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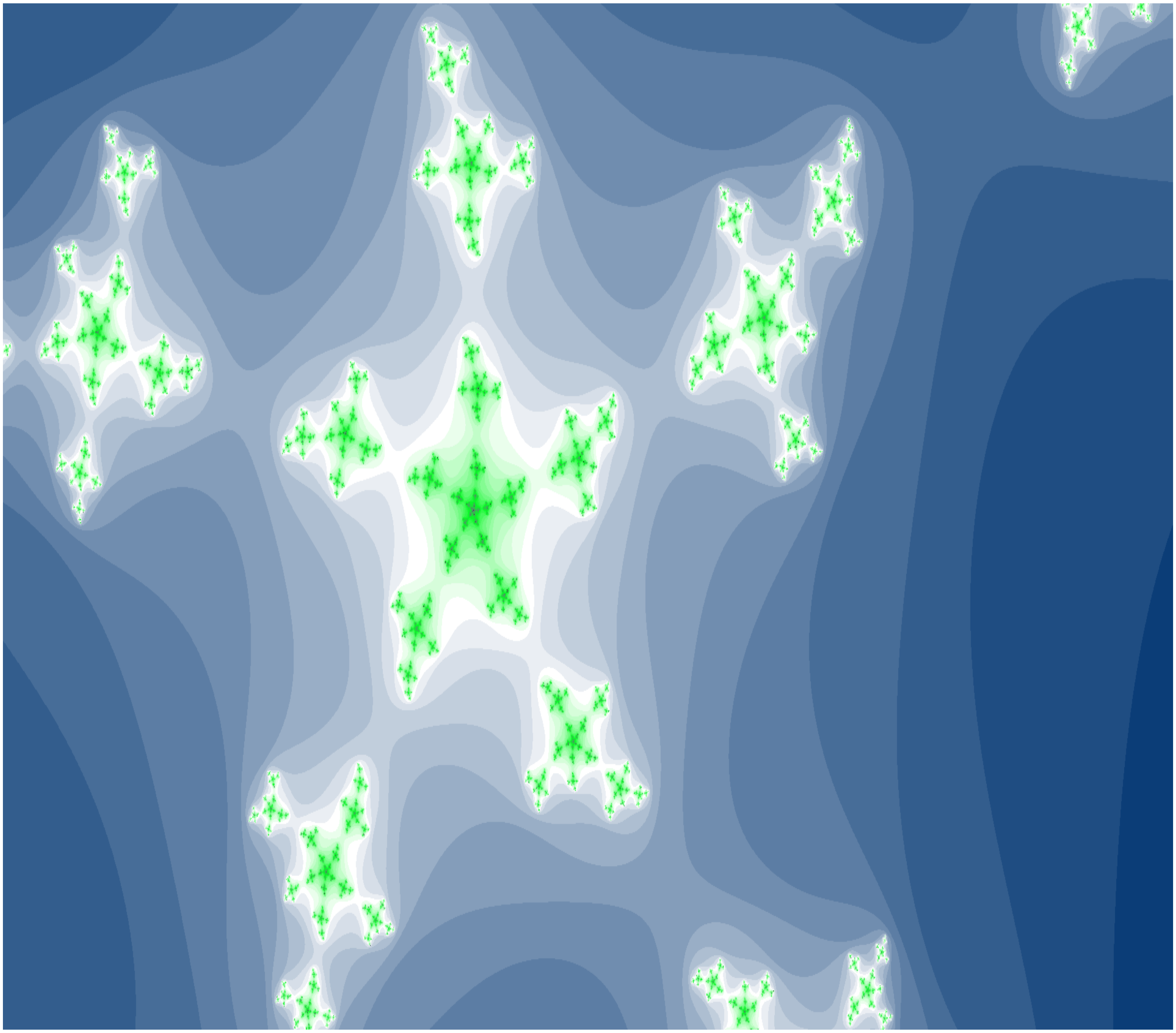
White Paper From the 2024 Consensus Committee on the Future of Medical Imaging and Radiation Therapy



American Society of Radiologic Technologists

Mapping the Future of Medical Imaging and Radiation Therapy: White Paper on the 2024 Consensus Committee Meeting Outcomes

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Endorsement is defined as acknowledgement of the white paper and acceptance of its contents.

Joint Review Committee on Education in Diagnostic Medical Sonography
Medical Dosimetrist Certification Board
Radiology Business Management Association
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Association of Collegiate Educators in Radiologic Technology
Association of Educators in Imaging and Radiologic Sciences
AHRA—Association for Medical Imaging Management
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Mapping the Future of Medical Imaging and Radiation Therapy: White Paper on the 2024 Consensus Committee Meeting Outcomes

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The medical imaging and radiation therapy profession, like other health care professions, is in the midst of a perfect storm: an aging population that needs more health care; fewer students preparing to enter the profession; and increasing numbers of professionals leaving for a variety of reasons, including retirement, burnout, and seeking opportunities elsewhere. This shortage is not limited to medical imaging technologists and radiation therapists but impacts medical physicists and others throughout the landscape. Combined, these factors have led to unprecedented numbers of job openings, overburdening the remaining staff and potentially affecting the quality of patient care. Charting a course out of the storm toward a sufficient, sustainable, and professionally fulfilled workforce will take a collaborative effort and innovative solutions from the profession as a whole.

To address the current workforce shortages and identify feasible solutions, including new career pathways in medical imaging and radiation therapy, the American Society of Radiologic Technologists (ASRT), the American Registry of Radiologic Technologists (ARRT), and the Joint Review Committee on Education in Radiologic Technology (JRCERT) hosted the Consensus Committee on the Future of Medical Imaging and Radiation Therapy, Feb. 19-20, 2024, at the ASRT office in Albuquerque, New Mexico.

Forty-five leaders in medical imaging and radiation therapy participated in the meeting, including managers, educators, clinicians from each of the imaging and therapeutic disciplines, industry representatives, and physicians. In addition to the host organizations, 15 other organizations also were represented at the event:

- American Association of Medical Dosimetrists
- American Association of Physicists in Medicine
- Association of Collegiate Educators in Radiologic Technology
- Association of Educators in Imaging and Radiologic Sciences
- AHRA—the Association for Medical Imaging Management
- Inteleos, specifically the American Registry for Diagnostic Medical Sonography
- Joint Review Committee on Education in Diagnostic Medical Sonography
- Joint Review Committee on Educational Programs in Nuclear Medicine Technology
- Medical Dosimetrist Certification Board
- Nuclear Medicine Technology Certification Board
- Society of Diagnostic Medical Sonography
- Siemens Healthineers
- Radiology Business Management Association
- Society of Nuclear Medicine and Molecular Imaging Technologist Section
- Society for Radiation Oncology Administrators

The 2-day meeting featured presentations, discussions, brainstorming, and planning focused on 2 primary objectives:

- Investigate factors contributing to the workforce shortage, its impact on the profession, and possible solutions
- Investigate career pathways for the profession

Key recommendations from the committee included ways to draw more students into the profession and keep professionals on the job, such as building career pathways with more steps, from imaging aides and limited x-ray machine operators (LXMOs) to advanced practitioners and C-suite executives.

As a starting point for the conversation, members of the Consensus Committee reviewed a report compiled from research and information from the ASRT, ARRT, JRCERT, Joint Review Committee on Education in Diagnostic Medical Sonography (JRCDMS), and Joint Review Committee on Educational Programs in Nuclear Medicine Technology (JRCNMT). The report also included the results of the 2023 Professional Workforce Survey conducted by the ASRT, JRCERT, ARRT, Nuclear Medicine Technology Certification Board (NMTCB), American Registry for Diagnostic Medical Sonography (ARDMS), and Medical Dosimetrist Certification Board (MDCB), which are discussed in this white paper. The research methodology for the Professional Workforce Survey is presented in **Appendix 1**.

Perspectives on the Staffing Shortage

Surveys conducted by ASRT in 2022 and 2023 highlight increases in vacancy rates for all imaging and therapeutic disciplines. Vacancy rates (the number of unfilled positions that are actively being recruited for) are at their highest levels since ASRT started tracking staffing metrics in 2003 (see **Figure 1)**. As an example, the estimated radiographer vacancy rate in 2023 was at an all-time high of 18.1%, an increase from 6.2% in 2021.

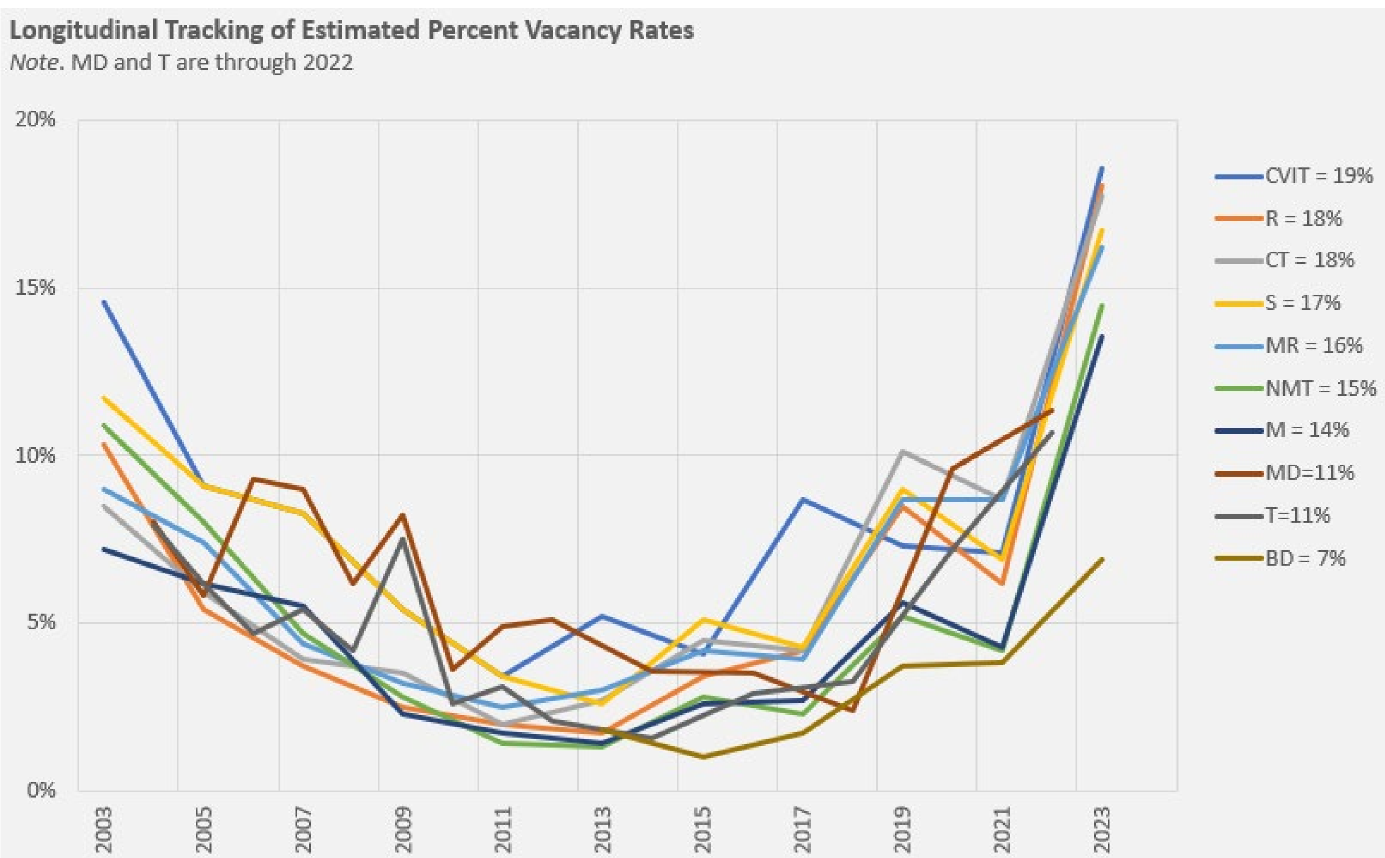

Figure 1. Changes in vacancy rates in medical imaging and radiation therapy disciplines during the period from 2003-2023. Reprinted from *Research Report for the Consensus Committee on the Future of Medical Imaging and Radiation Therapy*. Abbreviations: CVIT, cardiovascular-interventional technology; R, radiography; CT, computed tomography; S, sonography; MR, magnetic resonance imaging; NMT, nuclear medicine technology; M, mammography; MD, medical dosimetry; T, radiation therapy; BD, bone densitometry.

