

BRC Report Detail

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1. Test procedures, functions measured, associated brain regions and what each test means (its potential practical significance)

1.1 Cognition

1.1.1 Memory Recall and Recognition



Test procedure: The client is asked to recall a set of words after various time intervals and later recognize the words from a list of repeated and new words.

Functions measured: Ability for new auditory verbal learning, memory recall and recognition. Verbal self-monitoring.

Putative brain regions involved: Involvement of a fronto-parietal networks, including premotor, left prefrontal, left precuneus and left parietal regions.

Selected references: 15, 16

Practical significance: Ability to learn and remember new tasks based on verbal information. Critical, central everyday skill.

1.1.2 Digit Span



Test procedure: The client is presented with a sequence of digits and then has to repeat them in either forward or backward order.

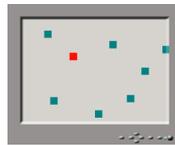
Functions measured: Short term verbal memory {Score Forwards}, working memory operations {Score Backwards}.

Putative brain regions involved: Prefrontal, temporal and inferior parietal cortex.

Selected references: 10, 11

Practical significance: Ability to hold, retain and operate on new verbal information. Skills crucial to most everyday, verbal tasks requiring memory. Everyday examples include remembering telephone numbers and shopping lists.

1.1.3 Span of Visual Memory



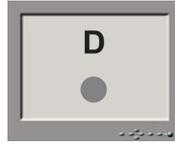
Test procedure: The client is required to press a series of squares on the screen in the order in which they previously lit up.

Functions measured: Short term visuospatial memory and attention.

Putative brain regions involved: Parietal, motor and prefrontal cortex.

Selected references: 8, 9

Practical significance: Ability to hold and retain new spatial information. Skills crucial to most everyday, non verbal tasks requiring memory. Examples include navigation, operating industrial machines.



1.1.4 Sustained Attention (CPT)

Test procedure: The client is presented with letters one by one, pressing a button if the same letter appears twice in a row.

Functions measured: Sustained attention, target detection.

Putative brain regions involved: Dorsolateral prefrontal and medial frontal cortex, thalamus, basal ganglia, posterior parietal and superior temporal lobe.

Selected references: 19, 20

Practical significance: Ability to detect and respond to significant change under conditions requiring vigilance. Fundamental everyday skills e.g. train, plane, automobile, computer and equivalent machine operations.



1.1.5 Switching of Attention

Test procedure: The test has two parts. Part1: Numbers are connected up sequentially in chronological order. Part2: Numbers and letters are connected up sequentially in chronological order.

Functions measured: Parts 1 and 2: Visuomotor tracking, simple attention. Part 2 only: Ability to shift the course of ongoing mental activity.

Putative brain regions involved: Dorsolateral frontal cortex (Part 2 only).

Selected references: 13, 14 (Part 2 only)

Practical significance: Part 1: Simple ability to attend. Part 2: Ability to sustain and control the direction of attention. Critical activity for everyday multitasking skills e.g. management, driving.



1.1.6 Motor Tapping

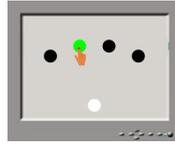
Test procedure: The client is required to tap a circle with the index finger of each hand in turn, as fast as possible.

Functions measured: Hand eye coordination and fine movement speed (manual dexterity).

Putative brain regions involved: Motor cortex, basal ganglia and cerebellum.

Selected references: 1, 2

Practical significance: Everyday motor skills such as typing and machine operation.



1.1.7 Choice Reaction Time

Test procedure: One of four circles lights up and the client is required to press the lit circle as quickly as possible.

Functions measured: Visuomotor coordination, speed and accuracy of selecting an appropriate response.

Putative brain regions involved: Occipital, parietal, frontal and motor cortices, diencephalon.

Selected reference: 3

Practical significance: Visual discriminative judgment and response. Examples: visual monitoring tasks requiring choice and reaction such as air traffic control, driving judgment.



1.1.8 Time Estimation

Test procedure: A circle appears on the screen for 1 to 12 seconds and the client is required to indicate the correct duration.

Functions measured: Ability to accurately estimate time duration.

Putative brain regions involved: Hippocampus and cerebellum.

Selected references: 4, 5

Practical significance: Time organization.



1.1.9 Verbal Interference

Test procedure: The test has two parts. The first part requires the client to read color words which are printed in colored ink. The second part requires the client to name the ink color in which the same color words are written.

Functions measured: The first part measures reading speed/accuracy for individual words. The second part measures the ability to inhibit inappropriate well-learned impulsive automatic responses.

