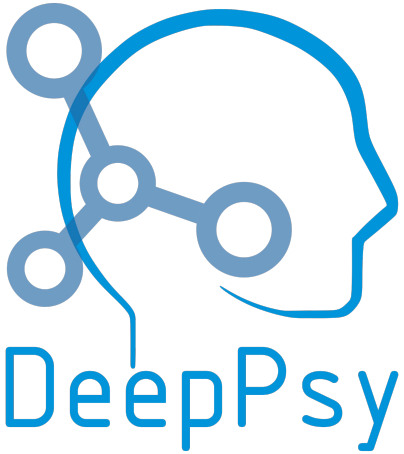


DeepPsy Biomarker's Report Guide

April 2024 - v1.0.0

Table of Contents

Introduction

The DeepPsy Biomarkers Report is generated from an analysis of patient EEG and ECG data. It provides a concise summary of the analysis performed, detailing the biomarkers identified from the physiological signals. The report includes charts that offer a comprehensive view of the mainly predictive markers for optimization of treatment and the patient's condition, alongside interpretations of the data, which are based on current scientific literature.

This guide will provide a description of the different sections in the report and how they can be interpreted and used.

Evidence level

Each “Interpretation” in the 3rd page (interpretations section) has a label with the “evidence level”. This is a statement about the strength of the evidence in this finding.

To rank the evidence level, we are using the "The Oxford 2011 Levels of Evidence" from the Oxford Centre for Evidence-Based Medicine.

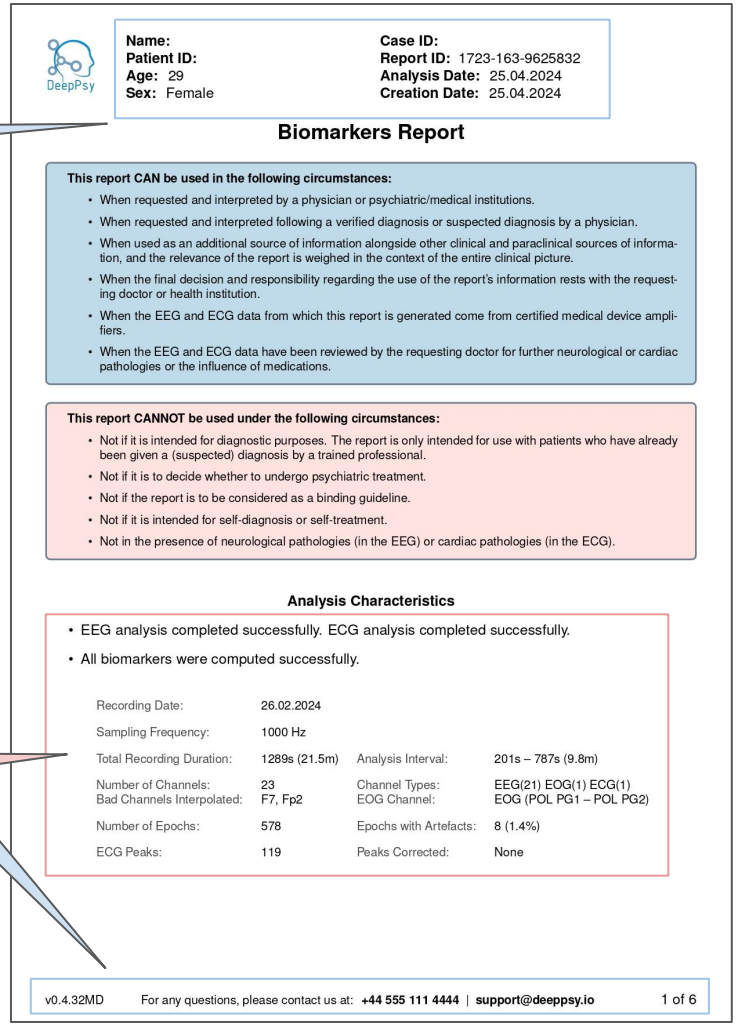
The system categorizes evidence from Level 1 (high-quality evidence) to Level 5 (lowest evidence level). In the case of our predictive biomarkers, we follow:

Level 1	Level 2	Level 3	Level 4	Level 5
Systematic review of inception cohort studies	Inception cohort studies	Cohort study or control arm of randomized trial*	Case-series or case-control studies, or poor quality prognostic cohort study**	n/a

The header and footer have basic identifying information that appears in every page. The patient information is printed in every page to avoid the mixing of reports.

