# ACGME Program Requirements for Graduate Medical Education in Nuclear Medicine

***Common Program Requirements are in BOLD***

*Effective: July 1, 2007*

Introduction

Int.A. Definition

Nuclear medicine is the clinical and laboratory medical specialty that uses radioactive and stable tracers to study physiologic, biochemical and cellular processes for diagnosis, therapy and research.

Int.B. Duration and Scope of Training

Int.B.1. Length of Program

The length of the nuclear medicine residency program is three years, following one year of preparatory clinical residency training (as described below).

Int.B.2. Admission Prerequisites

Before entering a nuclear medicine residency, residents must satisfactorily complete one year of training in a program accredited by the Accreditation Council for Graduate Medical Education (ACGME) or by the Royal College of Physicians and Surgeons of Canada, or equivalent. While the length of the nuclear medicine residency training is three years, residents may enter the program from different training backgrounds. The type and length of the prior training will determine the number of years the resident will be required to spend in the nuclear medicine program.

Int.B.2.a) For residents who have completed an accredited one year program of fundamental clinical education, the length of nuclear medicine training is three years. The one year pre-requisite program must provide broad clinical education, with primary emphasis on the patient and the patient's clinical problems. Residents should have a sufficiently broad knowledge of medicine to obtain a pertinent history, perform an appropriate physical examination, and arrive at a differential diagnosis.

Int.B.2.b) For residents who have completed an accredited patient care specialty program, the length of nuclear medicine training is two years.

Int.B.2.c) For residents who have completed an accredited program in diagnostic radiology, the length of nuclear medicine training is one year.

Int.B.3. Specific Description of Program Format

Residencies in nuclear medicine must teach the basic skills and clinical competence that constitute the foundations of nuclear medicine practice, and must provide progressive responsibility for and experience in the application of these principles to the management of clinical problems. Clinical experience must include the opportunity to recommend and plan, conduct, supervise, interpret, and dictate reports for nuclear medicine procedures that are appropriate for the existing clinical problem or condition.

Int.C. Broad Description of Training Objectives and Goals

The program must be structured so that residents' clinical responsibilities increase progressively during training. At the completion of the training program, residents should be proficient in all areas of clinical nuclear medicine, and be able to function independently as nuclear medicine consultants, plan and perform appropriate nuclear medicine procedures, interpret the test results, and formulate a diagnosis and an appropriate differential diagnosis. Residents should be qualified to recommend therapy or further studies. If radionuclide therapy is indicated, they should be capable of assuming responsibility for patient care. Residents should develop a satisfactory level of clinical maturity, judgment, and technical skill that will, on completion of the program, render them capable of the independent practice of nuclear medicine.

**I. Institutions**

**I.A. Sponsoring Institution**

**One sponsoring institution must assume ultimate responsibility for the program, as described in the Institutional Requirements, and this responsibility extends to resident assignments at all participating sites.**

**The sponsoring institution and the program must ensure that the program director has sufficient protected time and financial support for his or her educational and administrative responsibilities to the program.**

**I.B. Participating Sites**

**I.B.1. There must be a program letter of agreement (PLA) between the program and each participating site providing a required assignment. The PLA must be renewed at least every five years.**

**The PLA should:**

**I.B.1.a) identify the faculty who will assume both educational and supervisory responsibilities for residents;**

**I.B.1.b) specify their responsibilities for teaching, supervision, and formal evaluation of residents, as specified later in this document;**

**I.B.1.c)** **specify the duration and content of the educational experience; and,**

**I.B.1.d)** **state the policies and procedures that will govern resident education during the assignment.**

**I.B.2.** **The program director must submit any additions or deletions of participating sites routinely providing an educational experience, required for all residents, of one month full time equivalent (FTE) or more through the Accreditation Council for Graduate Medical Education (ACGME) Accreditation Data System (ADS).**

I.B.3. Integrated and Non-integrated Sites

Within a single program some participating sites may qualify as integrated, while others are non-integrated.

I.B.3.a) When another site is utilized and a single program director assumes responsibility for the entire residency, including the appointment of all residents and teaching staff, that site is designated as integrated. Rotations to integrated sites are not limited in duration and require prior approval of the Review Committee.

I.B.3.b) Participation by any non-integrated site providing more than three months of training must have prior approval by the Review Committee, according to criteria similar to those applied to the primary institution. A maximum of three months per year but not greater than nine months of the three-year nuclear medicine program may be spent outside the parent and integrated sites on rotation to non-integrated sites.

I.B.3.b).(1) Service responsibility alone at a non-integrated site is not a suitable educational experience.

I.B.3.b).(2) Non-integrated sites should not be so distant as to make it difficult for residents to travel for participation in clinical responsibilities or didactic activities, unless there is a comparable educational experience at the non-integrated sites.

