# In-Home EEG During the COVID-19 Pandemic

**A pandemic gives us cause to reconsider strengths and limitations of in-home EEG.**

**By Michelle L. Dougherty, MD, FAES, FAAN**

The relative advantages and pitfalls of inpatient videoEEG monitoring in an epilepsy monitoring unit (EMU) compared with in-home ambulatory EEG have been debated in recent years. In the context of the COVID-19 pandemic and required social distancing, there has been a shift to telemedicine and remote monitoring, warranting a reexamination of these differences. The challenge for epileptologists is to continue providing care for people with epilepsy while minimizing risk of exposure to SARS-CoV-2. Many medical centers have closed their EMUs either to free beds for actual or potential patients with COVID-19 or as part of temporarily stopping elective procedures. The American Clinical Neurophysiology Society (ACNS) has recommended that depending on the urgency of the request, in-home ambulatory EEG or in-home ambulatory videoEEG monitoring should be considered.[1]

## Strengths of In-Home EEG

Ambulatory EEG has advantages in cost, patient convenience and satisfaction, and accessibility compared with inpatient videoEEG monitoring. Ambulatory EEG is perhaps underutilized considering it has been evaluated and found to be a useful tool in up to 72% of cases[2,3] to:

- differentiate seizures from nonepileptic events,
- determine frequency of seizures and interictal discharges,
- corroborate a presumptive diagnosis of epilepsy,
- clarify diagnosis with lateralizing or localizing information.

Ambulatory EEG studies are logistically easier to extend if events are not recorded within a certain time frame. Ambulatory EEG also offers lower risk of exposure to SARS-CoV-2 for patients and technologists compared with a visit to an emergency department or an EMU. Accessibility is now a greater factor for consideration because many EMUs are closed entirely or only admitting urgent or emergent cases.

## Technology in Evolution

In comparison with an inpatient videoEEG study, ambulatory EEG has historically been considered inferior because of limitations in recording capacity, video capability, and artifacts. However, ambulatory EEG has been evolving and improving. Ambulatory recording units now are capable of recording an increasing number of channels and a longer duration of studies owing to advances in storage media. Video is now readily available with most ambulatory EEG setups, and in-home multicamera setups are also now possible. Furthermore, intermittent monitoring is now widely available, allowing for the recording of a technically sound study by maintaining electrodes and keeping video cameras trained on the patient. Rapid correction of the problems common to ambulatory EEG (eg, replacing a battery if needed) have also been facilitated by remote monitoring in the home. Monitored in-home ambulatory EEG now allows for dispatch of an on-call technologist to fix electrodes if needed. Monitoring technologists can also notify physicians of unexpected findings during EEG recording. Physicians can review intervals if patients upload data or if data is streamed to a secure server, although data access is generally less seamless than in an established EMU.

## Weaknesses of In-Home EEG

Ambulatory EEG, however, is not optimal for all patients. Some will require continuous review, which is difficult to achieve in the in-home setting because of the limitations in personal internet networks and Bluetooth antenna technology. Continuous monitoring is generally not clinically relevant in a person deemed stable enough to be home, however. Additionally, an in-home monitored study requires additional information security considerations because patient data must be transfer between locations and this must always be secure.

## Safety Considerations During COVID-19 Pandemic

Some long-term EEG studies will undoubtedly be necessary for both diagnosis and medication management during the pandemic. Although in-home ambulatory EEG is a reasonable means of decreasing the risk of exposure to SARS-CoV-2 for many to obtain needed information for treatment decisions, it is not entirely without risk that should be addressed (Table).

### Basic Precautions

Basic precautions include self monitoring by all personnel for symptoms, asking team members to stay home or seek