Putative brain regions involved: Part 1: Posterior cortical regions. Part 2: Multiple cortical sites mediated by the anterior cingulate cortex.

Selected reference: 12 (Part 2 only)

Practical significance: Part1: Simple reading ability. Part2: Ability to control impulses; behavioral control.



1.1.10 Spot the Real Word

Test procedure: A real word is presented simultaneously with a nonsense word. The client is required to select the real word.

Functions measured: English language recognition.

Putative brain regions involved: Broad cortical involvement but particularly left perisylvian regions (e.g. Wernickes area).

Selected references: 6, 7

Practical significance: Language skill; correlates with premorbid intelligence.



1.1.11 Word Generation

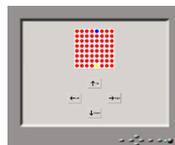
Test procedure: The client is required to say as many words as possible (in 1 minute) which start with given letters and then state as many animals as possible.

Functions measured: Verbal fluency and thinking ability.

Putative brain regions involved: Include left inferior frontal cortex, left dorsolateral prefrontal cortex, supplementary motor cortex, the anterior cingulate cortex and the cerebellum.

Selected references: 17, 18

Practical significance: Ability to generate and articulate thoughts and ideas in a systematic manner.



1.1.12 Maze

Test procedure: The client is required to discover (by trial and error) a hidden path through a maze and remember it.

Functions measured: Planning, abstraction, foresight, error correction, the ability to choose, try, reject and adapt alternative courses of thought and action; visuospatial learning and memory.

Putative brain regions involved: Widespread brain networks.

Selected reference: 21

Practical significance: Ability to plan, strategize and implement complex tasks involving visuospatial information.

1.2 Electrical Brain - Body Functions



1.2.1 Resting EEG

Test procedure: The client is asked to rest quietly and focus on the red dot on the computer monitor 60 cm in front of them, with eyes open and then the paradigm is repeated with eyes closed.

Functions measured: The EEG primarily arises from the summation of electrical potentials in thousands of synchronously active dendrites in cortical neurons, particularly pyramidal cells which are lined in columns perpendicular to the cortical surface and their summated activity is thereby discernable.

EEG electrical currents are measured non-invasively using recording disks on the scalp and reflect synchronized and desynchronized operations of the overall cortical electrical activity (and their subcortical modulations) in the brain. The time resolution is in the order of seconds.

A small number of fundamental EEG rhythms (cycles per second or Hz) emerge and index the underlying stability of brain function and its general response to stimulation. These are as follows:

- **Delta:** 1.5 – 3.5 Hz — This is best observed during deep sleep and is not generally prominent during cognitive activity.
- **Theta:** 4 – 7.5 Hz — theta1 (4 – 5 Hz), theta2 (5 – 7.5 Hz) — This is also normally observed during sleep but also reflects aspects of learning and attention.
- **Alpha:** 8 – 13 Hz — alpha1 (8 – 11 Hz), alpha2 (11 – 13 Hz) — This reflects the idling state of the brain based on thalamocortical processing – a relaxed readiness. It diminishes (desynchronizes) with the level of brain activation.
- **Alpha peak frequency:** This provides an index reflecting the capacity of verbal working memory. Semantic processing has been associated with higher frequency alpha (11 – 13 Hz) electroencephalographic (EEG) activity, while lower alpha frequency (8 – 11 Hz) is associated more with attentional processes.
- **Beta:** 14.5 – 30 Hz — beta1 (14.5 – 20 Hz), beta2 (20 – 25 Hz), beta3 (25 – 30 Hz) — This increases with the level of brain activation.
- **Gamma:** >35 Hz — Reflects integrative function across brain regions.

The EEG exhibits transient states across these frequencies that are perturbed by stimuli, at which time they rapidly switch to a new transient state. The spatial distribution of the EEG power changes with these state changes. For example, with eyes closed, alpha is more evident at the back of the head than with eyes open and vice-versa for beta activity.

Each of these components can be measured in terms of their power (microvolts²) and their peak frequency. Power scores can be absolute (raw power for each frequency) or relative (each relative to the total power of all frequencies). The scores in these reports measure the amount of power exhibited by each of these frequencies during two resting conditions - one with eyes closed and the other with eyes open.

