**Title:** Feasibility of Detecting Seizure Onsets in Ambulatory Patients: Initial Implementation

**Keyword 1:** Ambulatory EEG/monitoring **Keyword 2:** Seizure detection **Keyword 3:** Seizure monitoring **Keyword 4:** Seizure onset **Keyword 5:** Outpatient

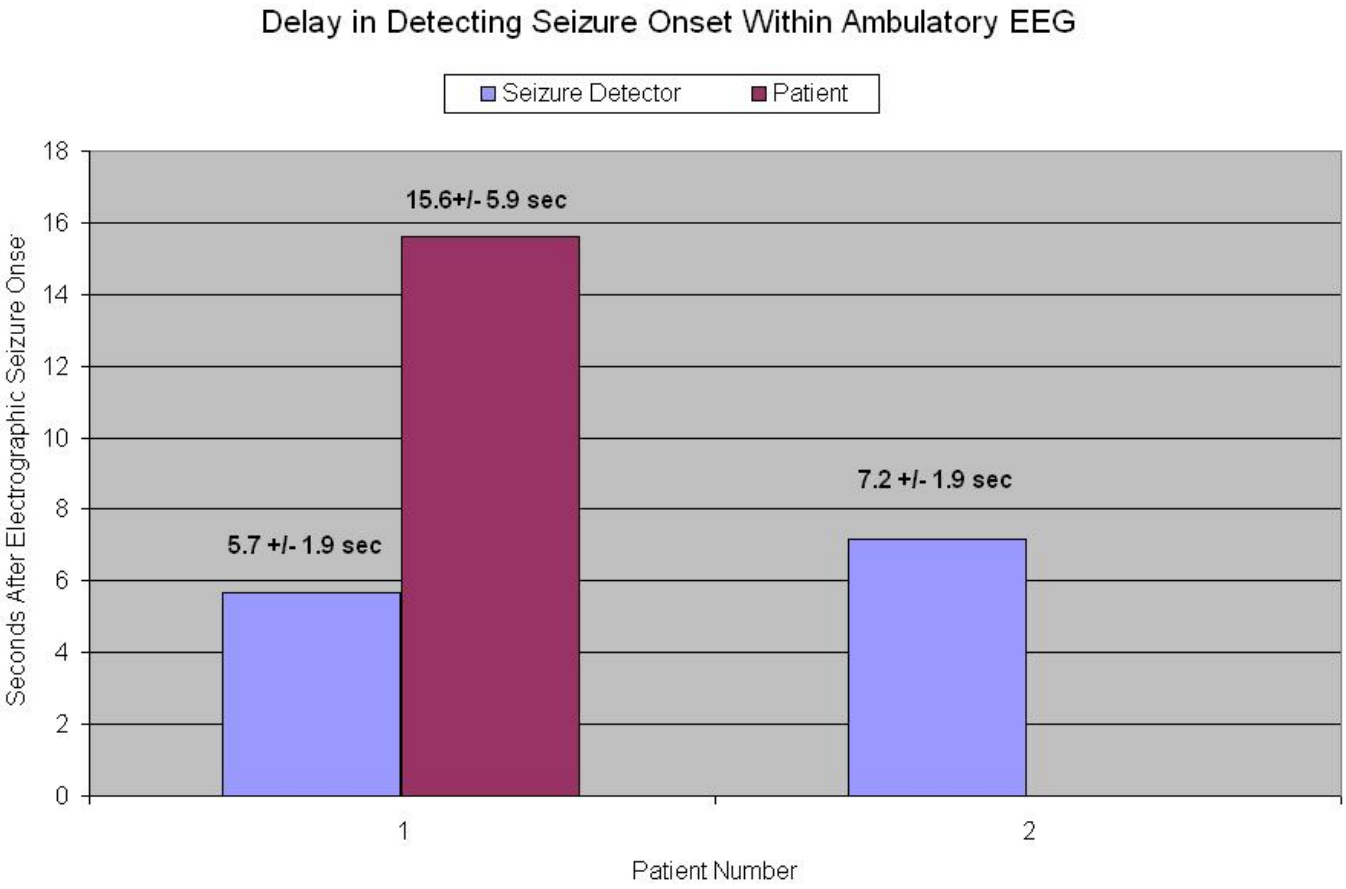
Steven Schachter, MD[1], Ali Shoeb[2], Blaise Bourgeois, MD[3], S. Ted Treves, MD[4] and John Guttag, PhD[2]. [1]Departments of Neurology, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA, United States, 02115; [2]Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Boston, MA, United States, 02139; [3]Departments of Neurology, Children's Hospital Boston, Boston, MA, United States, 02115 and [4]Nuclear Medicine, Children's Hospital Boston, Boston, MA, United States, 02115.

**RATIONALE:** The accurate detection of electrographic seizure onsets with an ambulatory system could potentially be used to trigger an acute intervention to limit seizure progression/duration, and could also serve to notify a caregiver or disable harmful elements in the patient's environment (eg, a gas stove that is lit).

**METHODS:** We implemented a patient-specific seizure detection algorithm (Shoeb A, et al. *Epilepsy Behav* 2004;5:483-498) on a small digital signal processor (DSP; TM320C6711, Texas Instruments), and streamed previously recorded ambulatory EEGs from two patients to the DSP at a rate of 200 samples/sec per channel. For each EEG, we noted the sensitivity and specificity of seizure detections, and the latency with which the algorithm declared seizure onset following the initial electroencephalographic changes.

**RESULTS:** The algorithm trained on seizure-free EEG epochs and 7 electrographic seizures uniformly sampled over the duration of the two EEG studies. The figure shows the average latency for detection of seizure onsets once the electroencephalographic changes began. The algorithm detected 70/72 seizure onsets (30/31 for patient #1, and 41/42 for patient #2), and declared 2 false detections (0 for patient #1, and 2 for patient #2) in 5.5 hours (2 hours for patient #1, 3.5 hours for patient #2) of ambulatory EEG epochs uniformly sampled over a 36-hour period (20 hours for patient #1, and 16 hours for patient #2). The figure also compares how soon following electrographic seizure onset patient #1 became symptomatic (indicated by pressing the event button). Patient #2 was unaware of his seizures and therefore did not press the event button.

**CONCLUSION:** These preliminary results demonstrate the high sensitivity and specificity of seizure onset detections using our algorithm and the feasibility of detecting seizures in the ambulatory setting within seconds of electrographic seizure onset and before symptoms occur. Further evaluation of our detection methodology on pre-recorded as well as on-line ambulatory EEG studies is underway.




**Funding supported by:** Center for Integration of Medicine and Innovative Technology (CIMIT); MIT Project Oxygen Partnership.