



DeepPsy

DeepPSY Biomarker's Report Guide

December 2024 - v1.1.0

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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.

Provides a summary of the correlations indicated by the literature given the electrophysiological profile derived from the analysis.

This feature is intended to provide physicians a quick overview of the correlations that may be useful in aiding the decision-making process.



Name:
Patient ID:
Age: 56
Sex: Male

Case ID:
Report ID:
Report Date: 19.12.2024
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EEG & ECG Biomarkers Report

- This report is intended to be used only by qualified medical practitioners.
- This report is intended to be used to improve decision-making within the scope of possible treatments already indicated for a patient.

- This report is not intended to be used to determine whether a patient should undergo treatment. It is also not intended to be used to determine if a treatment is indicated or contraindicated for a patient.
- This report is not intended for use in cases of neurological pathologies, scalp abnormalities, head injuries (in the EEG), or cardiac pathologies (in the ECG).
- This report is not intended to drive diagnosis, to be used as a vital signs monitor, or to be used in any situation where measured parameters could result in immediate danger to the patient.

Biomarker Correlations Summary

Condition	Treatment	Correlation
MDD	SSRI	Lower response rates than SNRI Vigilance Regulation: 2min
	SNRI	Higher response rates than SSRI Vigilance Regulation: 2min
	rTMS	10Hz left DLPFC has lower Response Rate than 1Hz right DLPFC Alpha Peak Frequency (APF)
	Ketamine (oral/i.v.)	Decreased response rates for Ketamine Heart Rate (BPM), Vigilance Regulation: A1 Stages
	ECT	Higher response rates for ECT and less side effects Alpha Peak Frequency (APF)
ADHD	Biofeedback	Higher response rates than for stimulants Alpha Peak Frequency (APF)
OCD	Combined SSRI and CBT	Increased response rates for combined SSRI and CBT treatment Vigilance Regulation: 0 Stages

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.

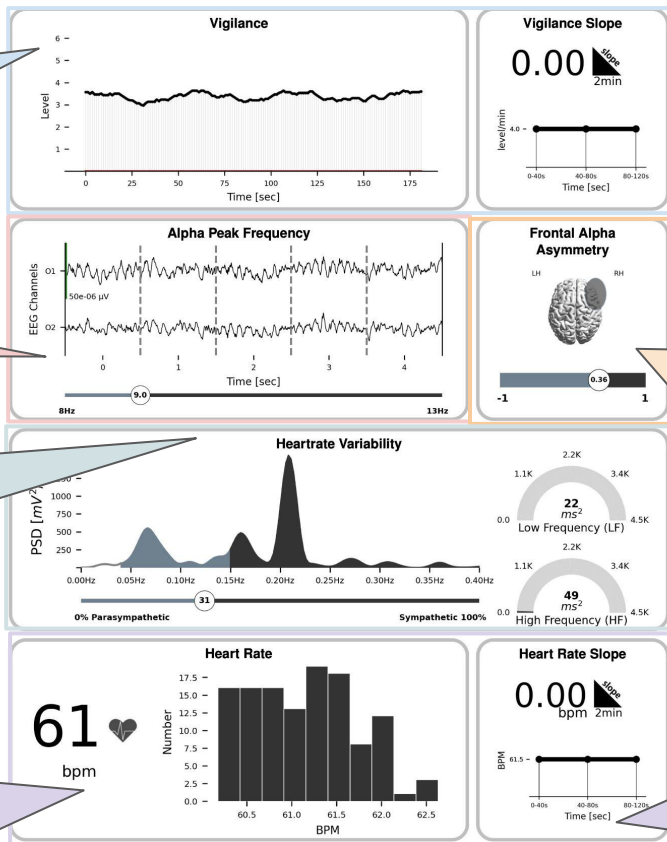
This marker has predictive clinical implications specific in female patients.

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



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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.

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.



