# Monitoring antiseizure medication change using ultra long-term subcutaneous EEG: a retrospective multicentre cohort

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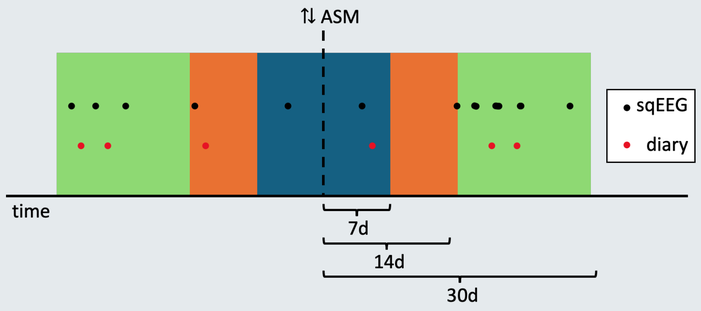
## INTRODUCTION

- Accurate seizure identification is crucial for evaluating treatment efficacy but remains clinically challenging.
- Seizure diaries are the standard tool in trials, yet they are subjective and often unreliable.
- Subcutaneous EEG (sqEEG) provides objective, ultra long-term seizure monitoring as a potential alternative.
- This study investigates whether sqEEG can more reliably measure the impact of antiseizure medication (ASM) changes on seizure frequency.

## METHODS

- **Study design**: Retrospective, multicenter cohort of adults with treatment-resistant epilepsy monitored with sqEEG across nine centres
- **Data collected**: Demographics, clinical info, sqEEG recording duration and adherence, timestamps from sqEEG seizures and patient diaries, ASM regimens and changes.
- Medication adjustments categorized as **dose increase** (including introduction) or **dose decrease** (including interruption)
- **Time windows of pre vs. post treatment change**: 7, 14 and 30 days




### Statistical Analysis

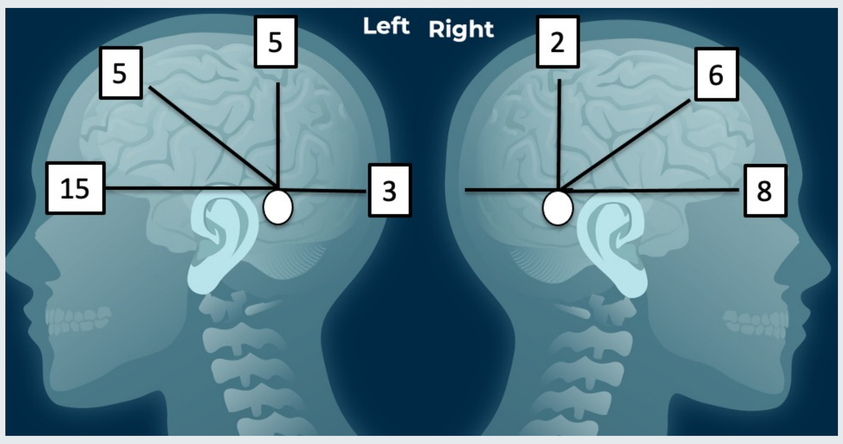
| Metric | Definition | Statistical Test |
|---|---|---|
| Trials of medication increase and decrease | | |
| Seizure counts | Change in seizure counts before vs after med. change | Paired Wilcoxon signed-rank test |
| Net direction of effect | (n. trials with ↑seizures – n. trials with ↓seizures) / (total n. trials) | McNemar test |
| Trials of medication increase | | |
| Median Percent Change | Median percent change vs baseline (only trials with >0 seizures at baseline) | Mann–Whitney U test |
| 50% responder rate | % events with ≥50% seizure reduction | McNemar test |
| Time to baseline seizure count | Days to reach pre-change seizure count | Kaplan–Meier curves, log-rank test |

## RESULTS

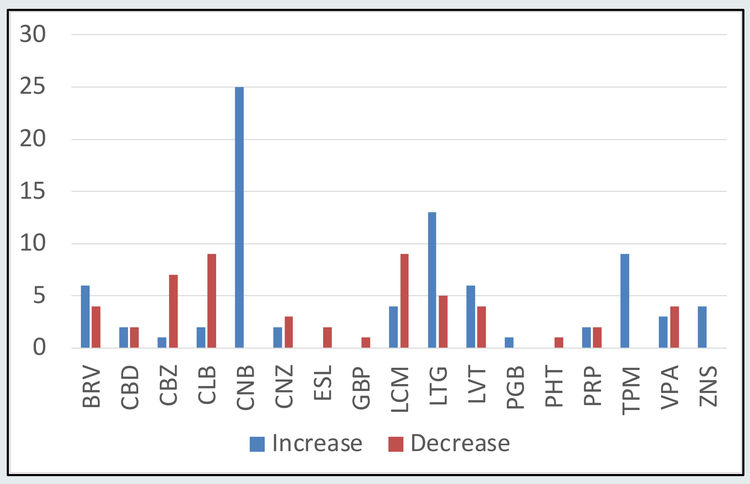
### Demographic, clinical and recording characteristics