This section gives general information about the EEG or ECG itself date, length etc) and the analysis performed by the DeepPsy specialist.

If there were any problems during the analysis, they're shown here. Additionally, if there's any information from the analysis that is important for the interpretation of the results, it'll be shown here as well.



DeepPsy

Name:
Patient ID:
Age: 29
Sex: Female

Case ID:
Report ID: 1723-163-9625832
Analysis Date: 25.04.2024
Creation Date: 25.04.2024

Biomarkers Report

This report CAN be used in the following circumstances:

- When requested and interpreted by a physician or psychiatric/medical institutions.
- When requested and interpreted following a verified diagnosis or suspected diagnosis by a physician.
- When used as an additional source of information alongside other clinical and paraclinical sources of information, and the relevance of the report is weighed in the context of the entire clinical picture.
- When the final decision and responsibility regarding the use of the report's information rests with the requesting doctor or health institution.
- When the EEG and ECG data from which this report is generated come from certified medical device amplifiers.
- When the EEG and ECG data have been reviewed by the requesting doctor for further neurological or cardiac pathologies or the influence of medications.

This report CANNOT be used under the following circumstances:

- Not if it is intended for diagnostic purposes. The report is only intended for use with patients who have already been given a (suspected) diagnosis by a trained professional.
- Not if it is to decide whether to undergo psychiatric treatment.
- Not if the report is to be considered as a binding guideline.
- Not if it is intended for self-diagnosis or self-treatment.
- Not in the presence of neurological pathologies (in the EEG) or cardiac pathologies (in the ECG).

Analysis Characteristics

- EEG analysis completed successfully. ECG analysis completed successfully.
- All biomarkers were computed successfully.

Recording Date:	26.02.2024		
Sampling Frequency:	1000 Hz		
Total Recording Duration:	1289s (21.5m)	Analysis Interval:	201s – 787s (9.8m)
Number of Channels: Bad Channels Interpolated:	23 F7, Fp2	Channel Types: EOG Channel:	EEG(21) EOG(1) ECG(1) EOG (POL PG1 – POL PG2)
Number of Epochs:	578	Epochs with Artefacts:	8 (1.4%)
ECG Peaks:	119	Peaks Corrected:	None

The Vigilance section (EEG) has a plot with the level of vigilance of the patient throughout the whole recording (left panel) and the slope of the vigilance level over the first two minutes (right panel).

The slope is the value that has predictive clinical implications.

