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AANEM PRACTICE TOPIC

AANEM Collaborative Position Statement

Guidelines for Qualifications of Neurodiagnostic Personnel: A Joint Position Statement of the American Clinical Neurophysiology Society, the American Association of Neuromuscular & Electrodiagnostic Medicine, the American Society of Neurophysiological Monitoring, and ASET The Neurodiagnostic Society

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Abstract

The Guidelines for Qualifications of Neurodiagnostic Personnel (QNP) document has been created through the collaboration of the American Clinical Neurophysiology Society (ACNS), the American Society of Neurophysiological Monitoring (ASNM), the American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM), and ASET The Neurodiagnostic Society (ASET). The quality of patient care is optimized when neurophysiological procedures are performed and interpreted by appropriately trained and qualified practitioners at every level. These societies recognize that neurodiagnostics is a large field with practitioners who have entered the field through a variety of training paths. This document suggests job titles, associated job responsibilities, and the recommended levels of education, certification, experience, and ongoing education appropriate for each job. This is important because of the growth and development of standardized training programs, board certifications, and continuing education in recent years. This document matches training, education, and credentials to the various tasks required for performing and interpreting neurodiagnostic procedures. This document does not intend to restrict the practice of those already working in neurodiagnostics. It represents recommendations of these societies with the understanding that federal, state, and local regulations, as well as individual hospital bylaws, supersede these recommendations. Because neurodiagnostics is a growing and dynamic field, the authors fully intend this document to change over time.

KEYWORDS
Clin- ical neurophysiology, Electrodiagnostic, Intraoperative monitoring, Neurodiagnostic creden- tials, Neurodiagnostic personnel, Neurodiagnostics, (J Clin Neurophysiol 2023;00: 1–15)

1 | TECHNOLOGIST POSITIONS (ALL ABBREVIATIONS AND CORRESPONDING DEFINITIONS ARE FOUND IN TABLE 1)[1,2]

1.1 | Neurodiagnostic Assistant (NDA)[3]

Job responsibilities (Tables 1 and 2).

Continuously monitors patients undergoing cEEG recording for safety, either in room or via remote video monitoring; possesses knowledge of monitoring system and camera controls; alerts nursing and/or technologist staff when clinical seizures or other paroxysmal events occur; may communicate with patients and bedside staff to obtain information about events; and may document observations. The NDA is not qualified to analyze EEG data.

May assist ND technologists as needed (restocking supplies, electrode removal, disinfection, etc).

Completes hospital training to alert supervisor and/or activate hospital systems, such as rapid response, cardiac arrest, etc., per established protocols when encountering patient clinical issues.

Education/certification.

High school diploma or equivalent. Successful completion of the ASET online course, LTM 100, titled Introduction to LTM for EMU Personnel.[4]

Experience.

No previous experience; no less than 20 hours of observation in an EMU or ND laboratory under the direction of a credentialed ND technologist (R. EEG T., CLTM, or NA-CLTM) (The registries for EEG and EP, and the certifications for IONM, LTM, ANS testing, and MEG are registered by ABRETd Neurodiagnostic Credentialing and Accreditation as follows: R. EEG T., R. EP T., CNIM, CLTM, CAP, and CMEG).

Competency assessments[5] including, but not limited to, recognition of clinical seizures and other clinical paroxysmal events, ictal testing procedures, measures to reduce risk of fall, and seizure first aid.

Supervision (Table 3).

General technical supervision by an ND Technologist III or above.

Ongoing education/maintenance of competency Should attend relevant educational offerings and be required to demonstrate ongoing competence.

TABLE 1 Abbreviations and Corresponding Definitions.

AAA	American Academy of Audiology
AAET	American Association of Electrodiagnostic Technologists
AANEM	American Association of Neuromuscular and Electrodiagnostic Medicine
ABCN	American Board of Clinical Neurophysiology
ABEM	American Board of Electrodiagnostic Medicine
ABNM	American Board of Neurophysiologic Monitoring
ABPN	American Board of Psychiatry and Neurology
ABPN-CN	Subspecialty board in Clinical Neurophysiology of the American Board of Psychiatry and Neurology
ABPMR	American Board of Physical Medicine and Rehabilitation
ABRET	ABRETdNeurodiagnostic Credentialing & Accreditation
ACGME	Accreditation Council for Graduate Medical Education
ACNS	American Clinical Neurophysiology Society
AEEG	Ambulatory EEG
AEF	Auditory evoked field
ANS	Autonomic nervous system
ASET	ASET The Neurodiagnostic Society
ASHA	American Speech–Language–Hearing Association
ASNM	American Society of Neurophysiological Monitoring
AuD	Doctor of Audiology
BAEP	Brainstem auditory evoked potential
CAAHEP	Commission on Accreditation of Allied Health Education Programs
CAP	ABRET credential for a certification in autonomic function testing
CCC-A	Certificate of clinical competency in audiology
cEEG	Continuous electroencephalography
CEU	Continuing education unit
CLTM	ABRET credential for a certification in long-term monitoring
CME	Continuing medical education
CMEG	ABRET credential for a certification in magnetoencephalography
CNCT	ABEM credential for a certified nerve conduction technologist
CNIM	ABRET credential for a certification in neurophysiologic intraoperative monitoring
CNP	Clinical neurophysiology
CoA-NDT	Committee on Accreditation for Education in Neurodiagnostic Technology
DABNM	Diplomate, American Board of Neurophysiologic Monitoring
DO	Doctor of Osteopathic Medicine
EDX	Electrodiagnostic
EEG	Electroencephalography
EMG	Needle electromyography
EMU	Epilepsy monitoring unit
EP	Evoked potential
FMG	Foreign medical graduate
ICU	Intensive care unit
ICU/cEEG	Continuous EEG monitoring in the intensive care unit
IONM	Intraoperative neurophysiologic monitoring
LEF	Language evoked field
LTM	Long-term monitoring
LTME	Long-term monitoring for epilepsy
MD	Doctor of Medicine
MEF	Movement/motor evoked field
MOC	Maintenance of certification
MRI	Magnetic resonance imaging
NA-CLTM	ABRET credential for a NeuroAnalyst certification in long-term monitoring
NCS	Nerve conduction studies
ND	neurodiagnostic(s)
NDA	Neurodiagnostic assistant
PhD	Doctor of Philosophy
PMR	Physical medicine and rehabilitation
QA	Quality assurance/assessment
QNP	Qualifications of neurodiagnostic personnel
RCPSC©	Royal College of Physicians and Surgeons of Canada
R. EEG T.	ABRET credential for a registered EEG technologist
R. EP T.	ABRET credential for a registered evoked potential technologist
R.NCS.T.	AAET credential for a registered nerve conduction study technologist
SA-CME	Self-assessment continuing medical education
SEF	Somatosensory evoked field
SSEP	Somatosensory evoked potential
VEF	Visual evoked field
VEP	Visual evoked potential