## II. Program Personnel and Resources

### II.A. Program Director

**II.A.1.** **There must be a single program director with authority and accountability for the operation of the program. The sponsoring institution's GMEC must approve a change in program director. After approval, the program director must submit this change to the ACGME via the ADS.**

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| **II.A.2.** | **The program director should continue in his or her position for a length of time adequate to maintain continuity of leadership and program stability.** |
| **II.A.3.** | **Qualifications of the program director must include:** |
| **II.A.3.a)** | **requisite specialty expertise and documented educational and administrative experience acceptable to the Review Committee;** |
| **II.A.3.b)** | **current certification in the specialty by the American Board of** Nuclear Medicine**, or specialty qualifications that are acceptable to the Review Committee; and,** |
| **II.A.3.c)** | **current medical licensure and appropriate medical staff appointment.** |
| **II.A.4.** | **The program director must administer and maintain an educational environment conducive to educating the residents in each of the ACGME competency areas. The program director must:** |
| **II.A.4.a)** | **oversee and ensure the quality of didactic and clinical education in all sites that participate in the program;** |
| **II.A.4.b)** | **approve a local director at each participating site who is accountable for resident education;** |
| **II.A.4.c)** | **approve the selection of program faculty as appropriate;** |
| **II.A.4.d)** | **evaluate program faculty and approve the continued participation of program faculty based on evaluation;** |
| **II.A.4.e)** | **monitor resident supervision at all participating sites;** |
| **II.A.4.f)** | **prepare and submit all information required and requested by the ACGME, including but not limited to the program information forms and annual program resident updates to the ADS, and ensure that the information submitted is accurate and complete;** |
| **II.A.4.g)** | **provide each resident with documented semiannual evaluation of performance with feedback;** |
| **II.A.4.h)** | **ensure compliance with grievance and due process procedures as set forth in the Institutional Requirements and implemented by the sponsoring institution;** |
| **II.A.4.i)** | **provide verification of residency education for all residents, including those who leave the program prior to completion;** |

**II.A.4.j)** implement policies and procedures consistent with the institutional and program requirements for resident duty hours and the working environment, including moonlighting, and, to that end, must:

**II.A.4.j).(1)** distribute these policies and procedures to the residents and faculty;

**II.A.4.j).(2)** monitor resident duty hours, according to sponsoring institutional policies, with a frequency sufficient to ensure compliance with ACGME requirements;

**II.A.4.j).(3)** adjust schedules as necessary to mitigate excessive service demands and/or fatigue; and,

**II.A.4.j).(4)** if applicable, monitor the demands of at-home call and adjust schedules as necessary to mitigate excessive service demands and/or fatigue.

**II.A.4.k)** monitor the need for and ensure the provision of back up support systems when patient care responsibilities are unusually difficult or prolonged;

**II.A.4.l)** comply with the sponsoring institution's written policies and procedures, including those specified in the Institutional Requirements, for selection, evaluation and promotion of residents, disciplinary action, and supervision of residents;

**II.A.4.m)** be familiar with and comply with ACGME and Review Committee policies and procedures as outlined in the ACGME Manual of Policies and Procedures;

**II.A.4.n)** obtain review and approval of the sponsoring institution's GMEC/DIO before submitting to the ACGME information or requests for the following:

**II.A.4.n).(1)** all applications for ACGME accreditation of new programs;

**II.A.4.n).(2)** changes in resident complement;

**II.A.4.n).(3)** major changes in program structure or length of training;

**II.A.4.n).(4)** progress reports requested by the Review Committee;

**II.A.4.n).(5)** responses to all proposed adverse actions;

**II.A.4.n).(6)** requests for increases or any change to resident duty hours;

**II.A.4.n).(7)** **voluntary withdrawals of ACGME-accredited programs;**

**II.A.4.n).(8)** **requests for appeal of an adverse action;**

**II.A.4.n).(9)** **appeal presentations to a Board of Appeal or the ACGME; and,**

**II.A.4.n).(10)** **proposals to ACGME for approval of innovative educational approaches.**

**II.A.4.o)** **obtain DIO review and co-signature on all program information forms, as well as any correspondence or document submitted to the ACGME that addresses:**

**II.A.4.o).(1)** **program citations, and/or**

**II.A.4.o).(2)** **request for changes in the program that would have significant impact, including financial, on the program or institution.**

II.A.4.p) develop a formal didactic schedule that indicates the specific date and time of each lecture, the topic of the lecture, the faculty individual presenting the lecture, and the duration of the lecture. This schedule must incorporate each of the elements of basic science detailed in section IV.A.5.below, and the program director must provide written documentation of this schedule as part of the information submitted to the Review Committee for its program review. The schedule must be current for each academic year. Visiting faculty and residents may provide some of the lectures;

II.A.4.q) ensure that all residents participate in regularly scheduled clinical nuclear medicine conferences and seminars and interdisciplinary conferences. In these conferences, residents are responsible for presenting case materials and discussing the relevant theoretical and practical issues. There should be active resident participation in well-structured seminars and journal clubs that review the pertinent literature with respect to current clinical problems and that include discussion of additional topics to supplement the didactic curriculum; and,

II.A.4.r) ensure that all residents participate in regularly scheduled, usually daily, procedure interpretation and review conferences. The program must provide the resident with the opportunity to gain progressively independent responsibility for review, technical approval and acceptance, and interpretation and dictation of consultative reports on completed nuclear medicine procedures.

II.A.5. The program director must have broad knowledge of, experience with, and commitment to general nuclear medicine, along with sufficient academic and administrative experience to ensure effective

implementation of these program requirements and sufficient experience participating as an active faculty member in an ACGME-accredited residency program.

II.A.6. The program director must demonstrate a strong interest in the education of residents, sound clinical and teaching abilities, support of the goals and objectives of the program, demonstrate a commitment to his or her own continuing medical education, and participate in scholarly activities.

