Eur J Nucl Med Mol Imaging (2014) 41:187–190
DOI 10.1007/s00259-013-2555-z

UEMS/EBNM

Nuclear medicine training and practice in Germany

L. S. Freudenberg · D. Hellwig · F. M. Mottaghy · C. Franzius · M. Gotthardt

Published online: 1 October 2013

The definition of nuclear medicine in Germany is laid out in the specialty training regulation (*Weiterbildungsordnung*, WBO) of the German Medical Association on Nuclear Medicine [1, 2]. In principle, it includes:

- Use of unsealed radioactive sources in diagnosis and therapy.
- Nuclear magnetic resonance imaging (MRI), but also
- Sonographic tests and the treatment of thyroid diseases, except for surgical procedures.
- The medical aspects of radiation protection form another area of competency.

In Germany the duration of training in the field of nuclear medicine is 5 years, of which 1 year must be spent in clinical inpatient patient care, and another 6 months of training in another field is possible. It is also permissible to work for up to a year in a radiology department. In contrast, to get credit for the training in nuclear medicine in other fields such as radiology is essentially impossible or there is a very strict time limit. The reason can be found in the differences within the Federal States in Germany with regard to acknowledging nuclear medicine as a "specialty of immediate patient care" [2].

The WBO of the German Medical Association constitutes one of the guidelines dictating the content of the training. The German Radiation Protection Ordinance and the guidelines on obtaining the special qualification contain further regulations. In this ordinance specific numbers are listed for guidance, which, however, do not constitute binding minimum numbers. In addition to the provision of the medical associations, the guideline on technical knowledge, which took effect on 1 November 2011, determines ballpark numbers and time frames for training programmes in expert knowledge of safe use of radiation. Essentially these match the provisions in the template regulation, with the exception of the number of therapies allowed for malignant thyroid diseases (only 100 instead of 200 therapies) and providing a separate regulation for endoluminal or endocavitary therapies. For this separate specialty ten documented applications are required each for selective internal radiation therapy (SIRT), endoluminal therapies and radiosynoviorthesis.

In the former specialty training regulation, MRI could be found as a subspecialization in the field of nuclear medicine. In the new specialty training regulation, an additional subject-

L. S. Freudenberg
ZRN Grevenbroich, Dormagen, Neuss, Germany

L. S. Freudenberg
Klinik für Nuklearmedizin des Universitätsklinikums, Essen, Germany

D. Hellwig
Universitätsklinikum des Saarlandes, Homburg, Germany

F. M. Mottaghy
Klinik für Nuklearmedizin, Universitätsklinikum der RWTH, Aachen, Germany

F. M. Mottaghy
Department of Nuclear Medicine, Maastricht University Medical Center, Maastricht, Netherlands

C. Franzius
Zentrum für Nuklearmedizin und PET/CT, Zentrum für morphologische und molekulare Diagnostik (ZeMoDi), Bremen, Germany

C. Franzius
Klinik und Poliklinik für Nuklearmedizin, Universitätsklinikum Münster, Münster, Germany

M. Gotthardt
Department of Nuclear Medicine, Radboud University, Nijmegen Medical Centre, Nijmegen, Netherlands

L. S. Freudenberg (✉)
Von-Werth-Strasse 5, 41515 Grevenbroich, Germany
e-mail: freudenberg@zrn-grevenbroich.de

related training has been introduced for MRI, which, in principle, can also be claimed by non-radiology fields. This training programme can be undertaken after completing the training to become a board-certified specialist in nuclear medicine. It takes 2 years in total, 1 of which has to be spent under the supervision of an approved mentor in radiology. Similarly, in the new regulation for specialist training, laboratory diagnostics counts as additional training beyond the definition of the field of nuclear medicine.

The training to become a specialist in nuclear medicine includes studies of the personal in-house production of radioactive drugs, as required by the German Pharmaceutical Legislation (Section 13, Paragraph 2b German Pharmaceutical Legislation).

Authorization for specialist training

The consultancy training takes place at approved training sites with authorized physicians (Section 5, WBO). Board-certified physicians who are professionally and personally capable and who have been working for more than 1 year after completing their own specialist training qualify as supervisors or mentors. The authorization to serve as an instructor in the specialist training programme can be limited to a time frame which is, however, not compulsory. In general, university and large community hospitals are accepted as training sites. Other institutions, namely private practices, can also be approved by the German Local Medical Association (Section 6, WBO). However, since the provision by the WBO requires at least 6 months of training time on a nuclear medical ward, only hospitals offering therapy with open radionuclides in a therapy unit can receive full authorization as training sites. In Germany, additional training to become a specialist in nuclear medicine focuses essentially on departments of nuclear medicine in university hospitals or full-service hospitals.