- 43 patients
- 44 implantations (n=1 bilateral temporal implantation)
- Age: median 41, IQR 33-52
- Gender: 25 F|M 18
- Epilepsy type: focal n=42, generalized n=1
- Adherence: median 18.8 hours/day, IQR, 15.6-21.8 hours/day

Distribution of implant locations in the cohort



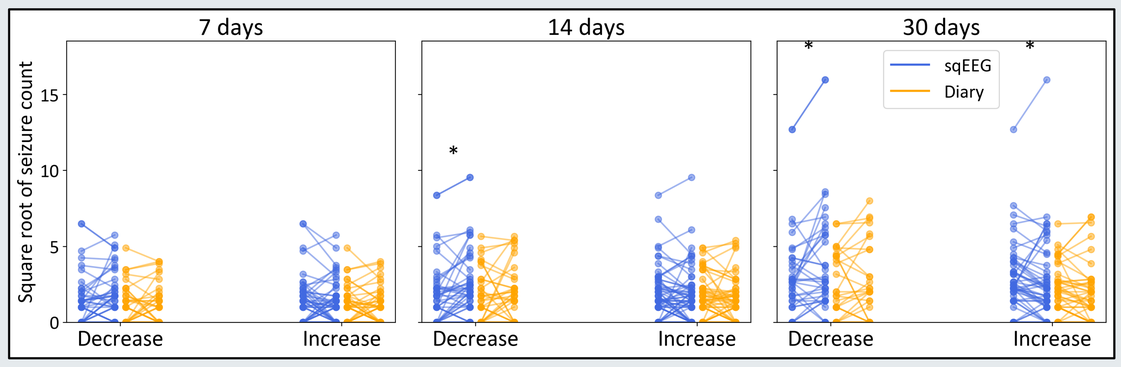

Types of medication change



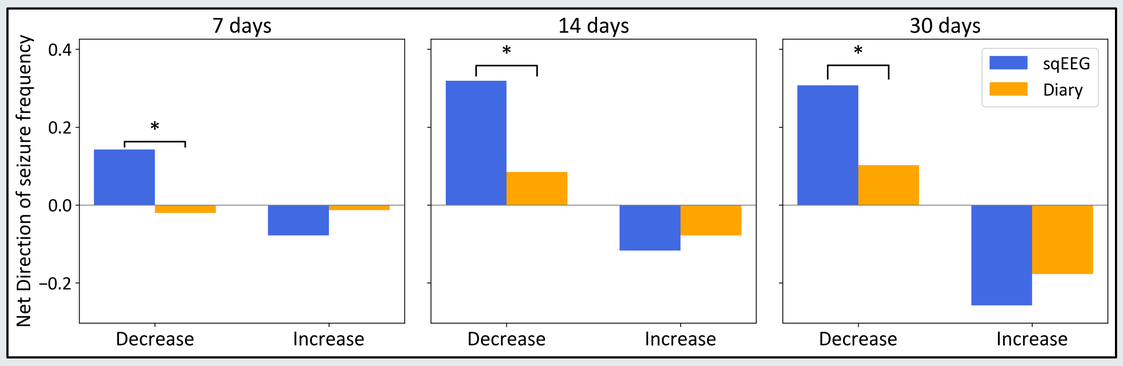

Number of trials with available data, per time window

| | 7 days | 14 days | 30 days |
|---|---|---|---|
| Treatment increase | 77 | 77 | 62 |
| Treatment decrease | 49 | 47 | 39 |

