# The regulatory background of nuclear cardiology in Europe: a survey by the European Council of Nuclear Cardiology

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**Abstract.** *Purpose:* Nuclear cardiology is a well-validated, non-invasive imaging modality that is highly cost-effective as a diagnostic and prognostic tool in the evaluation of patients with known or suspected coronary artery disease. However, the number of procedures in Europe is very far from that which would be expected on the basis of epidemiological data, particularly when comparison is made with the USA. As a preliminary step for future action aimed at improving and increasing nuclear cardiology practice in Europe, the European Council of Nuclear Cardiology performed a survey to identify the regulatory issues and the training components pertaining to the practice of nuclear cardiology.
*Methods:* a questionnaire was sent to 31 national nuclear medicine societies and to 40 national cardiology societies. The main areas covered by the survey were: (1) the license requirements, (2) the theoretical and practical aspects of training and (3) supervision of the stress test during a nuclear cardiology study.
*Results:* The results show that, in a setting of wide heterogeneity of national regulations, education and professional practice, nuclear medicine is a restricted and closely regulated specialty. This situation guarantees the quality and safe use of radionuclides; at the same time, however, it limits integration of nuclear medicine into the clinical arena.
*Conclusion:* Cardiologists should become more involved in nuclear cardiology, to further stimulate the use of this powerful diagnostic and prognostic imaging modality.

*Keywords:* Cardiac imaging – Education – Nuclear cardiology – Nuclear medicine

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## Introduction

Over the past 20 years, nuclear cardiology has emerged as a well-validated, non-invasive imaging modality and has proven to be cost-effective in the diagnostic and prognostic assessment of patients with known or suspected coronary artery disease [1–5]. Despite the many "evidence-based" qualities, the number of myocardial perfusion imaging (MPI) studies performed in Europe is far from that which would be expected on the basis of epidemiological data, and is in fact very low as compared with the number of procedures performed in the USA.

This lower usage of nuclear cardiology procedures in Europe may be related to a lesser demand by referring cardiologists, limited supply by an inadequate number of nuclear medicine facilities or lack of involvement of

cardiologists in the performance of nuclear cardiology. The latter point in particular may derive from cultural limitations (e.g. nuclear cardiology is not part of the cardiology curriculum in most European countries), logistical problems (e.g. absence of the cardiologist to perform the stress test), regulatory issues (e.g. cardiologists are not allowed to handle radionuclides) or the reimbursement policy (the cardiologist cannot obtain reimbursement for nuclear cardiology studies).

To provide a platform for future efforts aimed at improving the practice of nuclear cardiology in Europe, the European Council of Nuclear Cardiology (ECNC, http://www.ecnc-nuclearcardiology.org/index.php) performed a survey to identify the regulatory issues and the training components pertaining to the practice of nuclear cardiology.

## Methods

A questionnaire was sent out to 31 national nuclear medicine societies and to 40 national cardiology societies. The main topics of this survey covered were:

1. The license requirements
2. The theoretical and practical aspects of training
3. The supervision of the stress test during a nuclear cardiology study

The questionnaire structure is reported in the Appendix. Data are reported as absolute numbers or percentages.

## Results

Replies were received from 25 countries (81% of national nuclear medicine and 62% of cardiology societies): Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Israel, Italy, the Netherlands, Norway, Poland, Portugal, Romania, Russia, Spain, Sweden, Switzerland, Turkey and the United Kingdom (UK). The answers to the questionnaires formed the basis of the currently reported analysis.

### *License requirements*

In addition to specialist training, all countries except Sweden require a specialist to have a specific licence to handle radiopharmaceuticals, but access to such a licence varies among the countries (Table 1). In Belgium, Cyprus, Czech Republic, France, Italy, Norway, Portugal, Russia, Turkey and the United Kingdom, nuclear medicine specialists are licenced to handle radiotracers without additional training. In Austria, Bulgaria, Denmark, Estonia, Germany, the Netherlands, Switzerland, and Spain, additional training, mainly in radiation protection, is required. In Finland and Israel, the licence is awarded to the hospital or the department, which is required to ensure that only trained staff members perform nuclear medicine procedures. In Hungary, physicians with radiation protection certification can obtain a licence to administer radiopharmaceuticals without further training.