Putative brain regions involved:

- i. **Delta:** Brain stem
- ii. **Theta:** Limbic system

- iii. *Alpha*: Thalamocortical
- iv. *Beta and Gamma*: Cortical

Neurotransmitters / receptors involved:

- *Delta*: Activation of metabotropic glutamate receptor; GABA (A) receptor
- *Theta Cortex*: noradrenergic neurotransmission; cholinergic neurons
- *Theta Hippocampal*: serotonin inhibition; intrinsic noradrenergic activity; GABA interneurons
- *Alpha*: Cholinergic (muscarinic receptors); GABA (B)
- *Beta*: Nicotinic / cholinergic activation; GABA (A); dopamine
- *Gamma*: GABAergic interneurons

Selected references: EEG (22 – 29, 72 – 74) and Brain Chemistry (45 – 56)

Practical significance: Abnormal power in any or all of these fundamental frequencies reflects instability in brain function. However, changes in alpha and beta are also state dependent and the significance of the abnormality needs to be interpreted in conjunction with autonomic measures of arousal (sweat rate – skin conductance level [SCL] and heart rate that are simultaneously measured). Changes in peak frequency of alpha, theta and delta are also often associated with brain pathology (structural or electrochemical).



1.2.2 Event-related brain electrical activity (ERPs)

Test procedure:

- i. *Oddball (Selective Attention)*: The client is presented with differing tones (through headphones) and is required to ignore the low background tones and press the reaction time buttons (with the index finger of each hand), only when they hear infrequent high target tones.
- ii. *Go-NoGo (Inhibition)*: The color of the word PRESS is presented randomly in either red or green. The client is required to press a response button when they see the word PRESS in green (Go) but not to press the button when the word PRESS is in red (NoGo).
- iii. *Sustained Attention (CPT)*: A series of letters is presented on the screen one at a time. The client is required to press a response button only when the same letter appears twice in a row.

Functions measured: ERPs are transient electrical potentials occurring on a millisecond scale and which are time locked to discrete events (sensory stimuli or motor responses) during a task. Traditionally, EEG activity is sampled and time locked over multiple events of the same type and the samples averaged. This allows the extraction of brain activity that is specifically related to task processing i.e. the event-related potential.

The ERP generally consists of a series of peaks and troughs (components) that reflect stages of processing during task performance. The latency of these components reflects the speed of the related aspects of information processing. Component amplitude reflects the extent of cortical involvement in these processes.

Early components that occur within the first 80ms following a stimulus mainly reflect obligatory processing by the brain to external events. They are routinely used clinically to reflect the integrity of sensory neural pathways. Later components are primarily associated with task-related processes, such as:

- i. Obligatory and early attentional processing to stimuli (N1-P2).
 - ii. N2-P3 reflects processing due to novelty, orienting and significance evaluation of stimuli. There are multiple of N2-P3 subcomponents, including the ones scored in this report.
 - 1. Detection of stimulus change, self monitoring and error detection (N2)
 - 2. Face perception (N170)
 - 3. Automatic Orienting (P3a)
 - 4. Assessment of contextual significance and controlled attentional resources (P3b)
 - 5. Updating of verbal working memory (P3WM)
 - 6. Detection of contextual incongruity and semantic processing (N4)
 - 7. Suppression of motor response (N2 and P3)
 - iii. Integrative processing of these activities is reflected by gamma phase synchrony.
- In this report, the components assessed in each paradigm are:
- i. Oddball (Selective Attention):
 - 1. Target processing: N1, P2, N2, P3b
 - 2. Backgrounds: N1, P2
 - ii. Go-NoGo (Inhibition):
 - 1. NoGo: N1, P2, N3 and P350
 - iii. Sustained Attention (CPT):
 - 1. Backgrounds: N1, P150, N3 and P3WM

Putative brain regions involved:

- i. N1 — secondary and other sensory cortical networks
- ii. N170 — temporal gyrus
- iii. N2 — frontal regions, anterior cingulate, hippocampus and STG
- iv. P3a — anterior Cingulate, DLPFC, inferior parietal, hippocampus and frontal cortex
- v. P3b — orbitoprefrontal, STG, hippocampusparietal and association cortex
- vi. P3WM — parietal association cortex

Neurotransmitters / receptors involved:

- i. P1 — cholinergic neuronal projection system
- ii. N1 — GABA (A) receptor, GABA
- iii. P2 — alpha2 noradrenergic receptor
- iv. N2 — GABA, Dopamine
- v. P3 — cholinergic, noradrenergic, dopaminergic, serotonergic and gabaergic systems.

Selected references: ERPs (30 – 41, 66 – 71) and Brain Chemistry (57 – 63)

Practical significance: ERPs test a range of aspects of sensory, motor and cognitive activity by the brain. A fundamental distinction between ERPs and the Cognitive Performance profile rests in the time domain. ERPs provide real time indices of neuropsychological processes, on the time scale of milliseconds, whereas the measures obtained in the Cognitive Performance profile represent the behavioral outcomes of such processes, on the time scale of seconds.

