	N/A	N/A
Louisiana State University	Neurosurgical	3	3	6	N/A	N/A
McGill University	Rhinology/endonasal	3	3	6	N/A	N/A
Stanford University	Neurosurgical	3	3	6	14	N/A
University of Pittsburgh Medical Center	Rhinology/endonasal	5	1	6	N/A	25
Mount Sinai Health System	Rhinology/endonasal	1	4	5	N/A	35
Ohio State University Wexner Medical Center	Head and neck oncology	3	2	5	N/A	29
Oregon Health & Science University	Rhinology/endonasal	3	2	5	N/A	12
St. Joseph's Hospital (Barrow)	Neurosurgical	3	2	5	40	N/A
University of Ottawa	Neurosurgical	4	1	5	N/A	N/A
University of Pittsburgh Medical Center	Neurosurgical	2	3	5	32	N/A
Indiana University	Neurosurgical	3	1	4	N/A	N/A
John Wayne Cancer Institute	Neuro-oncology	3	1	4	N/A	N/A
	Neurosurgical	1	3	4	N/A	N/A

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Table 4 (*Continued*)

Institution	Type	Total recruitment variables	Total education variables	Cumulative score	Neurosurgery US news ranking	ENT US news ranking
Swedish Neuroscience Institute						
UC Irvine Medical Center	Neurosurgical	3	1	4	N/A	N/A
Providence Brain and Spine Institute	Neurosurgical	2	1	3	N/A	N/A
Johns Hopkins Hospital	Neurosurgical	1	0	1	5	N/A
New York University	Neurosurgical	1	0	1	1	N/A
Baylor College of Medicine—Houston	Neurotology	7	5		N/A	N/A
Duke University	Rhinology and endoscopic skull base	8	7		23	29
Emory University	Rhinology	6	8		24	30
Harvard/Massachusetts Eye & Ear Infirmary	Neurotology	8	5		N/A	4
House Clinic/UCLA	Neurotology	5	4		N/A	N/A
Indiana University	Neurotology	6	3		N/A	45
Indiana University	Advanced rhinology, endoscopic sinus and skull base surgery	4	8		N/A	45
Johns Hopkins Sinus Center	Rhinology and skull base surgery	7	8		5	5
Johns Hopkins University	Neurotology	7	6		5	5
Kaiser Permanente Orange County	Rhinology	6	8		N/A	N/A
Louisiana State University	Neurotology	7	9		N/A	N/A
Mass Eye & Ear/Harvard	Rhinology	8	8		N/A	4
Medical College of Georgia—Augusta University	Rhinology-skull base surgery	5	7		N/A	N/A
Medical University of South Carolina	Neurotology	5	7		N/A	15
Medical University of South Carolina	Rhinology and sinus/endoscopic skull base surgery	6	8		N/A	15
Mount Sinai Health System Rhinology Fellowship	Advanced rhinology and endoscopic skull base surgery	5	6		9	35
Mount Sinai-NY	Neurotology	5	7		9	35
New York University	Neurotology	6	6		N/A	26
Northwestern University	Academic rhinology	7	7		10	N/A
Rush University Medical Center	NeuroRhinology and advanced rhinology	6	7		4	34
Sinus & Nasal Institute of Florida	Rhinology	7	7		N/A	N/A
Stanford University	Neurotology	5	3		14	1
Stanford University	Rhinology	8	7		14	1
Ohio State University	Neurotology	8	6		29	19
Thomas Jefferson University	Rhinology/skull base	5	7		43	42
	Neurotology	7	4		21	21

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Table 4 (*Continued*)

Institution	Type	Total recruitment variables	Total education variables	Cumulative score	Neurosurgery US news ranking	ENT US news ranking
University California—San Diego						
University of Alberta—Alberta Sinus Centre	Rhinology/ endoscopic sinus and anterior skull base surgery	5	8		N/A	N/A
University of Arizona	Rhinology and skull base surgery	5	8		N/A	N/A
University of California—Los Angeles	Rhinology and skull base	6	5		12	2
University of Iowa	Neurotology	7	1		N/A	31
University of Miami Miller School of Medicine	Neurotology	3	4		25	N/A
University of Michigan	Neurotology	6	7		20	9
University of Minnesota	Neurotology	5	3		N/A	N/A
University of North Carolina	Neurotology	8	3		N/A	38
University of North Carolina	NeuroRhinology-advanced rhinology and skull base surgery	6	7		N/A	38
University of Pennsylvania	Neurotology	7	5		N/A	11
University of Pennsylvania	Rhinology and skull base surgery fellowship	8	6		N/A	11
University of Pittsburgh	Neurotology	6	6		N/A	25
University of Texas Southwestern Medical Center	Rhinology	6	5		30	N/A
University of Utah	Neurotology	6	4		N/A	N/A
University of Utah	NeuroRhinology and advanced sinus surgery	4	8		N/A	N/A
University of Virginia	Neurotology	7	4		N/A	N/A
University of Washington	Rhinology and anterior skull base surgery	6	7		N/A	24
Vanderbilt University	Rhinology and endoscopic skull base surgery	6	7		N/A	10
Vanderbilt University Medical Center	Neurotology	7	2		N/A	10
Washington University—St. Louis	Neurotology	7	5		N/A	N/A

and (5) University of Miami Miller School of Medicine Otorhinolaryngology.