Additionally, ASRT's 2023 Radiologic Sciences Staffing Survey identified the following vacancy rate increases from 2021:

- Cardiovascular interventional technology increased from 7.1% to 18.6%.
- Computed tomography increased from 8.7% to 17.7%.
- Sonography increased from 6.9% to 16.7%.
- Magnetic resonance imaging increased from 8.7% to 16.2%.
- Nuclear medicine increased from 4.2% to 14.5%.
- Mammography increased from 4.3% to 13.6%.
- Bone densitometry increased from 3.8% to 6.9%.

Similar trends were reported in ASRT's 2022 Radiation Therapy Staffing and Workplace Survey. At that time, the vacancy rate for radiation therapy was 10.7%, up more than 3 percentage points from 2020, and more than triple the percentage rate in 2018. The vacancy rate for dosimetry was 11.4%, up from 2 years prior, and more than 4 times the percentage rate in 2018.

And although the number of job openings in medical imaging and radiation therapy has steadily increased, the number of individuals taking the ARRT certification exam in radiography has declined, from a peak of 17,487 in 2006 to 14,330 in 2022 (see **Figure 2**).

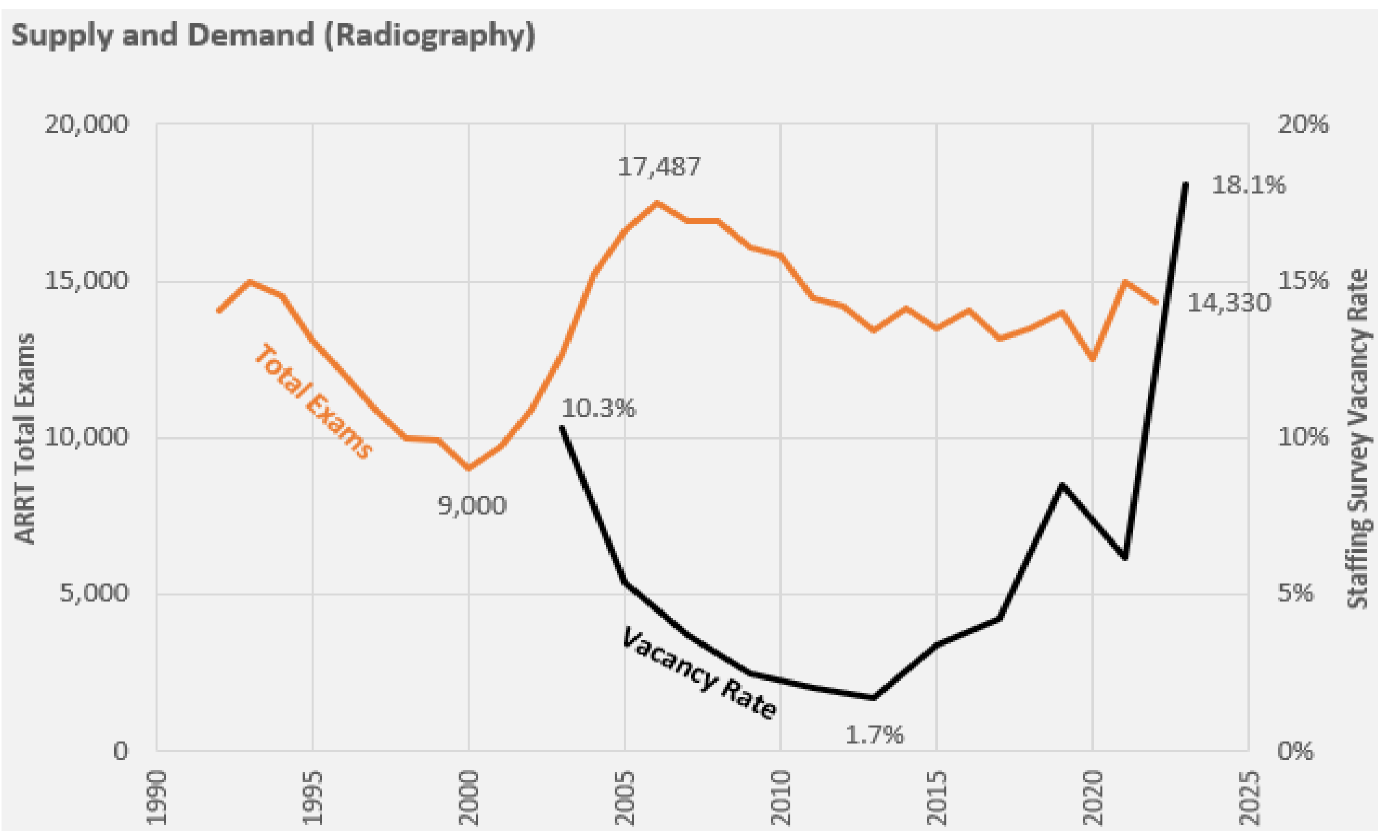

Figure 2. Total number of radiography certification exam takers compared with the job vacancy rate for radiographers over time. Reprinted from *Research Report for the Consensus Committee on the Future of Medical Imaging and Radiation Therapy*.

2023 Professional Workforce Survey

To collect additional data on the workforce shortage and some of the possible contributing factors, the ASRT, ARRT, Nuclear Medicine Technology Certification Board (NMTCB), American Registry for Diagnostic Medical Sonography (ARDMS), and Medical Dosimetrist Certification Board (MDCB) conducted the 2023 Professional Workforce Survey. These organizations emailed 353,489 invitations to medical imaging and radiation therapy professionals to participate in the survey. A total of 8,701 individuals responded to the survey, yielding a response rate of 2.5%. This sample size yields a ±1.0% margin of error for overall percentages at the 95% confidence level.

The survey asked respondents a number of demographic questions, and results provided a snapshot of the professional workforce today. The average survey respondent was 49.8 years old, had worked in medical imaging or radiation therapy for 22.2 years, and had been employed at their current job for 10.3 years; 72.6% were female and 26.1% were male. Regarding their highest level of educational attainment, 44.1% said they had an associate degree; 30.6% had a bachelor's degree, 13.4% had a certificate, 10.3% had a master's degree, and 1.2% held a doctoral degree.

The breakdown for respondents' primary entry certificate included:

- 71.3% in radiography.
- 16.6% in sonography.
- 7.7% in nuclear medicine technology.
- 4.6% in radiation therapy.
- 3.0% in medical dosimetry.

Most respondents (77.3%) were employed full time; 13.8% were employed part time, and the remaining 9.0% were not currently working in medical imaging or radiation therapy. Those currently working were asked about their job title and about the discipline in which they practice most of the time:

- 57.4% were staff level, 17.0% were senior/lead technologists or therapists, and 7.4% worked as supervisors/managers.
- 28.0% worked mostly in radiography, 14.8% worked mostly in sonography, and 14.0% worked mostly in computed tomography.

A majority of respondents (53.9%) worked in some type of hospital while 23.3% worked in an imaging center or clinic. Among those working in a hospital, there were an average of 330.7 beds at their facility. A plurality of respondents (45.2%) worked in an urban area; 36.1% worked in a suburban area, and 18.7% worked in a rural area. There were respondents from every U.S. state and the District of Columbia.

Part-time Employment, Job Turnover, and Reasons for Leaving the Profession

In addition to demographic characteristics, respondents were asked several questions regarding their employment status. For those working part time, they were asked why. The 3 most common reasons given were being semiretired (37.4%), not wanting full-time employment (30.6%), and having family obligations (24.7%)

Among those who are not working at all in medical imaging or radiation therapy, the most common reason by a considerable margin was that they are retired (60.4%); 10.8% said they are currently unemployed but not seeking work in medical imaging or radiation therapy, and 9.7% said they are working in another profession.

Most respondents (83.8%) had not changed jobs in the past year, but the 16.2% who had changed jobs were asked why they left their most recent position. A majority (68.3%) had resigned. Reasons for resigning varied, but the most commonly cited reasons were as follows:

- They changed to an equivalent position at another facility, received a promotion, or accepted a relocation (26.6%).
- They left due to burnout (24.8%).
- They left for better pay elsewhere (24.1%).
- They left due to problems with management (23.9%).
- They left for more desirable hours elsewhere (20.5%).

Furthermore, most survey respondents (70%) reported turnover among the staff working in their department during the previous year. On average, they estimated that about 5 full-time equivalent technologists left their department. The most commonly cited reasons for colleagues' departures were:

- The employees left to work at another facility (80.9%).
- They left due to burnout (35.0%).
- They retired (21.4%).
- They left because of family issues, such as taking care of a relative or raising children (16.3%).
- They left because of COVID-19 or COVID-related policies (11.9%).

Prevalence of Burnout

Survey data suggest that burnout, including emotional exhaustion and feeling underappreciated at work, are pervasive problems among medical imaging and radiation therapy professionals. More than half of all respondents (53.7%) reported feeling emotionally exhausted at least a few times each month, and an even larger percentage (56.9%) said they felt underappreciated on the job at least a few times each month. On a more positive note, many respondents also reported frequently feeling a sense of personal accomplishment on the job, with more than 25% of staff technologists and therapists indicating they had a daily sense of personal accomplishment at work.

Reliance on Travelers and Other Temporary Staff

The survey also inquired about employment of temporary or traveling technologists and therapists at respondents' workplaces and responses revealed that reliance on this short-term solution is common. Although a majority (66.0%) indicated their department is not currently using temporary or travelling staff to fill vacancies, more than one-third of respondents (34.0%) indicated they work in a department where temporary and traveling staff fill open positions. Among those working in a department where temporary or traveling staff are used:

- 41.7% said 1% to 5% of positions are filled by temporary staff.
- 22.1% said 6% to 10% of positions are filled by temporary staff.
- 16.5% said 11% to 20% of positions are filled by temporary staff.
- 18.9% said that more than 20% of positions are filled by temporary staff.

Objective 1: Addressing the Workforce Shortage

After reviewing the survey data, the Consensus Committee broke into discussion groups to begin formulating strategies to address the shortage. Other health care professions have taken similar steps. For example, **Appendix 2** is a statement from the American Society for Clinical Laboratory Science outlining its positions on the staffing shortage among laboratory personnel.

Although the Consensus Committee members generated diverse and wide-ranging insights, some common themes also emerged from the group discussions. For example, many participants pointed out the need to better educate the public about who medical imaging and radiation therapy professionals are and what they do, especially among junior high, high school, and college students who are exploring career options. Additionally, several committee members suggested that education programs in medical imaging and radiation therapy should be more closely aligned with current clinical practice to help facilitate graduates' transition to professional practice. This could be achieved through adjustments to the curriculum, such as incorporating more cutting-edge technology and training in cultural competency.