1.2 | Neurodiagnostic Technologist I (Grandfather clause*: Any ND technologist practicing in the ND field before December 31, 2021, shall be considered grandfathered in ND education, and therefore shall be deemed that the existing ND education requirement as outlined in Section 3 has been met (Table 2))

Job responsibilities.

This is a transitional position, and a new hire is expected to obtain credentials within 5 years.

Performs routine testing under supervision; writes a descriptive technical analysis for QA purposes only.[6]

Has hospital training to alert supervisor and/or activate hospital systems, such as rapid response, cardiac arrest, etc., per established protocols when encountering patient clinical issues.

TABLE 2 Overview of Technologist Positions.

Section #. Position Title	Responsibilities	Education/Certification	Experience
1. Neurodiagnostic Assistant (formerly Neurodiagnostic Lab Assistant or Patient Observer)	Assists technologists; patient safety	High school diploma; ASET online course, LTM 100: Introduction to LTM for EMU Personnel[4]	Internal training program
2. Neurodiagnostic Technologist I*	Routine testing under direct supervision	Associate degree preferred or enrollment in CAAHEP-accredited ND program†	Internal training program
		Must be credentialed within 5 years of hire	
3. Neurodiagnostic Technologist II*	Routine testing under general supervision	Associate degree or graduate of CAAHEP-accredited ND program	Board-eligible
		Board eligible: must be credentialed within 3 years of hire	Twelve months of patient care in field
4. Neurodiagnostic Technologist III*	Routine and advanced testing under supervision	Associate degree preferred or enrolled in CAAHEP-accredited ND program	Credentialed
		ABRET, AAET, and/or ABEM credentialed	
5. IONM Neurodiagnostic Technologist I	Assists IONM technologists	R. EEG T., R. EP T., or bachelor's degree	Six months of experience in patient care
		Must earn CNIM within 5 years of hire	
6. Neurodiagnostic Technology Specialist I	Routine and advanced testing	ABRET, AAET, or ABEM credentialed associate degree or graduate of CAAHEP-accredited ND program	One year after credential; 3 years in the field
		Bachelor's degree preferred	
6a. Neurodiagnostic Technology Specialist I LTME	Routine and advanced testing; advanced pattern recognition skills; summarizes data for MD review	R. EEG T. plus minimum associate degree or graduate of CAAHEP-accredited ND program	One year after credential; 3 years in the field
6b. Neurodiagnostic Technology Specialist I ICU cEEG	Routine and advanced testing; advanced pattern recognition skills; summarizes data for MD review	R. EEG T. plus minimum associate degree or graduate of CAAHEP-accredited ND program	One year after credential; 3 years in the field
6c. Neurodiagnostic Technology Specialist I IONM	Routine and advanced testing; works independently; advanced pattern recognition skills and ability to troubleshoot	CNIM	One year after credential
6d. Neurodiagnostic Technology Specialist I NCS	Routine and advanced testing; troubleshooting skills; ability to use critical thinking to enhance study	R.NCS.T. or CNCT plus minimum associate's degree or graduate of CAAHEP-accredited ND program	Four years after credential; 5 years in the field
6e. Neurodiagnostic Technology Specialist I MEG	Recognizes significant clinical events and EEG patterns	Meets CMEG examination requirements set forth by ABRET	Three or more years of experience in the field, 6 months of MEG experience, including 75 MEGs for epilepsy
7. Neurodiagnostic Technology Specialist II*	Routine and advanced testing; more detailed data review; ability to teach/train	ABRET, AAET, or ABEM credentialed; plus minimum associate degree or graduate of CAAHEP-accredited ND program	Three years after credential; 5 years in the field
7a. Neurodiagnostic Technology Specialist II LTME	Routine and advanced testing; more detailed data review; ability to teach/train; assists in development of policy and procedure manuals	CLTM plus minimum associate degree or graduate of CAAHEP-accredited ND program	Three years after credential; 5 years in the field

(Continues)

TABLE 2 (Continued)

