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Analysis of Requirements within Neuroradiology Job Advertisements in a Specific Timeframe

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ABSTRACT

BACKGROUND AND PURPOSE: The neuroradiology job market is constantly changing along with the skill sets needed by fellowship graduates to participate successfully in the job market. This study aimed to establish a baseline of employer requirements in the neuroradiology job market within the study timeframe.

MATERIALS AND METHODS: The American Society of Neuroradiology and American College of Radiology job boards were queried for neuroradiology positions between August 12, 2022, and December 31, 2022. The positions and requirements were categorized into academic versus private practice, general diagnostic radiology, full-subspecialized neuroradiology, hybrid remote/onsite, outpatient, inpatient/emergency, general interventional radiology procedures, and neuroradiology procedures. Exclusion criteria included neurointerventional only, remote-only, pediatric-only, no preference for neuroradiology, and duplicate posts within and between the job boards.

RESULTS: Of 1777 total job posts, 179 were neuroradiology-specific and the remainder were general. Of the 179 neuroradiology-specific jobs, 55 neuroradiology jobs were academic and 124 jobs were private practice. A higher proportion of private practice jobs required general diagnostic interpretations (83% versus 26%), a higher proportion of academic jobs required neuroradiology procedures (56% versus 31%), and a higher proportion of private practice jobs required general interventional radiology procedures (22% versus 0%). Thirty-nine percent of all neuroradiology-specific onsite jobs required neuroradiology procedures, and 15% required general interventional radiology procedures.

CONCLUSIONS: Because there was a sizable difference between general radiology and procedure requirements between academic and private practice positions, tailoring fellowship training for career aspirations of neuroradiology fellows should be considered to adapt to the skills needed for the evolving job market. In the queried timeframe, 61% of neuroradiology-specific onsite jobs did not have a specific procedure skill requirement for job applicants. This article serves as a single snapshot of the job market and its requirements for neuroradiologists, to aid in planning training to meet the needs of employers.

ABBREVIATION: ACGME = Accreditation Council for Graduate Medical Education; ACR = American College of Radiology; ASNR = American Society of Neuorradiology; IR = interventional radiology

Radiology fellowship training is currently an integral and nearly expected component in a trainee's journey; however, this training was not always required. Radiology fellowship training, specifically neuroradiology, started at Columbia University in 1959. The number of fellowship training programs started to increase from then on, leading to a steep rise in interest from the 1980s to the 1990s from 8% of residents entering fellowship in 1984 to 52% in the 1990s, continuing into the early 2000s when 85% of radiology residents entered fellowship.[1] A similar trend was seen in Canada, where many radiology residents choose to pursue fellowship training in the United States, showing a steady increase in fellowship interest from 2006 to 2011.[2] This trend has likely influenced current practices, which are becoming more subspecialized and in which a radiologist is valued as a subspecialty expert rather than a generalist.

During this time, the American Board of Radiology, subspecialty organizations such as the American Society of Neuroradiology (ASNR), and the Accreditation Council for Graduate Medical Education (ACGME)[3] have developed specific training requirements for radiology fellows. Regarding neuroradiology, an ACGME and ASNR task force created guidelines for neuroradiology fellows, which have been modified as job requirements change with time, with the most recent update in 2022. Some of the training

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SUMMARY

PREVIOUS LITERATURE: Radiology training requirements have changed over time as a result of the demands of the job market, for example, increased subspecialization created a greater need for trainees to pursue fellowships.

KEY FINDINGS: A minority of in-person jobs required any invasive procedures. A higher proportion of private practice jobs required general diagnostic interpretations, a higher proportion of academic jobs required neuroradiology procedures, and a higher proportion of private practice jobs required general IR procedures.

KNOWLEDGE ADVANCEMENT: Tailoring fellowship training for career aspirations of neuroradiology fellows should be considered to adapt to the skills needed for the evolving job market. Given the limited specific data on job postings, we encourage employers to increase transparency to applicants and accreditation committees.

requirements include 1500 MR imaging interpretations of 3000 total examinations interpreted, 250 vascular examinations interpreted, and 100 image-guided invasive procedures (with a specific requirement to demonstrate competence in accessing the spinal subarachnoid space for myelograms or therapeutic or other diagnostic purposes.) Modifications were made in 2019 that allowed increased flexibility to achieve some requirements such as with vascular imaging and procedures, possibly helping trainees tailor their experience to their specific interests and available opportunities at their program.[4]