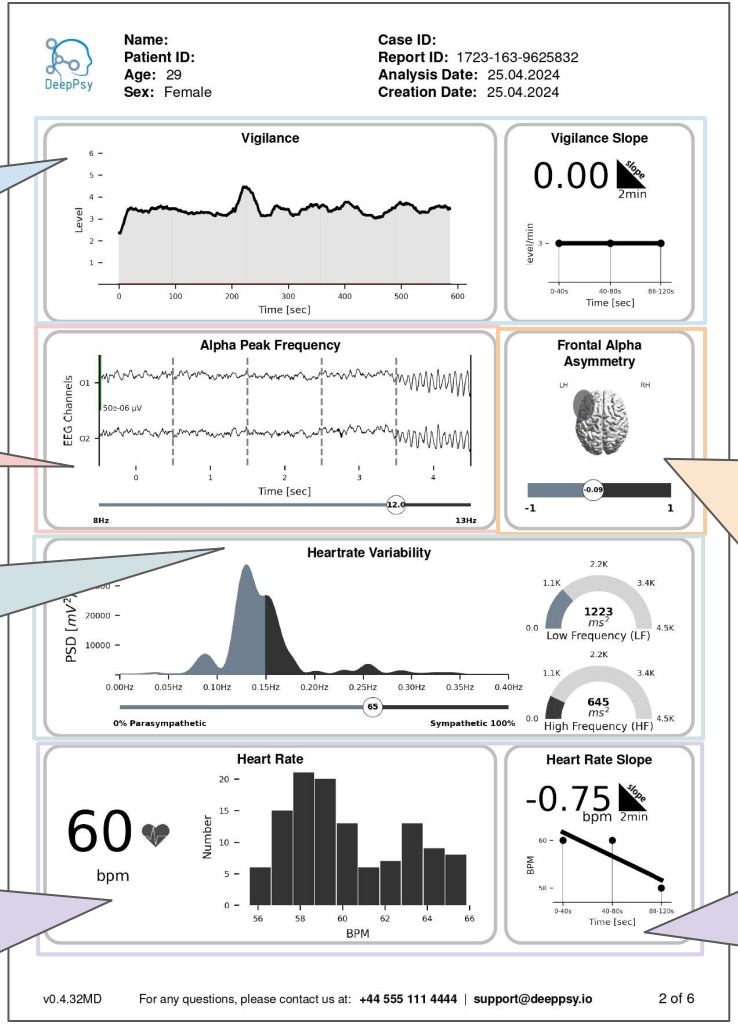
The plot shows an example of segments with the Alpha Peak Frequency (APF) for the patient (EEG). From the APF as the basic rhythm of the brain, several predictive aspects can be concluded.

This plot shows the distribution of Heart Rate Variability, derived from the ECG.

High values of Low Frequency (LF) power reflect the adaptive capabilities of the autonomic nervous system. Low LF values are usually associated with the potential for good relaxation.

High values of High Frequency (HF) power are associated with a relaxed state, where low HF power values can be associated with stress or anxiety

Histogram of beat per minute (BPM) for the ECG. This marker has predictive value for treatment options.



The hemisphere with greater frontal alpha power was highlighted for the frontal alpha asymmetry.

This marker s has predictive clinical implications specific in female patients.

Slope of the beat per minute (BPM) for the ECG. This marker has predictive value for treatment options.

The individual values or each of the biomarkers can be found here. For eligible biomarkers, the normal range in the healthy population is presented. Values outside the boundary of two standard deviations are presented in bold type.

Report interpretations concisely summarize the associations found in the scientific literature between EEG and ECG biomarkers and treatment effectiveness. All references to the corresponding studies are given alongside with a rating of the clinical evidence (level 1 -highest level of evidence- to level 4 -lowest level of evidence)

Note: Since there exist several different markers for specific treatments (e.g. for SSRIs), the results sometimes can be contradictory between biomarkers. The results need to be put into the clinical context by a physician and to be discussed with the patient.

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Biomarker Values

	Value (first 2min)	Normal Interval (2 SD)
EEG:		
Alpha Frontal Asymmetry	-0.0865	(-0.3 – 0.3)
Alpha Peak Frequency (Hz)	**12.0***	(8.0 – 11.7)
qEEG Alpha (μV^2)	45.4	(0.0 – 144.0)
qEEG Beta (μV^2)	**17.55***	(0.0 – 16.0)
qEEG Delta (μV^2)	6.02	(0.0 – 16.0)
qEEG Gamma1 (μV^2)	1.51	(0.0 – 2.0)
qEEG Gamma2 (μV^2)	**0.48***	(0.0 – 0.2)
qEEG Theta (μV^2)	5.37	(0.0 – 32.0)
Vigilance Regulation A1 Stages (%)	7.3	–
Vigilance Level ($Level$)	3.0	(2.2 – 6.0)
Vigilance Regulation ($Level/min$)	-0.0	(-0.5 – 0.4)
Vigilance Regulation 9.8min ($Level/min$)	-0.0	–
ECG:		
Heart Rate (BPM) ($beats/min$)	60.0	(53.0 – 76.0)
Heart Rate Trend (BPM Slope) ($beats/min^2$)	-0.75	(-2.91 – 2.73)
Parasympathetic Activity (HF) (ms^2)	644.73	(0.0 – 4320.0)
Sympathetic/Parasympathetic Ratio	**65.49***	(0.0 – 8.0)
Sympathetic Activity (LF) (ms^2)	1223.39	(0.0 – 4242.0)