Another commonly mentioned factor was the need for clear career pathways and ladders within the profession so that students and professionals can plan and pursue careers best suited to their individual interests and abilities, whether in clinical practice, management, or education, from entry level through advanced practice. Many committee members also commented on mentoring at all levels of the profession as an important factor to consider, as well as ensuring that medical imaging and radiation therapy professionals are recognized and valued for their contributions. This could take various forms, such as more competitive salaries and retention bonuses, flexible schedules and better work-life balance, additional support for continuing education and professional development, and recognition from colleagues and the community.

Based on the group discussions, the Consensus Committee selected the following 6 areas to focus on:

- Raising awareness, visibility, and respect for the profession
- Articulating career pathways
- Creating a pipeline with education programs
- Building a career ladder for advancement and mentorship
- Expanding opportunities for education and training that meet the emerging needs of students
- Sharing frameworks and tools to improve workplace satisfaction, employee engagement, and recognition

At the suggestion of the meeting's organizers, committee members agreed to focus on actionable, achievable initiatives through which the participating organizations were likely to have the greatest impact. For each of the 6 focus areas, the committee identified specific actions to take in the next 1 to 3 years that will positively address the workforce shortage without compromising the future of the profession. The nuclear medicine community is working on some of these pipeline and pathway issues separately; therefore, a separate review of nuclear medicine is not included.

Raising Awareness

To increase public awareness about the profession, especially among younger people, the Consensus Committee agreed to prioritize:

- Developing social media campaigns to attract more students to the profession with messaging on a variety of platforms, including TikTok, Snapchat, Instagram, Blue Sky, Mastodon, and Threads. The campaigns will feature both patient testimonials and a wide variety of medical imaging and radiation therapy professionals to ensure that the messaging is diverse and inclusive. All of the professional associations can participate in and have an impact through this initiative.
- Providing mentorship to potential and current students who reach out for additional information about the profession. The Consensus Committee envisions a national network of ambassadors who have been trained for this role by professional organizations that will collaborate to develop a curriculum for the ambassadors.

Articulating Career Pathways

To clarify the different ways individuals can enter and progress in the profession, the Consensus Committee agreed to prioritize:

- Defining the levels and roles for each step in the career pathway, from imaging medical aide through advanced practitioner, and at all educational levels. The Consensus Committee began this work at its February meeting (see Objective 2); however, more work remains for the profession as a whole.
- Developing a curriculum to introduce high school students to the medical imaging and radiation therapy profession. This will be a joint effort between high schools and professional education programs.
- Advertising and publicizing different educational pathways to obtain primary and postprimary credentials.

Creating a Pipeline from Educational Programs to the Workplace

To help new graduates transition to professional practice, the Consensus Committee agreed to prioritize:

- Surveying current students and recent graduates of medical imaging and radiation therapy programs to gather information on their perspectives and needs. Continuing education opportunities could be offered to recent graduates as an incentive to complete the survey.
- Making artificial intelligence (AI) a mandatory, rather than optional, component of the curriculum; developing an AI curriculum for students; and creating more continuing education modules on AI for practicing professionals. **Appendix 3** summarizes ASRT research regarding AI.

Building a Career Ladder

To help medical imaging and radiation therapy professionals advance in their careers, the Consensus Committee agreed to prioritize:

- Defining different clinical titles for professionals in both clinical and leadership roles.

Expanding Educational Opportunities

To widen educational access for students and assist educators in medical imaging and radiation therapy, the Consensus Committee agreed to prioritize:

- Expanding education programs, including clinical sites, to rural and underserved areas so more students can prepare to enter the profession where they live. This will be accomplished through a collaborative effort by educators, accrediting organizations, and hospital management groups.
- Creating a centralized, one-stop-shop portal for educators with resources from associations, educational accreditation organizations, and credentialing organizations.

Improving Workplace Satisfaction

To create frameworks and tools with the aim of improving medical imaging and radiation therapy professionals' engagement with their workplaces, job satisfaction, and recognition on the job, the Consensus Committee agreed to prioritize:

- Establishing an award program tied to key performance indicators and professional excellence similar to the DAISY Award or Magnet Recognition Program honoring outstanding nurses.
- Creating new continuing education opportunities on workplace satisfaction and a guide to employee satisfaction and recognition for medical imaging and radiation therapy managers.

Objective 2: Building Career Pathways

Career pathways can help draw more people into a profession and retain them over the course of their career by offering a variety of career tracks at different professional levels. Other health professions, such as nurses in the United States and radiographers in the United Kingdom, have well-defined career pathways and ladders.

Nursing Pathways

Nurses in the United States have a range of practice roles, including the limited-scope licensed practical nurse or limited vocation nurse, registered nurse (RN), and advanced practice nurse. As the American Nurses Association (ANA) explained, "RNs receive more training than LPNs and, as a result, have more responsibilities. A registered nurse works with physicians, advanced practice registered nurses (APRNs), and a team of specialists to develop a patient care plan that the LPN helps to execute."[1] Additionally, the ANA noted, more than half of states have recognized the role of medication assistant or aide; however, "there is a great deal of variation between states as to the agency with oversight as well as the required training and who may train."[2]

The RN designation is the credential nurses receive after passing a state licensure exam.[3] Educational preparation to take the RN licensure exam can be obtained via an associate degree in nursing or a Bachelor of Science in nursing (BSN). There are RN-to-BSN programs that allow nurses who obtained an RN via an associate degree program to complete a Bachelor of Science online while working. In addition to the RN, nurses can obtain subsequent certifications for specific clinical areas of concentration, such as bone marrow transplant, advanced diabetes management, and HIV/AIDS certified registered nurse, among others.[4]

To advance their professional practice, nurses can complete Master of Science in nursing (MSN) degrees, which include nursing education degrees and advanced practice clinical specialization degrees, such as midwifery, nurse practitioner, nursing informatics, and nurse anesthetists. Terminal degrees in nursing include the Doctor of Education, doctor of nursing practice (DNP), and doctor of philosophy in nursing (PhD) with education, clinical, and research foci.

Radiographer Pathways in the United Kingdom

An example of career pathways from the United Kingdom is the College of Radiographers' *Education and Career Framework for the Radiography Workforce*, which defines roles and levels of radiography practice and the educational requirements for each.

The framework includes 4 pillars of practice: clinical practice, education, leadership and management, and research and development. Within each pillar is an array of roles, ranging from entry-level support workers with basic education to practitioners, advanced practitioners, and higher-level positions, such as researchers, senior managers, and consultant practitioners (see **Figure 3**).

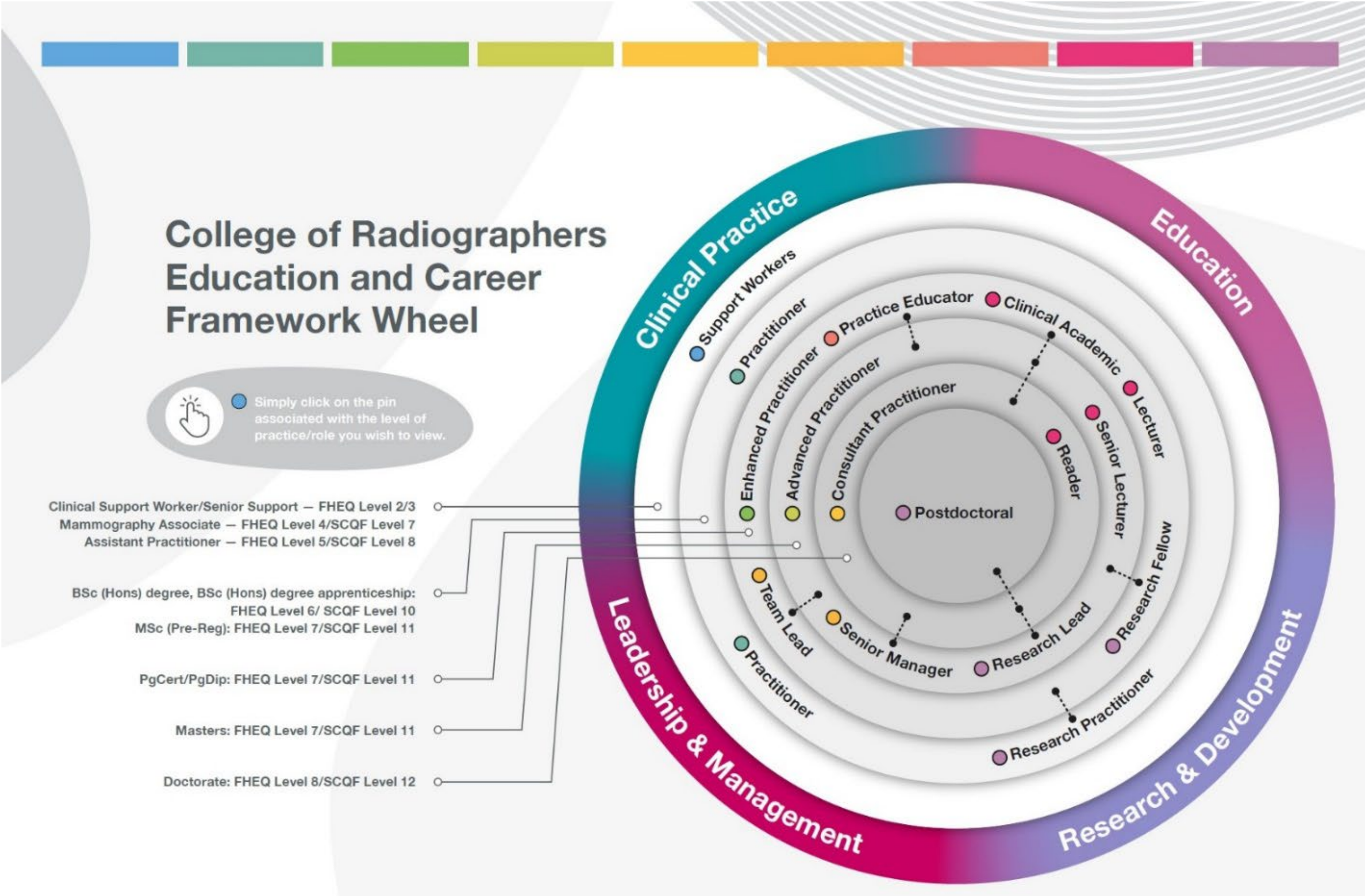

Figure 3. Career ladders for radiographers in the United Kingdom. Reprinted from The College of Radiographers. *Education and Career Framework for the Radiography Workforce.* 4th ed. Accessed September 26, 2023. https://www.sor.org/learning-advice/professional-body-guidance-and-publications/documents-and-publications/policy-guidance-document-library/education-and-career-framework-fourth

Considerations for Building Medical Imaging and Radiation Therapy Pathways in the United States
Some steps on the medical imaging and radiation therapy career pathways are already in place in the United States. For example, currently recognized advanced practice roles include the advanced practice sonographer, nuclear medicine advanced associate, and radiologist assistant, all of which have additional requirements for education, certification, and continuing education above the primary and postprimary credentials.[5-9] (The scope of practice for radiologist assistants is included as **Appendix 4**.) In addition, an emerging role is the advanced practice radiation therapist (APRT). Currently the APRT role is defined by task-shifting with the radiation oncology team based on the institution's needs.[10,11]

Other career pathways are less defined, however. For instance, there are currently no standard recommendations for degree level or type of degree for either educators or managers/administrators in medical imaging and radiation therapy. However, it is ASRT's position that medical imaging and radiation therapy program directors hold a minimum of a master's degree and that clinical coordinators hold a minimum of a bachelor's degree.[12]

Also of concern is the lack of regulation in the limited scope of practice in radiography role. To date, 30 states have state licensure requirements for the limited scope of practice role, although the terminology for the role varies, including practical radiologic technologist, limited licensed technologist, limited permit x-ray technician, limited scope operator, and others.

