



Neuroimaging Program Requirements

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I. INTRODUCTION

Neuroimaging is the subspecialty of Neurology dedicated to the study of the structure of the nervous system with techniques that provide an anatomical rendition, both static and dynamic, of the nervous system and related structures.

Because diseases of the nervous system alter its structure and function, neuroimaging contributes substantially to the diagnosis, monitoring, and treatment of neurological diseases.

Neuroimaging techniques currently employed include mainly computed tomography, nuclear magnetic resonance (MRI, MRS, MRA, fMRI), positron emission tomography, single photon emission computed tomography, and catheter angiography.

The training program on neuroimaging is expected to provide the trainee with expertise in the application of neuroimaging techniques to the management of disorders of the nervous system. As a subspecialty of Neurology, Neuroimaging focuses primarily on the integration of clinical information with information provided by neuroimaging techniques. Neuroimaging includes the selection of the appropriate technology to image the relevant structure or function of the nervous system and the correlation of the imaging findings with the rest of the clinical data. For this reason, the neuroimaging trainee should become well acquainted with the history, physical examination and other clinical data of the patients studied.

Emphasis is placed on the correlation of the clinical data with information derived from the various methods used to image and evaluate the nervous system and related structures (*integrated neuroimaging*) and on the updating of algorithms leading to a cost effective and efficient use of imaging modalities for the diagnosis and treatment of the different disorders of the nervous system.

II. INSTITUTIONAL SUPPORT

A. Sponsoring Institution

The sponsoring institution assumes ultimate responsibility for the neuroimaging training program. The governing body of the sponsoring institution should approve the existence of the program, its goals and its budget. It can delegate in appropriate committees or persons the duties of appointing teaching personnel and trainees, monitoring the quality of the program and providing periodic reports, as required by the UCNS Accreditation Committee.

B. Participating Institutions

Assignments to participating institutions must be based on a clear educational rationale and must have clearly stated learning objectives and activities.

Program letters of agreement must be developed for each participating institution that provides an educational experience for a trainee that is one month in duration or longer. In instances where two or more participating institutions in the program

function as a single unit under the authority of the program director, letters are not necessary.

The agreements should

1. identify the faculty who will assume the educational and supervisory responsibility for trainees and specify the faculty responsibilities for teaching, supervision, and formal evaluation of trainee performance;
2. outline the educational goals and objectives to be attained by the trainee during the assignment;
3. specify the period of trainee assignment;
4. establish the policies that will govern trainee employment during the assignment.

III. DURATION OF TRAINING AND TRAINEE APPOINTMENT

1. Minimum Length of Training

- a. Training in Neuroimaging shall encompass a period of at least twelve months, which must be preceded by the completion of a residency program in neurology or child neurology accredited by the Accreditation Council for Graduate Medical Education (ACGME) or the Royal College of Physicians and Surgeons of Canada (RCPSC). The training must be distinct from training required for certification in neurology or child neurology. The twelve-month period of training should be in the broad area of neuroimaging, as the trainee learns the application of the relevant neuroimaging techniques to the management of disorders of the nervous system.
- b. The objective of the total training outlined above is to provide the trainee with the opportunity to develop diagnostic, procedural, and technical skills essential to the performance of neuroimaging.

2. Number of Trainees

A program may have one or more trainees, depending on the number of faculty and the availability of equipment and teaching material.

IV. FACULTY AND PERSONNEL

A. Program Director Qualifications

The program director must be certified by a member board of the American Board of Medical Specialties (ABMS) or RCPSC in neurology, neurosurgery, radiology or nuclear medicine and appropriate subspecialty certification. The program director must spend at least 80% of his or her clinical and academic time in neuroimaging or a neurological-disease related field with an important content of neuroimaging.

The program director must possess the requisite subspecialty expertise, as well as documented educational abilities and administrative experience.

The program director must be appointed in good standing and based at the primary teaching site.

