Supplementary Material to De Calheiros Velozo & Habets et al, 2022 “***Designing Daily-Life Research combining Experience Sampling Method with Parallel Data*”**

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|  | **ESM Data** | **Parallel Data** |
| ***I.a. Research question and hypothesis*** |  |  |
| Hypothesis | More tremor episodes lead to more negative affect in Parkinson’s disease. | |
| Unique values of data types | Possibility to assess subjective affect during daily-life | Passive registration of movement during daily-life |
| Exact variables of interest | * Sum scores of negative affect items per questionnaire: stressed, anxious, depressed * Sum scores of positive affect items per questionnaire * Patient reported dopaminergic medication states | * Tremor representing features |
| Temporal relation and directionality of relation of interest | We are interested in negative affect after tremor, so parallel data windows are computed prior to the ESM questionnaire data timestamp. Due to the high volatility of negative affect, we down-sample the parallel data to windows of 30 minutes prior to each ESM questionnaire. | |
| ***I.b. Fluctuation and volatility*** | | |
| Expected fluctuation scale | Negative affect can fluctuate heavily within days as well as between days. | Tremor can fluctuate heavily in severity over minutes, but will also fluctuate over hours based on dopaminergic medication states. |
| Expected volatility | Negative affect is highly volatile. 7 to 10 ESM assessments would be desired, also regarding patient burden. | Tremor is a relatively volatile Parkinson motor symptom, and episodes can be less than a minute. Tremor severity must be assessed every ten to thirty seconds. |
| ***I.c. Data Analysis*** | | |
| Descriptive | Multi-level correlation analyses can show the within-subject correlation between the coupled ESM scores and tremor scores. Affect items can be used as confounding factors, same as the reported dopaminergic medication status.  Additionally, ESM scores can be compared as momentary off-set compared to the day mean. ESM scores can be normalized and similar correlative analyses can be performed on the group-level. | |
| Predictive | To assess the predictive potential of tremor score to predict negative affect changes, we need to split our data into a training and testing dataset. A rule of thumb is 80%/ 20% respectively for model development, and hold-out validation. The 14 days are rather short for individual model development, so a predictive analysis would fit better on the whole group. A leave-one-patient-out validation can be considered. | |
| ***II.a. Device Selection*** | | |
| Raw data versus proxy scores | The affect-related ESM items of interest are part of the questionnaire. | Raw accelerometer and gyroscope data are collected from both wrists. |
| Data storage or data transfer | Sufficient data storage for the amount of data that should be stored locally before a data transfer is performed. | Sufficient data storage for the amount of data that should be stored locally before a data transfer is performed. |
| Data security and governance | During pseudonymized data recording the mobile app guaranteed data security. The anonymized data is shared on an open science repository afterwards according to informed consent. | During pseudonymized data recording the mobile app guaranteed data security. The anonymized data is shared on an open science repository afterwards according to informed consent. |
| User-friendliness | Data collection with the applied methodology was reported to be feasible in this specific population. | |
| ***II.b. Sampling frequency*** | | |
| Sampling frequency | 7 to 10 ESM assessments have shown to capture affect without being overly burdensome. | At least 25 - 50 Hz is required for tremor detection. Current 200 Hz is oversampled but can be reduced during pre-processing. |
| Sampling duration | More than fourteen days would have been desirable, but a 14-day period is sufficient for first exploration. Especially for the group-level analyses. | |
| ***III.a. Feature extraction*** | | |
| Pre-processing and signal processing | Per completed ESM questionnaire:   * Extract negative affect items, create sum; consider normalization (per day) * Extract positive affect items, create sum; consider normalization (per day) * Extract dopaminergic medication status items | * Include 30 minute blocks of tri-axial acceleration and rotation before each completed ESM questionnaire * Depending on tremor signal processing approach: apply band-pass filtering of frequencies 4 – 8 Hz * Convert data collected in the time domain into spectral domains per 30 minutes, calculate tremor spectral power bands |
| Temporal aggregation | Compare ESM scores at 10 AM with tremor power bands between 09.30 – 10.00 AM, ESM scores at 4 PM with tremor power bands between 3.30 – 4.00 PM, etc. | |
| Missing Data | To check bias, the tremor power bands of parallel data windows before and at the moment of missed ESM questionnaires can be compared with the parallel data windows of completed ESM questionnaires. | |

**Supplementary Table 1: Practical example on how to implement the outlined considerations.** ESM: experience sampling methodology. For easier readability, references are included in the Supplementary Material.