The ASRT does not currently have a position statement specifically regarding the limited scope of practice role. However, to support safe practice, ASRT has outlined practice standards for the role[13] and offers a curriculum for the LXMO.[14] There is no national credentialing or registering exam for this role. The ARRT contracts directly with some states for individuals to take ARRT-administered exams for the purpose of state licensure in limited scope of practice in radiography, bone densitometry, and fluoroscopy. However, ARRT does not certify and register individuals based on the results of these exams, and the status of the individuals is not verifiable through the ARRT.

Another area for consensus building is the possible role of imaging medical aides (IMAs). The IMA is a proposed entry-level role that would support radiologic technologists by performing basic clinical tasks. Some hospitals already employ medical assistants in roles similar to the proposed IMA role, so the Consensus Committee considers it important to define and regulate the position.

As part of its discussion on addressing the workforce shortage by strengthening the pipeline into the profession, the Consensus Committee discussed career pathways for clinicians in both imaging and radiation therapy as well as pathways for managers and educators. For each of the proposed pathways, committee members considered the needed infrastructure and next steps to realistically move forward. The proposed new pathways are presented here.

The Medical Imaging Pathway

Entry Level

Consensus Committee members representing the imaging career pathway envision a new way to enter medical imaging through the IMA role. Currently, individuals also can enter the profession as LXMOs or as registered technologists (see **Figure 4**). IMAs and LXMOs who complete additional education and certification could progress to become registered technologists (R.T.s).

Committee members recommend that IMAs be required to complete a standardized educational curriculum and adhere to a professional scope of practice to be developed by the ASRT. The curriculum could be offered by high schools as well as community colleges, with possible dual enrollment. Consensus Committee members noted that the IMA role might be attractive to staff who are already working in similar health care roles, such as phlebotomists, medical assistants, and certified nursing assistants (CNAs). These individuals could complete additional training focused on radiology-related topics and transition to the IMA role.

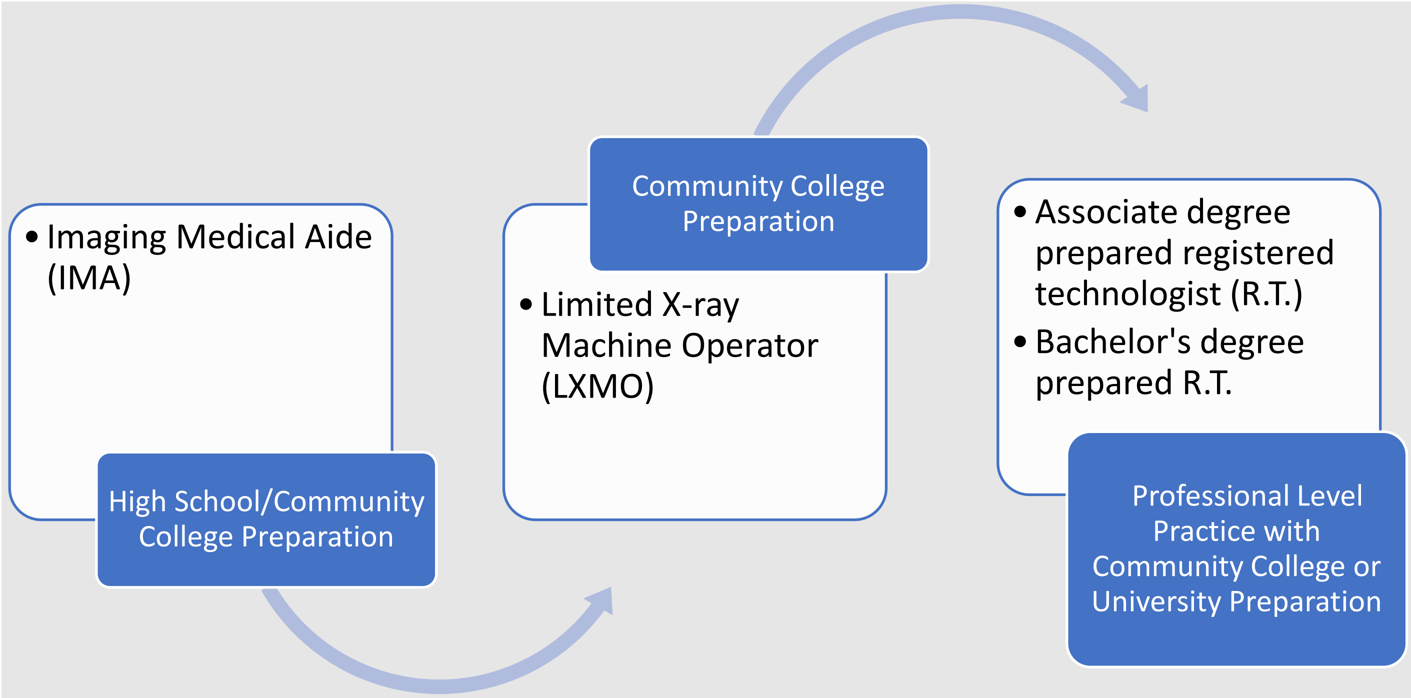

Figure 4. Flow chart demonstrating proposed new career pathways for entry into medical imaging. The IMA and LXMO are both entry-level roles and individuals could choose to enter through either. IMAs will be able to complete additional training to become LXMOs, and IMAs and LXMOs may opt to continue their education to become R.T.s. Additionally, individuals still can enter the professional pathway as R.T.s with either an associate degree, bachelor's degree, or certificate program with an associate degree prerequisite. Offering multiple routes into a medical imaging career may help attract more students and ease the staffing shortage.

As with CNAs, job tasks for IMAs would focus primarily on patient care and communication and might include the following:

- Transporting patients
- Obtaining patient histories
- Obtaining patient vital signs and weights
- Starting IVs
- Screening patients before magnetic resonance scans

Importantly, IMA job duties would ***not*** include exposing patients to radiation or injecting contrast media. Staff in the LXMO role will have additional education beyond the IMA level, including expanded knowledge of radiation protection and MR safety. LXMOs will be qualified to perform all of the tasks of the IMA with additional responsibilities in positioning and exposing patients for a limited list of radiography procedures as well as assisting with remote scanning for specific imaging modalities. (For survey data on remote scanning and the personnel who are currently performing it, see **Appendix 5**.)

The Consensus Committee members representing the imaging pathway recommend defining the LXMO role by requiring completion of ASRT's existing LXMO curriculum and adoption of the ASRT's LXMO practice standards, along with a newly implemented national certification for LXMOs. Current radiography programs and equipment vendors could partner with professional organizations to develop both IMA and LXMO programs. Through this approach, professional organizations can ensure consistent high quality in LXMO and IMA practice.

In summary, the Consensus Committee members representing the imaging educational pathway endorse requiring that both IMAs and LXMOs complete standardized educational curricula, qualify for national certification and registration provided by the ARRT, and validate their credentials by meeting continuing education requirements. It is noted that the attendees representing the SNMMI-TS section state that the IMA and LXMOs as entry level are not conducive to nuclear medicine.

Professional and Advanced Levels

Achieving Federal Recognition

Although all medical imaging and radiation therapy personnel consider themselves professionals, the U.S. Department of Labor and Statistics currently recognizes only radiation therapists and medical dosimetrists as professionals, not medical imaging practitioners. Therefore, the Consensus Committee members representing the imaging pathway selected achieving professional recognition by the Department of Labor and Statistics for imaging technologists as another of its goals. **Appendix 6** is a legal memorandum explaining the Department of Labor's requirements for designation as a learned profession; **Appendix 7** presents survey data on the behaviors medical imaging and radiation therapy professionals consider to be important aspects of professionalism.

Adding a Step on the Ladder for Bachelor's Degree Holders With Postprimary Certifications

Participants explored the appropriateness of supporting the baccalaureate degree as the educational requirement for entry-level professionals. However, results of the recent Professional Workforce Survey indicated that a clear majority of respondents (70.3%) did not favor this change and believe the associate degree should continue to be the minimum qualification for practice in their discipline, including certificate programs with an associate requirement. Two exceptions to this finding were radiation therapists and medical dosimetrists, among whom small majorities (50.7% and 56.4%, respectively) indicated that they *did* support the bachelor's degree as the entry-level minimum requirement for their disciplines.

Survey respondents cited numerous reasons for opposing the bachelor's degree requirement for professional practice, but the most commonly cited reason was that it would create an undue barrier to entering the profession and thus exacerbate the current staffing shortage. Additional reasons for opposing the bachelor's degree minimum requirement included the perception that it was unnecessary; would not increase pay, prestige, or professionalism among technologists; and that the educational infrastructure to support such a requirement is lacking. For an example of the process required to establish new bachelor's degree programs, see **Appendix 8**.

Consequently, the Consensus Committee members representing the imaging pathway support the associate degree, including certificate programs with an associate degree prerequisite, as a requirement for primary certifications, which represent the first step on the professional-level medical imaging clinical career pathway. As a long-term goal, the committee recommends the bachelor's degree as a requirement for postprimary certifications. This would represent a second, intermediary step on the career ladder for clinical imaging professionals (see **Figure 5**).

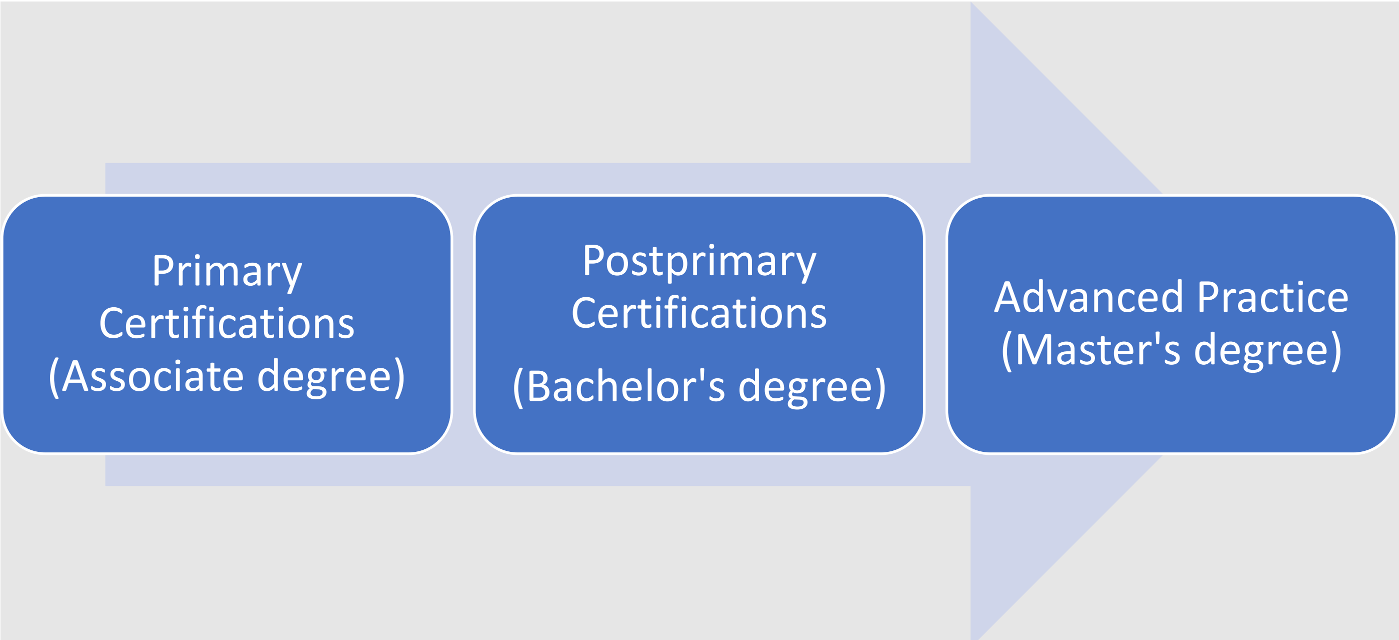

Figure 5. Proposed professional-level and advanced practice career pathway for medical imaging clinicians. Clinicians can enter the pathway with an associate degree and primary certification, progress to postprimary certification with a bachelor's degree, and ultimately become advanced practitioners.

