ASET Position Statement

Best Practices in Remote Continuous EEG (cEEG) Monitoring

The efficacy of continuous EEG (cEEG) monitoring of critically ill patients admitted to the intensive care unit (ICU) and patients admitted to the epilepsy monitoring unit (EMU) has been recognized by physicians, demonstrated by researchers, and described in the American Clinical Neurophysiology Society (ACNS), International League Against Epilepsy (ILAE), and International Federation of Clinical Neurophysiology (IFCN) guidelines (Claassen et al. 2013; Herman et al. 2015; Tatum et al. 2022). cEEG monitoring provides the ability to make real-time treatment decisions, improving patient safety and outcomes and reducing risk (Hill et al. 2019; Rosetti et al. 2020; Claassen et al. 2006; Friedman, Claassen, Hirsch 2009; Classen et al. 2013; Kubota et al. 2018). Qualified personnel must be available to recognize, document and communicate EEG changes and seizures in real time 24/7/365. Hospitals may be unable to provide continuous monitoring due to a lack of available onsite staffing, equipment, and other resources, so they often outsource cEEG monitoring services to a qualified and dependable remote service provider (RSP).

Guidelines, policies, and procedures for on-site cEEG monitoring are currently available through the ACNS, ILAE, and IFCN (ACNS 2008; Tatum et al. 2022) and ASET (ASET 2011a, 2011b, 2016a), but there are unique aspects related to RSP services that require additional consideration. These unique challenges are addressed in this best practices position statement.

I. Pre-Implementation Process: When considering an RSP for supplemental cEEG coverage, the following topics are assessed and agreed upon prior to implementation of services.

1. Contractual responsibilities.
   a. Responsibilities of both the client hospital and RSP are outlined in a service-level agreement (e.g., scope of services, personnel qualifications, liability coverage, security responsibilities, insurance, warranties, financial agreement, data management responsibilities, etc.)
   b. Responsibilities related to security and privacy of Protected Health Information (PHI) are generally outlined in a business associate agreement.

2. RSP vendor verification.
   a. Human Resources
      i. Defining qualified staffing, competencies, roles, and responsibilities
         1) State license (applicable to physicians), credentials, education, etc.
         2) Background and federal, state, and local government database checks (e.g., Office of the Inspector General)
      ii. Process and standards for approving and providing remote access to qualified staff
      iii. Onboarding for the RSP and client hospital specific accounts, as required
      iv. Reporting structure
v. Continuing education requirements

b. Compliance.
   i. Privacy and security policies, processes, and personnel
   ii. Verification of cyber liability insurance
   iii. Password management
   iv. Data management/security measures

c. Information Technology and Biomedical Engineering (i.e., Biomed).
Delineating responsibilities of hospital IT/IS/biomed and the RSP:
   i. Type of access provided for remote services
   ii. Secure transmission and storage of all patient data in compliance with regulatory requirements
   iii. Verification and testing of the hospital and RSP IT infrastructure to provide optimal connectivity for uninterrupted or delayed monitoring (e.g., firewalls, whitelisted domains, etc.)

d. Operations. Establishing clearly defined protocols, communication processes, and responsibilities between hospital and RSP staff for safe handoff of care, interpretation reporting, scheduling, and communications regarding treatment interventions.

II. Operations
1. Secure work environment.
   a. Ensuring consistent HIPAA/HITECH secure work environment (secure RSP facility/office or RSP approved home office) for remote personnel (HIPAA n.d.; US Dept. HHS 2017).
   b. Providing monitoring equipment (appropriate monitor screens, resolution) that, at minimum, meet ACNS criteria (Herman et al. 2015; ACNS 2008; Tatum et al. 2022).
   c. Providing high speed, secure internet that allows for continuous real-time monitoring of EEG and video data without lag or delay.

2. Staffing coverage plan.
   a. Scheduling: Redundant staffing model to guarantee adequate personnel to provide continuous or intermittent monitoring in compliance with regulatory standards and ensure:
      i. Additional RSP staffing resources during patient volume surges.
      ii. Physician coverage for interpretation of EEG and rapid communication of significant EEG findings for continuous and STAT EEGs, including documentation of communication timeline and pathways in collaboration with client facility (Hanna et al. 2005).
      iii. Staffing processes for equipment and network connectivity downtime with clear roles and responsibilities for technologists, physicians, biomed, and IT staff for both the client hospital and RSP.
      iv. Availability of back-up/on-call monitoring technologists for every shift with ability to respond within 30 minutes guaranteeing continuity of service.

