Is there a relationship between processed EEG characteristics during anaesthesia and general level of health? (EEGLoH)

Background
Processed EEG monitors are being used increasingly during anaesthesia to reduce the risk of awareness and to allow titration and individualisation of drug dosing. Early devices gave a single number to target and a short segment of a waveform. Newer devices give a derived index, multiple EEG waveforms and a detailed display of the frequency distribution of the EEG.

This frequency display, the spectrogram, conveys information about the energy of the EEG in different frequency bands. It is recognised that the EEG during anaesthesia gets less energetic with age, and we see this. We have also observed differences in the energy of the EEG between patients of similar age that appears to relate to their overall level of health.

There is increasing interest in predicting and optimising physical and mental recovery after surgery and anaesthesia.

Our hypothesis is that there is a relationship between general physical fitness and the amount of EEG activity as evidenced by the energy of the spectrogram. A secondary hypothesis is that this may be related to outcome, as preoperative fitness is a well-recognised predictor of postoperative outcome.

Methods
30-60 patients over 65yr in whom the anaesthetist plans to use processed EEG monitoring. No significant dementia and sufficiently fluent in English to give consent and be able to complete the questionnaires. We will exclude patients undergoing intracranial or cardiac surgery and those with neck of femur fractures. Patients will be selected to allow the preoperative assessments to be conducted without delaying surgery.
Preoperatively we will administer the Montreal Cognitive Assessment (MOCA), WHO disability assessment schedule (WHODAS), Edmonton Frailty assessment and a timed 'get up & go test'. We estimate this will take around 30 minutes.
Conduct of anaesthesia will be left to the anaesthetist in charge of the case. Processed EEG monitoring with Masimo Sedline. Details of the anaesthetic technique and operation will be recorded with operations stratified as minor, intermediate and major. Physiological and drug data will be recorded electronically. The EEG will be recorded and intensity of spectrogram derived off line. The intensity of the spectrogram will also be scored on an empirical scale.
Follow-up will be at days 1 and 30. Patients will be contacted and hospital notes reviewed. WHODAS will be administered and major morbidity recorded.

Analysis
The primary outcome will be the correlation between the energy of the EEG with the preoperative MOCA and "frailty" scores. We will also look at change in activity level, as measured by the WHODAS score. Given the small numbers, we would not expect to see any correlation with major morbidity or mortality.

Significance
The primary aim of this study is to assess our observation of a correlation between EEG "energy" and general level of health. Such a relationship would help us optimise measures to improve the post-operative outcomes for individual patients.
   This study is also a feasibility study for a more detailed investigation of the relationship between EEG "energy" during anaesthesia and changes in physical and cognitive performance after anaesthesia and surgery. The data collected during this study will allow us to superficially explore the effect of a range of covariates on the EEG intensity and on outcomes to help design further studies.