Neuroradiology subspecialty training requirements can be approached in various ways. The approach may include a top-down approach in which neuroradiology leaders take both a broad view of the various training pathways (eg, diagnostic-only or neurointerventional-based, or research-oriented versus clinical/education track) as well as a specific view to decide the ideal training content to ensure a minimum common level of subspecialty expertise in all aspects of neuroradiology. Another approach may be to include data from the neuroradiology job market to tailor training to the expertise required in the job market so that graduates are best-prepared for the job market as it evolves; the radiology job market changes continuously. The purpose of this study was to present a snapshot of patterns in the onsite adult neuroradiology job requirements during a specific time to evaluate their procedural requirements for a data-driven approach on how best to train fellows for the current job market.

MATERIALS AND METHODS

Search Strategy

The ASNR and American College of Radiology (ACR) job boards were queried for onsite adult neuroradiology-specific positions or in-person general radiology positions with preference given to neuroradiology fellowship–trained candidates. For the ASNR job board, queries were made for positions from August 12, 2022, to November 12, 2022 on November 13, 2022, and again for positions from November 13, 2022, to December, 31, 2022, on January 1, 2023. For the ACR job board, queries were made for jobs posted within the past 30 days on both November 13, 2022, and December 31, 2022. Jobs older than 30 days were labeled as "30+" without a specific date and were, therefore, excluded from the data set.

Exclusion Criteria

Remote-only positions were excluded, because procedures cannot be performed remotely. Because the purpose of the study was to analyze adult diagnostic neuroradiology-specific jobs, additional exclusion criteria were neurointerventional-only, pediatric neuroradiology–only, general radiology jobs with no preference for neuroradiology, and duplicate posts. Duplicate jobs between the ASNR and ACR job boards were excluded so that one of the duplicates remained in the data set; therefore, only unique positions were included.

Data Collected

The jobs were analyzed for the following categories: academic versus private practice, general diagnostic radiology, hybrid remote/onsite, outpatient, inpatient/emergency, general interventional radiology (IR) procedures, and neuroradiology procedures (as outlined in the neuroradiology fellowship requirements update in 2019).[4]

Analysis

The data were analyzed separately among the academic and private practice jobs and were also analyzed among all of the jobs compiled from both jobs boards.

The proportion of jobs that required each job description (ie, hybrid remote/onsite) was obtained from the total available data within each category to not exclude most data from analysis due to most job posts containing an incomplete set of data.

RESULTS

Of a total of 1777 jobs posted on the ACR and ASNR job boards, 385 were on the ASNR job board and 1392 were on the ACR job board. After exclusion criteria were applied, 179 total neuroradiology jobs remained for analysis. Of these, 55 jobs were academic, and 124 jobs were private practice. After we excluded jobs with incomplete data sets, 80 unique neuroradiology jobs remained for analysis, consisting of 29 academic jobs and 51 private practice jobs.

Due to the limited number of jobs with complete data sets, each job description was analyzed with the available data within that category among the 179 jobs that met the exclusion criteria. Most academic and private practice jobs required candidates to read both outpatient (92%, $n = 141$, Table 1 and Figure 1) and inpatient/emergency department studies (97%, $n = 146$, Table 1 and Figure). Additionally, most private practice jobs required candidates to read general diagnostic radiology (83%, $n = 90$, Table 1 and Figure) compared with a smaller proportion of academic jobs

(26%, $n = 11$, Table 1 and Figure). There was also a difference in academic and private practice jobs that required general ("light") IR procedures, with no academic jobs that required non-neuroradiology-specific procedures compared with 22% ($n = 17$, Table 1 and Figure) of private practice jobs. Neuroradiology-specific procedures were required by most academic jobs (56%, $n = 18$, Table 1 and Figure) but a minority of private practice jobs (31%, $n = 23$, Table 1 and Figure).

Thirty-nine percent ($n = 41$, Table 1 and Figure) of all jobs required neuroradiology-specific procedures, and 15% ($n = 17$, Table 1 and Figure) of all jobs required general IR procedures. Of the 41 jobs that listed neuroradiology procedure requirements, 3 academic and 8 private practice jobs listed all specific procedure requirements, and 6 academic and 1 private practice partially listed procedure requirements, limiting the ability to evaluate the breakdown and specific types of procedures required (Table 2). The remainder of the jobs listed less-specific expectations such as "spinal procedures," "CT and ultrasound-guided procedures," "fluoroscopy-guided procedures," or "neurointervention" without defining those specific procedures. Additionally, 1 job mentioned procedure assistance by physician assistants and neuroradiology-specific nurses.