Despite the fact that nuclear medicine is a recognised specialty in 24 of the 25 countries (96%), with specific training, other physicians may obtain a licence to practice nuclear medicine. But the scenario varies from one country to another, ranging from a full licence to a licence for restricted use. The licence is available to specialists other than nuclear physicians in Bulgaria, Czech Republic, Denmark, Hungary, Spain and the UK. A licence restricted to nuclear cardiology is available in Austria, Czech Republic, Estonia, Germany, Norway, Poland and the UK, and restricted practice can be conducted by a non-licence holder in collaboration with a licence holder in Israel, the Netherlands, Norway, Poland and the UK.

### *The theoretical and practical aspects of training*

Nuclear medicine is a recognised specialty in all countries except Estonia. Nuclear medicine specialist training consists of both theoretical and practical components in all countries, but content and duration are very variable (Table 2).

Nuclear cardiology is not a recognised specialty in any of the countries surveyed, but nuclear medicine can be acquired as a second specialty, e.g. by cardiologists, in most countries, the exceptions being Bulgaria, Denmark and Spain. In 11 countries (46%), training specific for nuclear cardiology is included in the curriculum of the nuclear medicine specialty; in the remaining countries, it is part of the general training.

### *Stress test supervision*

Cardiovascular stress tests must be conducted in the presence of trained personnel in all countries. Different personnel may be involved in the stress test supervision (i.e. nuclear medicine physicians, cardiologists, radiologists), but nuclear medicine physicians are the main specialists supervising the stress test in most countries, alone or in conjunction with cardiologists (Fig. 1). In 26% of cases, the stress test is supervised by cardiologists only; in a small minority of cases, radiologists supervise the execution of the stress test (Fig. 1).

Specific training, allowing physicians other than cardiologists to perform stress tests, is required in many countries (Austria, Bulgaria, Estonia, Finland, Hungary, Italy, the Netherlands, Norway, Portugal, Sweden, Switzerland and Turkey), although this can be achieved during the specialty training.

## Discussion

The main purpose of this survey was to collect some information on the practice of nuclear cardiology in

**Table 1.** Requirements to obtain a licence for the practice of nuclear medicine

| Country | Requirement[a] |
|---|---|
| Austria | To be an NM specialist and have radiation protection certification |
| Belgium | To be an NM specialist |
| Bulgaria | To be an NM specialist and have radiation protection certification |
| Cyprus | To be an NM specialist |
| Czech Republic | To be an NM specialist |
| Denmark | To be an NM specialist, and to attend a course and pass an examination *(in radiation protection?)* |
| Estonia | (At present nuclear medicine is not recognised as a specialty.) Licence regulated by Radiation Act and other regulations *(radiation protection?)* |
| Finland | Licence is given to hospitals; responsibility of hospitals to ensure employees have sufficient training |
| France | To be an NM specialist |
| Germany | To be an NM specialist and have radiation protection certification |
| Greece | To be an NM specialist |
| Hungary | To be an NM specialist and have radiation protection certification |
| Israel | Licence is given to departments; responsibility of hospitals to ensure employees have sufficient training |
| Italy | To be an NM specialist |
| Netherlands | To be an NM specialist and have radiation protection certification |
| Norway | To be an NM specialist |
| Poland | To be an NM specialist |
| Portugal | To be an NM specialist |
| Romania | To be an NM specialist |
| Russia | 2 years' training as an NM specialist |
| Spain | To be an NM specialist *(and attend course and pass examination in radiation protection?)* |
| Sweden | To be an NM specialist |
| Switzerland | To be an NM specialist and to have radiation protection certification |
| Turkey | To be an NM specialist |
| United Kingdom | Training equivalent of that of a nuclear physician |

[a]Items in italics are speculative since they were not specified in the answers

Europe, taking into account regulatory issues, the training requirements and the relative role of nuclear medicine physicians and cardiologists. The overall findings of this survey reflect the very wide heterogeneity of education and professional practice in Europe. The European Union of Medical Specialists requires a minimum duration of specialist training of 5 years [6], but in most countries the total duration of the training is 4 years, which corresponds with the minimum duration in the Directive of the European Community (Table 2). The specific components of the training in each country are beyond the scope of the present survey, but are documented on the European Council of Nuclear Cardiology website [7].