**II.B. Faculty**

**II.B.1. At each participating site, there must be a sufficient number of faculty with documented qualifications to instruct and supervise all residents at that location.**

**The faculty must:**

**II.B.1.a) devote sufficient time to the educational program to fulfill their supervisory and teaching responsibilities; and to demonstrate a strong interest in the education of residents, and**

**II.B.1.b) administer and maintain an educational environment conducive to educating residents in each of the ACGME competency areas.**

**II.B.2. The physician faculty must have current certification in the specialty by the American Board of** Nuclear Medicine**, or possess qualifications acceptable to the Review Committee.**

**II.B.3. The physician faculty must possess current medical licensure and appropriate medical staff appointment.**

**II.B.4. The nonphysician faculty must have appropriate qualifications in their field and hold appropriate institutional appointments.**

**II.B.5. The faculty must establish and maintain an environment of inquiry and scholarship with an active research component.**

**II.B.5.a) The faculty must regularly participate in organized clinical discussions, rounds, journal clubs, and conferences.**

**II.B.5.b) Some members of the faculty should also demonstrate scholarship by one or more of the following:**

**II.B.5.b).(1) peer-reviewed funding;**

**II.B.5.b).(2) publication of original research or review articles in peer-reviewed journals, or chapters in textbooks;**

**II.B.5.b).(3)** **publication or presentation of case reports or clinical series at local, regional, or national professional and scientific society meetings; or,**

**II.B.5.b).(4)** **participation in national committees or educational organizations.**

**II.B.5.c)** **Faculty should encourage and support residents in scholarly activities.**

II.B.5.d) The faculty as a whole must have demonstrated ongoing participation in scholarly activities during the past five years.

**II.C. Other Program Personnel**

**The institution and the program must jointly ensure the availability of all necessary professional, technical, and clerical personnel for the effective administration of the program.**

**II.D. Resources**

**The institution and the program must jointly ensure the availability of adequate resources for resident education, as defined in the specialty program requirements.**

II.D.1. The institution sponsoring a residency program in nuclear medicine should be of sufficient size and composition to provide an adequate volume and variety of patients for resident training. It must provide sufficient faculty, financial resources, as well as clinical, research, and library facilities to meet the educational needs of the residents, and to enable the program to comply with the requirements for accreditation.

II.D.2. The program must provide adequate space, equipment, and other pertinent facilities to ensure an effective educational experience for residents in nuclear medicine, and must possess the modern facilities and equipment required to practice nuclear medicine.

II.D.3. A nuclear medicine residency program requires the support of services in other specialties, notably internal medicine, surgery, radiology, pediatrics, and pathology. Training resources should be such that the total number of residents in the institution is large enough to permit peer interaction and intellectual exchange with residents in the nuclear medicine program.

II.D.4. While the number of procedures may vary from one training program to another, a well-designed program will perform at least 4,000 common nuclear medicine imaging procedures annually, a wide variety of non-imaging procedures, and at least 15 radionuclide therapeutic procedures annually. Imaging procedures should be distributed over the entire spectrum of nuclear medicine practice, including the pediatric age group. A minimum of 100 pediatric nuclear medicine cases should be available annually. Resident rotations to hospitals with a large pediatric caseload

should be considered if the number of pediatric studies in the primary site averages fewer than 100 per year.

II.D.5. Teaching case files involving diagnostic and therapeutic nuclear medicine procedures should be available and should cover the full spectrum of clinical applications: indexed, coded with correlative and follow-up data, and readily accessible for resident use. There must be a mechanism for maintaining case records and treatment results to facilitate patient follow-up and to provide teaching material. Electronic availability of teaching files is acceptable as a substitute or enhancement of on-site teaching case files.

**II.E. Medical Information Access**

**Residents must have ready access to specialty-specific and other appropriate reference material in print or electronic format. Electronic medical literature databases with search capabilities should be available.**

**III. Resident Appointments**

**III.A. Eligibility Criteria**

**The program director must comply with the criteria for resident eligibility as specified in the Institutional Requirements.**

III.A.1. Programs must demonstrate the ability to recruit and retain qualified residents. Residents should be appointed only when their documented prior experience and attitudes demonstrate the presence of abilities necessary to master successfully the clinical knowledge and skills required of all program graduates. All residents must have demonstrated understanding and facility in using the English language.

III.A.2. Residents should be reappointed only when their clinical judgment, medical knowledge, history-taking, professional attitudes, moral and ethical behavior, and clinical performance are documented to be entirely satisfactory.

**III.B. Number of Residents**

**The program director may not appoint more residents than approved by the Review Committee, unless otherwise stated in the specialty-specific requirements. The program's educational resources must be adequate to support the number of residents appointed to the program.**

III.B.1. At the time of the program's regular review, the Review Committee will assess the continued adequacy of the program's resources for the current number of residents.

**III.C. Resident Transfers**

**III.C.1. Before accepting a resident who is transferring from another**

**program, the program director must obtain written or electronic verification of previous educational experiences and a summative competency-based performance evaluation of the transferring resident.**

III.C.2. **A program director must provide timely verification of residency education and summative performance evaluations for residents who leave the program prior to completion.**

III.D. **Appointment of Fellows and Other Learners**

**The presence of other learners (including, but not limited to, residents from other specialties, subspecialty fellows, PhD students, and nurse practitioners) in the program must not interfere with the appointed residents' education. The program director must report the presence of other learners to the DIO and GMEC in accordance with sponsoring institution guidelines.**

IV. **Educational Program**

IV.A. **The curriculum must contain the following educational components:**

IV.A.1. **Overall educational goals for the program, which the program must distribute to residents and faculty annually;**

IV.A.2. **Competency-based goals and objectives for each assignment at each educational level, which the program must distribute to residents and faculty annually, in either written or electronic form. These should be reviewed by the resident at the start of each rotation;**