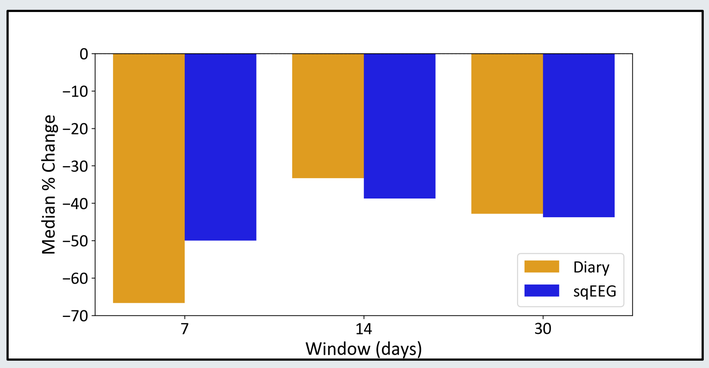
Seizure counts pre- vs. post-treatment change



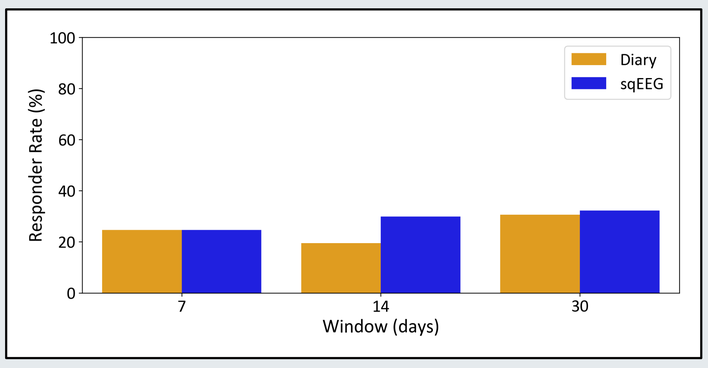

Net direction of effect



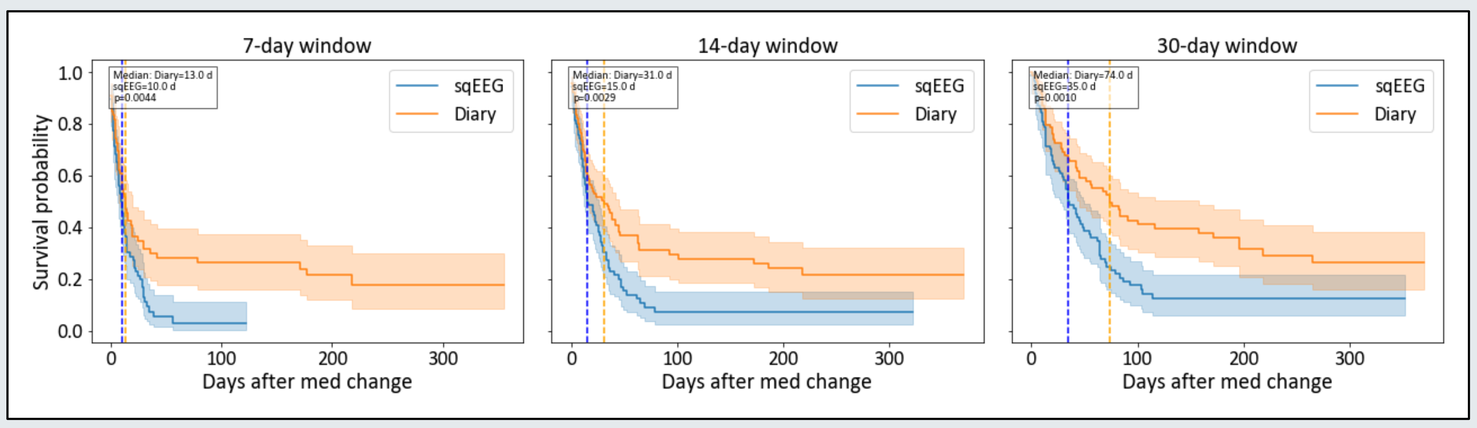

Median Percent Change in seizure frequency




50% Responder Rate




Time to baseline seizure counts, Kaplan-Meier survival curves and log-rank tests




## DISCUSSION

- **sqEEG captured both increases and decreases in seizure frequency**
- Net direction analyses suggest **diaries underestimate seizure worsening**, raising concerns about their sensitivity for clinical decision-making and clinical trials
- No significant differences between diary and sqEEG were found with typical RCT metrics (median percent change, 50% responder rate), despite meaningful differences in the sensitivity and speed with which SqEEG detects treatment change
- **Shorter time to baseline detection with sqEEG** indicates higher temporal resolution and reduced susceptibility to potential placebo effects of medication changes
- These findings support **the utility of ultra long-term sqEEG as a complementary tool to diaries** in evaluating changes to treatment
- sqEEG could be considered as a more **efficient outcome monitoring tool in pharmaceutical trials**

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