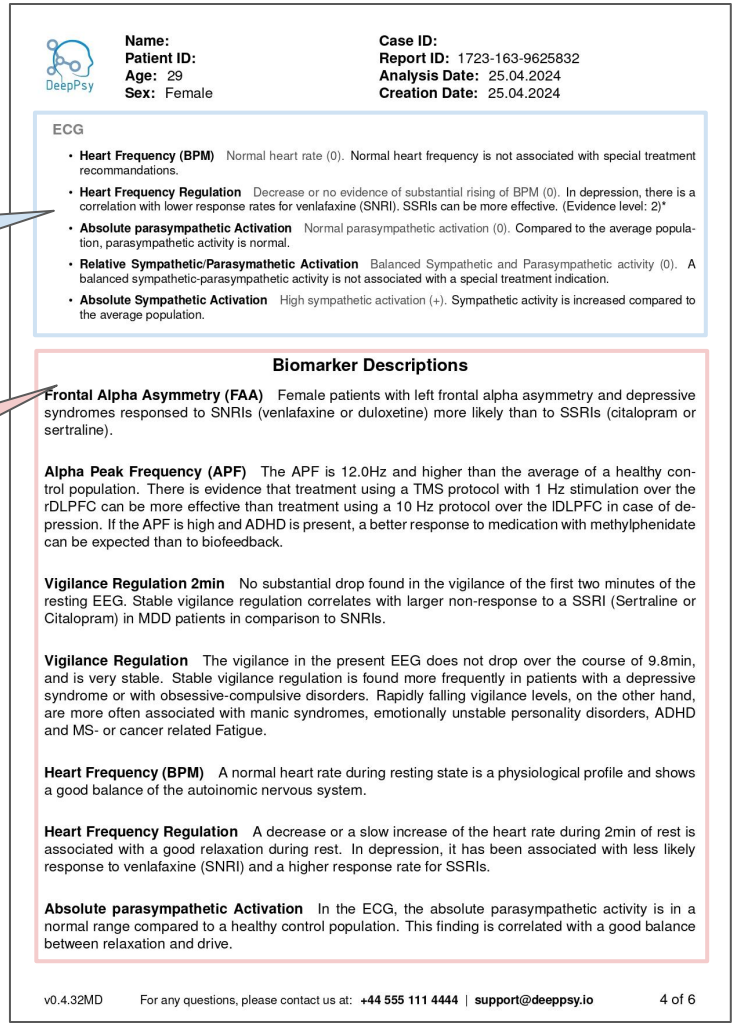
Interpretations

EEG

- **Frontal Alpha Asymmetry (FAA)** Left dominant frontal alpha activity (-). Female patients with depression show a decreased response to SSRIs (Evidence level: 2)*
- **Alpha Peak Frequency (APF)** High Alpha Peak Frequency (+). For depression, 1Hz TMS protocols over the rDLPFC may be more effective than 10Hz protocols over the left DLPFC (Evidence level: 2). There is also a negative correlation with the response to Sertraline (Evidence level: 2). In the case of ADHD, medication with Methylphenidate might be more effective than biofeedback treatment (Evidence level: 4).
- **Vigilance Level** Low vigilance level (-). Low vigilance levels can be associated with increased fatigue, drowsiness, medication or manic syndroms.
- **Vigilance Regulation 2min** Increase or no initial decrease of vigilance during the first 2 minutes (+). Literature shows lower response rates in depression to SSRIs. SNRIs can be more effective (Evidence level: 2)*. Increasing Vigilance levels were found more often in patients after a recent suicide attempt in comparison to healthy controls (Evidenzgrad: 4).
- **Vigilance Regulation** No decrease of vigilance (+) in the analysis interval of (9.8min). Commonly observed in patients diagnosed with depression or OCD (Evidence Level 2). Response to medication in case of ADHD less probable (Evidence Level 4).