IV.A.3. **Regularly scheduled didactic sessions;**

IV.A.4. **Delineation of resident responsibilities for patient care, progressive responsibility for patient management, and supervision of residents over the continuum of the program; and,**

IV.A.5. **ACGME Competencies**

**The program must integrate the following ACGME competencies into the curriculum:**

IV.A.5.a) **Patient Care**

**Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents:**

IV.A.5.a).(1) will obtain patient information relevant to the requested test or therapy using patient interview, chart and computer data base review, physical examination, and contact with the

referring physician;

IV.A.5.a).(2) will select appropriate procedures or therapy based on the referring physician's request and the patient's history. This involves selection of the appropriate radiopharmaceutical, dose, imaging technique, data analysis, and image presentation. It also includes review of image quality, defining the need for additional images and correlation with other imaging studies such as x-rays, CT, MRI, or ultrasound;

IV.A.5.a).(3) will communicate results promptly and clearly to the referring physician or other appropriate health care workers. This communication should include clear and succinct dictation of the results;

IV.A.5.a).(4) will conduct therapeutic procedures. Therapeutic procedures must be done in consultation with an attending physician who is a licensed user of radioactive material. These procedures should include dose calculation, patient identity verification, explanation of informed consent, documentation of pregnancy status, counseling of patients and their families on radiation safety issues, and scheduling follow-up after therapy;

IV.A.5.a).(5) will maintain records (logs) of participation in nuclear cardiology pharmacologic and exercise studies, and in all types of therapy procedures;

IV.A.5.a).(6) should attain sequentially increasing competence in selecting the most appropriate nuclear medicine studies, performing these studies in the technically correct manner, interpreting the information obtained, correlating this information with other diagnostic studies, and treating and following up the patient who receives radionuclide therapy. Under adequate faculty supervision, the resident should participate directly in the performance of imaging studies, non-imaging measurements and assays, and therapeutic procedures;

IV.A.5.a).(7) must be provided structured opportunities to:

IV.A.5.a).(7).(a) learn the indications, contraindications, complications, and limitations of specific procedures;

IV.A.5.a).(7).(b) develop technical proficiency in performing these procedures;

IV.A.5.a).(7).(c) learn to interpret the results of these procedures; and,

IV.A.5.a).(7).(d) dictate reports and communicate results promptly and appropriately. The program must provide adequate opportunity for residents to participate in and personally perform and analyze a broad range of common clinical nuclear medicine procedures.

IV.A.5.a).(8) must have experience in each of the following categories:

IV.A.5.a).(8).(a) musculoskeletal studies, including bone scanning for benign and malignant disease, and bone densitometry;

IV.A.5.a).(8).(b) myocardial perfusion imaging procedures performed with radioactive perfusion agents in association with treadmill and pharmacologic stress (planar and tomographic, including gated tomographic imaging). Specific applications should include patient monitoring, with special emphasis on electrocardiographic interpretation, cardiopulmonary resuscitation during interventional pharmacologic or exercise stress tests, pharmacology of cardioactive drugs, and hands-on experience with performance of the stress procedure (exercise and pharmacologic agents) for a minimum of 50 patients. Program directors must be able to document the experience of residents in this area, e.g., with logbooks;

IV.A.5.a).(8).(c) radionuclide ventriculography performed with ECG gating for evaluation of ventricular performance. The experience should include first pass and equilibrium studies and calculation of ventricular performance parameters, e.g., ejection fraction and regional wall motion assessment;

IV.A.5.a).(8).(d) endocrinologic studies, including thyroid, parathyroid, and adrenal imaging, along with octreotide and other receptor-based imaging studies. Thyroid studies should include measurement of iodine uptake and dosimetry calculations for radio-iodine therapy;

IV.A.5.a).(8).(e) gastrointestinal studies of the salivary glands, esophagus, stomach, and liver, both reticuloendothelial function and the biliary system. This also includes studies of gastrointestinal bleeding, Meckel diverticulum, and C14 urea breath testing;

IV.A.5.a).(8).(f) hematologic studies, including red cell and plasma volume, splenic sequestration, hemangioma studies, labeled granulocytes for infection, thrombus imaging, bone marrow imaging, and B12 absorption studies;

IV.A.5.a).(8).(g) oncology studies, involving gallium, thallium, sestamibi, antibodies, peptides, fluorodeoxyglucose (FDG), and other agents as they become available. Oncology experience should include all the common malignancies of the brain, head and neck, thyroid, breast, lung, liver, colon, kidney, bladder and prostate. It should also involve lymphoma, leukemia, melanoma, and musculoskeletal tumors. Hands-on experience with lymphoscintigraphy, including sentinel node mapping, is very important;

IV.A.5.a).(8).(h) neurologic studies, including cerebral perfusion with both single photon emission computed tomography (SPECT) and positron emission tomography (PET), cerebral metabolism with FDG, and cisternography. This experience should include studies of stroke, dementia, epilepsy, brain death and cerebrospinal fluid dynamics;

IV.A.5.a).(8).(i) pulmonary studies of perfusion and ventilation performed with radiolabeled macroaggregates and radioactive gas or aerosols used in the diagnosis of pulmonary embolus, as well as for quantitative assessment of perfusion and ventilation;

IV.A.5.a).(8).(j) genitourinary tract imaging, including renal perfusion and function procedures, clearance methods, renal scintigraphy with pharmacologic interventions, renal transplant evaluation, and vesicoureteral reflux;