ERPs provide the highest temporal resolution of brain imaging technologies and are therefore used as real time, biological markers of both psychological and physiological events in the brain. Abnormalities in such components (amplitude or latency) respectively reflect dysfunction in the brains contribution to these processes or in processing speed.



1.2.3 Autonomic (Body) measures are undertaken simultaneously with EEG and ERPs in the paradigms listed above

Test procedure: as above.

Functions measured:

- i. Tonic arousal (skin conductance level [SCL]) and phasic skin conductance response [SCR], which reflects attentional orienting. SCL and SCR measure sweat production.
- ii. Heart rate.

Putative brain regions involved: Brain stem and limbic regions

Neurotransmitters / receptors involved: Acetylcholine, nicotine

Selected references: Autonomic (Body) measures (42 – 44) and Brain Chemistry (64 – 65)

Practical significance: Optimal arousal is associated with optimal cognition. Orienting underpins survival and learning.

2. How the scores are derived

2.1 Cognition

2.1.1 Memory Recall

Immediate recall trial n: The number of words correctly recalled within 30 seconds in trial n. Repeated words are counted only once.

Total immediate recall trials 1-4: The sum of the scores in trials 1, 2, 3 and 4.

Learning rate trials 1-4: The slope of the linear regression of the scores in trials 1-4.

Total intrusions errors trials 1-4: The number of times a word not in the list was recalled in trials 1-4.

Total perseveration errors trials 1-4: The number of times a word was repeated in trials 1-4.

Distractor recall trial 5: The score for the words recalled from the new list used in the fifth trial.

Short delay recall trial 6: The number of words recalled from the first list (after the recall of the distractor list).

Long delay recall trial 7: The number of words recalled approximately 40 minutes after trials 1-6.

Intrusion errors trial n: The number of times a word not in the list was recalled in trial n.

Interference errors trial n: The number of times a word was recalled from the other list in trial n (first list for trial 5, second list for trial 6 and 7).

2.1.2 Memory Recognition

Recognition Accuracy: The number of words from the memory recall list that were correctly recognized.

Rejection Accuracy: The number of words that were correctly rejected as not being in the memory recall list.

2.1.3 Digit Span

Recall span: Length of the longest sequence correctly recalled in forward or reverse order.

Total score: Total number of correct trials attempted in forward or reserved order.

2.1.4 Span of Visual Memory

Recall span: Length of the longest sequence correctly identified twice.

Total score: Total number of correct trials attempted.

2.1.5 Sustained Attention (CPT)

Reaction time: The average reaction time to identify the repeated letters.

False alarms: The number of incorrect responses.

False misses: The number of targets that the client did not respond to.

2.1.6 Switching of Attention

Completion time: The total time to connect the sequence of digits or digits and letters.

Avg. connection time: The average time needed to connect two neighboring fields when no error was made.

Errors: The number of errors that the client made.

2.1.7 Motor Tapping

Number of taps: The number of times the client tapped the touch screen within 30 seconds with their right or left hand.

Variability of reaction time: The standard deviation between taps.

2.1.8 Choice Reaction Time

Reaction time: The average time that the client took to tap a lit circle.

2.1.9 Time Estimation

Accuracy: The value of the average difference between the actual length of the stimulus (l_s) and the clients estimate (l_u) weighted by the length of the

stimulus: $\frac{\sum^i l_u - l_s}{n \cdot l_s}$.

2.1.10 Verbal Interference

Accuracy: The number of correct responses in recognizing the color or the text of the displayed word.

Errors: The number of incorrect responses.

Reaction time: The average time to identify a stimulus when the response was correct.

2.1.11 Spot the Real Word

Accuracy: Number of words correctly recognized.

2.1.12 Word Generation

Number of words generated (FAS): The average number of words generated in one minute that began with a specific letter.

Number of animal names generated: The number of animal words generated in one minute.

2.1.13 Executive Function (maze)

Trials completed: The number of trials that the client completed before the task ended or a timeout occurred.

Completion time: The time the client took to complete the task twice without error (or until a timeout occurred after 8 minutes).

Path learning time: The time the client took to discover the hidden path. If no timeout occurred, this is the total time excluding the time needed for the last two trials (otherwise it is equal to the total time).

Total errors: The total number of errors that the client made including overruns.

Number of overruns: The total number of overrun errors that the client made. An overrun error occurs if the client goes in the same direction on a subsequent move but should have changed direction.

2.1.14 Oddball (Selective Attention)

Reaction time: The average time that the client took to respond to the targets.

False alarms: The number of incorrect responses.

False misses: The number of targets that the client did not respond to.

2.1.15 Go-NoGo (Inhibition)

Reaction time (Go): The average time that the client took to respond to the targets (word PRESS in green).