Recognition and Reimbursement for Radiologist Assistants and Other Advanced Practitioners

The radiologist assistant role is already well established as a model for advanced practice in medical imaging, with a master's degree as the minimum educational requirement and certification by the ARRT or minimum bachelor's degree for certification by the Certification Board for Radiology Practitioner Assistant. However, federal recognition and reimbursement for the radiologist assistant still are needed. Once recognition and reimbursement are secured, the Consensus Committee envisions additional advanced practice roles for professionals in every imaging discipline and practice area. These additional advanced practice roles also will require master's degrees tied to the area of clinical practice plus national certification to be offered by the appropriate certifying organizations. In addition to performing expanded clinical duties, advanced practitioners may pursue doctoral degrees, conduct research, present at conferences, and mentor the next generation of imaging professionals.

The Radiation Therapy and Medical Dosimetry Clinical Pathway

Consensus Committee members representing radiation oncology also advocated for a career pathway that will help draw more people into radiation therapy and medical dosimetry, retain current staff, and facilitate career progress for radiation oncology professionals while also ensuring quality patient care.

For example, the committee urges associations and credentialing organizations to lobby state legislatures to regulate professional practice by allowing only registered radiation therapists, not limited license personnel, to deliver radiation therapy treatments. To accomplish this goal, legislators and the public must be educated about how certification helps protect patients. A related goal is requiring facilities that provide radiation therapy services to be accredited by the American College of Radiology or have APEx accreditation from the American Society for Radiation Oncology to receive maximum reimbursement from the Centers for Medicare & Medicaid Services. This will also help ensure that only registered therapists deliver treatment and protect patients. At the same time, the committee supports developing education programs for professionals in other areas of health care who are interested in becoming radiation therapists. This will require a collaborative effort among several organizations.

In alignment with ASRT's position statement, the Consensus Committee supports the bachelor's degree as the entry-level degree for radiation therapists. To ensure that new radiation therapists are well prepared for current and future practice, the committee calls for more educational offerings and certification in special and emerging technologies such as proton therapy, FLASH therapy, adaptive radiation therapy, magnetic resonance linear accelerators, and brachytherapy. To support this goal, the committee recommends ongoing dialogue with industry leaders and vendors that can assist with professional development. The committee also supports enhanced education in cultural competency and patient communication and expanding the number of clinical sites available to students.

To draw radiation therapy professionals back into practice after time away, whether because of medical leave, caring for family members, or retirement, committee members propose a new pathway that will enable radiation therapists and dosimetrists to redemonstrate their clinical competency to potential employers, assuming they have maintained their credentials. Additionally, to help therapists transition to medical dosimetrist and quality assurance roles without leaving their current jobs to obtain additional education, committee members advocate for expanded access of certificate programs.

Finally, committee members strongly support development of the emerging advanced practice radiation therapist role. They believe this role should require a master's degree. Curricula and education program accreditation standards based on evidence-based practice must be established, along with a new certification exam. These steps will require profession-wide collaboration.

The Manager, Administrator, and Executive Pathway

Committee members representing the management pathway consider spreading the word about management careers for R.T.s as key to supporting their pathway. Current managers must promote the management option to younger medical imaging and radiation therapy professionals. One way to achieve this is by publishing the personal stories of R.T.s who have succeeded in management positions. In addition to raising awareness about opportunities in management, this type of storytelling can help generate excitement about the management career pathway. Professional societies can help with this goal.

Currently, there is no minimum educational requirement for entry-level managerial positions such as lead technologist or supervisor, although committee members envision an associate degree as the minimum requirement with a bachelor's degree preferred. For both entry-level and more experienced managers, professional development certificate programs are needed. In addition, managers will be expected to be actively involved with professional societies and preferably maintain their imaging or radiation therapy credentials.

In the future, the educational preparation for professional-level radiology and radiation oncology managers should be a minimum of a bachelor's degree with a master's degree preferred, including coursework in budgeting, leadership, and soft skills such as conflict resolution and team building. Mentoring and career coaching also are essential for managers and should be incorporated into degree programs, committee members said, along with internships or apprenticeships in management and administration. Senior managers may oversee multiple facilities and will typically hold master's degrees with training in process improvement.

In the future, their duties could expand to include developing recruitment and retention policies and quality assurance metrics.

Consensus Committee members representing the management pathway also envision an advanced career track for radiology managers interested in becoming hospital administrators, such as chief operating officers and chief executive officers. These individuals will hold master's degrees, preferably in business administration or hospital administration, in addition to their clinical qualifications in medical imaging or radiation therapy. They will also be required to hold the Certified Radiology Administrator credential offered by the Association for Medical Imaging Management. Additionally, the Society for Radiation Oncology Administrators provides educational resources for radiation oncology department administrators.

The Educator Pathway

National practice standards for educators are needed and could be developed by related professional associations. Other needs include professional development programs for educators focused on emerging technologies, such as artificial intelligence, and mentoring programs for educators at all career levels.

A new entry-level role for educators will be teaching in programs for students preparing to become LXMOs and IMAs, committee members noted. Instructors and adjunct faculty should hold bachelor's degrees in a related field, while an associate degree will be required for clinical preceptors. Program directors will hold a master's degree. All entry-level educators also will have primary and postprimary certifications, as required for their specific roles.

At the advanced career level, which includes roles such as full professors, department chairs, deans, provosts, administrators, and executives, doctoral degrees will become the expected educational preparation. Advanced-level educators will be expected to have extensive experience in teaching, leadership, research, finance, human resources, and accreditation.

Committee members also stressed the importance of identifying clinical staff with potential to become educators. Current educators must help communicate the advantages of the educator pathway, such as time off and tuition benefits, to help increase interest among students and younger clinicians in pursuing the educator pathway.

Conclusions

The medical imaging and radiation therapy profession faces a workforce shortage that exceeds levels documented in more than 20 years. Without intervention, the situation could worsen as more baby boomers approach retirement and remaining professionals consider leaving their jobs because of frustrations associated with understaffing and burnout. To help protect the quality of patient care, attract more students to the field, and ensure the professional satisfaction and longevity of current and future practitioners, leaders representing the entire profession gathered to develop specific, actionable, and achievable goals for the next few years and beyond. Bringing these aspirations to fruition will require the ongoing commitment and combined talents of professional societies, accrediting organizations, certifying bodies, equipment vendors, health care organizations, and educational institutions, as well as individual technologists, therapists, and dosimetrists at all levels of professional practice. While many organizations may be independently working on initiatives to address these challenges, the purpose of this committee was to bring the service line together to learn from each other and work collaboratively toward sustained change now and into the future.

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Appendix 1. Additional Methodology for the 2023 Professional Workforce Survey

Data Reliability

Numeric variables were examined for logically impossible or implausible values and for internally inconsistent responses across variable sets. Following this initial examination, z scores were computed for each numeric variable and analyzed for outliers. The z score outlier threshold was set at $|z| \geq 3.29$, $\hat{p} \leq .001$.

Coding of Other Responses

Demographic questions that included other as a possible response were analyzed and coded. If coded responses fell into one of the original categories of the question, they were included in the count of that category. If a coded response total was found to be ≥ 1% of the total responses, it was included as a new category in the frequency table and chart. All verbatim responses to other can be found in the appendix of the report.

Cross-tabulations

Cross-tabulations were run on multiple questions to analyze response patterns for possible systematic differences between groups in independent variables. Below are the variables treated as independent for cross-tabulations.

Certificate

	N	%
Radiography (ARRT)	6,207	71.3%
Sonography (ARDMS/ARRT)	1,441	16.6%
Nuclear Medicine Technology (ARRT/NMTCB)	669	7.7%
Radiation Therapy (ARRT)	403	4.6%
Certified Medical Dosimetry (MDCB)	264	3.0%

Note. The total percentage adds up to more than 100.0% due to multiple certifications.

Position

	N	%
Staff	4,812	63.6%
Management	2,404	31.8%
Education	349	4.6%
Total	7,565	100.0%

Position was collapsed down from the 11 response categories to the following 3 based upon the following definitions:

- Staff: Staff technologist or therapist, Locum tenens, Medical dosimetrist
- Management: Senior or lead technologist or therapist, Supervisor or manager, Administrator, Chief technologist or therapist, Assistant chief technologist or therapist, Corporate or commercial representative
- Education: Program director, Instructor or faculty

Education Level

	N	%
Certificate	1,164	13.4%
Associate degree	3,832	44.1%
Bachelor's degree	2,657	30.6%
Master's degree	895	10.3%
Doctoral degree (e.g., Ph.D., Ed.D., M.D.)	106	1.2%
Other:	35	0.4%
Total	8,689	100.0%

Facility Location

	N	%
Urban	3,555	45.2%
Suburban	2,838	36.1%
Rural	1,474	18.7%
Total	7,867	100.0%

Workplace

	N	%
Hospital	4,687	59.2%
Imaging center or clinic	2,026	25.6%
Physician's office	459	5.8%
Corporate, Industrial, and Other	334	4.2%
Education	321	4.1%
Mobile unit	87	1.1%
Total	7,914	100.0%

Workplace was collapsed down from the 13 response categories to the following 6 based upon the following definitions:

- Hospital
  - Hospital (not-for-profit), Hospital (for-profit), Hospital (rural critical access), Hospital (Government or VA)
- Imaging center or clinic
  - Imaging center or outpatient imaging facility, Large clinic, Small clinic
- Corporate, Industrial, and Other
- Physician's office
- Education
- Mobile Unit

Cross-tabulation Analysis

For ease of evaluating group comparisons, only percentages and group totals were included in the cross-tabulated tables. The percentages in this section were computed and summed in columns by each corresponding group total. Raw Ns within groups and row totals are available upon request. Tables with nominal variables were first sorted by column totals left to right in descending order, and then by row totals in descending order. Ordinal variables were not sorted. Due to the complexity of multiple categories within each independent and dependent variable, cross-tabulated charts were not included with the tables if the dependent variable categories were > 3. A graded color-scale was assigned to the percentage distribution for each cross-tabulation to provide an overall assessment of the distribution. The highest percentage in each category was bolded. For scaled ordinal questions, both the frequency distribution and the mean rating were computed and included in supporting tables and charts.