Section #. Position Title	Responsibilities	Education/Certification	Experience
7b. Neurodiagnostic Technology Specialist II ICU/cEEG	Routine and Advanced testing; more detailed data review; ability to teach/train; assists in development of policy and procedure manuals	CLTM plus minimum associate degree or graduate of CAAHEP-accredited ND program	Three years after credential; 5 years in the field
7c. Neurodiagnostic Technology Specialist II IONM	Routine and Advanced testing; more detailed data review; ability to teach/train; assists in development of policy and procedure manuals	CNIM	Three years after credential; 5 years in the field
7d. Neurodiagnostic Technology Specialist II NCS	Routine and Advanced testing; more detailed data review; ability to teach/train; assists in development of policy and procedure manuals	R.NCS.T. or CNCT plus minimum of a bachelor's degree	Five years with credential; 6 years performing NCS
7e. Neurodiagnostic Technology Specialist II MEG	Performs digitization for co-registration; performs initial MEG spontaneous recording with concurrent EEG; understands placement and recording of Evoked Field Testing.	CMEG	Three or more years in the field, specifically EEG, and 2 years in MEG
8. NeuroAnalyst (formerly Advanced Long-Term EEG Monitoring Analyst)	Acts as physician extender in LTM setting; writes detailed description of EEG and includes representative samples	CLTM plus associate degree or graduate of CAAHEP-accredited ND program or bachelor's degree	Five years in LTM, EMU, and/or ICU/cEEG post-CLTM
		NA-CLTM preferred	
9. Neurodiagnostic Technical Lab Supervisor	Provides direct supervision and education to other technologists; maintains policies and procedures; oversees day to day operations in collaboration with physician director.	Credential(s) in the areas supervised; associate degree or graduate of CAAHEPaccredited ND program minimum; bachelor's degree preferred	Five years of experience
10. Neurodiagnostic Education Specialist	Designs and implements competency and educational activities for ND personnel; develops new employees to meet job requirements; assists those who are not credentialed for registry examination.	Bachelor's degree, preferably in ND or advanced degree; minimum one ND credential	Five years of experience with previous teaching experience preferred
11. Neurodiagnostic Technical Lab Director	Works with hospital administration and the medical director to make personnel and budgetary decisions; may take on the responsibilities described in row nine above	Bachelor's degree in health sciences or ND minimum; credential in at least one ND modality	Five years of experience with 3 years of previous supervisory experience recommended

*For modality-specific roles, such as ND Tech I working in NCS, refer to respective sections in the text for additional information.
†Refer to the grandfather clause in the text.

Education/certification.

Associate degree or higher is preferred or enrollment in a CAAHEP-accredited ND program.[7,8]

For NCS Technologist I,[9] may have 6 months of personal supervision training under a Technologist III or higher with direct supervision of EDX physician.

Experience.

No specific previous experience required; must meet hospital standards for all patient care workers.

Competencies should at minimum include those specified by ASET's National Competency Skill Standards,[5] AANEM's skill standards for NCS,[10] and/or ABEM's eligibility and application requirements.[11]

TABLE 3 Supervision Levels in Neurodiagnostics.

Technologist*	
Level	Description
Direct technical supervision	Credentialed technologist or physician approved to perform all technical aspects of the procedure must be physically present at all times during the procedure.
Indirect technical supervision	Credentialed technologist or physician approved to perform all technical aspects of the procedure must be immediately available at all times to provide assistance and direction throughout the procedure.
General technical supervision	Performed under technical supervision as detailed in the facility policy and procedures. Requires ongoing evaluation of quality but not the necessity of immediate availability.
Physician†	
Level	Description
Personal supervision	The physician must be in attendance in the room during the performance of the service or procedure.
Direct supervision	The physician must present in the office suite and be immediately available to furnish assistance and direction throughout the performance of the procedure. It does not mean the physician must be present in the room when the procedure is performed.
General supervision	The procedure is furnished under the physician's overall direction and control, but the physician's presence is not required during the performance of the procedure.

*Adapted from ASET. Handbook of Neurodiagnostic Job Descriptions and Competencies, 2nd Edition. 2016.[5]
†Excerpt from United States. 42 CFR IV. 2011.[39] Adaptations are themselves works protected by copyright. So in order to publish this adaptation, authorization must be obtained both from the owner of the copyright in the original work and from the owner of copyright in the translation or adaptation.

Supervision (Table 3).

Direct technical supervision by a ND Technologist III or above is required. May be permitted to perform routine testing under indirect technical supervision after successful completion of all required competencies as established by a Technologist III or higher and the laboratory medical and technical supervisors.

Regular quality assessments of technical skills must be performed and documented at least yearly.

For EEG, EPs, and ANS testing, works under indirect supervi- sion of interpreting provider who can be immediately present either electronically or in person. For NCS, works under personal physician supervision.[9]

Ongoing education/maintenance of competency.

Should attend relevant in-house educational offerings and be required to demonstrate ongoing competence through an in- house developed program. Should obtain a minimum of 15 hours of education in ND each year covering all modalities performed by the technologist.

1.3 | Neurodiagnostic Technologist II

Job responsibilities.

This is a transitional position and new hires should obtain credential within 3 years of hire.

Performs routine testing under general supervision; writes a technical descriptive analysis for QA purposes only. For NCS Technologist II, 12 months of full-time (or equivalent) practical training in performing NCS under direct supervision of EDX physician.[9]

Has hospital training to alert supervisor and/or activate hospital systems, such as rapid response, cardiac arrest, etc., per established protocols when encountering patient clinical issues.

Education/certification.

Meets eligibility requirements set by credentialing bodies, i.e., ABRET,[12–18] AAET,[19] and/or ABEM,[11] to take a creden- tialing examination.

Associate degree or higher is preferred, or graduate of a CAAHEP-accredited ND program.[7,8]

Experience.

Twelve or more months of experience working in a patient care environment with supervised experience in performing primary testing modality.

Competencies should at minimum include those specified by ASET's National Competency Skill Standards[5] and/or AA- NEM's skill standards for NCS,[10] as appropriate.

Supervision (Table 3).

General technical supervision. Reports to ND Technologist III or above.

Works under supervision of interpreting provider who can be immediately present either electronically or in person. For NCS, works under direct physician supervision.[9]

Regular quality assessments of technical skills must be performed and documented at least yearly.

Ongoing education/maintenance of competency.

A minimum of 15 credits should be obtained every 3 years, covering all modalities performed by the technologist.

1.4 | Neurodiagnostic Technologist III

Job responsibilities.

Performs routine, as well as more advanced testing (per program guidelines); recognizes clinically significant events and patterns;

follows policy and procedures regarding critical test results; communicates with team members; writes a technical descriptive analysis.[6]

Has hospital training to alert supervisor and/or activate hospital systems, such as rapid response, cardiac arrest, etc., per established protocols when encountering patient clinical issues.