B. Program Director Responsibilities

The program director shall select and supervise the trainees, design and monitor the training program, assign relevant scholarly activities including research and academic tasks to the trainees, and select other neuroimaging faculty members. Depending on the availability of additional faculty, the program director must carry out enough direct trainee teaching and supervision to ensure their adequate training. The program director shall perform quarterly reviews of the trainees and obtain feedback from the trainees on the program and the faculty.

C. Faculty Qualifications

Depending on the size of the training program, other faculty may be needed. Faculty must be certified by a member board of the ABMS or RCPSC in neurology, neurosurgery, nuclear medicine, or radiology or possess qualifications judged to be acceptable by the UCNS. If certified in radiology, a one-year fellowship in neuroradiology must have been completed.

The faculty must possess the requisite subspecialty expertise, as well as documented educational and administrative abilities.

The faculty must be appointed in good standing and accountable to the primary teaching site.

D. Faculty Responsibilities

The faculty must provide teaching and supervision of the trainees in the selection, performance and interpretations of neuroimaging procedures.

E. Other Program Personnel

Other program personnel will usually include neuroimaging technologists. Their appropriate training must be insured by the training program director.

V. EDUCATIONAL PROGRAM

A. Role of Program Director and Faculty

The role of the neuroimaging program director includes:

- a. devoting sufficient time to provide leadership to the program and supervision of the trainees.
- b. monitoring the content and ensuring the quality of the program.
- c. preparation of a written statement outlining the educational goals and objectives of the program with respect to knowledge, skills, and other

attributes of trainees. This statement must be distributed to trainees and members of the teaching staff as they begin the program. It should be readily available for review. The program director also must develop criteria to use in the assessment of the extent to which the program's goals and objectives are met.

- d. selection of trainees for appointment to the program in accordance with institutional policies and procedures.
- e. selection and supervision of the teaching staff and other program personnel at each institution participating in the program.
- f. regular evaluation of trainees' knowledge, skills, and overall performance, including the development of professional attitudes and ethical behavior consistent with being a capable neuroimager. The program director, with the possible participation of members of the teaching staff, shall
 - 1) at least quarterly, evaluate the knowledge, skills, and professional growth of the trainees, using appropriate criteria and procedures;
 - 2) communicate each evaluation to the trainee in a timely manner;
 - 3) maintain a permanent record of evaluation for each trainee and have it accessible to the trainee and other authorized personnel.
 - 4) provision of a written final evaluation for each trainee who completes the program. The evaluation must include a review of the trainee's performance during the final period of training and should verify that the trainee has demonstrated sufficient professional ability to practice neuroimaging competently and independently. This final evaluation must be part of the trainee's permanent record maintained by the institution.
- g. implementation of fair procedures found in the Institutional Requirements, or the equivalent, as established by the sponsoring institution regarding academic discipline and trainee complaints or grievances.
- h. monitoring trainee stress, including mental or emotional conditions inhibiting performance or learning, and drug- or alcohol-related dysfunction. Program directors and teaching staff must be sensitive to the need for timely provision of confidential counseling and psychological support services to trainees. Training situations that consistently produce undesirable stress on trainees must be evaluated and modified.
- i. preparation of an accurate statistical and narrative description of the program, as requested by the UCNS Accreditation Committee.
- j. notification in writing to the Executive Director of the UCNS within 60 days of any major change in the program that may significantly alter the educational experience for the trainees, including but not limited to
 - (1) changes in the program directorship and
 - (2) changes in administrative structure.

Notification of a change in the program directorship must include a copy of the new director's curriculum vitae, including details of his/her experience and qualifications in graduate medical education.

Other Faculty. All members of the teaching staff must demonstrate a strong interest in the education of trainees, sound clinical and teaching abilities, support of the goals and objectives of the program, and a commitment to their own continuing medical education. In addition:

- a. The teaching staff must have regular documented meetings to review program goals and objectives as well as program effectiveness in achieving them. At least one trainee representative must participate in these reviews.
- b. The teaching staff must periodically evaluate the use of the resources available to the program, the contribution of each institution participating in the program, the financial and administrative support of the program, the volume and variety of patients available to the program for educational purposes, the availability of the needed technologies, the performance of members of the teaching staff, and the quality of supervision of trainees.