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Biomarker Values

	Value (first 2min)	Normal Interval (2 SD)
EEG:		
Alpha Peak Frequency (APF) (Hz)	9.0	(8.0 – 11.7)
Frontal Alpha Asymmetry (FAA)	0.3612*	(-0.3 – 0.3)
qEEG Alpha (μV^2)	27.73	(0.0 – 144.0)
qEEG Beta (μV^2)	3.99	(0.0 – 16.0)
qEEG Delta (μV^2)	12.73	(0.0 – 16.0)
qEEG Gamma1 (μV^2)	1.32	(0.0 – 2.0)
qEEG Gamma2 (μV^2)	0.98*	(0.0 – 0.2)
qEEG Theta (μV^2)	10.33	(0.0 – 32.0)
Slow Basic Rhythm	No	–
Vigilance Regulation: 0 Stages (%)	0.0	(0.0 – 75.0)
Vigilance Regulation: A1 Stages (%)	12.9	–
Vigilance Level (Level)	4.0	(2.2 – 6.0)
Vigilance Mean (Level)	2.5	(2.24 – 6.0)
Vigilance Regulation 2min (Level/min)	0.0	(-0.5 – 0.4)
ECG:		
Heart Rate (BPM) (beats/min)	61.0	(53.0 – 76.0)
Heart Rate Regulation (BPM Slope) (beats/min ²)	0.0	(-2.91 – 2.73)
Total HRV Power (ms ²)	71.0	(0.0 – 8011.0)
Parasympathetic Activity (HF) (ms ²)	49.17	(0.0 – 4320.0)
Sympathetic Activity (LF) (ms ²)	21.8	(0.0 – 4242.0)
Relative Sympathetic Activity (LFnu) (%)	30.7	(7.0 – 96.0)

Analysis Characteristics

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

Recording Date:	05.11.2024		
Sampling Frequency:	1000 Hz		
Total Recording Duration:	1274s (21.2m)	Analysis Interval:	60s – 241s (3.0m)
Number of Channels:	23	Channel Types:	EEG(21) EOG(1) ECG(1)
Bad Channels Interpolated:	F7	EOG Channel:	EOG (POL PG1 – POL PG2)
Number of Epochs:	132	Epochs with Artefacts:	49 (37.1%)
ECG Peaks:	122	Peaks Corrected:	None

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.

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)



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Interpretations

EEG

- **Alpha Peak Frequency (APF) [2, 3, 5, 19, 26]** In this EEG, a low Alpha Peak Frequency was found. In this case, for depressive symptoms, a 1Hz TMS protocols over the rDLPFC may be more effective than 10Hz protocols over the left DLPFC. There is also a positive correlation with the response to Sertraline. ECT therapy shows particularly good response with low APF. In the case of ADHD, there is evidence suggesting that biofeedback methods might be more effective than Methylphenidate. (Evidence Level 2)
- **Basic Rhythm Slow [11]** In this, a EEG normal Basic Rhythm Peak Frequency was found. No signs of generalized slowing of the basic EEG rhythm in this case. (Evidence Level 2)
- **Percentage of vigilance stage A1 [11]** In this EEG, a low occurrence of vigilance stage A1 was found. In this case, low percentages of EEG-vigilance stage A1 are associated with a lower probability to respond to i.v. ketamine and oral ketamine. (Evidence Level 2)
- **Vigilance Regulation 2min [12, 18, 20]** In this EEG increase or no initial decrease was found of vigilance during the first 2 minutes. For this case, literature shows lower response rates in depression to SSRIs and SNRIs can be more effective. (Evidence Level 2)

ECG

- **Heart Rate (BPM) [14]** In this ECG, a low heart rate was observed. In this case correlation with less likely response to ketamine (i.v.) in depression. (Evidence Level 2)
- **Heart Rate Regulation (BPM Slope) [18]** In this ECG, a decrease or no substantial increase in BPM was observed. In this case in depression, there is a correlation with lower response rates for venlafaxine (SNRI). SSRIs can be more effective. (Evidence Level 2)
- **Sum of Parasympathetic and Sympathetic Activity [14]** In this ECG, low overall activity of the autonomic nervous system is observed. In this case, correlation with increased likelihood of response to intravenous ketamine in depression. (Evidence Level 2)
- **Absolute parasympathetic Activation [15]** In this ECG, low absolute parasympathetic activation was observed. In this case correlation with an higher likely response to SSRI, CBT or combination in obsessive compulsive disorder. (Evidence Level 2)
- **Absolute Sympathetic Activation [21]** In this ECG, normal absolute sympathetic activation is observed. In this case compared to the average population, total sympathetic activity is normal.
- **Relative Sympathetic/Parasympathetic Activation [7]** In this ECG, a shift toward parasympathetic activity was observed. In this case no correlation with good response to Fluoxetine in generalized anxiety disorder. (Evidence Level 2)



Name:
Patient ID:
Age: 56
Sex: Male

Case ID:
Report ID: 1451-828-9631966
Report Date: 19.12.2024
Recording Date: 05.11.2024

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.