IV.A.5.a).(8).(k) therapeutic administration of radiopharmaceuticals, to include patient selection and understanding and calculation of the administered dose. Specific applications should include radioiodine in hyperthyroidism (minimum of 10 cases) and thyroid carcinoma (minimum of five cases), radiolabeled antibodies (minimum of three cases) and radionuclides for painful bone disease. Program directors must be able to document the experience of residents in this area, including patient follow-up, (e.g., with logbooks);

IV.A.5.a).(8).(l) PET imaging of the heart, including studies of myocardial perfusion and myocardial viability;

IV.A.5.a).(8).(m) PET imaging of the brain, including studies of dementia, epilepsy, and brain tumors;

IV.A.5.a).(8).(n) PET imaging in oncology, including studies of tumors of the lung, head and neck, esophagus, colon, thyroid, and breast, as well as melanoma, lymphoma, and other tumors as the indications become established;

IV.A.5.a).(8).(o) co-registration and image fusion of SPECT and PET images with computed tomography (CT) and magnetic resonance imaging (MRI) studies;

IV.A.5.a).(8).(p) anatomic imaging of brain, head and neck, thorax, abdomen, and pelvis with CT to be able to understand the correlation between anatomic and functional imaging. This training should include a minimum of 4 months of CT experience that may be combined with a rotation that includes PET-CT or SPECT-CT, although rotation on a CT service is desirable for part of the training. The experience must emphasize correlation of CT images associated with PET-CT or SPECT-CT. The resident must acquire sufficient experience with such studies under the supervision of qualified faculty to be able to supervise the performance and accurately correlate the CTs associated with PET-CT or SPECT-CT studies. This requirement does not apply to residents who have completed training in an ACGME-approved diagnostic radiology program; and,

IV.A.5.a).(8).(q) experience in radiation oncology and medical oncology. This is essential because of the increasing close interaction with these specialties. The experience can consist of one month rotations or an equivalent experience through participation in patient management conferences and clinics.

IV.A.5.a).(9) must have training in both basic life-support and advanced cardiac life-support.

**IV.A.5.b) Medical Knowledge**

**Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social-behavioral sciences, as well as the application of this knowledge to patient care. Residents:**

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| IV.A.5.b).(1) | will closely follow scientific progress in nuclear medicine, and learn to incorporate it effectively for modifying and improving diagnostic and therapeutic procedures; |
| IV.A.5.b).(2) | will become familiar with and regularly read the major journals in nuclear medicine. During the residency this will involve regular participation in journal club; |
| IV.A.5.b).(3) | will use computer technology including internet web sites and CDROM teaching disks; |
| IV.A.5.b).(4) | will participate in the annual in-service examination; |
| IV.A.5.b).(5) | know and comply with radiation safety rules and regulations, including NRC and/or agreement state rules, local regulations, and the ALARA (as low as reasonably achievable) principles for personal radiation protection; |
| IV.A.5.b).(6) | will understand and use QC (quality control) procedures for imaging devices, laboratory instrumentation, and radiopharmaceuticals; |
| IV.A.5.b).(7) | must have didactic instruction in the following areas: (Those residents who have completed an ACGME-accredited program in Diagnostic Radiology are exempted from a) and d)): |
| IV.A.5.b).(7).(a) | Physics: structure of matter, modes of radioactive decay, particle and photon emissions, and interactions of radiation with matter; |
| IV.A.5.b).(7).(b) | Instrumentation: principles of instrumentation used in detection, measurement, and imaging of radioactivity with special emphasis on gamma cameras, including SPECT and PET devices, and associated electronic instrumentation and computers employed in image production and display. Instruction must be provided in the instrumentation principles involved in magnetic resonance imaging and multi-slice computed tomography; |
| IV.A.5.b).(7).(c) | Mathematics, statistics, and computer sciences: probability distributions; medical decision making; basic aspects of computer structure, function, programming, and processing; applications of mathematics to tracer kinetics; compartmental modeling; and quantification of physiologic processes; |

IV.A.5.b).(7).(d) Radiation biology and protection: biological effects of ionizing radiation, means of reducing radiation exposure, calculation of the radiation dose, evaluation of radiation overexposure, medical management of persons overexposed to ionizing radiation, management and disposal of radioactive substances, and establishment of radiation safety programs in accordance with federal and state regulations; and,

IV.A.5.b).(7).(e) Radiopharmaceuticals: reactor, cyclotron, and generator production of radionuclides; radiochemistry; pharmacokinetics; and formulation of radiopharmaceuticals. Specifically, instruction should include the chemistry of byproduct materials for medical use; ordering and unpacking radioactive materials safely and performing the related radiation surveys; calibrating instruments used to determine the activity of dosages and performing checks for proper operation of survey meters; calculating and safely preparing patient or human research subject dosages; using administrative controls to prevent a medical event involving the use of unsealed byproduct material; using procedures to contain spilled byproduct material safely and using proper decontamination procedures; eluting generator systems appropriate for preparation of radioactive drugs for imaging and localization studies or that need a written directive; measuring and testing the eluate for radionuclide purity, and processing the eluate with reagent kits to prepare labeled radioactive drugs; and administering dosages of radioactive drugs for uptake, dilution, excretion, and imaging and localization studies.

