
ACR-SNM Task Force on Nuclear Medicine Training: Report of the Task Force

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The expansion of knowledge and technological advances in nuclear medicine and radiology require physicians to have more expertise in functional and anatomic imaging. The convergence of these two specialties into the new discipline of molecular imaging has also begun to place demands on residency training programs for additional instruction in physiology and molecular biology. These changes have unmasked weaknesses in current nuclear medicine and radiology training programs. Adding to the impetus for change are the attendant realities of the job market and uncertain employment prospects for physicians trained in nuclear medicine but not also trained in diagnostic radiology. With this background, the ACR and the Society of Nuclear Medicine convened the Task Force on Nuclear Medicine Training to define the issues and develop recommendations for resident training.

Key Words: Nuclear medicine; radiology; molecular imaging; resident training

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BACKGROUND

Since its inception, nuclear medicine (NM) has been noteworthy for its innovation and unique expertise in using radioisotopes for assessing organ function. More recently, this expertise has progressed to characterizing these processes at the cellular and subcellular levels with the emergence of molecular imaging. Within the past decade, assessment of function has become enhanced by the emergence of hybrid imaging techniques, notably PET/CT and SPECT/CT, which combine anatomic and functional imaging. Hybrid imaging has significantly increased the skills needed to practice. For radiologists who are already trained in anatomic imaging with some training in NM, the task has been to become more skilled in functional imaging, including PET. For NM physicians, additional training in ana-

tomic imaging has become necessary. The increasing use of radioisotopes for therapy, including radioimmunotherapy, radioactive microspheres, palliation of bone pain, and thyroid therapies, has required more training for radiologists and NM physicians.

During the past 2 decades, training programs in diagnostic radiology (DR) and in NM have maintained their separation as each discipline continues to pursue its primacy in anatomic and functional imaging, respectively (1). With a variety of training pathways accredited by 2 different ACGME residency review committees (RRCs), and with multiple pathways to certification offered by 2 separate American Board of Medical Specialties boards, significant variation in the experience and scope of skills of trainees has been inevitable. In the midst of these challenges in residency training, and fully recognizing the inherent complexities and limitations in the current training structures, the leadership of 2 prominent professional organizations, the ACR and the Society of Nuclear Medicine (SNM), submitted to work together to define the issues and seek solutions. As a consequence, in January 2009, the joint ACR-SNM Task Force on Nuclear Medicine Training was appointed, consisting of members of both societies with extensive experience in radiology and NM training in a wide variety of organizational and training venues. This organizational experience included the radiology and NM RRCs, the ABR and the American Board of Nuclear Medicine (ABNM), as well as the ACR and the SNM.

The task force members included Milton J. Guiberteau, MD (ACR Co-Chair), Michael M. Graham, PhD, MD (SNM Co-Chair), Manuel L. Brown, MD, Peter S. Conti, MD, PhD, Lawrence P. Davis, MD, Gary L. Dillehay, MD, Darlene Metter, MD, Leonie L. Gordon, MD, M. Elizabeth Oates, MD, and Henry D. Royal, MD.

In its deliberations, the task force was charged with the following:

1. Describe the current pathways to NM and radiology practice in the United States.
2. Review and compare the types and demographics of training programs serving these pathways.
3. Characterize and compare the educational backgrounds of those entering these training programs.

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4. Compare and contrast the inherent curricula and skills training of the programs.
5. Describe and characterize the formal requirements and oversight of these programs (RRC).
6. Review and compare the certifying bodies available to the graduates.
7. Assess the practice opportunities for and limitations facing graduates of the different training pathways.
8. Offer suggestions for possible changes in training to ensure appropriate skills.
9. Offer summary conclusions with insights and concerns regarding redundancies, economies, and opportunities for consolidation and cooperation that may be available in the future.

To acquire the information required by these charges and to accomplish the goals of the task force, 4 work groups consisting of paired task force members (one from the ACR and one from the SNM) were created: (1) the RRC work group, (2) the board certification work group, (3) the training pathway work group, and (4) the economics work group. The information gathered by each work group was obtained from peer-reviewed literature, Web sites and publications of relevant organizations (eg, the ACGME, ABR, ABNM, and SNM), and Web-based surveys of appropriate peer groups (see the Appendix). Although not presented in detail, the information collected was rigorously reviewed and used in the deliberations and conclusions of the task force. However, given the strong consensus for the need of timely recommendations for advancing the prospects of change in existing training pathways to NM practice, now and for the future, in this summary report we deliberately focus on the task force's conclusions and recommendations, with few necessary exceptions.