The general limitations of a questionnaire need to be taken into account when interpreting the results. A questionnaire analysis is dependent on the accuracy and care of responders. Some of the reported national data may thus not be completely accurate, but alternative methods of gathering information are difficult and laborious. Nevertheless, this survey clearly suggests that nuclear medicine remains a very restricted specialty that is subject to tight regulation, including national regulations. On the one hand, this guarantees the quality and safe medical use of radionuclides; on the other hand, however, it limits growth of nuclear medicine in the clinical field.

In almost all countries and centres, MPI is performed in nuclear medicine or radiology departments, often without the direct involvement of a cardiologist; in addition, national regulations preclude the handling of radiotracers by cardiologists in about 50% of the countries surveyed. This is in contrast to other cardiac investigations, such as echocardiography and coronary angiography, that are performed with the direct involvement of cardiologists. Moreover, nuclear medicine specialists, although able to adequately perform a stress test, do not always share the language and the knowledge of cardiology that would allow a pertinent discussion with the referring cardiologists and guarantee their credibility. Even technically accurate reports may fail to address important issues in particular cases or may be misleading for a referring cardiologist with a rudimentary "knowledge base" in nuclear cardiology, leading to a series of normal coronary angiograms and causing a sceptical cardiologist to lose confidence in the technique.

Significant efforts still need to be made to increase the availability of nuclear cardiology as a diagnostic and prognostic tool in an era in which primary and secondary prevention are identified as goals for healthcare organisations, particularly in populations with a relatively high prevalence of (mostly silent) ischaemic heart disease, such as diabetics [1, 4, 5]. Whether this should be achieved by opening nuclear medicine facilities to cardiologists (e.g. it is much easier in the USA for a cardiologist to obtain credentials to practice nuclear medicine), by specifically

**Table 2.** Total duration of training in nuclear medicine

| Country | Total duration |
|---|---|
| Austria | 5 years (incl. 1 year of radiodiagnostics); radiation protection |
| Belgium | 3 years |
| Bulgaria | 4 years |
| Cyprus | 5 years |
| Czech Republic | 3 years |
| Denmark | 4.5 years |
| Estonia | At present nuclear medicine is not recognised as a specialty |
| Finland | 4 years and 9 months (including 3–9 months of radiology) |
| France | 2 years + 1 year of radiology |
| Germany | 4 years; radiation protection |
| Greece | 4 years |
| Hungary | 5 years |
| Israel | Not detailed |
| Italy | 5 years |
| Netherlands | 2 years and 9 months (incl. 3–6 months of radiology); radiation protection |
| Norway | 5 years (incl. radiology/clinical chemistry research or other specialty) |
| Poland | 3 years |
| Portugal | 4 years + 3 months of radiology; radiation protection |
| Romania | Not detailed |
| Russia | 2 years |
| Spain | 4 years |
| Sweden | 5 years |
| Switzerland | 4 years; radiation protection |
| Turkey | Not detailed |
| United Kingdom | 4 years |

training more nuclear specialists, or both, is a decision that needs to be made in light of the limitations imposed by the present national and European regulations and the overall requirement to maintain high standards.

There is a need to define and agree the generic skills and experience that are required for sub-specialty practice in nuclear cardiology. The hypothesis is that specialists from several backgrounds are capable of practising nuclear cardiology but that training, accreditation and practice must be of a uniform and high standard whatever the background of the specialist. Currently, there are very different levels of curriculum development throughout Europe, both in cardiology and in nuclear medicine, and the subjects or activities that are considered core to the specialty vary significantly among countries. Creation of a common syllabus encompassing all the knowledge and skills required in the training of a specialist in nuclear cardiology is challenging: such a syllabus should include competence and core knowledge in non-imaging tests (e.g. cardiovascular stress testing) and other cardiac imaging investigations, as well as a good general background in cardiovascular physiology and pathology with reference to those conditions which may need to be investigated by nuclear cardiology techniques. Training is also required in basic related sciences, such as pharmacokinetics, radiochemistry, instrumentation, computer science and quality control. In addition, basic knowledge of nuclear cardiology should be included in the core curriculum of cardiologists, and actions should be taken to actively promote nuclear cardiology within the "world of cardiology". Nevertheless, until cardiologists become more involved and nuclear cardiology services are adequately resourced, the demonstration that MPI is of clinical value may remain largely of academic interest. Furthermore, long waiting times for MPI need to be avoided, because direct cardiac catheterisation or another non-invasive test may become a more efficient way of investigating potentially high-risk patients.