Interpretation for ECG (if present) data follow the same format as for EEG. The associations of biomarker values found for the patient and treatment effectiveness are reported. All references to the corresponding studies are given alongside with a rating of the clinical evidence (level 1 -highest level of evidence- to level 4 -lowest level of evidence)

The descriptions offer more comprehensive information about each biomarker. This can be useful in cases where one wishes to explain the meaning of the biomarkers to the patient, or simply to obtain more information in order to better support clinical decisions.



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ECG

- **Heart Frequency (BPM)** Normal heart rate (0). Normal heart frequency is not associated with special treatment recommandations.
- **Heart Frequency Regulation** Decrease or no evidence of substantial rising of BPM (0). In depression, there is a correlation with lower response rates for venlafaxine (SNRI). SSRIs can be more effective. (Evidence level: 2)*
- **Absolute parasympathetic Activation** Normal parasympathetic activation (0). Compared to the average population, parasympathetic activity is normal.
- **Relative Sympathetic/Parasympathetic Activation** Balanced Sympathetic and Parasympathetic activity (0). A balanced sympathetic-parasympathetic activity is not associated with a special treatment indication.
- **Absolute Sympathetic Activation** High sympathetic activation (+). Sympathetic activity is increased compared to the average population.

Biomarker Descriptions

Frontal Alpha Asymmetry (FAA) Female patients with left frontal alpha asymmetry and depressive syndromes responsed to SNRIs (venlafaxine or duloxetine) more likely than to SSRIs (citalopram or sertraline).

Alpha Peak Frequency (APF) The APF is 12.0Hz and higher than the average of a healthy control population. There is evidence that treatment using a TMS protocol with 1 Hz stimulation over the rDLPFC can be more effective than treatment using a 10 Hz protocol over the lDLPFC in case of depression. If the APF is high and ADHD is present, a better response to medication with methylphenidate can be expected than to biofeedback.

Vigilance Regulation 2min No substantial drop found in the vigilance of the first two minutes of the resting EEG. Stable vigilance regulation correlates with larger non-response to a SSRI (Sertraline or Citalopram) in MDD patients in comparison to SNRIs.

Vigilance Regulation The vigilance in the present EEG does not drop over the course of 9.8min, and is very stable. Stable vigilance regulation is found more frequently in patients with a depressive syndrome or with obsessive-compulsive disorders. Rapidly falling vigilance levels, on the other hand, are more often associated with manic syndromes, emotionally unstable personality disorders, ADHD and MS- or cancer related Fatigue.

Heart Frequency (BPM) A normal heart rate during resting state is a physiological profile and shows a good balance of the autoinomic nervous system.

Heart Frequency Regulation A decrease or a slow increase of the heart rate during 2min of rest is associated with a good relaxation during rest. In depression, it has been associated with less likely response to venlafaxine (SNRI) and a higher response rate for SSRIs.

Absolute parasympathetic Activation In the ECG, the absolute parasympathetic activity is in a normal range compared to a healthy control population. This finding is correlated with a good balance between relaxation and drive.

Literature references of all cited papers in the interpretation section.

The “interpretations” section in page 3 has a number of reference number next to each title. You can find further information about each interpretation in the literature listed here.

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Frequently Asked Answers (FAQs)

- **Why are some of the recommendations contradictory?**
  It’s possible that some biomarkers give contradictory information. This is the nature of assessing different sources of information. It’s important to weigh the merits of the interpretations against each other and against the patient’s medical history.