B. Competencies

The purpose of the training program is to prepare the physician for the independent practice of neuroimaging. This training must be based on supervised neuroimaging work with increasing responsibility for the selection, performance and interpretation of neuroimaging procedures. It must have a foundation of organized instruction in basic neuroscience, particularly as it relates to neuroanatomy, cerebral hemodynamics and neurobiochemistry. It should also include instruction in physics, applied to the neuroimaging procedures used in the program.

The training program must require its trainees to obtain competencies in the six areas below to the level expected of a practitioner. Toward this end, programs must define the specific knowledge, skills, and attitudes required and provide educational experiences as needed in order for their trainees to demonstrate the following:

1. Patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health
2. Medical knowledge about established and evolving biomedical, clinical, and cognate (e.g., epidemiological and social-behavioral) sciences and the application of this knowledge to patient care
3. Practice-based learning and improvement that involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care

4. Interpersonal and communication skills that result in effective information exchange and teaming with patients, their families, and other health professionals
5. Professionalism, as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population
6. Systems-based practice, as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value

C. Didactic Components

Neuroimaging programs should include instruction in basic neuroscience, particularly as it relates to neuroanatomy, cerebral hemodynamics and neurobiochemistry. It should also include instruction in physics, applied to the neuroimaging procedures used in the program. Although the instruction may be preferentially in adult or pediatric neuroimaging, all the programs should have some content of both.

An example of the content of the didactic component of training is outlined in the Neuroimaging Core Curriculum.

D. Clinical Components

To obtain the appropriate breadth of exposure to the full spectrum of neurologic diseases, neuroimaging could be learned in either inpatient or outpatient settings or both. Although the experience may be preferentially in adult or pediatric neuroimaging, all the programs should have some content of both.

An example of the content of the clinical component of training is outlined in the Neuroimaging Core Curriculum.

E. Scholarly Activities

Trainees must read regularly the best neuroimaging journals and neuroimaging papers that appear in other biomedical journals of a high impact factor. Trainees must report on clinical series or cases that contribute original ideas or perspectives to the field of neuroimaging.

F. Program Resources and Facilities

Program resources will depend on the emphasis of the neuroimaging training program. In general, equipment that may be available in a neuroimaging training facility would include:

- a. Magnetic resonance scanner, preferably with facilities to perform echoplanar imaging
- b. Computed tomography (CT) scanner

Facilities should be available for physiological monitoring and for emergency ventilation and cardiac life support. There must be adequate facilities adjacent to

or within examination rooms, for storing supplies needed for the conduct of invasive neuroimaging procedures, if they are carried out. In this case, there must be appropriately trained nurses and technologists for these invasive procedures.

Adequate space for image display and interpretation of studies must be available. There must be adequate office space and support space for neuroimaging faculty/staff and trainees.

The program should provide adequate office space, computers, supplies and secretarial support to facilitate the performance of research projects.

Library

A library with the core neuroimaging journals should be available. Alternatively, there could be access to these journals through workstations available to the trainees.

A teaching file of 500 representative neuroimaging cases, with case histories and images, must be available to the trainee, either from the training institution itself or on electronic media.

G. Trainee Duty Hours and Working Environment

Providing trainees with a sound academic and clinical education must be carefully planned and balanced with concerns for patient safety and trainee well being. Each program must ensure that the learning objectives of the program are not compromised by excessive reliance on trainees to fulfill service obligations. Didactic and clinical education must have priority in the allotment of trainees' time and energies. Duty hour assignments must recognize that faculty and trainees collectively have responsibility for the safety and welfare of patients.

1. Supervision of Trainees

- a. All patient care must be supervised by qualified faculty. The program director must ensure, direct, and document adequate supervision of trainees at all times. Faculty supervision must be available at all sites of training. Trainees must be provided with rapid, reliable systems for communicating with supervising faculty. The responsibility or independence given to trainees should depend on their knowledge, manual skills, and experience. Trainees must always have faculty backup when taking night or weekend call. All clinical neuroimages must be reviewed by faculty, who should sign all reports.
- b. Faculty schedules must be structured to provide trainees with continuous supervision and consultation.
- c. Faculty and trainees must be educated to recognize the signs of fatigue and adopt and apply policies to prevent and counteract the potential negative effects.