THE ROLE OF HISTORY

To understand the current issues in NM and radiology training, a brief overview of their origins and influence on the present is instructive (2). With the discovery of x-rays and naturally occurring radioactivity in the late 19th century, the therapeutic uses of radiation were paramount. However, primarily because of the ready availability of the x-ray tube, imaging the human body using x-rays quickly evolved, while modern physiologic imaging with radioisotopes awaited the advent of the rectilinear scanner, gamma camera, and radiopharmaceuticals more than a half century later. By this time, the specialty of DR, with standardized training programs, had become established, and radiologists had developed considerable interest in the use of radioisotopes within their specialty. The evolution of board certification in isotopic medicine began in the mid-1950s, when the ABR offered certification of radiologists in NM. However, the growing field of NM also attracted the keen interest and participation of physicians within a broad spectrum of medical training backgrounds besides radiology, including internal medicine, pathology, and others.

Competition for recognition of expertise through certification ensued. In 1971, the ABNM was formed as a conjoint board sponsored by 3 American Board of Medical Specialties boards: the ABR, the American Board of Internal Medicine, and the American Board of Pathology, as well as the SNM. Certificates of this conjoint enterprise were issued to successful qualified candidates from any medical background and were signed by the representatives from all 3 boards and the SNM.

The ABR withdrew from ABNM sponsorship and began offering its own certificate of competence in nuclear radiology in 1973. Subsequently, the ABNM became a primary member of the American Board of Medical Specialties, with a single sponsoring organization, the SNM. This schism set the stage for the duality of training and certification, which persists today. Thus, there are 2 separate board certifications: one in nuclear radiology from the ABR and another in NM from the ABNM, with different training pathways to each certificate. These 2 parallel pathways, with their differing specialty backgrounds and cultures, have continued for more than 4 decades.

The recognition of the strengths inherent in combined anatomic and functional imaging, as well as new skills required for molecular imaging, have prompted a reassessment of the optimal skills needed for imagers of the future. And because of health care reform and economic pressures, the implications for physician training in NM for radiologists and nonradiologists alike have become increasingly clear and pressing (3,4).

TRAINING IN THE ERA OF HYBRID AND MOLECULAR IMAGING

CT images that are acquired as part of PET/CT and single photon-emission SPECT/CT need to be interpreted by a physician with appropriate training and experience, which has resulted in recognition that NM physicians must obtain additional training in CT, although there is no consensus on the appropriate amount of training. In addition, molecular imaging requires a broad understanding of metabolism, receptors, cell signaling pathways, and molecular biology. The recent reduction in the number of months devoted to NM within radiology residency programs renders molecular imaging training unlikely within the current scope of prescribed training, although some programs may be able to provide such experience as electives. Furthermore, any expansion of anatomic imaging in NM residency programs necessarily comes at the expense of additional training in functional and molecular imaging. Designing training programs for the future will require careful attention to the trade-offs to ensure balance as well as expertise.

To understand how training requirements in NM might change in the future requires an understanding of the current available training pathways (5). Until 2007, NM training programs required 1 clinical year followed by 2 years in NM. Because of the recognition of the need for more training in CT, as well as the requirement for more

experience in the expanding aspects of the field, the training program was extended by 1 year. The current ACGME requirement for NM training is 1 clinical year followed by 3 years of NM training in an ACGME-approved program. Nuclear medicine residents who are already board certified or board eligible in other clinical specialties are required to train for only 2 years in NM. Nuclear medicine residents who are board certified or board eligible in DR are required to train for only 1 year in NM. There are 54 such programs currently available with 193 positions, of which 158 are filled for the 2010-2011 academic year.

Diagnostic radiology residents have at least 4 months of NM rotations during their residencies. In recent years, 1 or 2 of those months are often dedicated to PET/CT imaging, so that many radiology residents complete only 2 to 3 months in general NM. Before 2001, radiology residency programs required 6 months of NM training, but the requirement was decreased to 4 months when the Nuclear Regulatory Commission decreased some requirements for authorized users of radioactive materials. This trend of decreasing general NM training in DR residencies has become a cause for concern, as it is generally agreed that radiologists interpret the bulk of noncardiac, general NM procedures in the United States. Another training pathway for diagnostic radiologists seeking additional expertise in NM after the completion of residency is the 1-year, ACGME-approved nuclear radiology fellowship. There are 21 such programs currently available with a total of 35 positions, of which 15 are filled for academic year 2010-2011, revealing underutilization of this pathway.

Further supporting the inevitable need to change the existing training pathways are the many advances in technology, such as PET/MRI, as well as the development of new radiopharmaceuticals for molecular imaging. To take full advantage of these technological innovations, optimized training in complementary anatomic and physiologic imaging techniques will be mandatory. The introduction of these new technologies into training programs before clinical adoption is problematic, but they will never become part of clinical practice unless a significant number of imaging physicians have the knowledge and skills to use these approaches effectively.