Overall there are about 1,000 registered specialists in nuclear medicine in Germany compared to nearly 7,000 radiologists (Table 1). Most of them are older than 40 years. We are not aware of any official statistics on the number of trainees in nuclear medicine in Germany. Evaluating the consultancy training situation in 2009 [4] allows the estimate that there are a little more than 200 trainees. There is no general system for allocating or planning the capacity of the number of training sites required. The individual centres have to fund the training and the salary of the trainees themselves.

Quality assurance

During the training programme, the WBO requires that there must be at least an annual review between the training assistant and the authorized mentor (Section 8, WBO), which

Table 1 Physicians (registered practitioners and hospitalists) and their specialties, broken down by age group, shown as absolute number and in relation to the total number of doctors in a specialty (per cent in parentheses). Source of data: Statistics of Physicians by the German Medical Association [3]

Description of area	Number	Change from previous year	Age in years					
			<35	35–39	40–49	50–59	60–65	<65
Specialist in nuclear medicine, registered practitioners plus hospitalists	1,046	+2.9 %	26 (2 %)	93 (9 %)	442 (42 %)	334 (32 %)	76 (7 %)	75 (7 %)
Working as registered practitioners	717	+4.1 %	8 (1 %)	43 (6 %)	305 (43 %)	245 (34 %)	49 (7 %)	67 (9 %)
Working as hospitalists	329	+0.6 %	18 (5 %)	50 (15 %)	137 (42 %)	89 (27 %)	27 (8 %)	8 (2 %)
Radiologist, registered practitioners plus hospitalists	6,989	+2.7 %	204 (3 %)	744 (11 %)	2,730 (39 %)	2,403 (34 %)	685 (10 %)	223 (3 %)
All fields, registered practitioners plus hospitalists	333,599	+2.3 %	56,785 (17 %)	37,556 (11 %)	103,420 (31 %)	90,873 (27 %)	31,581 (9 %)	13,384 (4 %)

serves to document the status of the training and to disclose potential deficits. The evaluation protocols must be submitted to the Local Medical Association, together with the application for the board certification [4]. To obtain the degree, a professional panel evaluation and the completion of the training period are necessary. A board of examiners, consisting of at least three physicians (of which at least two are specialists in nuclear medicine) from the Medical Association conducts the evaluation.

Competency in radiation protection

Aspects of radiation protection are not only part of the training catalogue but also a requirement according to the strict formalities for obtaining the degree as a consultant in radiation protection [2].

- The German X-ray Protection Regulations (*Röntgenverordnung*) organizes the protection from damage through X-rays.
- The German Radiation Protection Ordinance (*Strahlenschutzverordnung*) regulates the principles and requirements of preventative and protective measures when using and applying radioactive substances.

The new regulation of the German Radiation Protection Ordinance, which became effective on 1 November 2011, requires a separate professional evaluation for granting the degree in radiation protection in nuclear medicine, which must take place independent of the board certification as a specialist in nuclear medicine [6].

Working in a sub-field

Apart from the board certification as specialist in nuclear medicine there is another possibility in Germany to qualify to conduct nuclear medical tests and therapies, namely by obtaining the requisite qualification in radiation protection for the medical use of unsealed radioactive substances. The criteria for these qualifications (both for the whole spectrum and the sub-fields) are regulated in a guideline that the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety developed.

The expertise for organ-related tests can be obtained during at least 1.5 years of work, subject to complying with the ballpark numbers [5–7]. For additional organ systems an additional 6 months per system is needed. There are no official statistics available on the frequency of requisite qualifications in radiation protection in sub-fields that are approved.

Since 1 November 2011, physicians with radiation protection qualifications for X-rays within the entire field of X-ray diagnostics (read: radiologists) have been able to complete a 2-year qualification in radiation protection in nuclear medical imaging diagnostics (without thyroid and in vitro diagnostics).

