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ABSTRACT

SUMMARY: The Young Professionals Committee of the American Society of Neuroradiology identifies and serves the interests of young professionals in neuroradiology, defined as those still in training or within 5 years of its completion. Being a young professional is an exciting, dynamic, and demanding stage of one's professional career. As the landscape of neuroradiology practice changes, new opportunities and challenges occur for those in the early stage of their career. It is important to recognize and support the needs of young professionals because an investment in their professional development is an investment in the future of our specialty. In this article, we aimed to address the most notable developments relevant to current and future young professionals in neuroradiology as well as highlight the work done by the Young Professionals Committee of the American Society of Neuroradiology in serving the needs of these young professionals, focusing on early neuroradiology engagement, flexible work arrangements, private practice, social media, artificial intelligence, and international collaborations.

ABBREVIATIONS: AI = artificial intelligence; ASNR = American Society of Neuroradiology; YPC = Young Professionals Committee

The Young Professionals Committee (YPC) of the American Society of Neuroradiology (ASNR) identifies and serves the interests of young professionals in neuroradiology, defined as those still in training or within 5 years of its completion. The 2023–2024 YPC has brought together 46 volunteers from different backgrounds, training and career stages, geographic locations, and practice settings to share their unique perspectives on serving the needs and supporting the professional development of young professionals in neuroradiology nationwide and outside the United States. Being in training and transitioning into practice as a junior practitioner are relatively short-but-demanding stages of one's professional career. Activities pertaining to this stage remain relevant across multiple generations of radiologists, including the excitement and challenges of choosing a first job, solidifying clinical expertise and developing a clinical practice, and establishing an academic niche and/or building a foundation for future promotion. Some of the opportunities and dilemmas posed before today's young professionals are unique, however, shaped by the current changing socioeconomic and health care environment and by technologic advances and generational changes, adding additional layers of complexity.

In this article, we aimed to address the most notable developments relevant to current and future young professionals in neuroradiology as well as to highlight the work done by the YPC of the ASNR in serving the needs of these young professionals, focusing on early neuroradiology engagement, flexible work arrangements, private practice, social media, artificial intelligence (AI), and international collaborations.

Significance of Early Engagement in Neuroradiology

With the expansion of academic and private medical centers and rising clinical volumes in neuroradiology, there is an increasing recognition of the importance of recruiting young physicians to our field.[1] Prior research shows that earlier exposure[1,2] and mentorship[3] during medical school, even as early as middle school,[4] influences entry into medicine as well as residency and specialty selection. Subsequent experiences in early radiology residency heavily influence the choice of subspecialty. Most important, mentorship at early stages of medical education also introduces diversity into the field, whereby those who are currently underrepresented are encouraged to engage with neuroradiology, generating a path toward an eventual career choice.[4] A recent survey of Program Directors in Radiology showed that early mentorship

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was thought to be the most important factor for increasing the recruitment of women and underrepresented-in-medicine students into the field of radiology.[5] In multiple other male-dominated specialties such as surgery, earlier outreach has been shown to decrease the sex gap.[6]

With these factors in mind, the ASNR and YPC recognize that early outreach to high school students, medical students, and junior residents is important for establishing a pipeline of future neuroradiologists from diverse backgrounds. This collective pool of learners will develop into the future leaders of our profession. To introduce medical students to a career in neuroradiology early in their medical education, at the 2023 ASNR Annual Meeting, the YPC hosted 10 medical students from the Chicago area on a tour of the Annual Meeting. These medical students attended oral and poster sessions and engaged with attendees. They were also invited to join the YPC mentoring reception and to meet with residents, fellows, and practicing neuroradiologists, to learn from both the junior and senior members of our society. Additionally, recognizing the importance of early engagement, for the first time, the ASNR sponsored fifteen $1000 scholarships for medical students who received awards for best abstracts, allowing them to attend and present their research at the 2023 Annual Meeting.

Before the 2023 Annual Meeting in the fall of 2022, the YPC hosted a virtual webinar directed at medical students and residents to introduce these learners to the diversity of career options in neuroradiology. In this webinar, speakers from different geographic and practice settings spoke about how they found their way to the field of neuroradiology and how they chose their practice setup and their subspecialty.

Finally, in an effort to engage with those early in training and to recruit them into neuroradiology, the YPC is expanding its current mentoring program to include medical students and residents. In the current mentorship program, senior faculty mentors are matched with junior faculty mentees from different institutions on the basis of mutual personal, research, and clinical interests. In an expansion of this program, junior faculty can serve as mentors for medical students, residents, and fellows, allowing mentorship and sponsorship across institutions starting at earlier levels of training. This plan will open opportunities for research and collaboration to those at smaller institutions and will expand the reach of engagement in neuroradiology.