TRAINING PATHWAYS FOR THE FUTURE: RECOMMENDATIONS

There was general agreement among the members of the task force that future radiologists and NM physicians will need more training in anatomic and functional imaging to be fully competent in the emerging field of molecular imaging. It is envisioned that most molecular imaging will be practiced by physicians who are dual certified by the ABR and the ABNM. It was also recognized that at present, there is still a need for general radiologists with basic NM training and for NM physicians with basic training in anatomic imaging.

The recommendations of the task force are summarized in Table 1. Pathways that would achieve the goals are as follows:

- A fully integrated radiology and NM training program: As envisioned by the task force, this would consist of a clinical year followed by a minimum of 3 years of radiology and 2 years of NM in temporal sequence designed to best suit the goal of achieving trainee expertise in both disciplines. Once trainees complete such a program, they will be well trained in both modalities and be board eligible for ABR certification in DR, ABNM certification in NM, or ABR subspecialty certification in nuclear radiology. Challenges likely exist to the funding for such a program, and creative solutions must be found.
- Incorporating NM fellowships within existing DR residencies: With the recent change to a 36-month core curriculum in DR residencies and the increase in permissible months of training in any one subspecialty area from 12 to 16 months within a 48-month program, the opportunity for significant additional NM training in DR residencies has become feasible. In 2010, the ABR approved 16 months of NM training within a DR residency at institutions with ACGME-approved nuclear radiology fellowships as a pathway to ABR subspecialty certificate eligibility, after obtaining certification in DR. In addition, the ABNM has approved a similar pathway at institutions with ACGME-approved NM residencies as leading to eligibility for its certifying

TABLE 1
Summary of Task Force Recommendations

A. Training programs	1. Short-term horizon	a. Harmonize NM residency and nuclear radiology fellowship program requirements
		b. Improve robustness of NM training in DR residencies
	2. Long-term horizon	c. Improve robustness of radiology training in NM residencies
		d. Encourage 16-month NM training pathway within DR residencies
B. Board certification	1. Short-term horizon	a. ABR and ABNM form strategic alliances to facilitate certifications for emerging training pathways of mutual interest
	2. Long-term horizon	a. Develop an ABR and ABNM combined certificate in molecular imaging

examination at the completion of DR residency. Although this should be a desirable training pathway for those interested in pursuing careers in NM, it is limited by the smaller number of institutions meeting the requirement and by the number of programs that can comfortably plan and arrange for 16 months of training in NM.

- Adding significantly more experience in radiology to NM training programs: Beginning July 1, 2011, the training requirements in NM will mandate 4 to 6 months of training in CT, during which time it is possible to acquire experience in the interpretation of 500 CT cases (6). This amount of training is regarded as minimal and will not be sufficient if MRI becomes a necessary part of the training. Extending the current 3-year training program by another year would provide time for up to 16 months in radiology, with extensive training in both CT and MRI, as well as some experience in ultrasound. Once trainees complete such a program, they will be board eligible by the ABNM and will have sufficient radiology training to be skilled in the interpretation of CT and MR images acquired as part of any hybrid molecular imaging study.
- Adding significantly more experience in NM within radiology training programs: Current 4-year radiology training programs require only 4 months of NM. Radiology residents who intend to practice NM as a significant part of their future clinical activity within their primary radiology practice should take additional NM training. This should be feasible with the coming restructuring of radiology residency programs, which allows residents to concentrate their training more narrowly in one or more areas during the final year of residency. It is not clear what fraction of radiology residents would select this pathway, and perhaps educational efforts will need to be developed to demonstrate the advantages of selecting NM as an area for concentration of study. In addition, the option is limited by the number of radiology programs that can comfortably plan and arrange for 16 months of training in NM.
- Adding significantly more experience in NM after radiology training via the nuclear radiology fellowship: For several years, this has been an available pathway for radiology residents who have completed their residencies to obtain additional training in NM, although relatively few residents enter this route. Trainees are eligible for a certificate of added qualification from the ABR after completion of the program. Nuclear radiology trainees are not ABNM eligible because the training and experience requirements in therapy with unsealed sources are different from those required by the ABNM. Harmonizing or even equalizing the curricula for the nuclear radiology fellowship with the 1-year NM residency available to physicians who are board certified in DR is desirable. This would

have the advantages of uniformity of training, equivalency of Nuclear Regulatory Commission authorized user status, and eligibility for the ABR subspecialty certificate in nuclear radiology or the ABNM certificate in NM. In addition, the cooperative development of requirements for the various training pathways would allow more rational mentoring and guidance of imaging trainees by facilitating a match between their anticipated level of clinical practice and the most appropriate NM training.

