Neuroimaging Program Requirements

I. Introduction

Neuroimaging is the subspecialty of neurology dedicated to the study of the structure of the nervous system with techniques that provide anatomical renditions, 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 but are not limited to computed tomography, nuclear magnetic resonance (MRI, MRS, MRA, fMRI), positron emission tomography, single photon emission computed tomography, and catheter angiography.

The training program in 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 histories, physical examinations, 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 to 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 United Council for Neurologic Subspecialties (UCNS) Accreditation Committee.

1. UCNS-accredited GME (Graduate Medical Education) programs must operate under the authority and control of a sponsoring institution, defined as the institution that assumes the ultimate responsibility for a program of GME. The sponsoring institution must assume the ultimate responsibility for the program and must meet the current ACGME Institutional Requirements (www.acgme.org). The sponsoring institution's responsibility extends to fellow assignments at all participating institutions.
2. The sponsoring institution must be appropriately organized for the conduct of GME in a scholarly environment and must be committed to excellence in both medical education and patient care.

B. Participating Institutions

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

1. Participating Institution 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. Such letters must:
   i. confirm the relationship of the participating institution to the program;
   ii. state commitment to training and education;
   iii. list specific educational activities that will be undertaken, supported, and supervised at the participating institution;
   iv. establish the policies that will govern trainee employment during the assignment; and
   v. be signed by the department chair of the participating institution.

III. DURATION OF TRAINING AND TRAINEE APPOINTMENT

A. Minimum Length of Training

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, neurosurgery 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.

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. (See clinical components under V.D.)

B. Number of Trainees

1. The minimum number of trainees to be trained is one (1).
2. The minimum faculty to trainee ratio is 2:1.

C. Eligibility

The trainee must:

1. have a current valid and unrestricted license to practice medicine in the US or Canada.
2. be a graduate of a residency program in either neurology or child neurology accredited by the ACGME or the RCPSC.

IV. FACULTY AND PERSONNEL A. Program Director Qualifications

There must be a single program director responsible for the program. The program director must:

A. Program Director Qualifications

1. be certified by a member board of the American Board of Medical Specialties (ABMS) or RCPSC in neurology, child neurology, neurosurgery, or radiology. If certified in radiology, a one-year fellowship in neuroradiology must have been completed.
2. be certified by the UCNS or possess the appropriate qualification (as determined by the UCNS Accreditation Council).
3. 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.

4. possess the requisite subspecialty expertise, as well as documented educational abilities and administrative experience.
5. be appointed in good standing and credentialed to interpret imaging studies at all teaching sites where he/she works.
6. possess a valid license in the state of the program.

B. Program Director Responsibilities

The role of the neuroimaging program director includes:

1. devoting sufficient time to provide leadership to the program and supervision of the trainees. The Program Director must organize and oversee the activities of the educational program in all institutions that participate in the program.
2. monitoring the content and ensuring the quality of the program.
3. 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 must also develop criteria to use in the assessment of the extent to which the program's goals and objectives are met.
4. selection of trainees for appointment to the program in accordance with institutional policies and procedures.
5. selection and supervision of the teaching staff and other program personnel at each institution participating in the program.
6. 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 participation of members of the teaching staff, shall:
    i. evaluate, on a quarterly basis, the knowledge, skills, and professional growth of the trainees, using appropriate criteria and procedures;
    ii. communicate each evaluation to the trainee in a timely manner;
    iii. maintain a permanent record of evaluation for each trainee and have it accessible to the trainee and other authorized personnel;
    iv. provide 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.
7. Implementation of fair procedures as found in the Institutional Requirements, or the equivalent, established by the sponsoring institution regarding academic discipline and trainee complaints or grievances.
8. Monitoring of 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.
9. Preparation of an accurate statistical and narrative description of the program, as requested by the UCNS Accreditation Council.
10. 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
    i. changes in the program directorship and
    ii. changes in administrative structure.

11. 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.
12. The program director, with assistance of the faculty, is responsible for developing and implementing the academic and clinical program of fellow education by:
    i. using the neuroimaging (NI) Core Curriculum to define core competencies with regard to the medical knowledge, patient care skills, interpersonal and communication skills, practice- and systems-based competencies, and standards of professionalism that are to be developed during the period of fellowship training in NI.
    ii. providing fellows with direct experience in progressively increasing responsibility for patient management.
    iii. providing clinical opportunities and experience as outlined in III. 1. b.