III. Information Technology (IT) / Information Systems (IS): IT and IS are crucially important for RSPs to establish and maintain safe and compliant on-demand remote connections with
client hospitals, including but not limited to compliance with networking, cybersecurity, HIPAA/HITECH, regulatory standards (i.e., Department of Public Health [DPH], and other federal, state, and/or local mandates). Protocols also guide staff during downtime(s), troubleshooting, and safety issues that have a direct impact on patient care. IT, IS, and biomed policies clearly define roles and staff responsibilities and, regardless of whether equipment is owned by the RSP or client hospital, include:

   Security compliance in any location with access to PHI includes:
   a. Data and device security (e.g., encryption, multi factor authentication, email accounts, antivirus, internet security, data storage and transfer if applicable, individual password management security, role-based access, security audits).
   b. Data security breach and reporting.
   c. Guidelines for secure storage of RSP monitoring equipment and devices, and PHI data.

   a. Technical support, network/software maintenance
   b. When the RSP provides cEEG recording equipment to the client facility, it ensures the electrical and equipment safety, removal of potentially unsafe or broken equipment for repair and quarantine, equipment calibration, data management and retention, as required by the FDA and other regulatory bodies.
   c. Monitoring of all systems to identify IT issues (e.g., network, storage server failures, network issues, such as latency drops, etc.).

Provision of real-time assistance to cEEG technologists and interpreting physicians

   a. Disaster recovery (including information regarding any redundancy of data storage and external connectivity, to avoid impact on the performance of monitoring, medical records, and patient care)
   b. Downtime procedures for the client hospital and RSP, and the RSP response to downtimes
   c. Secure communication platform/portal
   d. Safety drills (e.g., internet or power downtime, IT infrastructure outages, etc.)

4. Infrastructure: Both hardware and software applications essential for providing remote cEEG monitoring (i.e., operating systems, EEG software applications, cloud storage, routers, servers, computers, phone systems, etc.).
   a. Equipment inventory, maintenance, and cleaning.
   b. Ensure all infrastructure equipment and software are compatible and provide optimal cEEG functionality (i.e., rapid storage, correct antivirus policies, etc.).
   c. Both infrastructure-monitoring equipment and RSP cEEG equipment (if provided) should be compliant with ACNS, ILAE, IFCN guidelines (Herman et al. 2015; Tatum et al. 2022) and HIPAA/HITECH (HIPAA n.d.; US Dept. HHS 2017) and other regulatory mandates.

5. Network connection quality criteria to ensure that the method of remote monitoring allows for the level of monitoring services (e.g., real-time continuous monitoring versus real-time intermittent monitoring versus retrospective review of unmonitored recordings).
   a. For real-time continuous and real-time intermittent monitoring: The network connection quality should be equivalent to in-facility monitoring, without lag,
interruption, or visual gaps in the EEG or video data, and without limiting the ability to simultaneously view the data streaming in real-time side-by-side with a review window that allows for reviewing data previously recorded.

b. For retrospective review of unmonitored recordings: The network connection quality should allow for the ability to scroll through the entire recording, to place annotations as appropriate, to mark or otherwise manipulate the data for the purposes of highlighting specific sections, and to clip and prune the data per facility protocol in compliance with state and federal guidelines for maintaining PHI (e.g., HIPAA/HITECH) (HIPAA n.d.; US Dept. HHS 2017).

IV. Monitoring Protocols: The RSP has detailed protocols for each level (real-time continuous, real-time intermittent) and type [EMU, ICU, pediatric ICU (PICU), neonatal ICU (NICU), etc.] of monitoring performed. Acuity-based protocols include, but are not limited to, the following: hypothermia monitoring, invasive monitoring, NICU, neuro ICU, etc., and are determined by the facility’s clinical team and stipulated in the contractual agreement. Protocols address responsibilities of monitoring personnel, details of communication between RSP and client facility, documentation and reports specific to each level and type of monitoring performed as outlined below:

1. Handoff between the client hospital and RSP and internally between RSP team members minimally include:
   a. Confirmation of level and type of monitoring requested
   b. Indications and goals for monitoring
   c. Patient information: name, date of birth, medical record number, EEG machine ID, facility ID, room location (EMU, ICU, floor/unit, etc.), current medications, indication(s) for monitoring, relevant history, current and previous EEG findings, time/date of hand-off, client hospital time zone.
   d. Critical values established by the patient’s clinical team (events for which the clinical team would be notified: seizures, specific EEG and ECG patterns, asystole, push-button or clinical events, etc.) (See Section V. Patient and Staff Safety)
      i. Re-evaluation of critical values throughout the course of monitoring by the patient’s clinical team
   e. Details of communication and documentation of critical values (Hanna et al. 2005).
   f. Details of non-critical communications, such as reporting high electrode impedance, equipment malfunctioning that may require maintenance by on-site personnel. Communication parameters with each facility include the following contact information for each monitored patient per facility protocol:
      i. Critical communications
         1) Patient’s clinical care team
         2) Interpreting physician on-call
         3) Rapid response team
      ii. Non-critical communications
         1) Patient’s clinical care team
         2) On-site neurodiagnostic technologist
         3) On-site ancillary support staff (i.e., IT, biomed, equipment vendor, etc.). RSP ancillary support staff (i.e., IT, shift coordinator, equipment vendor, etc.)
iii. RSP personnel
   1) Shift Coordinator
   2) RSP’s emergency call tree
   3) Assigned remote monitoring technologist

   g. Information regarding planned procedures (i.e., dialysis, percussion therapy, etc.),
      medication and treatment changes, and all events reported by the facility (i.e., O₂
      desaturation, cardiac events, patient-reported events, unusual behaviors, etc.).

   h. Any monitoring interruptions (e.g., for other procedures, breaks, etc.).
      i. Documentation of hand off
         i. Between client facility and RSP at a minimum of every 24 hours
         ii. Between every RSP shift change.

2. Reportable safety events (e.g., falls, patient out of bed, witnessed abuse, skin injury,
   family/caretaker safety, etc.) (see Section V. Patient and Staff Safety for additional
   details)

3. Protocol for downtime/unexpected power/connectivity loss communication and transfer
   of care.

4. Responsibilities of monitoring technologist include:
   a. Real-time continuous or intermittent monitoring of EEG and video
   b. Recognizing, immediately reporting and documentation of seizures, critical
      values, and other reportable safety events to appropriate onsite personnel
   c. Annotation and clipping of the EEG per facility protocol
   d. Verification of quality and integrity of recording
   e. Preparing shift report
   f. Preparing technical reports consistent with ACNS guideline 7 (Tatum et al. 2016)
      and ABRET NA-CLTM (ABRET 2022a), which includes:
      i. Patient history
      ii. Technical description
      iii. EEG description utilizing current ACNS nomenclature (either Tatum et al.
           2016; Hirsch et al. 2021; or Scheffer et al. 2017)
      iv. Reporting frequency as stipulated per facility protocol
   g. Documentation of monitoring per facility protocol [e.g., hourly log or summary of
      each patient’s EEG and video findings, discontinuation or interruptions of
      monitoring, compliance with required technologist to patient ratios per CPT code
      (AMA 2022; AAN 2020)], etc.

6. Physician interpretation reports per ACNS guidelines (Herman et al. 2015; Tatum et al. 2016).

V. Patient and Staff Safety: Safety policies provide guidance for personnel and are established
   in compliance with all regulations (OSHA, TJC, state/local, etc.). Adherence to TJC standards
   and TJC accreditation (or equivalent) are highly recommended (Meldi, Rhoades, Gippe 2009;
   Ringquist 2013).
   1. Patient safety measures include:
      a. Minimum monitoring ratios of 1 technologist to 4 patients for real-time continuous
         EEG monitoring and 1:12 for real-time intermittent EEG as mandated by the
         American Medical Association (AMA) CPT and adopted by the Centers for Medicare
         & Medicaid Services (CMS) (AMA 2022; AAN 2020). Best practice standards
recommend a lower patient to technologist ratio and higher level of technologist expertise for the following patient populations:

i. Special patient populations, such as those undergoing invasive electrode monitoring (i.e., surgical), or other sensitive monitoring (i.e., ictal SPECT patients)

ii. Patient-specific scenarios as related to acuity of illness or active treatment implementation/changes or as requested by the patient’s clinical care team.

iii. Neonatal patients

b. Rapid communication and documentation of seizures and critical values to appropriate personnel (Hanna et al. 2005).

c. Rapid communication and documentation of reportable safety events as established by the RSP, state/local authorities, and/or the client facility: falls, patient out of bed, witnessed abuse, skin injury, family/caretaker safety, impaired practitioner, etc. (TJC 2022)

d. Patient safety training for RSP personnel [e.g., EMU Caring (AES n.d.)] with documentation

e. Appropriate monitor size and resolution to properly identify seizures and other clinical events [ACNS Guideline 17b (Herman et al. 2015)].