IV.A.5.b).(8) should have continuing extensive instruction in the relevant basic sciences. This should include formal lectures and formal labs, with an appropriate balance of time allocated to the major subject areas, which must include physical science and instrumentation; radiobiology and radiation protection; mathematics; radiopharmaceutical chemistry; and computer science. Instruction in the basic sciences should not be limited to only didactic sessions. The resident's activities also should include laboratory experience and regular contact with basic scientists in their clinical adjunctive roles;

IV.A.5.b).(9) must have didactic instruction in both diagnostic imaging and non-imaging nuclear medicine applications and therapeutic applications. The instruction must be well

organized, thoughtfully integrated, and carried out on a regularly scheduled basis. Instruction must include the following areas:

IV.A.5.b).(9).(a) Diagnostic use of radiopharmaceuticals: clinical indications, technical performance, and interpretation of in vivo imaging of the body organs and systems, using external detectors and scintillation cameras, including SPECT and PET and correlation of nuclear medicine procedures with other pertinent imaging modalities such as plain film radiography, angiography, computed tomography, bone densitometry, ultrasonography, and magnetic resonance imaging;

IV.A.5.b).(9).(b) Exercise and pharmacologic stress testing: the pharmacology of cardioactive drugs; physiologic gating techniques; patient monitoring during interventional procedures; management of cardiac emergencies, including electrocardiographic interpretation and cardiopulmonary life support; and correlation of nuclear medicine procedures with other pertinent imaging modalities such as angiography, computed tomography, bone density measurement, ultrasonography, and magnetic resonance imaging;

IV.A.5.b).(9).(c) Non-imaging studies: training and experience in the application of a variety of non-imaging procedures, including instruction in the principles of immunology; preparation of radiolabeled antibodies; uptake measurements; in-vitro studies including Schilling test, glomerular filtration rate, red blood cell mass and plasma volume, and breath tests;

IV.A.5.b).(9).(d) Therapeutic uses of unsealed radiopharmaceuticals: patient selection and management, including dose administration and dosimetry, radiation toxicity, and radiation protection considerations in the treatment of metastatic cancer and bone pain, primary neoplasms, solid tumors, and malignant effusions; and the treatment of hematologic, endocrine, and metabolic disorders; and,

IV.A.5.b).(9).(e) Fundamentals of the operation of a positron tomography imaging center, including medical cyclotron operation for production of PET radionuclides such as fluorodeoxyglucose (FDG), experience in PET radiopharmaceutical synthesis,

and image acquisition and processing.

**IV.A.5.c) Practice-based Learning and Improvement**

**Residents must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. Residents are expected to develop skills and habits to be able to meet the following goals:**

**IV.A.5.c).(1)** **identify strengths, deficiencies, and limits in one's knowledge and expertise;**

**IV.A.5.c).(2)** **set learning and improvement goals;**

**IV.A.5.c).(3)** **identify and perform appropriate learning activities;**

**IV.A.5.c).(4)** **systematically analyze practice using quality improvement methods, and implement changes with the goal of practice improvement;**

**IV.A.5.c).(5)** **incorporate formative evaluation feedback into daily practice;**

**IV.A.5.c).(6)** **locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems;**

**IV.A.5.c).(7)** **use information technology to optimize learning; and,**

**IV.A.5.c).(8)** **participate in the education of patients, families, students, residents and other health professionals.**

IV.A.5.c).(9) develop and continuously improve skills in obtaining medical knowledge using new techniques as they develop in information technology. This includes:

IV.A.5.c).(9).(a) using the internet and computer data bases to search for patient information, disease, and technique information. Residents should also be familiar with viewing and manipulating images with the computer, both locally and remotely;

IV.A.5.c).(9).(b) improving one's understanding of diseases and patient care by attending inter-specialty conferences, correlative conferences, mortality and morbidity conferences, and utilization conferences; and,

IV.A.5.c).(9).(c) regularly obtain follow-up information, which is essential for determining the accuracy of study interpretation, and correlate the clinical findings with their study interpretation.

**IV.A.5.d) Interpersonal and Communication Skills**

**Residents must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. Residents are expected to:**

**IV.A.5.d).(1) communicate effectively with patients, families, and the public, as appropriate, across a broad range of socioeconomic and cultural backgrounds;**

**IV.A.5.d).(2) communicate effectively with physicians, other health professionals, and health related agencies;**

**IV.A.5.d).(3) work effectively as a member or leader of a health care team or other professional group;**

**IV.A.5.d).(4) act in a consultative role to other physicians and health professionals; and,**

**IV.A.5.d).(5) maintain comprehensive, timely, and legible medical records, if applicable.**

IV.A.5.d).(6) communicate clearly and effectively, and work well with each of the following groups:

IV.A.5.d).(6).(a) patients and their families;

IV.A.5.d).(6).(b) physicians in nuclear medicine and radiology;

IV.A.5.d).(6).(c) referring physicians from other specialties;

IV.A.5.d).(6).(d) nuclear medicine technologists; and,

IV.A.5.d).(6).(e) other health care workers throughout the site.

IV.A.5.d).(7) must have on-call responsibilities and provide consultation for emergency procedures performed.

**IV.A.5.e) Professionalism**

**Residents must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Residents are expected to demonstrate:**

**IV.A.5.e).(1) compassion, integrity, and respect for others;**

**IV.A.5.e).(2)** **responsiveness to patient needs that supersedes self-interest;**

**IV.A.5.e).(3)** **respect for patient privacy and autonomy;**

**IV.A.5.e).(4)** **accountability to patients, society and the profession; and,**

**IV.A.5.e).(5)** **sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation.**

IV.A.5.e).(6) professional behavior, including:

IV.A.5.e).(6).(a) a consistent demonstration of completely ethical behavior;

IV.A.5.e).(6).(b) a respect for the dignity of patients and all members of the medical team; and,

IV.A.5.e).(6).(c) a responsiveness to patients' needs by demonstrating integrity, honesty, compassion, and commitment.