Almost twice the proportion of private practice jobs (46%, $n = 32$, Table 1 and Figure) allowed candidates to partially work remotely compared with academic jobs (24%, $n = 8$, Table 1 and Figure), though most (61%, $n = 63$, Table 1 and Figure) academic and private practice jobs did require candidates to be in-house full time.

Table 1: Ratio of neuroradiology job requirements in academic, private practice, and all jobs

Job Requirement	Academic Jobs	Private Practice Jobs	All Jobs
General diagnostic	11/43 = 26%	90/108 = 83%	101/151 = 67%
Outpatient studies	38/43 = 88%	103/110 = 94%	141/153 = 92%
Inpatient/ER studies	42/43 = 98%	104/108 = 96%	146/151 = 97%
General IR procedures	0/35 = 0%	17/77 = 22%	17/112 = 15%
Neuro IR procedures	18/32 = 56%	23/74 = 31%	41/106 = 39%
Hybrid remote/onsite	8/34 = 24%	32/69 = 46%	40/103 = 39%

Note:—ER indicates emergency room; Neuro, neuroradiology.

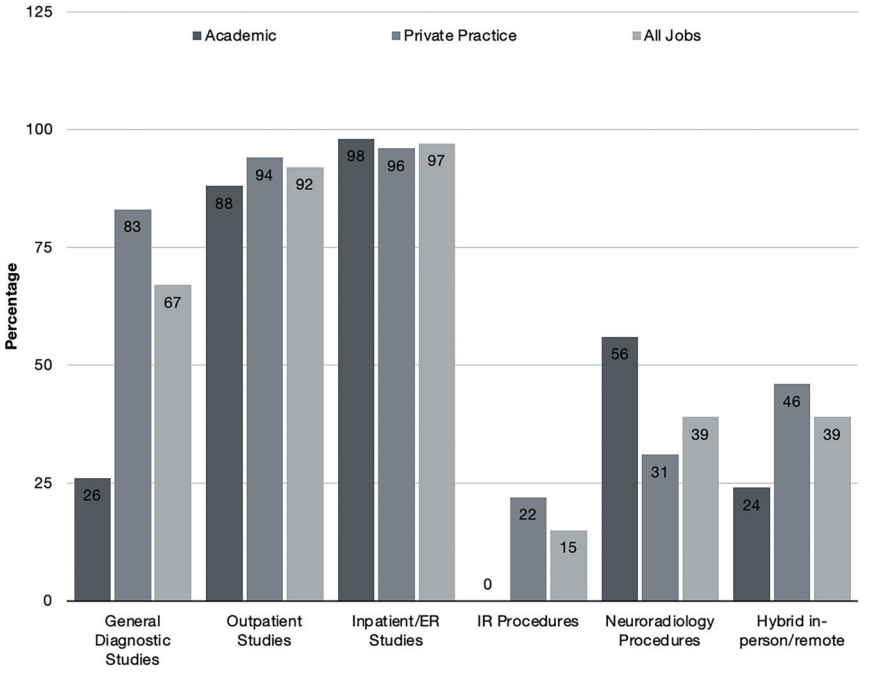

FIG 1. Percentage of neuroradiology job requirements in academic, private practice, and all jobs. ER indicates emergency room.

DISCUSSION

Radiology volumes are increasing at a rate that has continually challenged diagnostic radiologists, now more than ever.[5] As a result, the demand for a subspecialized radiologist to read outside his or her specialty has increased and is almost expected in most private practices. This demand is evident in the job data in this study, which demonstrate most private practice jobs expecting candidates to read general radiology studies. Furthermore, about one-fourth of academic positions also require reading studies outside of neuroradiology, despite a general perception that academic jobs are often more subspecialized than private practice jobs.