Statistical Testing

Pearson's chi-square was computed on nominal cross-tabulated variables. For cases where the independent variable was a multiple response question, (e.g., Certificate), Rao and Scott's adjusted chi-square was reported.[1] For Likert-scale type questions, a one-way analysis of variance (ANOVA) was also computed.[2] For cross-tabulations with groups ≥ 3, Bonferroni post hoc tests were computed. Due to the general complexity of category combinations, the results were not included in this report but are available upon request. Tukey's HSD was computed for the one-way ANOVAs and are included in the report. Cohen's f statistic was computed to measure the effect size for the one-way ANOVAs, and Cramér's V statistic was computed to measure the effect size for the chi-squares.

Interpretation of Cramér's V[3]

Value	Interpretation
≥ .22	Large
≥ .13	Medium
≥ .05	Small
< .05	Negligible

Values measure the estimated overall percentage variance within the table. The value ranges are determined by the smallest degrees of freedom (df) from either row or column totals. To maintain consistency in the interpretation of the values throughout the report, the values above reflect df = 5. Similarly, Cohen's f is defined as: small ≥ .10, medium ≥ .25 and large ≥ .40.[4] The interpretation in relation to the values is subjectively defined and should serve as a general starting point for assessing the magnitude of the difference between the groups. As J. Cohen notes, "The investigator is best advised to use the conventional definitions as a general frame of reference for ES [effect size] and not to take them too literally."[5]

Statistical Test Results

With the relatively large sample size, it is recommended that the reported P-values be viewed as just one factor in determining if mean or proportional differences are significant. The effect-size (magnitude of the difference between groups) should also be taken into consideration as a measure of practical significance when making comparisons between groups. And finally, the straightforward frequency and descriptive statistics should also be given equal consideration as they often provide both a more nuanced and comprehensive understanding of the results.

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Appendix 2. American Society for Clinical Laboratory Science Position Statements to Address the Clinical Laboratory Workforce Shortage

- ASCLS believes that we will only be able to address the critical workforce shortage of medical laboratory professionals with a coordinated commitment from all interested parties to include laboratory and medical professional organizations, clinical laboratory and hospital administrations, educational institutions, the laboratory industry, and federal and state government agencies.
- ASCLS supports the need for a congressional study through the U.S. Government Accountability Office to identify the nature of the ongoing workforce shortage in clinical laboratories and the impact on the healthcare system and offer solutions.
- ASCLS supports the expansion of Title VII Authorization, which federally funds education for healthcare professions, to specifically include clinical laboratory science.
- ASCLS supports the continued efforts of the Coordinating Council for the Clinical Laboratory Workforce (CCCLW) in their mission to address the workforce shortage.
- ASCLS supports the CLIAC recommendation that the HHS Secretary issue a recommendation to the US Department of Education to include laboratory science professions in STEM programming so that grant funding opportunities can be made available to our profession.
- ASCLS supports engaging in outreach opportunities that promote the clinical laboratory science profession within middle and high schools, including guidance counselors and science teachers, and partnering with STEM education activities.
- ASCLS supports efforts to improve the visibility of the profession, promote recognition, and showcase the medical laboratory profession as a vital and promising health care career.
- ASCLS believes that clinical laboratory training is an essential part of educating medical laboratory professionals, and innovative ways to provide this clinical laboratory experience should be explored.
- ASCLS supports establishing an electronic clearinghouse for programs to advertise unexpected vacancies in MLS and MLT clinical laboratory training sites.
- ASCLS believes that medical laboratory certification is the benchmark for appropriately educated and adequately trained staff.
- ASCLS encourages members in the profession to undertake research studies, surveys, and to look more closely at existing data to publish information about the state of the laboratory profession, including workforce challenges, patient safety, quality, and the impact of the profession on healthcare.
- ASCLS supports the promotion of the consulting role of laboratory professionals as an integral part of the clinical care team to patients, health care administrators, providers, educators, policy makers, and the public at large.
- ASCLS supports the promotion of the DCLS in addressing gaps in the patient care continuum.
- ASCLS supports the promotion of a career ladder for staff recruitment and retention, as outlined in the ASCLS Model Career Ladder position paper, 2004.

Adopted by the ASCLS House of Delegates on July 2, 2020.

Reprinted from The Society of American Clinical Laboratory Science. Addressing the Clinical Laboratory Workforce Shortage. Accessed September 27, 2023. https://ascls.org/addressing-the-clinical-laboratory-workforce-shortage/

Appendix 3: ASRT Research on Artificial Intelligence in Medical Imaging and Radiation Therapy

Overall Summary of Research

ASRT's research into artificial intelligence (AI) has aimed to capture the knowledge and attitudes of interested parties, including technologists practicing in medical imaging and radiation therapy, original equipment manufacturers (OEMs) who manufacture equipment with AI-enabled features and provide applications training, and the educators who prepare the next generation of radiologic technologists.

General awareness of AI and machine learning (ML) is high among every one of these groups, according to survey results. The surveys showed consistent awareness of both rigorous definitions of AI and ML, and awareness of AI in everyday technology applications.

Beyond that, however, the extent to which AI is taught, used and understood appears to be highly varied. For example, clinical technologists' awareness and usage of AI-enabled features on the equipment they use is far from comprehensive and showed little in the way of meaningful increase between the original 2019 survey and the resurvey conducted in 2022.

And, while nearly 85% of educators believe that teaching about AI is important, more than 75% of them said that AI is not part of their program's curriculum and almost 60% of those believe that lack of expertise on the part of educators is a key reason their program does not teach AI. Only 11% of educators said their program uses AI-enabled tools in their curriculum.

Meanwhile, clinical technologists are less likely than vendors to see AI as having a beneficial impact on various areas of the profession, and although the differences are not statistically significant, technologists responding to the 2022 survey were generally less sanguine about the impact of AI on matters ranging from throughput, to safety, to quality of scans.

The upshot of these diverse research projects appears to be that there are a wide range of perspectives on AI among interested parties in the radiologic sciences, with practicing technologists, OEM representatives, managers, and educators all having different levels of understanding of what AI does and different perceptions of how it will affect the radiologic sciences as a whole.

Steps must be taken in the creation and use of AI and ML algorithms to mitigate bias that can widen health disparities and inequities.[6] Examples include integration of workflow rules, training on diverse datasets, and implementation of quality assurance measures. The American College of Radiology (ACR) provides input to the United States Food and Drug Administration (FDA) on the clearance of algorithms for use in medical imaging; the ACR's Data Science Institute created a searchable database of these FDA cleared algorithms.[7]

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Initial 2019 Survey
ASRT began studying AI and ML in the radiologic sciences with a 2019 survey. The 2019 Artificial Intelligence Survey was designed to determine working technologists' relationship with AI and ML: their understanding of the concepts, their usage of equipment features that employ AI and ML, and their thoughts on how AI and ML may affect the radiologic sciences in the near future.

The survey asked demographic questions along with questions about general technology use and attitudes toward technology. These questions were used to gauge respondents' overall comfort with technology and to cross tabulate against the more substantive questions about AI and ML within the radiologic sciences to determine potential differences between groups.

This initial survey was sent via email to 20,000 ASRT members in August 2019. When the survey was closed in September 2019, there were 416 complete responses, yielding a response rate of 2.1% and a margin of error of ±4.8% at the 95% confidence level.

The key takeaways from the report included:

- Respondents were largely comfortable with technology and frequently used it in their everyday lives.
- Most respondents were broadly familiar with the concepts of AI and ML.
- Respondents were mixed in their familiarity with AI features on their equipment; however, a majority were confident that those features function correctly and provide trustworthy results. A vocal minority were more skeptical.
- Respondents indicated a lack of standardized process for resolving discrepancies between machine-recommended procedures and technologist judgment.
- Respondents were inclined to see AI as having a beneficial impact on considerations such as safety and quality but worried about a deleterious effect on the more human aspects of the profession, such as patient interaction and creativity.
- Respondents showed no widespread consensus that AI would adversely affect their professional prospects.

Vendor Survey
In order to determine differences between how staff working for original equipment manufacturers (OEMs) and clinical technologists perceive AI, a slightly modified version of the original 2019 survey instrument was sent to corporate vendors in 2021. This modified survey was sent to six different OEMs in March 2021, with instructions to share it internally with 50 employees with knowledge of the firm's business in the radiologic sciences. When the survey was closed in April 2021, 140 complete responses had been received, a response rate of 46.7%.

Vendors were significantly more likely to be familiar with the concepts of AI and ML and to be comfortable with AI being used in their everyday devices. These differences carried over into outlook on how AI and ML will affect medical imaging and radiation therapy: vendors were significantly more likely than the general population to see widespread benefits to implementing AI in the radiologic sciences, with those who attended the ASRT Foundation Corporate Roundtable Summit being especially so. Vendors and Corporate Roundtable Summit attendees were also significantly more likely to see the implementation expanding the role of radiologic science professionals.

2022 Follow-up Survey
In 2022, a repeat survey was sent to the population of ASRT members. The 2022 Artificial Intelligence Follow-Up Survey was sent to the same sample of ASRT members as the original 2019 survey. Subtracting out those who had opted out of emails, the survey was sent to 13,688 people in October 2022. When the survey closed in December 2022, a total of 441 responses had been received. A sample of 441 yields a margin of error of ± 4.7% at the 95% confidence level.

The key takeaways were:

- In general, there were relatively few statistically significant differences in how the 2019 cohort and the 2022 cohort use technology and think about AI and ML in their day-to-day and professional lives.
- Respondents from the respective cohorts were largely the same in their general attitudes toward technology and in how they use technology in their day-to-day lives. The only major change in this area was a significant increase in their use of streaming services.
- Large majorities of both cohorts are familiar with the concepts of AI and ML and are aware of applications to everyday software and devices.
- Respondents were asked about their usage of features on the diagnostic imaging or radiation therapy equipment that employ AI or ML. There were relatively few significant differences in usage between the two cohorts.
- Where significant differences existed, they showed a decline in the usage of specific equipment features.
- The major exception was in radiation therapy, where there were several significant increases in the use of automated features.
- The two cohorts had similar overall levels of trust in the features on their equipment that employ AI and ML.
- The two cohorts were largely aligned in what they perceived to be the potential benefits and drawbacks of automated features in the radiologic sciences.
- A total of 59 responding to the 2022 survey (41.2% of the total 2019 survey respondents) said they had taken the 2019 survey. Among that group, a majority said their understanding of AI had increased since 2019, and that they trusted it more than they did previously.

Educator Survey
Finally, the 2023 AI Educator Survey was sent to 5,066 educators in February 2023. At the close of the survey in April 2023, a total of 373 responses had been received, a response rate of 7.4%. At the widest, this response yields a margin of error of ±4.9% at the 95% confidence level.

The key takeaways from this survey were:

- Most respondents (64.9%) work at a college or university.
- A large majority of respondents (78.3%) actively teach radiography, with 15.8% teaching CT and 11.8% teaching MRI.
- The average respondent has been an educator for 16.1 years, is 51.8 years old and female (74.5%).
- A large majority of respondents (96.2%) were familiar with the concept of AI, with a slightly smaller majority (79.3%) also familiar with ML, and a large majority (97.3%) agreeing that the definitions of these concepts provided within the survey are in line with their own understanding of these issues.

While 84.5% of educators responding to the survey think it is important to teach AI, only 23.7% said their program includes AI in the curriculum. As to why their program does not include AI in its curriculum:

- 59.1% indicated it was due to lack of expertise among educators.
- 45.6% said it was due to lack of guidance on developing a curriculum.
- 39.5% said it was due to lack of time to develop resources.