f. Platforms used for remote access to the EEG recording consistently display waveforms at the resolution identical to that shown on the acquisition system

2. Staff Safety: Polices conform to regulatory agencies (e.g., OSHA, ADA, furniture safety codes, compliance requirements, etc.) and include:

a. Ergonomic training

b. Accommodations for an ergonomic workspace and provision of ergonomic office equipment (i.e., monitors mounted at optimal level and distance, ergonomic chairs)

c. Work and lunch breaks

d. Processes for reporting occupational injury(s) and other safety concerns

VI. Quality Assurance (QA): Ongoing efforts to improve are part of the RSP work culture. All personnel are responsible for high-quality standards, employee feedback and involvement in improvement initiatives is encouraged. QA initiatives include:

1. A QA plan that outlines dedicated efforts to monitor and measure quality through surveillance methods, metrics, reporting outcomes, and continuous QA performance improvement initiatives (QAPI).

2. Personnel dedicated to QA and improvement, such as a QA Manager or Coordinator (i.e., CLTM®-level)

3. Quality metrics may include, but are not limited to:

a. Audits of all processes

b. Audits of cEEG monitoring for accuracy and timeliness in identifying seizures, critical events, technical reports, and physician notification.

b. Audits of adherence with protocols, technologist-to-patient ratios, documentation, communication with the client hospital.

d. Peer audits of interpreting physician records.

e. Feedback (i.e., satisfaction surveys) from client hospitals and physicians.

f. Feedback from monitoring technologists regarding workflow and communication with client hospital/facility.
g. Referring provider relations survey (i.e., patient experience, service quality)
4. Quarterly quality summary reports shared with client hospitals.
5. Root cause analyses, process improvement plans, corrective action plans, individual technologist feedback, education, and retraining should be described in the QA Plan and documented in a quality management system or personnel records.
6. A continuing education policy and provision of opportunities for technologists and clinical personnel to attend educational sessions, webinars, clinical neurophysiology conferences, etc.

VII. Compliance: RSP compliance efforts include:
1. Ensuring personnel, such as interpreting physician and other independent licensed practitioners, meet all required credentialing criteria.
2. Providing policies around risk management addressing appropriate work environment, environmental safety, disaster management, infection prevention, etc.
3. Providing a process and training necessary for reporting quality and safety issues anonymously, per applicable requirements (TJC 2022).
4. Ensuring all RSP employees, including contracted interpreting physicians, have disclosed or are free of conflict of interests (annual disclosures, attestation/equipment procurement, patient/vendor gifts/gratuities, etc.).

VIII. Human Resources (HR): Competency and skills of personnel have direct impact on patient safety, treatment, and outcomes. RSPs HR policies address:
1. Organizational chart for reporting structure
2. Job descriptions, including position responsibilities, requirements for education, years of experience, credentialing, and other qualification skillsets.
   a. Technologists who monitor and clip EEG and video data are, at a minimum, ABRET-credentialed in EEG and/or LTM (R. EEG T.®, with CLTM® or NA-CLTM® preferred) (ABRET 2022b, ABRET 2022c, ABRET 2022d), competent in epilepsy, critical care EEG, and pediatric and neonatal EEG [refer to ASET technologist job description levels, qualification, and competencies (ASET 2016a)].
   b. It is recommended that the hiring process include testing of candidate skills and knowledge of EEG in areas of critical care, ICU, NICU, and EMU, artifact and EEG pattern recognition, and computer technology.
3. Onboarding, training, and competency verification in specific job responsibilities as shared between the RSP and client hospital clinical care teams [ASET competency assessments and annual performance reviews (ASET 2016a)]
4. Personnel dedicated to training and quality (see Section VI. Quality Assurance).
5. Professional advancement to training and quality (see Section VI. Quality Assurance).
6. Professional code of conduct
7. Attendance.

Summary
RSPs should strive to partner with client facilities by providing flexible and customized service options to supplement hospital coverage of long-term EEG monitoring. These service options should include continuous or intermittent EEG monitoring by credentialed technologists (as defined in section VIII. Human Resources), retrospective EEG data review and clipping,
24/7/365 staffing coverage, (especially for night and evening shifts, holidays, and weekends), and timely interpretation by a credentialed physician licensed in the state in which the study is performed.

To ensure patient safety, RSPs should prioritize well written communication protocols, quality assurance and improvement initiatives, and invest in secure infrastructure, competent personnel, redundancy, and adequate staffing coverage.

References:


---Approved by the ASET Board of Trustees, November 1, 2022---

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