False alarms (NoGo): The number of incorrect responses.

False misses (Go): The number of targets that the client did not respond to.

2.2 Electrical Brain - Body Functions

EEG was acquired using a Quikcap and 40 channel NuAmps with electrodes located according to the 10% or 10-10 system (Nuwer et al, 1998) from the following 26 sites: Fp1, Fp2, F7, F3, Fz, F4, F8, FC3, FCz, FC4, T3, C3, Cz, C4, T4, CP3, CPz, CP4, T5, P3, Pz, P4, T6, O1, Oz and O2. Horizontal eye movements were recorded from electrodes placed 1.5cm lateral to the outer canthus of each eye. Vertical eye movements were recorded with electrodes placed 3mm above the middle of the left eyebrow and 1.5cm below the middle of the left bottom eye-lid. Additional physiological data was obtained from the orbicularis oculi and the masseter.

All data was recorded relative to the virtual ground and referenced offline to linked mastoids. Electrode impedance was kept below 5 kOhms. Data was sampled at 500 Hz using a 22 bit analog-to-digital converter (NuAmps). A low pass filter with attenuation of 40dB per decade above 100 Hz was employed prior to digitization. Data was corrected off-line for EOG artefact using the method of Gratton et al. (1983).

2.2.1 Resting EEG

Each 2 minute recording (for eyes closed and for eyes open) is divided into 2 second epochs, and power spectral estimation performed for each epoch at each recording site by applying a Welch window and then Fast Fourier Transform (FFT) to the signal. The power spectra are then averaged for each recording (eyes closed, eyes opened) at each recording site. The following statistical analyses are performed between the client and the controls for each measure:

- i. Mahalanobis analysis (multivariate statistical comparison) for sites F3, Fz, F4, C3, Cz, C4, P3, Pz and P4.
- ii. Mahalanobis analysis across all 26 sites: Fp1, Fp2, F7, F3, Fz, F4, F8, FC3, FCz, FC4, T3, C3, Cz, C4, T4, CP3, CPz, CP4, T5, P3, Pz, P4, T6, O1, Oz and O2.
- iii. Mahalanobis analysis across all 26 sites of relative EEG power.
- iv. Factor analysis by site using Principle Components Analyses, followed by a Varimax rotation. The criteria for accepting a new factor was an eigen value >1 . Factor loadings were used to generate factors scores, based firstly per-site on which factor had an obviously dominant loading (difference between loadings $> .10$). When there was no dominant loading, the assignment of a factor group for each site was decided by a ranked heuristic: (1) Symmetry, (2) Consistency with it's complement in EO/EC, 3) Or, by which loading was higher, even if the difference was $<.10$ (If necessary, when (1) and (2) were equal). The sites used for each measure:
 - EC (eyes closed) delta power: All 26 sites.
 - EC theta power: All 26 sites.
 - EC alpha power frontal: Fp1, Fp2, F7, F3, Fz, F4, F8, FC3, FCz, FC4, T3, C3, Cz, C4 and T4.
 - EC alpha power posterior: CP3, CPz, CP4, T5, P3, Pz, P4, T6, O1, Oz and O2.
 - EC beta power frontal: Fp1, Fp2, F7, F3, F4, F8, T3 and T4.
 - EC beta power central: Fz, FC3, FCz, FC4, C3, Cz, C4, CP3, CPz, CP4, P3, Pz and P4.

EC beta power posterior: T5, T6, O1, Oz and O2.
 EO (eyes open) delta power: All 26 sites.
 EO theta power: All 26 sites.
 EO alpha power frontal: Fp1, Fp2, F7, F3, Fz, F4, F8, FC3, FCz, FC4, T3, C3, Cz, C4 and T4.
 EO alpha power posterior: CP3, CPz, CP4, T5, P3, Pz, P4, T6, O1, Oz and O2.
 EO beta power frontal: Fp1, Fp2, F7, F3, F4, F8, T3 and T4.
 EO beta power central: Fz, FC3, FCz, FC4, C3, Cz, C4, CP3, CPz, CP4, P3, Pz and P4.
 EO beta power posterior: T5, T6, O1, Oz, O2.