- R. EEG T.[18]dPerforms clinical EEG in the adult, pediatric, and neonatal populations. Also performs studies in ICUs.
- R. EP T.[17]dDemonstrates proficiency in the acquisition and recognition of basic EP waveforms relevant to EP modality being tested. Includes VEP, BAEP, and SSEP.
- R.NCS.T. or CNCT[11,19]dPerforms NCS; recognizes clinically significant events and follows facility policy and procedures regarding critical test results.
- CAP[14]dPerforms basic and advanced ANS testing proce- dures independently with a high degree of technical proficiency; recognizes physiologic and nonphysiologic artifacts and takes appropriate steps to eliminate them; and describes normal and abnormal clinical manifestations observed during the testing.

Education/certification.

ABRET, AAET, or ABEM credential required.

Associate degree or higher is preferred, or graduate of a CAAHEP-accredited ND program.[7,8]

Experience.

Meets qualifications and requirements of Technologist II, is credentialed, and meets all education requirements set forth by ABRET, AAET, or ABEM.

Supervision (Table 3).

Works under general technical supervision as specified in departmental policy and procedure manual.

Regular quality assessments of technical skills must be performed and documented at least yearly.

Works under supervision of interpreting provider who can be immediately present either electronically or in person. For NCS, works under direct physician supervision.[9]

Ongoing education/maintenance of competency.

A minimum of 30 credits should be obtained every 5 years covering all modalities performed by the technologist. This is a minimum requirement and is superseded by individual credential requirements as set forth by ABRET, AAET, and ABEM.

1.5 | IONM Neurodiagnostic Technologist I

Job responsibilities.

This is a trainee-level position and is considered transitional. It is expected that new hires will obtain CNIM certification within 5 years.

Helps set up monitoring equipment while assuring patient safety. Communicates effectively with team members.

Has hospital training to alert supervisor and/or activate hospital systems, such as rapid response, cardiac arrest, etc., per established protocols when encountering patient clinical issues.

Education/certification.

R. EEG T. or R. EP T. or a bachelor's degree.

Experience.

Six or more months of experience working in a patient care environment. For individuals entering the field with a bachelor's degree, patient experience requirements will be determined by their employer.

Supervision (Table 3).

Requires direct technical supervision.

Works under supervision of interpreting provider who can be immediately present either electronically or in person.

Regular quality assessments of technical skills must be performed and documented at least yearly.

Ongoing education/maintenance of competency.

A minimum of 30 credits should be obtained every 5 years. This is a minimum requirement and is superseded by individual credential requirements.

1.6 | Neurodiagnostic Technology Specialist I

Job responsibilities.

Includes all of those required for a Neurodiagnostic Technologist III but exhibits additional critical thinking skills.

Able to recognize critical values in critically ill patients of all ages and report the values to the appropriate medical personnel.

Education/certification.

Associate degree or graduate of a CAAHEP-accredited ND program,[7,8] bachelor's degree is preferred.

Current credentials required from ABRET, AAET, or ABEM.

Experience.

Meets all requirements of experience and qualifications as specified in Tech level III in the ND field that includes an additional 1 year of experience in one of the advanced modalities listed below in Sections 6a–6e.

Supervision (Table 3).

Works under general technical supervision.

Works under supervision of interpreting provider who can be immediately present either electronically or in person. For NCS, works under direct physician supervision.[9]

Regular quality assessments of technical skills must be performed and documented at least yearly.

Ongoing education/maintenance of competency.

A minimum of 30 credits should be obtained every 5 years. This is a minimum requirement and will be superseded by individual credential requirements and/or maintenance of certification requirements.

1.6.1 | Neurodiagnostic Technology Specialist I LTME (R. EEG T)

Specific experience

- R. EEG T.

- Three or more years of experience in the ND field that includes 1 year of experience in LTM for epilepsy.

Specific job responsibilities

- Recognizes and reports critical values to the appropriate medical personnel, significant clinical events, and EEG patterns.
- Prepares, organizes, and summarizes data for physician review.

1.6.2 | Neurodiagnostic Technology Specialist I ICU cEEG (R. EEG T)

Specific experience

- R. EEG T.
- Three or more years of experience in the ND field that includes 1 year of experience in ICU/cEEG monitoring.

Specific job responsibilities

- Recognizes significant clinical events and EEG patterns; provides alerts as detailed in departmental policy and pro- cedure manual.
- Prepares, organizes, and summarizes data for physician review.

1.6.3 | Neurodiagnostic Technology Specialist I IONM (CNIM)

Specific experience

- CNIM©
- Minimum of 1 year of experience in an IONM setting.

Specific job responsibilities

- Able to apply electrodes and obtain high-quality waveforms independently.
- Able to recognize changes and communicate such with team as specified in the departmental policy and procedure manual.
- Able to troubleshoot common problems in IONM recordings.

1.6.4 | Neurodiagnostic Technology Specialist I NCS (R.NCS.T. or CNCT)

Specific experience

- Bachelor's degree preferred.
- CNCT or R.NCS.T. required, plus training in performing advanced NCS. A minimum of 4 years as CNCT or R.NCS.T. performing NCS in the patient setting, with at least a total of 5 years of experience in performing NCS and may have experience in the ICU. Technologists may perform pediatric studies.

Specific job responsibilities

- Able to perform basic and advanced NCS procedures independently, including pediatric NCS, repetitive nerve stimulation, and autonomic studies with a high degree of technical proficiency; can perform studies in routine and ICU settings; with additional training may perform neuro- muscular ultrasound.
- Recognizes physiologic and nonphysiologic artifacts and takes appropriate steps to eliminate them.
- Describes normal and abnormal clinical manifestations observed during the testing.
- Uses critical thinking and clinical expertise to determine the need for further NCS testing as needed to assist with interpretation.