**IV.A.5.f)** **Systems-based Practice**

**Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Residents are expected to:**

**IV.A.5.f).(1)** **work effectively in various health care delivery settings and systems relevant to their clinical specialty;**

**IV.A.5.f).(2)** **coordinate patient care within the health care system relevant to their clinical specialty;**

**IV.A.5.f).(3)** **incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population-based care as appropriate;**

**IV.A.5.f).(4)** **advocate for quality patient care and optimal patient care systems;**

**IV.A.5.f).(5)** **work in interprofessional teams to enhance patient safety and improve patient care quality; and,**

**IV.A.5.f).(6)** **participate in identifying system errors and implementing potential systems solutions.**

IV.A.5.f).(7) work in a variety of heath care settings, and understand the inter-relationship with other health care professionals. Specifically, residents should be aware of:

IV.A.5.f).(7).(a) work conditions in hospitals, out-patient clinics, diagnostic centers, and private practice settings;

IV.A.5.f).(7).(b) resource allocation and methods directed towards controlling health care costs such as Diagnostic Related Groups (DRGs), APC, and pre-certification by medical insurers;

IV.A.5.f).(7).(c) the concept of providing optimal patient care by selecting the most cost-effective procedures and by using or recommending other diagnostic tests that might complement the nuclear medicine procedures; this involves also an awareness of the relevant risk-benefit considerations; and,

IV.A.5.f).(7).(d) basic financial and business skills to function effectively in current health care delivery systems; this includes an understanding and knowledge of coding, procedure charges, billing practices, and reimbursement mechanisms.

IV.A.5.f).(8) have instruction in quality management and improvement: principles of quality management and performance improvement, efficacy assessment, and compliance with pertinent regulations of the Nuclear Regulatory Commission and the Joint Commission on the Accreditation of Healthcare Organizations.

IV.A.6. The Two-year Clinical Curriculum Content

The two-year clinical curriculum should provide the general Nuclear Medicine content as described in Section IV.A.5.a.7 above, with less emphasis on endocrinologic, gastrointestinal, hematologic, and pulmonary studies (Section IV.A.5.a.7 subsection d, e, f, and i). The two year curriculum should include the minimum number of cases as stated above, i.e., radioiodine in hyperthyroidism (minimum of 10 cases), thyroid carcinoma (minimum of five cases), radiolabeled antibodies (minimum of three cases), and radionuclides for painful bone disease. Program directors must be able to document the experience of residents in this area, including patient follow-up, e.g. with logbooks.

IV.A.7. The One-year Clinical Curriculum Content

The one year clinical curriculum should emphasize PET, cardiac studies

and therapy (sections V.B.4.b), c), g), k), l), m), n) in the context of general nuclear medicine. The one year curriculum should include the minimum number of cases as stated above, i.e.: radioiodine in hyperthyroidism (minimum of 10 cases), thyroid carcinoma (minimum of five cases), radiolabeled antibodies (minimum of three cases) and radionuclides for painful bone disease. Program directors must be able to document the experience of residents in this area, including patient follow up, e.g. with logbooks.

**IV.B. Residents' Scholarly Activities**

**IV.B.1. The curriculum must advance residents' knowledge of the basic principles of research, including how research is conducted, evaluated, explained to patients, and applied to patient care.**

**IV.B.2. Residents should participate in scholarly activity.**

**IV.B.3. The sponsoring institution and program should allocate adequate educational resources to facilitate resident involvement in scholarly activities.**

**IV.C. Specialty Curriculum**

**The program must possess a well-organized and effective curriculum, both didactic and clinical. The curriculum must also provide residents with direct experience in progressive responsibility for patient management.**

**V. Evaluation**

**V.A. Resident Evaluation**

**V.A.1. Formative Evaluation**

**V.A.1.a) The faculty must evaluate resident performance in a timely manner during each rotation or similar educational assignment, and document this evaluation at completion of the assignment.**

**V.A.1.b) The program must:**

**V.A.1.b).(1) provide objective assessments of competence in patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice;**

**V.A.1.b).(2) use multiple evaluators (e.g., faculty, peers, patients, self, and other professional staff);**

**V.A.1.b).(3) document progressive resident performance improvement appropriate to educational level; and,**

V.A.1.b).(4) **provide each resident with documented semiannual evaluation of performance with feedback.**

V.A.1.c) **The evaluations of resident performance must be accessible for review by the resident, in accordance with institutional policy.**

V.A.2. **Summative Evaluation**

**The program director must provide a summative evaluation for each resident upon completion of the program. This evaluation must become part of the resident's permanent record maintained by the institution, and must be accessible for review by the resident in accordance with institutional policy. This evaluation must:**

V.A.2.a) **document the resident's performance during the final period of education, and**

V.A.2.b) **verify that the resident has demonstrated sufficient competence to enter practice without direct supervision.**

V.B. **Faculty Evaluation**

V.B.1. **At least annually, the program must evaluate faculty performance as it relates to the educational program.**

V.B.2. **These evaluations should include a review of the faculty's clinical teaching abilities, commitment to the educational program, clinical knowledge, professionalism, and scholarly activities.**