2. Duty Hours

- a. Trainee duty hours and work environment should be consistent with the ACGME requirements.

3. On-Call Activities

- a. The objective of on-call activities is to provide trainees with continuity of patient care experiences throughout a 24-hour period. In-house call is defined as those duty hours beyond the normal workday when trainees are required to be immediately available in the assigned institution.
- b. On-call activities should be consistent with the ACGME requirements.

4. Moonlighting

- a. Because fellowship education is a full-time endeavor, the program director must ensure that moonlighting does not interfere with the ability of the trainee to achieve the goals and objectives of the educational program.
- b. The program director must comply with the sponsoring institution's written policies and procedures regarding moonlighting.

5. Oversight

- a. Each program must have written policies and procedures consistent with the Institutional and Program Requirements for trainee duty hours and the working environment. These policies must be distributed to the trainees and the faculty. Monitoring of duty hours is required with frequency sufficient to ensure an appropriate balance between education and service.
- b. Back-up support systems must be provided when patient care responsibilities are unusually difficult or prolonged, or if unexpected circumstances create trainee fatigue sufficient to jeopardize patient care.

VI. EVALUATION

A. Trainee Evaluation

The program must have an evaluation system that provides information about each trainee's educational progress and the extent to which each trainee has accomplished the program's learning and performance objectives.

- a. The training program must demonstrate that it has an effective plan for assessing trainee performance throughout the program and for utilizing assessment results to improve trainee performance. This plan should include:
 - i. use of dependable measures to assess trainees' competence in patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice;
 - ii. mechanisms for providing regular and timely performance feedback to trainees; and

- iii. a process involving use of assessment results to achieve progressive improvements in trainees' competence and performance.
- b. Programs that do not have a set of measures in place must develop a plan for improving their evaluations and must demonstrate progress in implementing the plan.
- c. Formative evaluation
 - i. Trainee performance must be monitored and feedback provided on an ongoing basis.
 - ii. The program director or his or her designee must meet with each trainee quarterly in a formal feedback session to discuss the trainee's standing in relation to specific learning and performance objectives. Plans to correct any deficiencies must be discussed. Each trainee must be an active participant in formulating plans for his or her development. Evaluation data should be used to advise the trainee and to make decisions regarding the progression in the trainee's level of responsibility.
- d. Final evaluation

At the conclusion of the trainee's period of training in the program, the program director must prepare a detailed, written evaluation of the trainee's performance in relation to the program's learning and performance objectives and discuss this evaluation with the trainee.
- e. Records

A written record of the contents of the quarterly review session must be prepared and filed in the trainee's permanent record. The written record of the evaluation and the review must be signed by the trainee. The trainee must have the opportunity to append a written response to the written record of the evaluation and review.

B. Faculty Evaluation

The performance of the faculty must be evaluated quarterly. The evaluations should include a review of their teaching abilities, commitment to the educational program, clinical knowledge, and scholarly activities. Annual written confidential evaluations by trainees must be included in this process. In addition, the training site should have a quality assurance program regarding neuroimaging interpretations.

C. Program Evaluation

The educational effectiveness of a program must be evaluated in a systematic manner. In particular, the quality of the curriculum and the extent to which the educational goals have been met by trainees must be assessed. Confidential written evaluations by trainees must be used in this process.

- a. The training program should use trainee performance and outcome assessment results in their evaluation of the educational effectiveness of the training program.

- b. The training program should have in place a process for using trainee and performance assessment results together with other program evaluation results to improve the program.
- c. Evaluations of trainees' attainment of the program's learning and performance objectives must be used as the basis for program evaluation. Trainee's performance data must be compared with the program's own criteria, performance criteria set by the UCNS Accreditation Committee, and attainment of trainees at other neuroimaging training programs. For the last comparison the program can use trainee's performance in the ASN-Neuroimaging Certification Examination or the type of examination used instead after the UCNS integration process.
- d. Trainees must evaluate the program at least annually.