1.6.5 | Neurodiagnostic Technology Specialist I MEG (CMEG-eligible)

Specific experience

- Meets CMEG examination requirements set forth by ABRET, including completion of MEG certificate program.[15]
- Three or more years of experience in the field of ND, which includes at least 6 months of supervised clinical and hands-on experience in an active MEG center.
- Experience of 75 MEGs for epilepsy; know the 10 to 20 International System of Electrode Placement.
- Twenty-five MEG evoked potentials including three or more of the five EP scans: auditory, language evoked, motor evoked, sensory evoked, and visually evoked.
- Experience to trouble shoot the system, including filling liquid helium MEG system.

Specific job responsibilities

- Recognizes significant clinical events and EEG patterns; demonstrates competency in operational routines, including helium filling (if applicable), tuning procedures (as appli- cable), standard testing procedures, troubleshooting, artifact prevention and elimination, and data storage, and sufficient understanding of source localization to preprocess routine clinical data for the analysis by a physician magnetoencephalographer.

1.7 | Neurodiagnostic Technology Specialist II

Job responsibilities.

Generally similar to Neurodiagnostic Technology Specialist I descriptions but provides more detailed preliminary reports and more detailed data review (as specified in departmental policy and procedures) to the interpreting provider.

Able to provide higher level of teaching and training for other technologists.

Education/certification.

Associate degree or graduate of a CAAHEP-accredited ND program,[7,8] bachelor's degree is preferred.

Experience.

Minimum of 5 years of experience, of which 3 years are postcredential.

- NCS specialist II requires a minimum of 5 years as a CNCT or R. NCS.T., with 6 years of experience, including ICU experience.[9]

Advanced modality requirements for experience and qualifications are listed below in Sections 7a–7e.

Supervision (Table 3).

Works under general technical supervision as specified in departmental policy and procedure manual.

Works under supervision of interpreting provider who can be immediately present either electronically or in person. For NCS, works under direct physician supervision.[9]

Ongoing education/maintenance of competency.

A minimum of 30 credits should be obtained every 5 years. This is a minimum requirement and may be superseded by the requirements of credentialing boards.

1.7.1 | Neurodiagnostic Technology Specialist II LTME (Long-Term Video EEG Monitoring) (CLTM)

Specific education/certification

- CLTM©

Specific job responsibilities

- Assists in development of and monitoring of adherence to policies and procedures for LTME; assists other ND technol- ogists in LTME.

1.7.2 | Neurodiagnostic Technology Specialist II ICU/cEEG (Continuous EEG Monitoring in the Intensive Care Unit) (CLTM)

Specific education/certification

- CLTM©

Specific job responsibilities

- Assists in development of and monitoring of adherence to policies and procedures for ICU/cEEG; assists other ND technologists in ICU/cEEG.

1.7.3 | Neurodiagnostic Technology Specialist II IONM (CNIM)

Specific education/certification

- CNIM©

Specific job responsibilities

- Assists in development of and monitoring of adherence to policies and procedures for IONM; assists other ND technol- ogists in IONM.

1.7.4 | Neurodiagnostic Technology Specialist II NCS (R.NCS.T. or CNCT)

Specific education/certification

- Meets all qualifications of NCS Specialist I.
- Bachelor's degree required.
- A minimum of 5 years as a CNCT or R.NCS.T. performing NCS in the patient setting, with at least a total of 6 years of experience in performing NCS (Grandfather clause: Technologists who do not hold a bachelor's degree or higher and who meet all the requirements of an NCS Specialist I may be considered for NCS Specialist II if they have a minimum of 10 years of continuous experience in performing NCS, a minimum of 8 years as a CNCT or R.NCS.T., a minimum of three faculty engagements in the NCS field, and at least two reference letters from ABEM physicians (Table 2)) and may have ICU experience.[9]

Specific job responsibilities

- Assists in development of and monitoring of adherence to policies and procedures for NCS.
- Demonstrated ability to train others in the principles and practice of NCS, including technologists, residents, and fellows.

1.7.5 | Neurodiagnostic Technology Specialist II MEG (CMEG)

Specific education/certification

- CMEG.
- Three or more years of experience in the ND field, specifically EEG, and 2 years of experience in MEG.

Specific job responsibilities

- Performs digitization for co-registration to MRI, performs initial MEG spontaneous recording with concurrent EEG recording, understands placement and recording of evoked field trials (SEF, VEF, MEF, AEF, and LEF), implements nontraditional activation procedures as required (or ordered by attending physician),

performs initial filtering and review of MEG/EEG data, performs preprocessing and localization of interictal activity, review of initial localization with physician, localization of evoked field data (for review by physician), and archiving and retrieval of MEG data.

1.8 | NeuroAnalyst (Formerly Advanced Long-Term EEG Monitoring Analyst) (CLTM with NA-CLTM Preferred).

Job responsibilities.

Monitors (on-site or remotely), evaluates, annotates, and classifies ictal, interictal, and paroxysmal events from EEG/video data. Recognizes physiologic and nonphysiologic artifacts.

Writes detailed description of EEG patterns, seizure semiology, ictal and interictal abnormalities, and selection of representative EEG samples.

Acts as a physician extender in collaboration with the supervising physician and other health care staff.

If the NeuroAnalyst is working in an EMU, they must be able to perform the following duties:

- All duties and responsibilities for typical and special consid- eration for routine and advanced EEG/ECoG.
- Extensive knowledge in neuroanesthesia and its application to neuromonitoring.
- All aspects of invasive implants preoperatively, intraopera- tively, and postoperatively, including, but not limited to, electrode setup, montage creation/verification, troubleshoot- ing, hook-up and discontinuation, and stimulation for cortical mapping.

Education/certification.

Holds credentials in EEG (R. EEG T.) and LTM (CLTM) with the NeuroAnalyst (NA-CLTM) credential preferred.