2.2.2 ERP

Conventional ERP averages were formed at each recording site. Before averaging, each single-trial waveform was filtered at 25 Hz with a Tukey or cosine taper to 35 Hz, above which frequency no signal was passed. For the target waveforms, the peaks (amplitude and latency) of the N100, P200, N200 and P300 ERP components were identified (relative to a pre-stimulus baseline average of -300 to 0ms) at each of the 26 sites N100 and P200 for backgrounds. The following statistical analyses are performed between the client and the controls for each measure:

- i. Mahalanobis analysis for sites F3, Fz, F4, C3, Cz, C4, P3, Pz and P4.
- ii. Mahalanobis analysis across all 26 sites.
- iii. T-test for key sites according to the scientific literature.
 - Oddball N1: Fz.
 - Oddball P2: FCz.
 - Oddball N2: Cz.
 - Oddball P3: Pz.
 - Oddball N1 – P2: FCz.
 - Oddball N2 – P2: FCz.
 - Oddball N2 – P3: Pz.
 - Sustained Attention N1: FCz
 - Sustained Attention P150: FCz
 - Sustained Attention N3: FCz
 - Sustained Attention P3WM: CPz
- iv. Factor analysis by site using Principle Components Analyses, followed by a Varimax rotation. When the criteria for accepting a new factor was an eigen value >1, four factors were extracted for some measures. However it was found that much more consistent and clean solutions emerged when 3 factors were extracted, and thus 3 factors were extracted for each measure. Factor loadings were used to generate factors scores, based firstly per-site on which factor had an obviously dominant loading (difference between loadings > .10). When there was no dominant loading, the assignment of a factor group for each site was decided by a ranked heuristic: (1) Symmetry, (2) Consistency with it's complement in EO/EC, 3) Or, by which loading was higher, even if the difference was <.10 (If necessary, when (1) and (2) were equal). The sites used for each measure:
 - Oddball Targets N1 amplitude frontal: Fp1, Fp2, F7, F8, T3 and T4.
 - Oddball Targets N1 amplitude central: F3, Fz, F4, FC3, FCz, FC4, C3, Cz, C4, CP3, CPz and CP4.

Oddball Targets N1 amplitude posterior: T5, P3, Pz, P4, T6, O1, Oz and O2.

Oddball Targets N1 latency frontal: Fp1, Fp2, F7, F3, Fz, F4, F8, FC3, FCz, FC4, T3 and T4.

Oddball Targets N1 latency central: C3, Cz, C4, CP3, CPz, CP4, P3, Pz and P4.

Oddball Targets N1 latency posterior: T5, T6, O1, Oz and O2.

Oddball Targets P2 amplitude frontal: Fp1, Fp2, F7, F3, Fz, F4, F8, FC3, FC4, T3 and T4.

Oddball Targets P2 amplitude central: FCz, C3, Cz, C4, CP3, CPz, CP4, P3, Pz and P4.

Oddball Targets P2 amplitude posterior: T5, T6, O1, Oz and O2.

Oddball Targets P2 latency frontal: Fp1, Fp2, F7, F3, Fz, F4, F8, FC3, FCz, FC4, T3 and T4.

Oddball Targets P2 latency central: C3, Cz, C4, CP3, CPz, CP4, P3, Pz and P4.

Oddball Targets P2 latency posterior: T5, T6, O1, Oz and O2.

Oddball Targets N2 amplitude frontal: Fp1, Fp2, F7, F3, Fz, F4, F8, FC3, FC4, T3 and T4.

Oddball Targets N2 amplitude central: FCz, C3, Cz, C4, CP3, CPz, CP4, P3, Pz and P4.

Oddball Targets N2 amplitude posterior: T5, T6, O1, Oz and O2.

Oddball Targets N2 latency frontal: Fp1, Fp2, F7, F8, T3 and T4.

Oddball Targets N2 latency central: F3, Fz, F4, FC3, FCz, FC4, C3, Cz and C4.

Oddball Targets N2 latency posterior: CP3, CPz, CP4, T5, P3, Pz, P4, T6, O1, Oz and O2.

Oddball Targets P3 amplitude frontal: Fp1, Fp2, F7, F3, Fz, F4 and F8.

Oddball Targets P3 amplitude central: FC3, FCz, FC4, T3, C3, Cz, C4, T4, CP3, CPz, CP4, P3, Pz and P4.

Oddball Targets P3 amplitude posterior: T5, T6, O1, Oz and O2.

Oddball Targets P3 latency frontal: Fp1, Fp2, F7, F3, Fz, F4, F8, T3 and T4.

Oddball Targets P3 latency central: FC3, FCz, FC4, C3, Cz, C4, CP3, CPz and CP4.

Oddball Targets P3 latency posterior: T5, P3, Pz, P4, T6, O1, Oz and O2.

Oddball Backgrounds N1 amplitude frontal: Fp1, Fp2, F7, F8, T3 and T4.

Oddball Backgrounds N1 amplitude central: F3, Fz, F4, FC3, FCz, FC4, C3, Cz, C4, CP3, CPz and CP4.

