When do patients track their seizures in an electronic seizure diary? An interim analysis of the Human Epilepsy Project.

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Background

Electronic diaries are increasingly used to record seizures clinically & in research[1–6]. Key advantages cited over paper diaries are increased accessibility, reminders to track and timestamps of data entry[1]. This study investigated variables that influence the duration between when a seizure was reported to occur, and when the participant entered the event in their electronic diary.

Methodology

Study Design

The Human Epilepsy Study (HEP) is a six-year, prospective, observational study whose goal is to identify markers of treatment response in patients with newly treated focal epilepsy. The HEP seizure diary, an app designed by Irody Inc. was installed on a provided iPod or on participants' personal smart phone. Participants were instructed to track seizure status daily. Participants received a daily reminder to enter their seizure status. All seizures were stamped with date & time of entry, and classified by reported semiology in clinic according to the ILAE classification system[7]:

- ❑ Focal aware without motor (FA-M)
- ❑ Focal aware with motor (FA+M)
- ❑ Focal with impaired awareness (FIA)
- ❑ Focal to bilateral tonic clonic seizures (FBTC)

Seizures were then more broadly grouped as:

- ❑ Retained awareness (RA = FA-M & FA+M)
- ❑ Impaired awareness (IA = FIA & FBTC)
- ❑ Unknown

Diary compliance ("tracker type") was categorized based on percentage of days with data entered as "Trackers" (>80%), "Moderate Trackers" (20-79%) or "Non-Trackers" (<20%). Lag time was calculated as the difference between time & date of entry to time & date of seizure as reported by the participant, in hours.

Data Analysis

The effect of seizure type on lag time was modelled using Generalized Estimating Equations (GEE) to account for within-participant correlation using log transformed hours as the dependent variable and a gamma distribution. Age at enrolment (years), sex, study site and tracker type were included as covariates. In the first model, we examined the effect of broad seizure categories (RA vs IA) on mean tracking lag time. Seizures categorised as unknown were excluded. In the second model, ILAE seizure type (FA-M as reference) was used as the predictor variable. In each case, model-based estimates of adjusted mean and 95% CI tracking lag time were calculated. Analysis was performed using Stata version 15.1 (College Station, TX).

Results

Figure 1. Sample of diary tracking by subjects

A total of 10,575 seizures were logged by 232 participants from November 2012 to May 2019. Excluding seizures missing either time of seizure (1432), missing date & time stamp (598), seizures reported as occurring after time stamp of entry (296) or duplicate entries (>1 seizure reported with same time & date) (128), there were 8121 seizures reported by 232 participants. The median tracking lag time was 28 hrs (IQR 10-103, range 0–27,546).

In the first model (N=211 participants, n=6953 seizures), there was a significant effect of RA vs IA (p<0.001), tracker type (p< 0.001 for moderate tracker and poor tracker vs good tracker) and male sex (p=0.001) on lag. In the second model (N=213 participants, n=7001 seizures), compared to FA-M, FBTC seizures were associated with an increased lag (p = 0.001) whereas FIA (P>.001) and FA+M seizures (P=.03) were associated with decreased lag. Tracker type and male sex remained significant predictors of lag. The model predicted mean tracking lag was 558 hours (95% CI: 445 – 671) for FA-M, 277 hours (95% CI: 223 – 330) for FIA, and 873 hours (95% CI: 650 – 1097) for FBTC seizures.

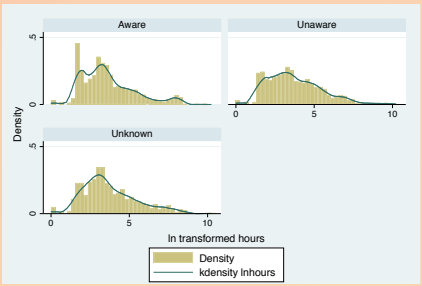

Figure 2. Distribution of log transformed lag hours by seizure type

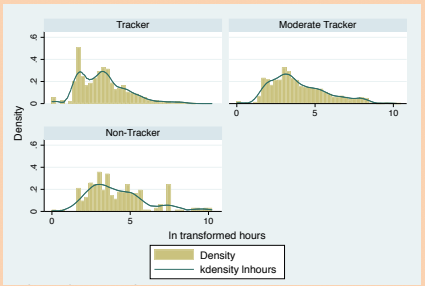

Figure 3. Distribution of log transformed lag hours by tracking pattern

Conclusions

More than half of diary keepers do not log their seizures on the day they occur. One quarter take more than 4.3 days to log a seizure after it occurred. Type of seizure, gender and tracking compliance influence tracking lag. Tracking lag may affect the reliability of reported seizures.

References

1. Fisher RS, Blum DE, Diventura B, et al. Epilepsy & Behavior Seizure diaries for clinical research and practice : Limitations and future prospects. *Epilepsy Behav*. 2012;24(3):304-310. doi:10.1016/j.yebeh.2012.04.128
2. Fisher RS, Bartfeld E, Cramer JA. Epilepsy & Behavior Use of an online epilepsy diary to characterize repetitive seizures. *Epilepsy Behav*. 2015;47:66-71. doi:10.1016/j.yebeh.2015.04.022
3. Le S, Shafer PO, Bartfeld E, Fisher RS. An online diary for tracking epilepsy. *Epilepsy Behav*. 2011;22(4):705-709. doi:10.1016/j.yebeh.2011.08.035
4. Ernst L de L, Harden CL, Pennell PB, et al. Medication adherence in women with epilepsy who are planning pregnancy. *Epilepsia*. 2016;57(12):2039-2044. doi:10.1111/epi.13586
5. Pennell PB, French JA, Harden CL, et al. Fertility and birth outcomes in women with epilepsy seeking pregnancy. *JAMA Neurol*. 2018. doi:10.1001/jamaneurol.2018.0646
6. Fisher RS. Tracking epilepsy with an electronic diary. *Acta Paediatr Int J Paediatr*. 2010;99(4):516-518. doi:10.1111/j.1651-2227.2010.01694.x
7. Fisher RS, Cross JH, French JA, et al. Operational classification of seizure types by the International League Against Epilepsy: position paper of the ILAE Commission for Classification and Terminology. *Zeitschrift fur Epileptol*. 2018;31(4):272-281. doi:10.1007/s10309-018-0216-8

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Human Epilepsy Project