C. Faculty Qualifications

Depending on the size of the training program, other faculty may be needed. Faculty must:

1. be certified by a member board of the ABMS or RCPSC in neurology, neurosurgery, child neurology 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.
2. possess the requisite subspecialty expertise, as well as documented educational and administrative abilities.
3. possess a current valid and unrestricted license.
4. be appointed in good standing and accountable to the teaching site.
5. be certified by the UCNS or possess appropriate qualifications (as determined by the UCNS Accreditation Council.

Faculty Responsibilities: The Faculty must:

1. provide teaching and supervision of the trainees in the selection, performance and interpretation of neuroimaging procedures.
2. be available for consultation, education, and mentoring.
3. participate in the education and evaluation of the trainee.
4. contribute to the evolution of the program and subspecialty.
5. devote time to the trainee in proportion to the area of expertise expressed and required.

D. Other Program Personnel

Other program personnel must include neuroimaging technologists with appropriate training ensured by the program director.

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:

1. 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.
2. 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.

Appropriate administrative support must be provided.

V. EDUCATIONAL PROGRAM

A. 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 neurochemistry. 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 ACGME core competencies below to the level expected of a practitioner in Neuroimaging (www.acgme.org). 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 patients' 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.

B. Didactic Components

Neuroimaging programs should include instruction in basic neuroscience, particularly as it relates to neuroanatomy, neuropathology, cerebral hemodynamics and neurochemistry. It should also include instruction in physics, applied to the neuroimaging procedures used in the program. Instruction may preferentially emphasize either adult or pediatric neuroimaging, The content of the didactic component of training is outlined in the Neuroimaging Core Content.

C. Clinical Components

In 12 month programs, 80% of the time must be spent in activities directly related to the care of patients. 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. The experience may preferentially emphasize either adult or pediatric neuroimaging. The content of the clinical component of training is outlined in the Neuroimaging Core Content.

Each fellow must interpret a minimum of 200 MRI and 200 CT cases and provide written reports on a minimum of 100 MRI and 100 CT cases. The training must include significant didactic and clinical experience (or both) reflecting appropriate representation of the current status and trends in imaging modalities as well as a breadth and balance of care for patients with neurologic conditions. Programs that do not provide experiential training in some modalities (e.g. ultrasound, catheter angiography) must present concepts in didactic form to ensure the trainees acquire working familiarity with the entire field.

D. Scholarly Activities

Trainees must regularly read 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.

E. Program Resources and Facilities

Program resources will depend on the emphasis of the neuroimaging training program. Equipment that must be available in a neuroimaging training facility includes:

1. magnetic resonance scanner, preferably with facilities to perform echoplanar imaging.
2. computed tomography (CT) scanner.
3. In addition to these required imaging modalities, fellows must be exposed to and receive appropriate instruction in the use of CT perfusion, MR perfusion and other emerging neuroimaging technologies using these platforms.

Facilities must 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 must provide adequate office space, computers, supplies and secretarial support to facilitate the performance of research projects.

F. Library

Access to core neuroimaging journals must be readily available to the trainees in electronic or hard copy format.

A teaching file of at least 500 representative neuroimaging cases, with case histories and images, covering a wide variety of disorders 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
    i. 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.
    ii. Faculty schedules must be structured to provide trainees with continuous supervision and consultation.
    iii. 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
    i. Trainee duty hours and work environment must be consistent with the ACGME requirements (www.acgme.org)
3. On-Call Activities
    i. 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.
    ii. On-call activities must be consistent with the ACGME requirements (www.acgme.org).
4. Moonlighting
   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. The program director must comply with the sponsoring institution's written policies and procedures regarding moonlighting.
5. Oversight
   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. 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.

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:

1. 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.
2. Mechanisms for providing regular and timely performance feedback to trainees.
3. A process involving use of assessment results to achieve progressive improvements in trainees' competence and performance.

Programs must have a set of measures in place for their evaluations:

1. Trainee performance must be monitored and feedback provided on an ongoing basis.
2. 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 in writing and be used to advise the trainee and to make decisions regarding the progression in the trainee's level of responsibility.

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 including the trainee's ability to practice independently.

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 be in writing and 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 must 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.

1. The training program must use trainee performance and outcome assessment results in their evaluation of the educational effectiveness of the training program.
2. The training program must have in place a process for using trainee and performance assessment results together with other program evaluation results to improve the program.
3. 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.
4. Trainees must evaluate the program at least annually.

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