For those programs that do include AI in their curriculum, the five most common formats were:

- Didactic lessons (47.1%).
- Short, in-person courses (31.0%).
- Asynchronous online short courses (28.7%).
- Live online short courses (27.6%).
- Simulation (23.0%).

A majority of respondents (64.8%) found that their students were interested in AI. However, only 11.1% of programs actually used AI-enabled tools as part of their curriculum. Of those programs, 46.1% of the students used AI-enabled features always or often, while 33.3% used them sometimes and 25.6% used them rarely or never.

Among programs that use AI-enabled tools, the most common uses were:

- To teach general curriculum concepts (53.8%).
- For exam practice (51.3%).
- To allow students to test their knowledge of a topic (38.5%).

Specifically, programs often used AI-enabled tools for:

- Patient positioning (50.0%).
- Image quality evaluation (42.1%).
- Radiation physics (42.1%).

Only 32.7% of respondents indicated that they consider AI systems almost failure free. A plurality of respondents (49.2%) believe bias can occur in AI image processing; another 46.2% did not know. A majority of respondents (70.2%) believe that AI often produces consistent outcomes. A large majority (84.8%) did not believe AI threatens their job. Almost all respondents (98.1%) believe that OEMs need guidance from practicing technologists in the development of their algorithms, and 87.3% believe practicing technologists would be interested in helping to develop such algorithms. Most respondents (82.4%) see the future of the radiologic sciences as being more positive with the implementation of AI.

Staffing Survey

Although not a dedicated AI survey, several questions around AI-enabled features were added to ASRT's biennial Radiologic Sciences Staffing and Workplace Survey, which is sent to managers of imaging facilities. In 2023, over 67% of respondents said they were at least somewhat familiar with the AI-enabled features on the equipment used in their department; more than 57% said their staff was at least somewhat familiar. While 73% of respondents indicated that their facility has received applications training at least once over the last 3 years, 66% said they had never received apps training that specifically focused on AI-enabled features. Nonetheless, almost 53% of respondents said their department was using AI-enabled features the same or more than they had previously over the past 3 years.

Appendix 4. Scope of Practice for Radiologist Assistants

According to the ASRT Practice Standards, the scope of practice of the medical imaging and radiation therapy professional includes:

- Administering medications enterally, parenterally, through new or existing vascular or through other routes as prescribed by a licensed practitioner.
- Administering medications with an infusion pump or power injector as prescribed by a licensed practitioner.
- Applying principles of ALARA to minimize exposure to patient, self and others.
- Applying principles of patient safety during all aspects of patient care.
- Assisting in maintaining medical records while respecting confidentiality and established policy.
- Corroborating a patient's clinical history with the procedure and ensuring information is documented and available for use by a licensed practitioner.
- Educating and monitoring students and other health care providers.
- Evaluating images for proper positioning and determining if additional images will improve the procedure or treatment outcome.
- Evaluating images for technical quality and ensuring proper identification is recorded.
- Identifying and responding to emergency situations.
- Identifying, calculating, compounding, preparing and/or administering medications as prescribed by a licensed practitioner.
- Performing ongoing quality assurance activities.
- Performing point of care testing as prescribed by a licensed practitioner.
- Performing venipuncture as prescribed by a licensed practitioner.
- Postprocessing data.
- Preparing patients for procedures.
- Providing education.
- Providing input for equipment and software purchase and supply decisions when appropriate or requested.
- Providing optimal patient care.
- Receiving, relaying and documenting verbal, written and electronic orders in the patient's medical record.
- Selecting the appropriate protocol and optimizing technical factors while maximizing patient safety.
- Starting, maintaining and/or removing intravenous access as prescribed by a licensed practitioner.
- Verifying archival storage of data.
- Verifying informed consent for applicable procedures.

Additionally, the scope of practice for a radiologist assistant includes:

- Assessing, monitoring and managing patient status, including patients under minimal and moderate sedation.
- Assisting with data collection and review for clinical trials or other research.

- Communicating the supervising radiologist's report to the appropriate health care provider consistent with the ACR Practice Guidelines for Communication of Diagnostic Imaging Findings.
- Completing patient history and physical.
- Emphasizing patient safety and verifying procedure appropriateness by analyzing and incorporating evidenced-based practices for optimal patient care.
- Evaluating images for completeness and diagnostic quality and recommending additional images.
- Identifying and administering radioactive materials as prescribed by a supervising radiologist and under the supervision of an authorized user.
- Identifying variances that may influence the expected outcome through preprocedural evaluation as part of the radiologist-led team.
- Obtaining images necessary for diagnosis and communicating initial observations to the supervising radiologist. The radiologist assistant does not provide image interpretation as defined by the ACR.
- Participating in or obtaining informed consent.
- Participating in quality assurance activities within the radiology practice.
- Performing or assisting with invasive or noninvasive imaging procedures as delegated by the radiologist who is licensed to practice and has privileges for the procedure being performed by the radiologist assistant.
- Providing follow-up patient evaluation.

Appendix 5. 2023 Professional Workforce Survey: Status of Remote Scanning

Respondents were asked a number of questions about the prevalence of remote imaging at their facilities. Overall, only 7.2% of respondents said they work at a health care system that uses remote imaging. Among those who work at a facility that uses remote imaging:

- 89.0% said modality-certified personnel manage the remote imaging equipment.
  - Among the 11.0% (61) respondents who said modality-certified personnel do not manage the remote imaging equipment:
    - 42.9% said it is a registered technologist certified in another modality.
    - 14.3% said it is a medical aid.
    - 7.1% said it is a nurse.
    - 35.7% provided some other explanation.

- 87.3% said modality-certified personnel are screening and positioning the patient onsite where the equipment is located.
  - Among the 12.7% (70) who said modality-certified personnel are not screening and positioning patients onsite:
    - 40.3% said it is a registered technologist certified in another modality.
    - 29.9% said it is a medical aid.
    - 4.5% said it is a nurse.
    - 25.4% provided some other explanation.

- 82.4% said modality-certified personnel are administering contrast agents when appropriate.
  - Among the 17.6% (96) who said modality-certified personnel do not administer contrast:
    - 25.3% said it is a registered technologist certified in another modality.
    - 21.1% said it is a nurse.
    - 5.3% said it is a medical aid.
    - 48.4% provided some other explanation.

- A slim majority (51.7%) said the remote technologist is considered primarily responsible for the procedure; 41.4% said it is the individual who is with the patient, and 6.9% said it is someone else.

- An overwhelming majority of respondents (97.1%) believe the remote technologist should be modality certified. Only 7 respondents believe the remote technologist does not need to be modality certified.

- A similar majority (97.4%) believe the personnel with the patient and equipment should be modality certified, with only 5 respondents believing otherwise.

Respondents were also asked whether they believe that a modality-certified technologist working off-site can teach an onsite technologist certified in another modality to competently perform a procedure; 24.6% said yes, while 75.4% said no.

Asked if they would feel comfortable managing procedures as the primary technologist from a remote location, 28.6% said yes while 71.4% said no. This was largely echoed across primary entry certificates, with between 24.7%-28.2% saying they would feel comfortable remotely managing procedures among all but medical dosimetrists, among whom 36.7% said they would be comfortable managing procedures remotely.

- 28.3% of staff level technologists would be comfortable managing procedures remotely.
- 32.3% of managers would be comfortable managing procedures remotely.
- 20.1% of educators would be comfortable managing procedures remotely.

Asked who they believe should be the primary personnel responsible for a procedure in which remote technology is used:

- 68.2% believe it should be a modality-certified technologist who is with the patient and the equipment.
- 17.5% believe it should be a modality-certified remote technologist.
- 8.2% believe it should be a technologist certified in a different modality who is with the patient and the equipment.
- 6.0% believe it should be other health care personnel who are with the patient and equipment and assisting the remote technologist.

Appendix 6. Memo From Webster, Chamberlain & Bean, LLP Re: Efforts to Attain Learned Professional Designation

This memorandum provides an overview of the learned professional exemption under federal labor laws and an examination of the feasibility of radiologic technologists in achieving such recognition. It looks at the experience of the nursing profession and considers whether radiologic technologists would be able to draw an analogy with nurses sufficient to gain similar recognition. It concludes that such an effort would be very difficult given current interpretation of federal labor law and realities in the profession.

Executive Summary

Given the present interpretation of the learned professional exemption under the Fair Labor Standards Act and related guidance, as well as the difficulty among various health care occupations in gaining similar recognition to that of nurses, it will be very difficult in the current environment for radiologic technologists to claim the learned professional designation.

The Learned Professional Designation / Exemption – An Overview

The basic requirements for meeting the learned professional exemption under the FLSA are as follows:

- The employee must be compensated on a salary or fee basis at a rate not less than $684 per week;
- The employee's primary duty must be the performance of work requiring advanced knowledge defined as work which is predominantly intellectual in character and which includes work requiring the consistent exercise of discretion and judgment;
- The advanced knowledge must be in a field of science or learning; and
- The advanced knowledge must be customarily acquired by a prolonged course of specialized intellectual instruction.

Of these factors, the Department of Labor has consistently emphasized the second factor – i.e. the nature of the work performed – as the most critical. The work must consistently involve the exercise of discretion and professional, independent judgment.

The Nursing Profession and the Learned Professional Designation

Section 13(a)(1) of the FLSA provides an exemption from both the minimum wage and overtime pay requirements for employees employed as executive, administrative, professional and outside sales employees. To qualify for the exemption, nurses must meet certain tests regarding their job duties and be paid on a salary basis of not less than $684 per week.

There is a breakdown in the nursing profession in terms of what kinds of nurses meet this exemption. Registered nurses who are paid on an hourly basis should receive overtime pay. However, registered nurses who are registered by the appropriate state examining board – in most cases – meet the requirements for the learned professional exemption and (so long as they are paid on an hourly basis of at least $684 per week) may be classified as exempt. By contrast, licensed practical nurses and similar health care workers do not – as a general rule – qualify as exempt learned professionals. In large part, this is because possession of a specialized advanced academic degree is not a standard prerequisite for entry into such jobs.

Based on our research, the experience of nurses with respect to the learned professional designation appears to be a special case. In the health care space, physician assistants are arguably the closest parallel. In non-health care, certified athletic trainers and executive chefs (with specialized academic degrees) are commonly cited. In those cases, the learned professional designation stems largely from an ability for such professions to claim that their day-to-day work involves application of intellectual discretion and independent judgment; in the case of an athletic trainer, for instance, the argument would be that they are consistently presented with cases that they have to both diagnose based on their specialized educational background and tailor individualized treatment based on independent judgment. The consistent theme is the ability to demonstrate independent judgment in one's role.

Radiologic Technologists and the Learned Professional Designation

The primary difficulty for attaining the professional occupational category for radiologic technologists lies in the challenge in meeting the second and fourth prongs of the FLSA learned professional test. It is for primarily this reason that R.T.s and many other occupations have struggled in arguing that they should be considered as learned professionals. For example, cardiovascular technologists, diagnostic medical sonographers, nuclear medicine technologists, and magnetic resonance imaging technologists are all classified as technicians under the EEO-1 Job Classification Guide.

While this guide is not itself indicative of the Department's formal classifications, it does serve as a window into the range of professions that – similar to R.T.s – have faced difficulty in seeking the same recognition as nurses. Each faces difficulty in claiming that the ordinary duties of the occupation involve the consistent application of independent judgment. Under the current guidance, it is likely the case that the R.T.'s workplace functions will continue to be viewed primarily as technical.