V.B.3. **This evaluation must include at least annual written confidential evaluations by the residents.**

V.C. **Program Evaluation and Improvement**

V.C.1. **The program must document formal, systematic evaluation of the curriculum at least annually. The program must monitor and track each of the following areas:**

V.C.1.a) **resident performance;**

V.C.1.b) **faculty development;**

V.C.1.c) **graduate performance, including performance of program graduates on the certification examination; and,**

V.C.1.d) **program quality. Specifically:**

V.C.1.d).(1) **Residents and faculty must have the opportunity to evaluate the program confidentially and in writing at**

**least annually, and**

**V.C.1.d).(2)** **The program must use the results of residents' assessments of the program together with other program evaluation results to improve the program.**

**V.C.2.** **If deficiencies are found, the program should prepare a written plan of action to document initiatives to improve performance in the areas listed in section V.C.1. The action plan should be reviewed and approved by the teaching faculty and documented in meeting minutes.**

V.C.3. Performance of program graduates on the certification examination should be used as one measure of evaluating program effectiveness. As part of the overall evaluation of the program, the Review Committee will take into consideration the information provided by the ABNM regarding resident performance over the most recent five-year period.

**VI. Resident Duty Hours in the Learning and Working Environment**

**VI.A. Principles**

**VI.A.1.** **The program must be committed to and be responsible for promoting patient safety and resident well-being and to providing a supportive educational environment.**

**VI.A.2.** **The learning objectives of the program must not be compromised by excessive reliance on residents to fulfill service obligations.**

**VI.A.3.** **Didactic and clinical education must have priority in the allotment of residents' time and energy.**

**VI.A.4.** **Duty hour assignments must recognize that faculty and residents collectively have responsibility for the safety and welfare of patients.**

**VI.B. Supervision of Residents**

**The program must ensure that qualified faculty provide appropriate supervision of residents in patient care activities.**

**VI.C. Fatigue**

**Faculty and residents must be educated to recognize the signs of fatigue and sleep deprivation and must adopt and apply policies to prevent and counteract its potential negative effects on patient care and learning.**

**VI.D. Duty Hours (the terms in this section are defined in the ACGME Glossary and apply to all programs)**

**Duty hours are defined as all clinical and academic activities related to the program; i.e., patient care (both inpatient and outpatient), administrative**

**duties relative to patient care, the provision for transfer of patient care, time spent in-house during call activities, and scheduled activities, such as conferences. Duty hours do *not* include reading and preparation time spent away from the duty site.**

**VI.D.1.** **Duty hours must be limited to 80 hours per week, averaged over a four-week period, inclusive of all in-house call activities.**

**VI.D.2.** **Residents must be provided with one day in seven free from all educational and clinical responsibilities, averaged over a four-week period, inclusive of call.**

**VI.D.3.** **Adequate time for rest and personal activities must be provided. This should consist of a 10-hour time period provided between all daily duty periods and after in-house call.**

**VI.E. On-call Activities**

**VI.E.1.** **In-house call must occur no more frequently than every third night, averaged over a four-week period.**

**VI.E.2.** **Continuous on-site duty, including in-house call, must not exceed 24 consecutive hours. Residents may remain on duty for up to six additional hours to participate in didactic activities, transfer care of patients, conduct outpatient clinics, and maintain continuity of medical and surgical care.**

**VI.E.3.** **No new patients may be accepted after 24 hours of continuous duty.**

VI.E.3.a) A new patient is defined as any patient for whom the resident has not previously provided care.

**VI.E.4.** **At-home call (or pager call)**

**VI.E.4.a)** **The frequency of at-home call is not subject to the every-third-night, or 24+6 limitation. However at-home call must not be so frequent as to preclude rest and reasonable personal time for each resident.**

**VI.E.4.b)** **Residents taking at-home call must be provided with one day in seven completely free from all educational and clinical responsibilities, averaged over a four-week period.**

**VI.E.4.c)** **When residents are called into the hospital from home, the hours residents spend in-house are counted toward the 80-hour limit.**

**VI.F. Moonlighting**

**VI.F.1.** **Moonlighting must not interfere with the ability of the resident to achieve the goals and objectives of the educational program.**

**VI.F.2.** **Internal moonlighting must be considered part of the 80-hour weekly limit on duty hours.**

**VI.G. Duty Hours Exceptions**

**A Review Committee may grant exceptions for up to 10% or a maximum of 88 hours to individual programs based on a sound educational rationale.**

**VI.G.1.** **In preparing a request for an exception the program director must follow the duty hour exception policy from the ACGME Manual on Policies and Procedures.**

**VI.G.2.** **Prior to submitting the request to the Review Committee, the program director must obtain approval of the institution's GMEC and DIO.**

**VII. Experimentation and Innovation**

**Requests for experimentation or innovative projects that may deviate from the institutional, common and/or specialty specific program requirements must be approved in advance by the Review Committee. In preparing requests, the program director must follow Procedures for Approving Proposals for Experimentation or Innovative Projects located in the ACGME Manual on Policies and Procedures. Once a Review Committee approves a project, the sponsoring institution and program are jointly responsible for the quality of education offered to residents for the duration of such a project.**

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ACGME: 6/2002; Effective Date: January 1, 2003
Editorial Revision (Common Program Requirements): ACGME approved: February 2003; Effective Date July 2004
ACGME Approved: September 2005; Effective Date: July 2007
Revised Common Program Requirements Effective: July 1, 2007
Editorial Revision December 1, 2007