Associate degree or graduate of a CAAHEP-accredited ND program,[7,8] bachelor's degree is preferred.

Experience.

Minimum of 5 years of experience in LTM in the ambulatory setting, EMU, and/or critical care postcertification in LTM.

Supervision (Table 3).

Works under general supervision of the neurodiagnostic technical lab supervisor or the neurodiagnostic lab director and the interpreting physician.

Ongoing education/maintenance of competency.

A minimum of 30 credits should be obtained every 5 years. This is a minimum requirement and is superseded by individual credential requirements.

1.9 | Neurodiagnostic Technical Lab Supervisor

Overview.

Each laboratory requires technical supervision. These qualifications refer only to the issues specifically related to supervision of technical activities. The laboratory supervisor may take on additional responsibilities as dictated by hospital administrative policies and organization.

Job responsibilities.

Provides direct supervision and education to other technologist levels; oversees day-to-day operations; responsible for maintaining policies and procedures; and QA program development and implementation in conjunction with the medical and technical laboratory directors.

Education/certification.

Must have a minimum of one credential in ND technology, two or more preferred, in the area supervised.

Associate degree or graduate of a CAAHEP-accredited ND program,[7,8] bachelor's degree is preferred.

Experience.

Minimum of 5 years of experience in ND.

Supervision (Table 3).

Works under the neurodiagnostic technical lab director and with the medical director.

For clinical studies, works under supervision of interpreting provider who can be immediately present either electronically or in person.

Ongoing education/maintenance of competency.

A minimum of 30 credits should be obtained every 5 years. This is a minimum requirement and is superseded by individual credential requirements.

1.10 | Neurodiagnostic Education Specialist

Overview.

Functions in the role of educator, facilitator, change agent, consultant, and leader for professional development.

Job responsibilities.

Designs and implements competency and educational activities for ND personnel, including annual competency programs, orientation, continuing education, and professional development within a collaborative practice framework.

Develops new employees to meet job requirements.

Assists those who are not credentialed for board examination. Coordinates continuing education and competency activities for staff.

Education/certification.

Graduate of an accredited Baccalaureate program, preferably in ND[7,8] or higher education.

Must have a minimum of one ND-related credential, two or more preferred. Credential should be specific to the modality for which education is being provided.

Experience.

Minimum of 5 years of experience in ND with previous teaching experience preferred.

Supervision (Table 3).

Works under the neurodiagnostic technical lab director.

Ongoing education/maintenance of competency.

A minimum of 30 credits should be obtained every 5 years. This is a minimum requirement and is superseded by individual credential requirements.

1.11 | Neurodiagnostic Technical Lab Director

Overview.

This position can be held either by a ND professional with additional management training or experience, or by non-ND manager, typically with experience in other diagnostic services.

- There are situations in which the administrative leadership of the CNP department may not, for the purposes of timekeeping, record-keeping, and basic personnel management, have specific ND technology training. In that case, there must be a technologist at the level of Neurodiagnostic Technologist III or above who can provide technical supervision.

Job responsibilities.

Works with hospital administration and the laboratory Medical.

Director to make personnel and budgetary decisions. Involved with marketing efforts. Serves as a liaison across departments when necessary. May also assume responsibility for productivity and financial viability, patient safety, and accreditation of the laboratory[20–23] among other high-level functions that contribute to the success of the department in support of the employer's mission.

Education/certification.

A minimum of a bachelor's degree in health sciences; if job description includes performing ND studies, must have at least one ND credential.

Experience.

Minimum of 5 years of minimum experience; 3 years of previous supervisory experience is recommended.

Supervision (Table 3).

Works with hospital administration and Medical Director.

If job description includes performing clinical ND studies, works under general supervision of interpreting provider who can be immediately present either electronically or in person.

Ongoing education/maintenance of competency.

A minimum of 30 credits should be obtained every 5 years. This is a minimum requirement and is superseded by other individual credential requirements.

2 | NONPHYSICIAN NEUROPHYSIOLOGIST POSITIONS

2.1 | (All abbreviations and corresponding definitions are found in Table 1)

NOTE: As may pertain to all higher levels of practitioners, please note that there are individuals who perform, and in some cases interpret, testing under the supervision of a licensed and qualified physician. These individuals do not have a medical or osteopathic doctorate and are referred to as "Advanced Practi- tioners" or other "Qualified Health Care Providers."

This document recommends privilege-based licensure, as well as skills, knowledge, and abilities, gained through training, experience, and accredited programs.[24–29] These are demon- strated by passing board examinations and maintained through continuing education.[30–34] This document does not supersede applicable state law.

These practitioners work within their state's regulatory and/ or statutory scope of practice guidelines and within institutional credentialing. The scope of practice may differ across states, institutions, and insurance carriers.

2.2 | Audiologist (Lab)

Job responsibilities[35.]

Audiological and vestibular testing and BAEPs including both the technical and the interpretative components related to the assessment of the function of the eighth cranial nerve and peripheral hearing apparatus.

Education/certification.

All audiologists must be an AuD or hold current board certification.

Experience.

Has performed and interpreted the number of studies required by federal, state, institutional, and/or certifying organization regulations. The minimum number should be sufficient for the practitioner to have gained mastery of all aspects of testing.

Supervision (Table 3).

May work independently or under supervision as specified by federal, state, and hospital regulations.

To supervise technologists performing audiological testing within the ND laboratory, the audiologist must have a minimum of 3 years of experience in clinical practice in addition to the AuD.

Ongoing education/maintenance of competency.

Minimum of 50 CEUs spanning 5 or more years, as required for maintenance of certification. This is a minimum requirement and is superseded by other individual credential requirements.