This growth in radiology study volume has increased the burnout of daytime radiologists along with the need to provide 24/7 coverage to expand turnaround and reduce the daytime burden[5] in the setting of a predicted neuroradiologist shortage.[6] This expansion has also led to potential increases in error rates, depending on the number of studies read.[7] The high proportion of jobs, particularly private practice jobs, that allow part-time remote work may incentivize radiologists to cover those shifts, many times from a different city or state, and help reduce burnout

Table 2: Neuroradiology procedure job requirements

Neuro Procedure Requirement	Lumbar Puncture	Myelogram	Head and Neck Biopsies	Bone Biopsies of the Spine	Conventional Angiogram	Epidural Injections/Pain Procedures
Academic	3	2	5	2	3	2
Private practice	9	6	1	0	0	1
Total	11	8	6	2	3	3

Note:—Neuro indicates neuroradiology.

from excess volume. In academic settings, where trainees may be providing preliminary interpretations of studies overnight, there may be less need for attending radiologists to read remotely overnight unless final interpretations are requested. Ultimately, the high volumes and high demand for staffing has likely encouraged practices to implement a remote reading setup.

The inconsistencies in procedure training led to the development of specific guidelines for neuroradiology fellows and the consideration of, and eventual development of, neurointerventional radiology training programs.[8] For example, the 2019 update emphasized that most neuroradiology trainees are not performing catheter angiograms in practice; therefore, the vascular imaging requirement was broadened to include other imaging modalities to fulfill the requirement.[4] These data of this study show that more than one-half of neuroradiology jobs, private practice in particular, do not require neuroradiology-specific procedures, and this feature was even more evident with general IR procedures. These data may inform the evolution of fellowship procedure requirements, while recognizing that pathways are necessary for exposure and entry to neurointerventional fellowships and maintaining procedure skills that are necessary for patient care.

The data in this study should be interpreted noting the following limitations. Remote-only positions were excluded, because procedures cannot be performed remotely. Given that there are jobs that are advertised as remote-only, the percentage of jobs we report requiring procedures is higher than what would be reflective of the total job market if we did not exclude remote-only jobs. Employer expectations may not necessarily be entirely reflected within the description of the job posting. The neuroradiology job market is constantly changing, and it would be difficult or impossible to provide a continuous, up-to-date analysis of job postings. These data serves as a single reference data point for comparison with future job data. Most job post content did not contain all the job requirements studied. Given the limited specific data on job postings, we encourage employers to increase transparency to give applicants and accreditation committees more data to give them a better understanding of how to adapt to the changing job market. In the future, a more extensive study can involve directly contacting the employers to obtain the missing data, or job boards could require more specific and higher-quality job descriptions. Data were also collected at 2 specific points in time from the job boards, and jobs may have been posted and removed between data acquisitions. Furthermore, jobs posted on the ACR job board provided a specific date only if they were posted in the past 30 days; those jobs were the only ones included in the data set. Although a large data set was queried between the 2 job boards, these limitations do affect the diversity of jobs available to interpret.

CONCLUSIONS

This study serves as a single snapshot of the procedure requirements of the neuroradiology job market for comparison with future job market requirements.

Disclosure forms provided by the authors are available with the full text and PDF of this article at www.ajnr.org.

REFERENCES

1. Gay SB, Resnik CS, Harolds JA, et al. **The radiology fellowship and fellowship match: current status.** *Acad Radiol* 2003;10:303–08 CrossRef Medline
2. Ryan J, Khandelwal A, Fasih N. **Trends in radiology fellowship training: a Canadian review 2009-2011.** *Can Assoc Radiol J* 2013;64:176–79 CrossRef Medline
3. ACGME Program Requirements for Graduate Medical Education in Neuroradiology. https://www.acgme.org/globalassets/pfassets/programrequirements/423_neuroradiology_2022v2.pdf. Accessed November 11, 2022
4. Kennedy TA, Anderson J. **Neuroradiology Fellowship Requirements: updates in 2019.** *AJNR Am J Neuroradiol* 2020;41:370–72 CrossRef Medline
5. Aggarwal A, Lazarow F, Anzai Y, et al. **Maximizing value while volumes are increasing.** *Curr Probl Diagn Radiol* 2021;50:451–53 CrossRef Medline
6. Chen JY, Lexa FJ. **Baseline survey of the neuroradiology work environment in the United States with reported trends in clinical work, nonclinical work, perceptions of trainees, and burnout metrics.** *AJNR Am J Neuroradiol* 2017;38:1284–91 CrossRef Medline
7. Ivanovic V, Broadhead K, Chang Y-M, et al. **Shift volume directly impacts neuroradiology error rate at a large academic medical center: the case for volume limits.** *AJNR Am J Neuroradiol* 2024;45:374–78 CrossRef Medline
8. Friedman DP, Pramanik BK. **Fellowship and practice trends in neuroradiology training programs in the United States.** *AJNR Am J Neuroradiol* 2001;22:1650–53 Medline