Young professionals in the neuroradiology community can actively participate in these efforts by joining the YPC mentorship program, by being matched with trainees around the country. Locally, early career faculty can reach out to underrepresented students and offer shadowing experience in the reading room, as well as mentorship in research and educational projects. Faculty can support and sponsor students' entry into the field of radiology and neuroradiology and grow the ranks of our profession.

The Value of Flexible Work Arrangements

Workplace flexibility is of varying importance across generations, with Millennials (born between 1981 and 1996) and Gen Z (born between 1996 and 2010) placing the highest value on such arrangements. Recent surveys reveal that workplace flexibility is the foremost criterion for new job selection among these age groups,[7] including young professionals in neuroradiology. This preference is especially important because Millennials will constitute 75% of the workforce by 2025.[8]

Flexible work arrangements remove barriers to career advancement and foster a sense of inclusion among radiologists. Workplace flexibility can be achieved in multiple ways, such as flexitime (flexible work hours within a defined timeframe such as flexible starting and ending times), flexiplace (remote work), a compressed week, and part-time work. At the individual level, flexible arrangements increase radiologists' autonomy and reduce burnout by allowing them to better manage their personal and professional responsibilities. This flexibility is especially important for individuals with more personal responsibilities, particularly women, young radiologists, those in dual-earner households, and individuals with children.[9] Institutions, as well as radiologists, will benefit from the flexibility. At the organizational level, workplace flexibility has been shown to increase productivity, lower costs, improve recruitment and retention of radiologists, increase diversity, and improve job satisfaction.[10]

Limited data are available on the prevalence of flexible work arrangements in radiology. Initially used for after hours or urgent studies, teleradiology services were primarily provided by corporate practices. Especially with the onset of the coronavirus 2019 (COVID-19) pandemic, however, academic institutions have started to embrace fully remote positions. For example, the University of Rochester Medical Center (Rochester, New York) has seen notable adoption of remote positions, with 40% of new faculty hires in 2022 being in fully remote roles. As of April 2023, 12.5% of the clinical faculty at the institution are completely remote and seamlessly integrated into the academic and education mission.[11] According to the 2019 American College of Radiology Commission on Human Resources Workforce Survey, 16% of radiologists worked part-time and 68% of practices had part-time radiologists in 2019.[12]

It is time to re-imagine neuroradiology workspace and workflow along with other industries. As we move forward, we should not only allow but also encourage flexible practices to conform to the preferences of a new generation of practitioners. We must also actively work on biases such as proximity bias, which is the unfair preference and recognition given to employees working on-site based on the false assumption that people are more productive on-site than at home.[13]

A hybrid remote approach, in which radiologists are present on-site for a few days per week and work the remaining days remotely, may be an appropriate intermediate approach. This model offers numerous benefits in both academic and private practice environments, such as expanded access to skilled professionals for remote sites, improved equity and fairness, increased productivity, reduced expenses, added personal flexibility and autonomy, and overall better work experiences for radiologists.

Changing the Private Practice Landscape

One of the strategic goals of the ASNR YPC is to identify the specific needs and career development resources for supporting young professionals in neuroradiology in private practice settings. Neuroradiology, similar to other subspecialties in radiology, is undergoing an evolution in private practice. There is an overall

increased demand for radiology services as the number of examinations continues to grow after the immediate and marked increase in imaging examination volume following the COVID-19 pandemic, known as the post-COVID-19 bounce.[14,15] Additionally, the trend toward increased subspecialization, as well as retirement and burnout, has increased the need for neuroradiologists in private practice.[16] This need is driven by requests of referring clinician specialists, the desire for increased quality, the need for efficiency with ever-larger imaging sets, the increased need to be familiar with advanced technology and how to use it, and the advancement of stroke management with the neuroradiologist serving a key role. All these factors have increased the needs of private practices to employ neuroradiologists.[17-19] The further consolidation of private practices into larger groups has also contributed to the trend of subspecialization from a practical aspect. In many groups, however, some degree of general skills may also be preferred to manage on-call and cross-coverage responsibilities. Smaller private practices are most likely to continue to have opportunities for those who want to practice both general radiology and neuroradiology.