A minimum of 1,600 tests must be recorded, of which at least 800 are not in positron emission tomography (PET) or single photon emission computed tomography (SPECT) technology. A comparable X-ray degree for specialists in nuclear medicine that also includes CT applications is mutually recognized according to a recommendation of the Committee for Radiation Protection [7]. Currently, this plan is integrated into a new specialty guideline on X-ray regulations (*Richtlinie Strahlenschutz in der Medizin zur Röntgenverordnung*).

PET and hybrid imaging

While the board certification as a specialist in nuclear medicine entitles the specialist to perform nuclear medical services in Germany, there are additional quality requirements in the area of PET and PET/CT diagnostics which the provider needs to fulfill when caring for statutory insurance policy holders. Though PET is an essential component of nuclear medicine, so far the attempt to integrate this modality as a sub-specialty into the specialty training regulation, analogous to MRI, has failed.

Specialists in nuclear medicine are only allowed to perform PET or PET/CT in patients with a statutory insurance if they can demonstrate current experience in conducting and diagnosing at least 1,000 PET tests for oncological issues, usually from within the past 5 years [8, 9]. The PET certificate of the German Society for Nuclear Medicine (DGN) and the Professional Association of German Specialists in Nuclear Medicine (BDN), which is person and site related, requires a professional evaluation in addition to these provisions, and health insurances and medical services of the health insurances regard it as the standard for illustrating expertise in the area of PET.

The hybrid PET/CT and SPECT/CT modalities necessitate a closer collaboration between specialists in nuclear medicine and radiologists to diagnose both components of this imaging technique. The mutual approach towards each other is carefully taking place and requires further coordination. A formal path for a respective initiative was created at the German Medical Assembly in 2011 in Kiel [10].

References

1. Bundesärztekammer. Musterweiterbildungsordnung der Bundesärztekammer. www.bundesaerztekammer.de/downloads/MWBO_07122011.pdf 2003. Accessed 7 July 2013.
2. Hellwig D, Freudenberg LS, Mottaghy FM, Franzius C, Krause T, Garai I, et al. Nuklearmedizin in Europa. Ausbildungssituation. Nuklearmedizin 2012;51(2):35–46.

3. Bundesärztekammer. Ärztestatistik der Bundesärztekammer. www.bundesaerztekammerde/specialdownloads/Stat10Abbildungsteil.pdf 2011. Accessed 15 Feb 2012.
4. Bundesärztekammer. Ergebnisse der ersten Befragungsrunde für das Gebiet Nuklearmedizin. 2010; Bundesärztekammer: Evaluation der Weiterbildung 2009. www.bundesaerztekammer.de/downloads/2009-EVA_WB-Ausw-Nuklearmedizin.pdf 2008. Accessed 7 July 2013.
5. Bundesärztekammer. Muster-Logbuch der Bundesärztekammer über die Facharztweiterbildung Nuklearmedizin. www.bundesaerztekammerde/downloads/MLogbuch-21-FA-Nuklearmedizin.pdf 2003. Accessed 7 July 2013.
6. BMU. Strahlenschutz in der Medizin. Richtlinie zur Verordnung über den Schutz vor Schäden durch ionisierende Strahlen (Strahlenschutzverordnung –StrlSchV). Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit 2011: RS II 4 – 11432/11431.
7. Strahlenschutzkommission. Anforderungen an die Strahlenschutz-Fachkunden in der Medizin für Ärzte – Erläuterungen zur Sachkunde. Empfehlung der Strahlenschutzkommission 2010 (Verabschiedet in der 246. Sitzung der Strahlenschutzkommission am 22./23. Dezember 2010) www.ssk.de/de/werke/2010/volltext/ssk1011.pdf 2010. Accessed 7 July 2013.
8. G-BA. Richtlinie Methoden vertragsärztliche Versorgung/Anlage 1 und 2 (PET beim nichtkleinzelligen Lungenkarzinom). BAnz Nr 79 (S 4362) vom 26.04.2007.
9. G-BA. Richtlinie Methoden vertragsärztliche Versorgung (Positronenemissionstomographie (PET); PET/Computertomographie (CT) bei malignen Lymphomen). BAnz Nr 192 (S 4505) vom 21.12.2011.
10. Bundesärztekammer. Beschlussprotokoll des 114. Deutschen Ärztetages. www.baekde/downloads/114Beschlussprotokoll20110704.pdf 2011. Accessed 7 July 2013.