Educational Factor Under the Learned Professional Designation

One of the main difficulties for radiologic technologists in seeking to gain the learned professional designation, as this research document explored, is the educational prong of the FLSA test for a learned professional. As previously stated, in order to meet this learned professional exemption, the "advanced knowledge" of the profession "must be customarily acquired by a prolonged course of specialized intellectual instruction." While in ordinary thinking one might be justified in thinking that a bachelor's degree satisfies this definition, the requirement is in fact more nuanced.

Put more simply, a bachelor's degree is often not considered enough; more often, evidence of an additional level of specialized training is required. In addition, the Standard Occupational Classification will assign a profession into a category based on the lowest possible level of degree necessary. That is, if an occupation requires either an associate degree or a bachelor's degree, the associate degree level of education will be used to classify that occupation. In 2017 ASRT engaged in research on this same question in relation to a motion which would have amended a position statement to state that the baccalaureate degree is the entry level of medical imaging and radiation therapy education (Research on Main Motion C-17.12). This research document ultimately stated that adopting the position statement would have been problematic for the profession for several reasons, including that it would not accurately reflect the reality of education in radiologic sciences. In the distribution of radiologic technology programs (JRCERT Accredited), this research showed that 72% are at the associate degree level. In the eyes of the Department of Labor, if nothing else, this would represent a continued, major impediment toward receiving the learned professional designation.

Nature of Work or Duties Factor – Learned Professional Designation

Moreover, the most critical factor under the learned professional test is the nature of the work performed. Looking again at the 2017 research, radiation therapists and respiratory therapists have historically been categorized as professionals even though the associate degree is the typical education requirement for entry into the field. By contrast, medical laboratory technologists – whose typical educational requirement for entry into the field is a bachelor's degree – are considered technicians instead of professionals. While this shows that the majority of the professions having an associate degree is not in itself disqualifying to receiving the learned professional recognition, it also does show that in most cases – particularly those that could be considered close calls – the answer will depend more heavily on the nature of the work itself.

In the case of radiation and respiratory therapists, the argument for being categorized as learned professionals is that their work involves the consistent application of discretion and independent judgment based on one's specialized training. Medical laboratory technologists, however, perform work that – at least in the eyes of the Department of Labor – is seen as assisting that of an individual with learned professional status and does not involve the exercise of independent judgment. The approach to this analysis is often formulaic and lacks in a practical awareness of the realities of the workplace and the profession where oftentimes such individuals may be called upon to exercise independent judgment; so even where an R.T. or a medical laboratory technologist is, for all intents and purposes, doing the work of the learned professional, the analysis under the Department of Labor's guidance is to look simply at what the duties of an R.T.'s work are in general. This adds greatly to the difficulty of R.T.s gaining learned professional recognition.

This then is the fundamental difficulty in seeking to obtain learned professional status: the nature of the work is considered the most critical factor and yet it is not interpreted with a practical awareness of changing methods of health care delivery. The Department of Labor, for example, does not consider a licensed practical nurse (LPN) to be an occupation that requires "advanced knowledge or education," and for that reason cannot be a learned professional. R.T.s would have to demonstrate a level of discretion in their day-to-day work environment that likely is far above current conditions; and even then, gaining learned professional recognition would not be definite. Even if this could be accomplished, R.T.s would likely face an uphill battle in contending that their education is sufficient to claim the learned professional designation. Many other professions in the health care space have not been able to make a sufficiently compelling argument to be considered alongside certain nurses as learned professionals.

Relatedly, the Standard Occupational Classification (SOC) looks at whether or not an occupation is supervised by an occupation in another major or minor SOC group, and whether a profession's role is to assist an occupation in another category. This is yet another challenge facing R.T.s with respect to the learned professional designation. Regardless of the practical realities of the workplace and the often-changing nature of health care delivery, the SOC will look at the R.T. role primarily as that of assistant to another learned profession: radiologists. By and large, the experience of the nursing profession with respect to the learned professional designation seems to be a rather special case. We have not come across research which suggests that there is an easy parallel or comparison to another profession that has been able to claim learned professional recognition with the same level of success and consistency as many within the nursing profession. This tends to reinforce the conclusion that R.T.s face a significant challenge in seeking to claim learned professional recognition.

Conclusion

Given the current interpretation of the FLSA exemptions, existing Department of Labor guidance, and present realities in the R.T.'s workplace, it would be very difficult for radiologic technologists to argue for a learned professional designation similar to that which nurses have achieved.

Appendix 7. 2023 Professional Workforce Survey: Professionalism

Respondents were presented with an extensive battery of items describing behaviors associated with professionalism. They were asked to rate each item on a scale of agreement from strongly agree to strongly disagree on whether medical imaging and radiation therapy professionals should exhibit the behaviors in question. In general, respondents tended to agree or strongly agree that medical imaging and radiation therapy professionals should exhibit each of the behaviors listed, however there was variation in the strength of the agreement.

The 5 behaviors with the highest levels of strongly agree were:

- Maintain confidentiality of patient (82% strongly agree)
- Safeguard patient’s right to privacy (80% strongly agree)
- Protect health and safety of the public (78% strongly agree)
- Provide care without prejudice to patients of varying lifestyles (76% strongly agree)
- Maintain competency in area of practice (76% strongly agree)

The 5 behaviors with the lowest levels of strongly agree were:

- Participate in peer review (39% strongly agree)
- Participate in public policy decisions affecting distribution of resources (38% strongly agree)
- Refuse to participate in care if in ethical opposition to own professional values (37% strongly agree)
- Participate in activities of professional associations (35% strongly agree)
- Participate in research and implement research findings appropriate to practice (30% strongly agree)

Medical imaging and radiation therapy professionals should exhibit these behaviors:

Behavior	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total	Mean
Maintain confidentiality of patient	**82%**	17%	1%	0%	0%	8,630	1.80
Safeguard patient's right to privacy	**80%**	19%	1%	0%	0%	8,638	1.78
Protect health and safety of the public	**78%**	20%	2%	0%	0%	8,641	1.74
Provide care without prejudice to patients of varying lifestyles	**76%**	21%	2%	0%	0%	8,626	1.72
Maintain competency in area of practice	**76%**	22%	2%	0%	1%	8,638	1.72
Protect moral and legal rights of patients	**75%**	22%	2%	0%	0%	8,637	1.71
Accept responsibility and accountability for own practice	**71%**	26%	2%	0%	0%	8,638	1.66
Maintain a practice guided by principles of fidelity and respect for person	**67%**	29%	3%	0%	0%	8,620	1.63
Act as a patient advocate	**63%**	29%	6%	1%	0%	8,633	1.54
Request consultation and collaboration when unable to meet patient needs	**62%**	32%	4%	0%	0%	8,652	1.56
Engage in ongoing self-evaluation	**57%**	36%	5%	1%	1%	8,657	1.48
Initiate actions to improve environments of practice	**56%**	37%	6%	0%	0%	8,643	1.49
Promote and maintain standards where planned learning activities for students take place	**56%**	35%	8%	1%	1%	8,636	1.45
Protect rights of participants in research	**55%**	33%	11%	0%	0%	8,628	1.43
Establish standards as a guide for practice	**55%**	37%	7%	1%	0%	8,638	1.46
Seek additional education to update knowledge and skills	**54%**	36%	8%	1%	1%	8,647	1.41
Promote equitable access to medical imaging, radiation therapy and health care	**50%**	37%	11%	1%	1%	8,636	1.33
Assume responsibility for meeting health needs of culturally diverse populations	**48%**	34%	14%	2%	2%	8,630	1.24
Educate national, state and local legislators and regulators on the important role medical imaging professionals and radiation therapists play in the provision of health care	**48%**	34%	15%	2%	1%	8,627	1.26
Confront practitioners with questionable or inappropriate practice	**47%**	37%	13%	2%	1%	8,631	1.26
Recognize role of professional associations in shaping health care policy	**42%**	**42%**	14%	2%	1%	8,633	1.22
Advance the profession through active involvement in health-related activities	**41%**	39%	18%	2%	1%	8,639	1.17
Participate in peer review	39%	**40%**	18%	2%	1%	8,648	1.13
Participate in public policy decisions affecting distribution of resources	**38%**	**38%**	21%	2%	1%	8,639	1.10
Refuse to participate in care if in ethical opposition to own professional values	**37%**	24%	24%	9%	6%	8,602	0.78
Participate in activities of professional associations	35%	**36%**	26%	3%	1%	8,628	1.00
Participate in research and implement research findings appropriate to practice	30%	**37%**	30%	3%	1%	8,625	0.92

Note. Sorted descending on Strongly agree.

Rating for mean: Strongly agree = 2, Agree = 1, Neutral = 0, Disagree = -1, Strongly disagree = -2

Appendix 8. Requirements To Develop a New Undergraduate Degree Program in the University of North Carolina (UNC) System

Proposals for new undergraduate degrees must submit a *Request for Preliminary Authorization for New Academic Degree Program* (using the *Request to Establish* as a guide). The Department or Curriculum must create the proposal and have it approved through all internal, departmental, or program processes.
• The Dean of the appropriate College or School must approve the proposal prior to submission to The Office of Undergraduate Curricula.
• For degree programs housed in the College of Arts and Sciences, the Administrative Boards must approve the proposal prior to submission to the Office of the Provost. For degree programs administered in a Professional School, the College's Administrative Boards will review and provide feedback.
• The Office of the Provost will review the proposal, request any changes, and report on progress to the Faculty Council as appropriate.
• Upon approval by the Provost, the Chancellor will review, approve, and update the Board of Trustees as appropriate.
• The Chancellor will authorize submission of the proposal to the UNC System.

Notification to the UNC System may be sent at any time, but programs should plan on a year-long planning process at minimum prior to the proposed date of establishment. Please see the sample timelines for the order and expected response times for the approval stages.
The UNC System's approval of the *Request for Preliminary Authorization* and permission to submit the *Request to Establish* does not constitute a commitment on the part of the Board of Governors to approve the program. UNC System Academic planning maintains a listing of all programs being planned system-wide. All undergraduate degree program proposals approved for planning must submit a *Request to Establish New Academic Degree Program.* The proposal should be reviewed once again by the same campus units that reviewed the *Request for Preliminary Authorization* before it is submitted by the Chancellor to the UNC System. A report summarizing progress can be provided by the Chancellor to the Faculty Council or Board of Trustees as appropriate.
All proposals should ensure they address the following key areas:
• Budget information, especially addressing how the new program will be implemented, supported, and sustained if there should be no enrollment growth funding;
• Student demand for the program;
• Societal need for the program (i.e., employment opportunities for graduates);
• Collaboration opportunities considered/investigated with other institutions; and
• How the proposed program supports the campus' Institutional Mission.

After collecting all feedback from the external reviews (where appropriate), the UNC System will recommend approval of the program to the Board of Governors' Committee on Educational Planning, Policies & Programs, and through it, to the full Board. In general, reviews will be completed within 3 to 6 months. Once complete, the UNC System will notify the Chancellor, who will inform the University and campus offices involved. The program, the Office of Undergraduate Curricula, and the Office of the University Registrar work collaboratively to institute the necessary procedures for the new degree program.

Reprinted from The University of North Carolina at Chapel Hill. Developing New Undergraduate Program. https://curricula.unc.edu/program-proposals/developing-new-degree/ Accessed October 12, 2023.