**TABLE. SUMMARY OF PRECAUTIONS FOR IN-HOME EEG DURING COVID-19 PANDEMIC**

| | |
|---|---|
| **General** | • Self-monitor for COVID-19 symptoms<br>• Stay home or seek care if symptoms occur<br>• Practice meticulous hand hygiene<br>• Stagger office shifts if they are necessary<br>• Clean surfaces frequently |
| **Previsit screening** | • Assess patient's risks for poor COVID-19 outcome<br>• Triage urgency with ordering physician<br>• Call patient 1-2 days before test to screen for symptoms<br>• Screen patients' cohabitants for symptoms<br>• Reschedule if symptoms are present in household<br>• Consider completing history via phone<br>• Consider completing documents online<br>• Prepare single-use technologist equipment kit |
| **During setup** | • Use personal protective equipment for technologist<br>• Use cloth masks for patients/caregivers<br>• Minimize the number of people in the room<br>• Balance risks and benefits of longer studies that require multiple visits by technologist |
| **Postvisit** | • Arrange for porch pick up of equipment<br>• Dispose of or sanitize equipment |

medical care if they are ill, practicing hand hygiene, using staggered shifts for personnel in any office locations, and frequently cleaning surfaces, (eg, desktops and doorknobs). Several changes to routine preparation for an EEG study should also be considered.

### Premonitoring Screening

Before scheduling an in-home ambulatory EEG identify whether a patient is at higher risk for poor outcomes of COVID-19, such as comorbid diabetes, hypertension, or cardiopulmonary disease and review the desired time frame for study completion with the ordering physician. The optimal triage for each patient will depend on the indication for the EEG, specific risk factors for COVID-19, local resources available for EEG monitoring, and local COVID-19 activity. The optimal timing of an ambulatory EEG should be coordinated with the ordering physician for patients who have higher risks. In the 24 to 48 hours prior to the appointment, call the patient or their caregiver to review for symptoms of potential concern. Any symptoms concerning for COVID-19 (eg, fever, cough, shortness of breath, anosmia, or "COVID toes") should prompt rescheduling and a referral to medical evaluation. Enhanced preappointment screening for safety should also include screening of other members of the household. Technologists should also take steps to minimize the time spent in patients' homes. This may include taking all or part of the history on the phone prior to the appointment, completing documents online ahead of the appointment, and preparing single-use equipment kits including supplies (eg, disposable paper measuring tapes and disposable electrodes), if available, for each appointment rather than utilizing a reusable equipment case.[4]

### Monitoring Setup

During the appointment personal protective equipment (PPE) is required. If the patient and household members have been appropriately screened, surgical facemasks and goggles are reasonable for technologists to wear.[4] Patients should also wear cloth or surgical facemasks in accordance with Centers for Disease Control and Prevention (CDC) recommendations. Many state healthcare directives, such as a 6-foot social distance cannot be maintained during electrode application. The number of additional people in the room should be minimized whenever possible. Ideally, only the technologist and the patient would be in the room; however, for small children or persons with disabilities, a caregiver's presence may be needed.

### During and After Monitoring

Studies longer than 72 hours generally require a technologist to enter the home again to reconnect or repair electrodes. The relative risks of the additional exposure to the patient and technologist should be balanced against the benefit of the additional information that would be gathered. After technologist appointments, arranging for contactless "porch pickup" of equipment is preferable. Equipment sanitization is unchanged because solutions such as dilute bleach or disinfectant wipes are effective and were commonly in use before the pandemic. There are also some special considerations that should be taken into account for each case, such as the relative risks and benefits of hyperventilation or the need for collodion application with an air compressor as opposed to paste. Finally, recommendations continue to change as the medical community gains experience with and knowledge about COVID-19; continued vigilance in following recommendations of the World Health Organization (WHO), CDC, and state and local health departments is strongly recommended. ■

1. *COVID-19 Resources for Clinical Neurophysiology*. American Society for Clinical Neurophysiology. Updated May 8, 2020. Accessed May 15, 2020. https://www.acns.org/practice/covid-19-resources
2. Syed TU, LaFrance WC Jr, Loddenkemper T, et al. Outcome of ambulatory video-EEG monitoring in a ~10,000 patient nationwide cohort. *Seizure*. 2019;66:104-111.
3. Dash D, Hernández-Ronquillo L, Moien-Afshari F, Tellez-Zenteno JF. Ambulatory EEG: a cost-effective alternative to inpatient video-EEG in adult patients. *Epileptic Disord*. 2012;14(3):290-297.
4. Khozein R, Hirsch L. *COVID-19 and Neurodiagnostic Testing Webinar*. ASET-The Neurodiagnostic Society. Accessed May 15, 2020. https://www.aset.org/i4a/pages/index.cfm?pageid=4335

**Michelle L. Dougherty, MD, FAAN, FAES**
Chief Medical Officer
Neurotech, LLC
Waukesha, WI