Comparison with Other Specialty Fellowship Programs

►**Table 5** presents results from similar analyses of fellowship program informational material in other surgical subspecialties. Previously, Gerlach and colleagues assessed the state of spine fellowship informational resources, which included overlap with many neurosurgical fellowships but was not exclusively neurosurgical.[3] The present study is largely neurosurgical in focus with the caveat that skull base surgery is often multidisciplinary in nature, involving collaboration with subspecialties within otorhinolaryngology-head and neck surgery (such as neurotology/lateral skull base surgery and rhinology/anterior skull base surgery). The lone purely neurosurgical study in ►**Table 5** was performed using the American Association for Stereotactic and Functional Neurosurgery (ASSFN) and AANS Web sites to assess the current state of functional neurosurgery fellowship program Web

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Table 5 Comparison of critical evaluation of surgical fellowship Web sites across disciplines

Author, year	Surgical discipline	Fellowship specialty	Program number	Number of Web sites	Description (rank)	Faculty list (rank)	Fellow list (rank)	Research opportunities (rank)	Operative case listing (rank)
Silvestre, 2016[17]	Plastic surgery	Craniofacial surgery	28	24	95.8 (3)	83.8 (3)	41.7 (3)	70.8 (4)	75.0 (4)
Huang, 2017[4]	General surgery	Vascular surgery	94	89	97.8 (2)	89.9 (2)	10.1 (8)	34.8 (8)	21.3 (7)
Shaath, 2018[18]	Orthopaedic surgery	Trauma surgery	54	51	100 (1)	29 (6)	35 (5)	45 (5)	76 (3)
Maisner, 2021[15]	Plastic surgery	Aesthetic surgery	28	28	85.7 (6)	17.9 (8)	32.1 (6)	35.7 (7)	35.7 (6)
Gerlach, 2021[3]	Orthopaedic/ neurosurgery	Spine surgery	74	74	87.8 (5)	77.0 (4)	43.2 (2)	81.1 (1)	78.4 (2)
Aryanpour, 2022[19]	General surgery	Surgical oncology	88	88	100 (1)	64.0 (5)	40.0 (4)	56.0 (5)	12.0 (8)
Gariscsak, 2023[2]	Neurosurgery	Functional neurosurgery	43	35	81.4 (7)	97.1(1)	25.7 (7)	71.4 (3)	60.0 (5)
Present study	Neurosurgery/ENT	Skull base surgery	67	53	94.3 (4)	43.4 (6)	45.3 (1)	77.4 (2)	88.7 (1)

Abbreviation: ENT, ear, nose, throat.

sites.[2] Ultimately, the objective of the Gariscsak et al study was similar to that of the present study: to evaluate the education and recruitment information available on the ASSFN and AANS Web site fellowship databases, and to ascertain associations between Web site comprehensiveness and program characteristics.[2]

Discussion

Social distancing imposed by the recent COVID pandemic helped shift the approach of fellowship program outreach and matching toward one that is increasingly dependent on online materials.[9] Web-based program materials have become popular as a cost-effective means by which applicants can learn about programs and through which programs can attempt to recruit from amongst a diverse group of applicants. Information on program Web sites and within subspecialty fellowship directories (e.g., AANS and NASBS directories for skull base fellowships) functions as the most readily available sources of information for most applicants. Although most program Web sites are easily accessible and have existed for several years, surveys of neurosurgery fellowship applicants have indicated that the lack of standardized program information and standard application process across Web sites significantly contribute to the growing heterogeneity in the overall fellowship match process.[10] Overall, this can increase the amount of time needed to complete the fellowship application process and thus, place undo administrative burden upon fellowship candidates. Previous studies[3,4,11–15] have investigated the quality of information provided on web platforms for other surgical specialties, including functional neurosurgical fellowships and neurosurgical residency; however, the present work is the first critical appraisal of skull base fellowship Web site information.

In the present study, essential recruitment features such as program description, contact information, and selection/evaluation criteria were reported for most skull base surgical fellowships, yet less than half of the assessed programs list any additional information. Only 29 out of 99 programs have information on greater than half of the 13 recruitment features available online. Similarly, for educational features, less than half of the programs listed features outside of operative experience, research opportunities, and faculty list. Only 43 out of 99 programs listed greater than or equal to 6 of the 11 education features. This indicates a scarcity of information available on skull base fellowships. Unfortunately, when important fellowship information is difficult to access, applicants must expend additional time reaching out to programs and current fellows at those programs to learn critical details. This increases the stress placed upon applicants who are busy fulfilling residency training requirements.

