Nuclear Medicine Training in Europe: "All for One, One for All"

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The crucial question with respect to nuclear medicine training requirements is what we are aiming for. Are we aiming for a "driver's license," allowing us to drive safely under standard conditions, or is it our ambition to train "Formula 1 drivers," experts who know every part of a car, competent to get the maximum out of it in different terrains and weather conditions and to provide engineers with the necessary feedback on every detail for further improvement of the car's performance?

When it comes to nuclear medicine training, both options allow physicians to safely and adequately perform diagnostic and (depending on the "license") therapeutic nuclear medicine procedures in clinical routine. However, only the "Formula 1 driver" option ensures that the next-generation nuclear medicine physicians will have the necessary skills and competence to shape the best conditions for the further development of molecular imaging and radionuclide therapy.

Nuclear medicine in Europe has never been in a better shape than today. This is no coincidence but the result of nuclear medicine's being an independent specialty with a 4- to (mostly) 5-y dedicated training program in most European countries. The advantage of such a dedicated training program is that it covers the pathophysiology and biology of diseases, therapy-related radiobiology and dosimetry, integration of functional and molecular imaging in the clinical context, and patient management. This clinical and translational approach has been the cornerstone of nuclear medicine since its foundation about 60 y ago as a joint initiative of internal medicine physicians, physiologists, and clinical biologists. This "genetic" link between "molecule and man" providing insight on the potential of radiopharmaceuticals and on the clinical need in patient management is undoubtedly the key to success, resulting in the recent major advances in molecular imaging and theranostics and opening the door for patient-tailored image-guided therapy.

From a technical point of view, the emerging field of hybrid imaging during the past decade has contributed tremendously to the increased impact of nuclear medicine on patient management, facilitating the localization of molecular findings and hence improving diagnostic accuracy. The introduction of hybrid imaging has created the need for changes in the nuclear medicine training program to provide sufficient expertise in anatomic cross-sectional imaging, allowing an integrated interpretation and report of the hybrid examination.

Although professional activity is regulated by national law in European Union (EU) member states, the European Union of Medical Specialists (UEMS) and European boards provide specialty-based recommendations for decision makers at the national and European levels to comply with the European Directive (2005/36/EC) establishing the mechanism of automatic mutual recognition of qualifications for medical doctors according to training requirements within all member states. During the council of the UEMS held in Tel-Aviv in April 2017, the training requirements for the specialty of nuclear medicine were discussed and officially endorsed (*1*). The resulting document defines specialist competencies and procedures and describes how to document and assess them; it aims to provide the training requirements not only for trainees but also for trainers and training institutions. Compared with the previous version, the new version fully integrates hybrid imaging into the content of training regarding both theoretic knowledge and practical and clinical skills.

Because of the many differences among EU member states with respect to national laws on professional activity (e.g., the use of unsealed radioactive sources is in most EU countries restricted to nuclear medicine physicians, whereas in other countries its use is authorized for other specialties; a double specialization is allowed in one EU country and prohibited in another), there is a wide diversity of nuclear medicine training programs across Europe, resulting in significant differences in competencies among nuclear medicine physicians, particularly in the field of hybrid and cross-sectional imaging.

In most EU countries, a dedicated nuclear medicine training program is applied, often consisting of 1–2 y of training in internal medicine, as well as integration of education and training in hybrid imaging into the nuclear medicine curriculum, with or without dedicated training in anatomic cross-sectional imaging in radiology. Some countries changed their nuclear medicine curriculum recently.

In the United Kingdom, nuclear medicine services are provided by 2 groups of specialists registered as consultants: nuclear medicine physicians who can provide comprehensive radioisotope services that include both diagnostic and therapeutic services, and radionuclide radiologists who provide diagnostic radioisotope services. A new training curriculum for nuclear medicine physicians was implemented in August 2015, expanding the training program from 4 to 6 y (*2,3*). After completion of core medical training and the Royal College of Physicians membership examinations or equivalent, the first 3 y

Received Oct. 15, 2017; revision accepted Oct. 17, 2017.
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Published online Oct. 19, 2017.

DOI: 10.2967/jnumed.117.201012

are dedicated primarily to the acquisition of radiologic skills under the auspices of the Royal College of Radiologists. The second 3 y are dedicated primarily to nuclear medicine training under the Royal College of Physicians. As a result, nuclear medicine physicians who complete the new curriculum will have diagnostic radiology skills equivalent to those of their radiology peers without having lost any opportunities in terms of clinical or scientific experience, training, and qualifications, offering the best of both worlds. The curriculum of radionuclide radiologists (5 y of radiology training plus 1 y of radionuclide subspecialty radiology training) remained unchanged.

In The Netherlands, a combined 5-y residency curriculum for radiology and nuclear medicine (*4*) has been implemented, with 8 differentiations or subspecialties, including a nuclear medicine and molecular radiology subspecialty, consisting of 20 mo of nuclear medicine training. Whether this new training program will allow automatic mutual recognition of the qualifications of a future Dutch "nuclear radiologist" as a nuclear medicine physician in other EU countries and vice versa is still an open question. The same applies for the short- and long-term effects on the development of nuclear medicine–related research at a national level.

Given the wide diversity of national nuclear medicine training programs across Europe and the changing educational needs of the nuclear medicine community, the European Association of Nuclear Medicine (EANM) decided to review and modernize its educational system by founding the European School of Multimodality Imaging and Therapy (ESMIT) in 2016 (*5*) as a response to the rising demand for education and training in multimodality imaging and the fast-evolving field of theranostics. ESMIT is structured in 3 levels. Level 1, the entry level, is a 100% electronic learning platform covering basic topics. All contents can be viewed free of charge; they build the basis of knowledge required for levels 2 and 3. Level 2, the intermediate level, goes to the heart of evidence-based teaching, focusing on clinical practice by providing a mixture of theoretic and practical, interactive 3-d courses in academic centers all over Europe. In level 3, the advanced level, knowledge is deepened and expanded for individuals developing subspecialty areas of interest. These high-end courses are held in the EANM Learning Center in Vienna. EANM/ESMIT and UEMS/EBNM (European Board of Nuclear Medicine) are working closely to provide certification for each ESMIT level by next year.

In conclusion, the translational and clinical roots of nuclear medicine are the strength of the specialty and the driving force behind the fast-emerging field of diagnostic and therapeutic applications with radiopharmaceuticals, catalyzed by the introduction of hybrid imaging. In Europe, these clinical and translational genes of the specialty are still dominant and expressed in the nuclear medicine training programs in most European countries, consistent with the nuclear medicine syllabus of the UEMS and providing current and future nuclear medicine trainees with the dedicated background needed to contribute to the further development of nuclear medicine throughout Europe. Recent technologic and radiopharmaceutical developments have contributed to tremendous progress in the field of nuclear medicine, creating the need for changes in nuclear medicine training programs. ESMIT is EANM's answer to this need for education in cross-sectional and multimodality imaging as well as in rapidly emerging diagnostic and therapeutic nuclear medicine procedures by providing a 3-level education structure (from the basic to expert levels); a certification for each level is under development in collaboration with UEMS/EBNM.

DISCLOSURE

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGMENTS

We thank Charlotte Fowler for her input with respect to nuclear medicine training in the United Kingdom.

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