2.3 | Nonphysician (PhD, AuD[35], FMG) Neurophysiologist Performing IONM

Job responsibilities This may include:

- Management of personnel and instrumentation that support IONM.
- Technical performance of IONM.
- IONM planning.
- Real-time interpretation of IONM under the supervision of a licensed physician who is immediately available, either in person or

online, if needed, e.g., for rendering of medical opinion, decisions, and recommendations during surgery.[36]

This physician must be a clinical neurophysiologist trained, qualified, and experienced in IONM as referenced under Section 18.

- Providing recommendations for obtaining optimal neurophys- iological data.
- Postoperative IONM report.

Education/certification.

Possess a minimum of an earned doctoral degree in a physical science, life science, or clinical allied health profession from an accredited educational institution. Education must include successful completion of graduate-level training in neurophysiology and anatomy.

Must have medical staff privileges for the performance of IONM in all hospitals where practicing.

The DABNM is required (Grandfather clause: PhD neurophysiologists with a minimum of 20 years of experience in IONM are not required to hold the DABNM).

Experience.

Evidence of continuous experience in IONM including case logs that document a minimum of 300 cases monitored with the primary responsibility for the clinical tasks in which the provider will participate.

Supervision (Table 3).

The nonphysician neurophysiologist functions under the supervision of a licensed physician who is immediately available, either in person or online, if needed, e.g., for rendering of medical decisions and recommendations during surgery.[36] This physician must be a clinical neurophysiologist trained, qualified, and experienced in IONM as referenced in Section 18.

Ongoing education/maintenance of competency.

Maintenance of all credentials required for medical staff privileges in IONM.

A minimum of 100 cases per year averaged over 3 years. Forty-five CEUs in IONM per year averaged over 5 years.

2.4 | Senior Nonphysician (PhD, AuD, FMG) Neurophysiologist Performing IONM

Job responsibilities.

May perform any of the job responsibilities described for the nonphysician neurophysiologist (Section 13) as described above. Available for teaching less experienced providers.

The specific responsibilities assigned to each practitioner should be documented by the employer.

Education/certification.

All requirements are the same as for the nonphysician neurophysiologist performing IONM except:

- The DABNM credential is required.

Experience.

All requirements are the same as for the nonphysician neurophysiologist except that:

- At least 7 years of clinical activity in IONM is required.

Supervision (Table 3).

The requirements are the same as the nonphysician neurophysiologist (Section 13).

Ongoing education/maintenance of competency.

The requirements are the same as the nonphysician neurophysiologist (Section 13).

3 | PHYSICIAN POSITIONS (ALL ABBREVIATIONS AND CORRESPONDING DEFINITIONS ARE FOUND IN TABLE 1)

3.1 | Physicians (MD, DO, or Foreign Equivalent) Who are Neither Neurologists, Physiatrists, nor

Clinical Neurophysiologists.

Job responsibilities.

Interprets CNP studies under supervision as discussed below.

Education/certification.

Valid state license to practice medicine in the state in which the study is performed.

Completion of an ACGME-accredited residency.

If practicing in a hospital setting, must satisfy the hospital's requirements for medical staff privileges in their specialty area. If the hospital has separate criteria for performing and interpret- ing neurophysiologic tests, the practitioner must meet those requirements for the particular test performed.

A minimum of 6 months of full-time supervised training in the area(s) of neurophysiology practiced. If training is not full time, there should be equivalent of 6 months of supervised training when totaled. The training should be under the supervision of a board-certified clinical neurophysiologist[32] with expertise in the field of training. It is preferable if this training occurred as part of a program accredited by the institutional graduate medical education committee or by the ACGME. EDX physicians should refer to the AANEM position statement,[27] "Who Is Qualified to Practice Electro- diagnostic Medicine?"

Acceptable board certification for the supervising neuro- physiologists includes any of the following: ABPN–CN (American Board of Psychiatry and Neurology Clinical Neurophysiology).

ABCN (American Board of Clinical Neurophysiology)[30] ABEM (American Board of Electrodiagnostic Medicine)[31] ABNM (American Board of Neurophysiologic Monitoring) for IONM only[37.]

Experience.

Before practicing independently, this physician should have completed the number of studies outlined below under supervision for which privileges are being requested.

- EEG 500 studies
- Long-term video EEG monitoring 100 studies
- EMG/NCS 200 complete EDX evaluations
- IONM 100 patients
- Diagnostic evoked potentials 50 studies; at least 15 in each modality the practitioner will interpret.

Supervision (Table 3).

EEG clinical neurophysiologist or neurologist credentialed to interpret EEG studies should be available to review record or help with any questions or complex patients.

Long-term video EEG monitoring should work with a clinical neurophysiologist or neurologist credentialed to interpret these studies who provides ongoing review of each study.

EMG/NCS neurologist/physiatrist/clinical neurophysiologist credentialed to interpret these studies should be available to review records or help with questions or complex patients.

IONM should work with clinical neurophysiologist, neurologist, or physiatrist credentialed to interpret these studies and who provides ongoing review of each study.

Diagnostic evoked potentials should work with clinical neurophysiologist or neurologist who provides ongoing review of each study.

Ongoing education/maintenance of competency Must maintain certification in primary specialty.

Must have ongoing education in the area practiced with an average of 15 CME credits annually in the area(s) of CNP practiced, averaged over 3 years.

Must participate in ongoing QA and quality improvement activities. A board-certified clinical neurophysiologist should be involved in these activities.

3.2 | Neurologist (Without Board Certification in Any Area of CNP) or Physiatrist Certified by Their Respective Boards

Job responsibilities.

Interprets routine studies of the specified type.

Education/certification.

Valid state license to practice medicine.

For IONM, EEG, and EPs, a minimum of 6 months of full-time, supervised training in these areas. If training is not full time, there should be equivalent of 6 months supervised training when totaled. The training should be under the supervision of a board- certified clinical neurophysiologist or neurologist with expertise in the field of training. It is preferable if this training occurred as part of a program accredited by the institutional graduate medical education committee or by the ACGME.

Completion of an ACGME-accredited residency in neurology or physical medicine rehabilitation would be applicable for EDX physicians.

