

Quantitative EEG for the Diagnosis of Disease States

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An increasing number of patients with psychopathologies is being treated with pharmacological interventions. Currently the decisions whether or not to start pharmacological treatment and which drug is the most appropriate are not only based on evidence from clinical studies, but also rely heavily on personal experience of the clinician and trial-and-error processes. The trial-and-error method is essential, since outcomes from clinical trials cannot entirely predict treatment outcomes in a highly variable patient population as seen in the hospitals and practices. Knowledge generated by these trial-and-error processes have therefore to be captured and fed back into the clinical system, a procedure that is only minimally implemented in current day-to-day care.

In a consortium of clinics and practices in The Netherlands, existing behavioral measurements (such as questionnaires and neuropsychological tests) are combined with new measurements (brain activity) in order to objectify treatment choice and outcomes, thereby capturing the trial-and-error processes in the day-to-day care. The addition of brain measurements (in the form of quantitative EEG) are based on a growing body of evidence that shows that quantification of brain activity can evaluate effects of pharmacological interventions in a much more sensitive way. Above that, changes in bodily functions due to drug use can be detected much faster using brain measurements. Therefore, it is expected that the addition of brain measurements will ultimately result in a more reliable choice of drug treatment and faster and more reliable outcome monitoring in patients who use these drugs. We tested these hypotheses by means of a pilot study in which we added quantitative EEG in the routinely psychological testing of adult patients with depression and anxiety disorder of the Psychiatry Department and the Medical Psychology Department of the Atrium Medical Centre. We included 125 patients who filled out common symptoms- and personality questionnaires, before and after treatment. We found significant correlations between the use of certain drugs and brain activity. We also found typical brain activation patterns for depression and anxiety disorder. Some of these results are consistent with existing publications in the field of psychology and pharmaco-EEG, other results are not yet described in scientific literature in a consistent way. Especially these novel patterns in patients with depression seem to predict treatment outcomes of antidepressants.

Based on the results of this initial project, a larger project in two hospitals is now being planned, where brain and behavior measurements are implemented by means of a quality management system. The QM system will monitor and evaluate the following items and questions:

A) the predictability of the combination of brain and behavioral measurements for the effects of pharmacological interventions in patients with psychopathologies: can these measurements guide/quantify the choice of drugs in these patients?

B) the added value of brain measurements for the fast detection of treatment effects: can brain measurements evaluate drug interventions faster and more reliable than existing behavioral measurements, so that changes in the type and dose of drugs can be made faster and more reliable?

C) quantifying the added value per test: which tests are necessary for getting the required outcomes, and which tests do not provide any additional value and could potentially be eliminated from the measuring and monitoring process?

D) the added value of the combination of brain and behavioral measurements as a quality management system in clinical practice: can standardized measurement procedures improve patient satisfaction while reducing costs of pharmacological interventions?

This second project will include more than 1500 patients, ranging from adult patients with depression and anxiety disorder to children with development disorders (ADHD). We will present 1) results from the first study, and 2) consequences from these results for the quality management system in the second, larger study.

Keywords. mental health, pharmaco-EEG, quality management system, practice based evidence.