Larger private practice groups allow a larger number of neuroradiologists to share the call pool and coverage for vacation, holidays, and weekends. These features have resulted in an increased demand for neuroradiologists by private practices with a variety of job opportunities. Neuroradiology job seekers have options of traditional on-site, remote, and hybrid work settings to meet the demands of the specific group and the desired lifestyle for the individual radiologist. Many larger practices have 24/7 stroke coverage, which often warrants employment of a team of neuroradiologists to allow complete coverage. Remote work has now become a mainstay of most private practices, and many groups offer remote or hybrid work.[20] The opportunity to choose a lifestyle-based practice also exists, with evening and overnight shifts often offering more vacation than traditional day shifts.

Regarding types of private practices, one can expect a choice of independent private practices; multispecialty private practices, which are often hospital based; and private equity–owned practices with the latter trend considerably increasing.[21-23] Full-time employed, part-time employed, and independent contractor opportunities are currently available and allow radiologists to customize their type of employment setting. The trend toward commoditization of radiology has also led to some practices that allow variable workloads with compensation proportionate to the number of studies read. Overall, private practice offers neuroradiologists flexibility to customize a work setting that is best for their lifestyle.

The Role of Social Media in a Professional Career

Professional social media use continues to become more prevalent in the radiology community, especially during and following the height of the COVID-19 pandemic. Twitter (now X) continues to be one of the most popular social media platforms in the radiology space. However, other platforms are also being used such as YouTube, Instagram, and TikTok, among others. There are many potential benefits to using social media professionally, including in education, leadership, mentorship/sponsorship, research, branding, and academic advancement.[24] These are areas that can impact young professionals in their early careers.

The COVID-19 pandemic helped us see the positive effects that social media can have on professional networking and branding. The lack of geographic barriers allows social media to connect people across the world who might not ever cross paths physically. Additionally, social media is traditionally less hierarchical, potentially creating a sense of ease for young professionals to connect with more experienced radiologists. These interactions via social media can, therefore, lead to informal mentorship relationships for young professionals, in addition to the formal mentorship opportunities already available through the ASNR YPC. Professional relationships extending beyond colleagues at our workplace can be especially important when it comes to seeking referees for academic promotion.

The ASNR YPC has used social media to reach young professionals to alert them to opportunities. One specific example is using social media to advertise the dedicated YPC programming at the ASNR Annual Meeting. The free ASNR webinar that are shared via social media, as well as via e-mail, can also be very beneficial for young professionals. ASNR also uses social media to share volunteer opportunities, such as calls for committee or task force members, that can boost a young professional's curriculum vitae and serve as a networking opportunity within the society.

Some of the potential negative aspects of social media use are important to highlight as well. Before starting to use social media professionally, one should investigate any institutional or departmental social media policies, because these are becoming more common. Additionally, online information should always be scrutinized, especially if a peer-reviewed resource is not included, and the reputation of the individual posting the information can also be considered.

An underappreciated potential negative aspect of social media is the impact on the mental health of young professionals, specifically regarding well-being and self-esteem. These negative effects have been demonstrated in children and adolescents previously.[25] Social media is used by some for self-advocacy toward academic advancement, but this sort of self-advocacy is potentially difficult and uncomfortable for others.[26] The number of those using social media for self-advocacy or self-promotion can result in what is known as an "echo chamber" effect, creating groups of like-minded users with a shared narrative.[26, 27] The amount of time spent on social media, either consuming or creating content, also needs to be monitored and regulated by the individual, because it can take time away from other academic and clinical endeavors, as well as personal time.

Finally, while there can be benefits to using social media professionally, participation in social media is not required to succeed as a young professional in radiology, and it has not been well-studied in regard to academic advancement at this time.[26]

The Promise and Pitfalls of Artificial Intelligence

AI is expected to have a substantial impact on radiology practice in the coming years and to particularly affect the careers of neuroradiologists who are currently in the field or who have recently entered the field. Some of the ways AI is likely to influence the field are the following:

- Automated analysis: AI algorithms can process and analyze medical images more quickly and potentially more accurately than humans. This feature can help radiologists detect abnormalities such as tumors, aneurysms, or strokes with higher sensitivity and specificity. AI-based systems can act as powerful diagnostic aids, improving the efficiency and accuracy of interpretation.
- Workflow optimization: AI tools can streamline the workflow of radiologists by automating certain tasks. For example, AI algorithms can automatically prioritize urgent cases, flag potential abnormalities for further review, and perform quantitative measurements,[28] saving time and allowing radiologists to focus on more complex and critical cases.[29]
- Decision support: AI can provide decision support to radiologists by integrating patient data, clinical history, and imaging findings. By analyzing a wide range of information, AI systems can offer suggestions for diagnosis, treatment planning, and patient management. This support can enhance the decision-making process and help radiologists and neuroradiologists make more informed choices.
- Precision medicine: AI can contribute to the development of personalized treatment plans by analyzing imaging data in combination with genomic information and clinical data. AI algorithms can identify imaging biomarkers, predict disease progression, and assess treatment response,[30] facilitating the implementation of precision medicine approaches tailored to individual patients.
- Quality assurance: AI algorithms can be used for quality control and standardization of radiologic interpretations. By comparing radiologists' reports with AI-generated assessments, potential discrepancies or errors can be identified. This feedback loop can help improve the accuracy and consistency of radiologic interpretations.
- Research and education: AI can aid in the discovery of new imaging biomarkers and patterns that may not be easily discernible to human observers. Additionally, AI-based virtual training platforms can simulate realistic radiology cases, providing a valuable tool for training and continuing education for radiologists.[31]

While AI has great potential, it is not expected to replace radiologists.[32-34] Instead, it is envisioned as a valuable tool that can augment their capabilities, improve efficiency, and enhance patient care in neuroradiology practice.[28] This issue should be specially highlighted and clarified for trainees and medical students because there is a general negative perception regarding the impact of AI on radiology practice.[35] Some of the key points to highlight include the following:

- Complementary tool: Computer-assisted diagnosis and AI should be introduced as tools that complement radiologists rather than replace them, by reducing their workload, catching missed findings, and reducing errors.
- Limitations of AI: While AI excels at specific, well-defined tasks, it still struggles with many aspects of image interpretation that require human judgment, understanding of clinical context, and integration of information from multiple sources.
- The human element: Radiology is not just about interpreting images. It is about communicating results, consulting with other physicians, and integrating imaging findings with clinical information. These "soft skills" are deeply human and difficult for machines to replicate.
- Continual learning: Medicine, including radiology, is a continually evolving field. AI models are only as good as the data on which they were trained. Radiologists will always be needed to understand and adapt to new diseases, techniques, and technologies.
- Validation and regulation: The process of validating, regulating, and incorporating AI tools into clinical practice is rigorous. These checks and balances ensure that AI is used safely and appropriately.
- Continuous feedback loop: The evolution of AI in radiology will require a continuous feedback loop with radiologists. This will involve radiologists training AI, validating its findings, and refining its algorithms.

Finally, a radiologist's or neuroradiologist's training is not just about reading scans; it involves understanding anatomy, pathology, physiology, and clinical medicine at a deep level. This holistic approach to patient care is beyond the current reach of AI.

Bringing the World Together: International Outreach and Collaborations

Young professionals increasingly recognize the value and significance of international outreach and collaboration in neuroradiology. In the current century, it is easier than ever to communicate and share knowledge with anyone in the world. Technologic advances are spreading to all corners of the Earth in record time. It is the responsibility of science and medicine to use these to advance medical knowledge, clinical practice, and human health globally. Within the field of neuroradiology, the ASNR contributes in multiple ways, including the International Collaborations Committee, the Anne G. Osborn ASNR International Outreach Professor Program, and initiatives conducted by the YPC. For example, the YPC newsletter reaches out 4 times per year to all members worldwide, with information about the events and opportunities of ASNR directed toward young professionals.

For young neuroradiology clinician-scientists, international collaborations can be especially fruitful: Shared projects and research fellowships provide a win-win situation in terms of ideas, resources, knowledge, and network. For randomized controlled trials, international collaborations can improve inclusion speed and generalizability with 1 example being the Canadian Efficacy and Safety of Nerinetide for the Treatment of Acute Ischaemic Stroke (ESCAPE-NA1) trial.[36] In clinical practice, sharing of experiences and knowledge is valuable to improve practice on both sides. This sharing may be useful on a personal scale too: Approximately 12% of practicing radiologists in the United States are foreign medical graduates, and the participation of foreign graduates in radiology training programs increased from 2% to 15% between 2006 and 2020.[37]

At the ASNR Annual Meeting, of almost 2000 in-person and more than 4500 virtual registrations, approximately 5% are international participants. For young professionals, including

international young professionals, workshops and networking events are organized to expand their knowledge and networks. Now that COVID-19-related travel restrictions have ended, we hope that international participation will continue to increase.

CONCLUSIONS

Being a young professional is an exciting, dynamic, and demanding stage of one's professional career. As the landscape of neuroradiology practice changes, new opportunities and challenges arise for those in the early stage of their career. The ASNR YPC recognizes the importance of identifying and supporting the needs of young professionals because an investment in their professional development is an investment in the future of our specialty.

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

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