Oddball Backgrounds N1 amplitude posterior: T5, P3, Pz, P4, T6, O1, Oz and O2.

Oddball Backgrounds N1 latency frontal: Fp1, Fp2, F7, F3, Fz, F4, F8, FC3, FCz, FC4, T3 and T4.

Oddball Backgrounds N1 latency central: C3, Cz, C4, CP3, CPz, CP4, P3, Pz and P4.

Oddball Backgrounds N1 latency posterior: T5, T6, O1, Oz and O2.

Oddball Backgrounds P2 amplitude frontal: Fp1, Fp2, F7, F3, Fz, F4, F8, T3 and T4.

Oddball Backgrounds P2 amplitude central: FC3, FCz, FC4, C3, Cz, C4, CP3, CPz, CP4, P3, Pz and P4.

Oddball Backgrounds P2 amplitude posterior: T5, T6, O1, Oz and O2.
Oddball Backgrounds P2 latency frontal: Fp1, Fp2, F7, F8, T3 and T4.
Oddball Backgrounds P2 latency central: F3, Fz, F4, FC3, FCz, FC4, C3,
Cz, C4, CP3, CPz, CP4, P3, Pz and P4.
Oddball Backgrounds P2 latency posterior: T5, T6, O1, Oz and O2.

2.2.3 Gamma Phase Synchrony

For each epoch, the gamma (37 to 41 Hz) phase synchrony was computed as a function of time within 7 regions of interest. The phase synchrony waveform for a given region and epoch was computed as follows. Firstly, time series (from -500 to 750 ms) of the phase of gamma oscillations were derived for each site in the region by means of a moving Welch window and short-time FFT. Then the circular variance of phase was computed across the sites in the region for each point in time. Once the synchrony waveforms were computed, the waveforms from all the target epochs from a given region were averaged, and similarly for all the background epochs from that region. This yielded a single average target synchrony waveform, and a single average background synchrony waveform, for each region. A pre-stimulus baseline synchrony average (from -450 to -150 ms) was then subtracted from the waveform and the waveform was inverted for ease of interpretation. The 7 regions used were all sites (global), frontal, centro-temporal, parieto-occipital, left hemisphere, midline, right hemisphere. Since both the following measures existed for each of the 7 regions, a multivariate comparison (Mahalanobis distance) was performed between the client and the controls.

Gamma 1: The total synchrony (area under the curve) for the latency window - 100 to 150 ms.

Gamma 2: The total synchrony (area under the curve) for the latency window 200 to 450 ms.

3. Questions list for demographics (Web Questionnaire)

3.1 Physical/Medical

Vision Impairment: Do you have any vision impairment (sight/color), or do you wear glasses or contact lenses?

Hearing difficulties: Do you have difficulties with your hearing?

Restricted movement: Do you have restricted movement for any reason, or do you have reduced dexterity in one or both hands (i.e., do you have trouble moving your hands/fingers quickly or do you have trouble performing delicate tasks)?

Mobile phone: Do you regularly use a mobile phone?

Dyslexia (learning difficulties): Have you ever experienced learning difficulties, or dyslexia?

Traumatic experience: Have you had any traumatic experiences?

Family or personal psychiatric illness: Have you ever been diagnosed with a psychiatric disorder, or is there a history of psychiatric disorders in your family?

Family or personal neurological disorder: Have you ever been diagnosed with a neurological disorder (such as epilepsy, stroke, head injury, etc), or is there a history of neurological disorders in your family?

CNS surgery: Have you ever undergone surgery for a condition related to your brain, head, or spine?

Physical trauma: Have you ever experienced physical trauma (physical injury) to your head and lost consciousness?

Head trauma: Did you receive a physical injury to your head, spine, or both?

Sleep difficulties: In the last month, have you experienced, or have you been told about any of the following sleep symptoms - difficulty in falling asleep at night; frequent night awakenings; breathing difficulties, snorting, gasping or loud snoring?

Staying awake difficulties: In the last month have you experienced problems staying awake during the day?

Eating problems: Do you often feel you can't control what or how much you eat, or do you spend a great deal of time restricting what you eat?

Number of caffeine beverages per week: How often do you consume beverages containing caffeine?

3.2 Substance Used

Tobacco: Do you regularly smoke tobacco?

Alcohol: Do you regularly consume alcohol?

Marijuana: Do you regularly smoke marijuana?

Non-prescription/recreational drugs: Do you regularly take non-prescription/recreational drugs (other than marijuana)? For example, Ecstasy, Cocaine, Amphetamines etc?

3.3 Prescription Drugs

Use prescription medications: Are you currently taking any prescription medications?

Name: Name of the prescription medication?