Skull base is one of the most competitive fields within both neurosurgery and otorhinolaryngology, which are already highly competitive fields. Considering this, it could be argued that candidates intent on pursuing a skull base fellowship would not be deterred by a fellowship Web site having limited

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information. Considering the short list of well-recognized, reputable names within the field, the list of fellowships narrows down even further for those who wish to remain within academic skull base neurosurgery/otorhinolaryngology. For what is undoubtedly an important career decision, it could also be argued that those willing to pursue skull base training would not be deterred by the presence or absence of quality online information. Nonetheless, it is also important to consider the fact that optimizing availability of online informational content regarding skull base fellowships might help clarify interest in the field among residents considering post-residency training options.

Comparison to Other Subspecialty Fellowships

Similar evaluations of fellowship informational materials have been conducted in other surgical disciplines such as plastic surgery, orthopaedic spine surgery, general surgery, emergency medicine, orthopaedic sports medicine, and hand surgery.[3,4,11–15] Overall, these studies also draw attention to the dearth of online information available regarding subspecialty fellowships. This may be unfortunate for candidates interested in matching into these fellowships because this information would help potential candidates gain as much insight as possible regarding essential program/training features at an early junction in their training. Thus, this information could help residents make decisions regarding their interest in pursuing a specific subspecialty and prepare accordingly to optimize their candidacy for their fellowship of interest. Examples of factors that candidates may be interested in learning more about include expected clinical and operative experiences (types and numbers of cases), faculty with whom the fellow would work, and demonstrated track record of placing fellows into desirable faculty positions post-fellowship. However, as of now, skull base fellowship program Web sites consistently lack information on these factors. Improving accessibility, uniformity, and quality of information provided by program Web sites can enable applicants to make better-informed decisions during the application process.

A Step in the Right Direction: Recent Changes to the NASBS Web Site

At the time of initiation of this study in April 2023, the NASBS had announced its plan to finalize a skull base fellowship match program through its own Web site.[16] The idea behind this announcement was to address many of the areas of need outlined herein. Ultimately, any program that agreed to join in line with the NASBS announcement could officially enroll to participate in the match process through nasbs.org. The NASBS Skull Base Fellowship Match Web site now features a total of 22 programs that will accept applications through nasbs.org.[16] According to the Web site, the first fellowship positions will be offered for the July 1, 2025, match class. Senior residents interested in applying must submit their application during the open window of acceptance from May 8 to June 15, 2023. On July 1, participating programs will be able to download candidate applications and begin scheduling interviews, which will take place from July 1 through October 1 of this year. Finally, candidates will be expected to complete and submit rank lists by October 15, 2023. Other instructions featured on the Web site include a notice to applicants to prepare a Letter of Intent, curriculum vitae, and three letters of recommendation prior to the opening of the application window. This centralized site offers the benefits of a more uniform and streamlined application process for both applicants and program coordinators. Specifically, it will streamline common processes by reducing overlap and requiring the maintenance of a comprehensive and up-to-date database featuring participating programs. Support for a centralized match system has been demonstrated by program directors in other specialties such as interventional neuroradiology.[14] However, the process of centralizing the current match system may entail creating an oversight committee, which would need unanimous and active support from programs to be successful. Although an enrollment of 22 programs in the NASBS fellowship registry is a step in the right direction, the NASBS will undoubtedly look to recruit more programs to participate each year. From the fellowship candidate's perspective, increased utilization of the central fellowship match through the NASBS would likely reduce the administrative burden associated with applying to programs inside and outside of the central match.

Limitations

We acknowledge several limitations to the present study. As all program Web sites and resources were not standardized, some information may have been missed due to variation in sources. Evaluator bias may also have impacted the extraction of data, despite our attempts to mitigate the likelihood of this occurring by incorporating multiple reviewers. When extracting data, few programs listed their clinical versus research faculty, which may result in misrepresentation of program size in terms of the number of full-time clinical faculty. This would tend to be a significant consideration for fellows looking to optimize their experience by gaining the maximum operative exposure during their clinical year, so it would be useful to know the ratio of skull base surgeons who are full-time clinical faculty versus those who are research faculty. This study listed all faculty that were mentioned in direct association with the individual program, but specific definitions or requirements used to delegate individuals as "faculty" were not provided. Furthermore, it is possible that certain fellowship programs were not listed or discoverable through search engine queries or through the NASBS, AANS, ANS, and ARS databases and were thus overlooked and not included in this study. Former studies have demonstrated that applicants do not rely greatly on academic society Web sites or databases for fellowship program information.[14] However, a survey of neurosurgical residents showed that approximately 93% of them wished that national organizations would do more to aid fellowship applicants. Suggested areas of improvement include a common application and established due dates, a detailed database, and transparency throughout the match process, among others.[10]

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Conclusion

To our knowledge, this study is the first to perform a thorough appraisal of the Web sites and available online information for skull base fellowship programs. Despite the availability of extensive online resources for many programs, our data indicate that critical information relating to recruitment and education are lacking. By presenting information in a more comprehensive and transparent manner, programs may be able to attract more suitable candidates and enable potential fellows to identify programs that best fit their professional goals.