If practicing in a hospital setting, should satisfy the hospital's requirement for medical staff privileges in neurology or PMR.

If the hospital has separate criteria for performing and interpreting neurophysiologic tests, the practitioner should meet those requirements for the particular test performed.

Meets hospital requirements to have medical staff privileges as a neurologist or for IONM and EDX testing as a PMR physician.

Experience.

Before practicing independently, the physician should have completed under supervision the number of studies in an ACGME or RCPSC in a neurology or PMR residency program outlined below for which privileges are requested.

- EEG 500 studies
- Long -term video EEG monitoring 100 studies
- EMG/NCS 200 complete EDX evaluations
- IONM 100 patients
- Diagnostic evoked potentials 50 studies; at least 15 in each modality the practitioner will interpret.

Supervision (Table 3).

Supervised by a clinical neurophysiologist who participates in quality assessment and quality improvement activities, including peer review, and is available for consultation regarding complex or difficult cases.

Ongoing education/maintenance of competency.

Must maintain medical staff privileges in neurology or physical medicine rehabilitation would be acceptable for EDX physicians. Must have ongoing education in the area practiced with an average of 15 CME credits annually in the area(s) of CNP practiced, averaged over 3 years.

Must participate in ongoing QA and quality improvement activities. A board-certified clinical neurophysiologist should be involved in these activities.

3.3 | Clinical Neurophysiologist (MD, DO)

Job responsibilities.

Supervises and interprets general CNP studies in the area of their expertise.

Available for consultation with other staff on complex or difficult cases.

Participates in QA and quality improvement activities.

Involved in ongoing training and education of physicians and technologists.

Education/certification.

Valid state license to practice medicine in the state in which the study is performed.

Completion of an ACGME-accredited fellowship in CNP or equivalent training before the establishment of accredited training programs as recognized by board certification as specified below.

Board eligibility or certification by ABPN-CN, ABCN, or ABEM.

Experience.

One should have performed or interpreted under supervision at least the number of studies specified in Section 16. At least 3 years in clinical practice of CNP.

Supervision (Table 3).

Supervises studies performed by other providers with less experience or training.

Ongoing education/maintenance of competency.

Must maintain medical staff privileges in CNP as applicable.

Must have ongoing education in the area practiced with an average of 15 CME credits annually in the area(s) of CNP practiced, averaged over 3 years.

Must participate in ongoing QA and quality improvement activities.

3.4 | Subspecialty Neurologist or Physiatrist (MD, DO)

Job responsibilities.

Supervises and interprets general and complex CNP studies in the areas of expertise.

Involved in planning QA and quality improvement activities in the ND department.

Available for consultation with other staff on complex or difficult cases.

Involved in ongoing training and education of physicians and technologists.

Education/certification.

Valid state license to practice medicine in the state in which the study is performed.

Completion of an ACGME-accredited fellowship in CNP or equivalent training before the establishment of accredited training programs as recognized by board certification as specified below. Board certification by ABPN-CN,[32] ABCN,[30] or ABEM.[31] Completion of an ACGME-accredited residency in physical medicine and rehabilitation or neurology.

A minimum of 6 months of full-time supervised training in the area of neurophysiology in which they will practice. If training is not full time, there should be equivalent of 6 months of supervised training when totaled. The training should be under the supervision of a board-certified clinical neurophysiologist with expertise in the field of training.

Experience.

Along with the larger years of experience, the subspecialist should have performed or interpreted at least twice the number of studies specified for the neurologist or physiatrist (Section 16). Should have at least 5 years of clinical practice in neurophysiology.

Supervision (Table 3).

Supervises studies performed by other providers with less experience or training.

Available for teaching and supervision of less experienced practitioners.

Ongoing education/maintenance of competency.

Must maintain medical staff privileges/subspecialty privileges in CNP as applicable.

Must have ongoing education in the area practiced with an average of 15 CME credits annually in the area(s) of CNP practiced, averaged over 3 years.

Must participate in ongoing QA and quality improvement activities.

3.5 | Neurodiagnostic Medical Director (MD, DO)[38]

Job responsibilities.

Development and implementation of policies and procedures for ND laboratory.

Supervision and assessment of competency of ND laboratory staff at all levels.

Assures that there is ongoing teaching and educational activities within the department.

Supervises quality improvement activities.

Works with technical director/manager in planning for the laboratory, staff, equipment, and budget.

Education/certification.

Valid medical license to practice in the state where supervising studies.

Case experience equal to or greater than that required for subspecialty neurologist or physiatrist (Section 18).

Board certified by ABPN or ABPMR.

Board certified in at least one area of CNP (ABPN-CN, ABCN, or ABEM).

For AANEM medical director for EDX laboratories or EDX laboratory accreditation,[23] the qualifications of a medical labo- ratory director shall meet AANEM medical lab director qualifi- cations and AANEM CME requirements:

- 1. Completed ACGME or RCPSC neurology or PMR residency.
- 2. Completed primary board certification in ACGME or RCPSC neurology or PMR.

3. Completed 3 months of training in EDX medicine during neurology or PMR ACGME or RCPSC residency or fellowship.

Experience.

At least 5 years of professional practice in neurophysiology.

Supervision (Table 3).

Department Chair/Vice Chair, Chief Medical Officer, or Section Chief as governed by the department or medical facility.

Ongoing education/maintenance of competency.

Must maintain medical staff privileges in neurology or PMR, and CNP.

Should have ongoing education in the area practiced with an average of 15 CME credits annually in the area(s) of CNP practiced, averaged over 3 years.

Should be involved in managing ongoing QA and quality improvement activities.

ADDITIONAL RESOURCES

The field of clinical neurophysiology is large, diverse, and in constant evolution, and this document is not a review of the clinical indications or use of neurodiagnostic procedures. For more information, the following are additional resources.[1,5,40–51]

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