- Molecular imaging fellowships to train future academic molecular imaging physicians: Residents who are interested in academic careers may do PET or research fellowships for 1 year to increase their knowledge base and gain experience in clinical and basic research that they will carry into their subsequent careers. There is a definite need for such programs to continue and even expand. They should accept both radiologists and NM physicians into the programs.

Implementation of these suggestions would be aided by vetting through strategic alliances between the DR and NM RRCs, as well as the ABR and ABNM. Such movement requires the anticipation of reciprocal or mutual benefits and trust. However, because these organizations have powerful status as purveyors of change in training, such cooperation would greatly facilitate timely responses to the challenges of the future.

CONCLUSION: A TASK FORCE FACILITATING CHANGE

Although changes in training pathways may be seen as necessary by this task force, and recommendations for change have been advanced, the task force is cognizant that hurdles must be leaped and barriers taken down. Given the well-developed cultures that have evolved around the current training pathways, RRCs, and certifying boards and the substantial territorial investments in ownership by both radiology and NM, community-wide acceptance of a new paradigm of compromise and cooperation will be a critical step going forward. Although this task force is composed of members with prominent leadership roles in the major stakeholder organizations, these members do not actually represent the governing bodies of these organizations on the task force. Thus, the recommendations presented as an outgrowth of this forum must be taken as proposals for further discussion by the stakeholders. These include the radiology and NM RRCs, the ABR and ABNM, and the ACR and SNM and their respective memberships. The acknowledgment of barriers to substantial changes in the status quo within and between the NM and radiology professional organizations and desire to craft solutions for their resolution are imperative for a positive result. It is our earnest hope that the information collected, the analyses offered, and the suggestions for change presented by the task force will serve as a beginning for further discussions and, ultimately, cooperative actions among the stakeholders

representing the wider professional community. The foremost desired outcome of these recommendations is better patient care. There is much to be accomplished.

APPENDIX: TASK FORCE SURVEYS

To better understand the current training environment and employment opportunities, the ACR-SNM Task Force on Nuclear Medicine Training conducted 2 small surveys of the following groups: (1) NM program directors were surveyed regarding the demographics of NM residents, and (2) chairs of DR (academic and community based) and chiefs of NM sections were queried regarding attending physician salaries, interpreting physician certifications, anticipated manpower needs, and preferred training pathways and most important capabilities for potential NM physician hires. Selected data pertinent and important to the task force's deliberations and conclusions are summarized below.

Survey of NM Program Directors

Fifty-seven NM residency programs were contacted. Twenty-two responded to the survey.

On average, 2 residents complete each program per year. More than 50% of NM residents are international medical graduates. About 30% of residents enter with prior training in radiology, and about 35% of residents move into radiology training after leaving the NM programs. Thus, approximately 65% of trainees obtain additional training in radiology. About 75% get jobs within 6 months of graduating, but only about 40% obtain positions in private practice.

Survey of Diagnostic Radiology Department Chairs and Nuclear Radiology Section Chiefs

A total of 508 surveys were sent, with 108 respondents.

Salaries. Forty-four percent hire only radiologists. Of the remainder, about 50% pay NM physicians and radiologists equally, and about 50% pay radiologists salaries higher than the NM physicians.

Certification. Among physicians who interpret their facilities' NM studies, 28% have ABR DR and ABNM certification, 26% are ABNM certified only, 32% have ABR DR certification only, 7.5% are ABR certified DR and have nuclear radiology certificates of added qualification, and 6% are ABNM certified with 3 to 4 months of additional cross-sectional training.

Anticipated Future Manpower Needs. Seventy-five percent of respondents indicated a need for additional or replacement physicians in NM and PET/CT in the next 3 to

5 years, 66% indicated that their need for physicians to provide NM coverage would remain unchanged in the near future, and 31% thought the need would increase and 3% thought it would decrease.

Employer-Preferred Training of NM Hires. Twenty-seven percent of respondents preferred diagnostic radiologists with standard NM training during residency, 45% preferred diagnostic radiologists with an additional year of NM training, 8% preferred NM physicians (nonradiologists) with standard NM training, 8% preferred NM physicians (nonradiologists) with 3 to 4 months of cross-sectional imaging training, and 12% preferred NM physicians (nonradiologists) with an additional year of cross-sectional imaging.

Most Important Consideration in Choosing an NM-Capable Imaging Physician. Sixty percent cited the ability to provide daily coverage or take calls in areas other than NM, and 22% cited advanced NM or molecular imaging training.

Summary of Task Force Conclusions from Survey Data

- Physicians with only NM training have severely limited employment prospects, especially in the private sector.
- Conversely, physicians with both radiology and NM training have excellent employment prospects in all market segments.
- A slim majority (60%) of trainees seem to have solved this issue for themselves by pursuing 2 separate residencies or fellowships in nuclear radiology.
- Combined training pathways are a more efficient solution for the training of NM physicians for clinical practice.

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