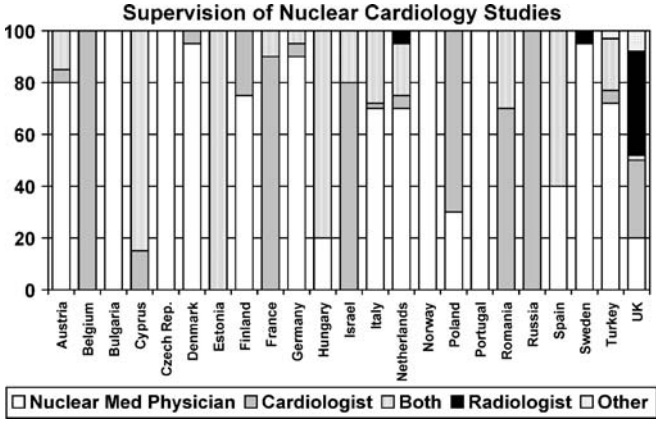


**Fig. 1.** Percentage of stress tests supervised by the different specialists in each country

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## Appendix: survey structure

1. Is nuclear medicine a specialty by itself?
2. 
   a) What is the training to become a nuclear medicine specialist?
   b) Is there specific training for nuclear cardiology?
3. Who is allowed to practice nuclear medicine?
4. 
   a) Is a licence required to order and/or to inject radiopharmaceuticals?
   b) Do specialists other than NM specialists have the possibility:
   to obtain a full licence?
   to obtain a restricted licence?
   to engage in restricted practice?
5. Is it possible to acquire the specialty of nuclear medicine as a second specialty?
6. Is a physician required to be present at the performance of a stress test?
7. Are nuclear medicine specialists allowed to perform stress tests on patients?
   If yes, is specific training required?

## References


1. ACC/AHA/ASNC. Guidelines for the Clinical Use of Cardiac Radionuclide Imaging—Executive Summary: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2003;42:1318–1333
2. American Society of Nuclear Cardiology. Updated imaging guidelines for nuclear cardiology procedures, Part 1. J Nucl Cardiol 2001;8:G5–52
3. American Society of Nuclear Cardiology. Imaging guidelines for nuclear cardiology procedures: Part 2. J Nucl Cardiology 1999;6:G49–G84
4. Mowatt G, Vale L, Brazzelli M, Hernandez R, Murray A, Scott N, et al. Systematic review of the effectiveness and cost-effectiveness, and economic evaluation, of myocardial perfusion scintigraphy for the diagnosis and management of angina and myocardial infarction. (http://www.nice.org.uk/pdf/Scintigraphy_Assessment_Report.pdf)
5. Brindis RG, Douglas PS, Hendel RC, Peterson ED, Wolk MJ, Allen JM, et al. ACCF/ASNC appropriateness criteria for single-photon emission computed tomography myocardial perfusion imaging (SPECT MPI): a report of the American College of Cardiology Foundation Quality Strategic Directions Committee Appropriateness Criteria Working Group and the American Society of Nuclear Cardiology. J Am Coll Cardiol 2005;46:1587–1605
6. Union Européene des Medécins Spécialistes, Section of Nuclear Medicine, European Board of Nuclear Medicine, Syllabus for postgraduate specialisation in Nuclear Medicine, 2002 Update (http://www.eanm.org)
7. Nuclear Cardiology in Europe. National Variation in Education and Legislation (http://www.ecnc-nuclearcardiology.org/index.php)