Conflict of Interest
None declared.

References

1 Davidson AR, Murphy RF, Spence DD, Kelly DM, Warner WC Jr, Sawyer JR. Accessibility and quality of online information for pediatric orthopaedic surgery fellowships. J Pediatr Orthop 2014; 34(08):831–834
2 Gariscsak P, Figueredo L, Singh R, et al. Critical evaluation of functional neurosurgical fellowship program websites. World Neurosurg X 2023;18:100184
3 Gerlach EB, Plantz MA, Swiatek PR, et al. The content and accessibility of spine surgery fellowship websites and the North American Spine Surgery (NASS) fellowship directory. Spine J 2021;21(09):1542–1548
4 Huang BY, Hicks TD, Haidar GM, Pounds LL, Davies MG. An evaluation of the availability, accessibility, and quality of online content of vascular surgery training program websites for residency and fellowship applicants. J Vasc Surg 2017;66(06):1892–1901
5 Charalel RA, Pua BB, Galla N, Trehan SK, Madoff DC. Interventional radiology fellowship website content: what is the relevance to potential applicants? Clin Imaging 2016;40(06):1070–1074
6 Gupta S, Palmer S, Ferreira-Dos-Santos G, Hurdle MF. Pain Medicine Fellowship Program websites in the United States of America - a nonparametric statistic analysis of 14 different criteria. J Pain Res 2021;14:1339–1343
7 CAST approved fellowship programs in Skull Base. New. Published June 24, 2022. Accessed May 30, 2023 at: https://sns-cast.org/cast-approved-fellowship-programs-in-skull-base/
8 Miles 0. 200 400. Census regions and divisions of the United States. Accessed May 30, 2023 at: https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf
9 Naaseh A, Thompson S, Tohmasi S, et al. Evaluating applicant perceptions of the impact of social media on the 2020–2021 residency application cycle occurring during the COVID-19 pandemic: Survey study. JMIR Med Educ 2021;7(04):e29486
10 Dossani R, Karsy M, Waqas M, Menger R, Guthikonda B. A survey of applicant views regarding the neurosurgical fellowship application process. World Neurosurg 2020;139:e373–e382
11 Mukhdomi T, Woolley P, Mukhdomi J, et al. An evaluation of the online quality of content of United States accredited pain medicine fellowship training programs. Anesth Pain Med 2021;11(03): e115981
12 Skovrlj B, Silvestre J, Ibeh C, Abbatematteo JM, Mocco J. Neurosurgery residency websites: a critical evaluation. World Neurosurg 2015;84(03):727–733
13 Ruddell JH, Hartley-Blossom ZJ, Bajaj AI, Grand D, Eltorai AEM. Analysis of Abdominal Radiology fellowship website content and comprehensiveness. Abdom Radiol (NY) 2019;44(04):1601–1605
14 Vilanilam GK, Wadhwa V, Purushothaman R, Desai S, Kamran M, Radvany MG. Critical evaluation of interventional neuroradiology fellowship program websites in North America. World Neurosurg 2021;146:e48–e52
15 Maisner RS, Babu A, Ayyala HS, Ramanadham S. How comprehensive are aesthetic surgery fellowship websites? Ann Plast Surg 2021;86(06):615–617
16 North American Skull Base Society (NASBS) "NABS has launched the Skull Base Fellowship Match Program". Nasbs.org. Accessed 20 May 2023. https://www.nasbs.org/fellowship-match-programs/
17 Silvestre J, Agarwal D, Taylor JA. Craniofacial Surgery Fellowship Websites. J Craniofac Surg 2016;27(04):831–834
18 Shaath MK, Yeranosian MG, Ippolito JA, Adams MR, Sirkin MS, Reilly MC. Evaluation of the Content and Accessibility of Web Sites for Accredited Orthopaedic Trauma Surgery Fellowships. J Bone Joint Surg Am 2018;100(09):e60
19 Aryanpour Z, Ananthasekar S, Rajan SS, Reddy S. Evaluation of surgical oncology fellowship websites: Are we showing what applicants need to see? Surg Open Sci 2021;7:1–5

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