Reason: The reason for which it was prescribed?

Dosage: Dosage?

Frequency: How regularly do you take it?

3.4 **Traumatic Experience**

Direct combat in war: Have you ever had direct combat experience in a war?

Life-threatening accident: Have you ever been involved in a life-threatening accident?

Natural disaster: Have you ever been involved in a fire, flood or other natural disaster?

Witnessed someone injured or killed: Have you ever witnessed someone being badly injured or killed?

Raped: Have you ever been raped, that is someone has sexual intercourse with you when you did not want to, by threatening you, or using some degree of force?

Sexually molested: Have you ever been sexually molested, that is someone touched or felt your genitals when you did not want them to?

Attacked or assaulted: Have you ever been seriously attacked or assaulted?

Threatened with weapon or kidnapped: Have you ever been threatened with a weapon, held captive, or kidnapped?

Tortured or victim of terrorists: Have you ever been tortured or the victim of terrorists?

Extremely stressful or upsetting event: Have you ever experienced an extremely stressful or upsetting event?

Shock (happened to someone close): Have you ever suffered a great shock because one of the events on the list happened to someone close to you?

3.5 **Vision**

Vision: Which of the following categories would best describe your vision?

Other: If other: please specify?

Glasses/contact lenses: Do you wear glasses or contact lenses?

3.6 **Hearing**

Hearing: Which of the following categories would best describe your hearing?

Other: If other: please specify?

Hearing aid: If you use any form of hearing aid device, is the device attached to the ear or has it been implanted?

3.7 **Mobility/Dexterity**

Mobility: Which If you have restricted movement, which of the following categories would best describe your mobility?

Other: If other: please specify?

Reduced dexterity on hand: If you have reduced dexterity in your hands, is it in one or both of your hands (i.e. do you have trouble moving your hand/fingers quickly or do you have trouble performing delicate tasks)?

3.8 **Mobile Phone**

Frequency: How often do you use a mobile phone to make or receive a call?

Duration per call: What would be the duration, on average, of each call?

Duration per day: How much time, on average, would you spend on the mobile phone each day?

Years of usage: How many years have you been using a mobile phone?

3.9 **Dyslexia (Learning Difficulties)**

Learning difficulty at school: Have you ever had periods of learning difficulty at school?

Repeat year of school: Have you ever had to repeat a year of school?

Remedial lessons: Have you ever attended remedial lessons at school?

Diagnosed with dyslexia: Have you ever been diagnosed with dyslexia?

Diagnosed at age: If so, at what age were you diagnosed?

3.10 **Psychological History**

Diagnosed with psychiatric disorder: Have you ever been diagnosed with a psychiatric condition?

Nature: Nature of condition?

Year: Year diagnosed?

Duration: Duration of condition?

Treatment: Have you received any form of treatment for this condition?

Treatment type: If yes, please select type of treatment?

Family history: Is there a family history of psychiatric disorders in your immediate family (i.e. mother, father, brother, sister, children)?

Family condition: If yes, what is the nature of the condition?

3.11 **Neurological History**

Diagnosed with neurological disorder: Have you ever been diagnosed with a neurological disorder?

Nature: Nature of condition?

Year: Year diagnosed?

Duration: Duration of condition?

Treatment: Have you received any form of treatment for this condition?

Treatment type: If yes, please select type of treatment?

Family history: Is there a family history of psychiatric disorders in your immediate family (i.e. mother, father, brother, sister, children)?

Family condition: If yes, what is the nature of the condition?

3.12 **Sleep History**

Snorting or gasping: During the last month how often you had, or been told about, snorting or gasping?

Loud snoring: During the last month how often you had, or been told about, loud snoring?

Breathing stops or struggle for breath: During the last month how often you had, or been told about, breathing stops or struggle for breath?

Frequent awakenings: During the last month how often you had, or been told about, frequent awakenings?

Tossing, turning or thrashing: During the last month how often you had, or been told about, tossing, turning or thrashing?

Difficulty falling asleep: During the last month how often you had, or been told about, difficulty falling asleep?

Legs feel jumpy or jerky: During the last month how often you had, or been told about, legs feel jumpy or jerky?

Morning headaches: During the last month how often you had, or been told about, morning headaches?

Falling asleep when at work: During the last month how often you had, or been told about, falling asleep when at work?

Falling asleep when driving: During the last month how often you had, or been told about, falling asleep when driving?

Excessive sleepiness during the day: During the last month how often you had, or been told about, excessive sleepiness during the day?

Awaken feeling paralyzed: During the last month how often you had, or been told about, awaken feeling paralyzed?

Vivid dreamlike state: During the last month how often you had, or been told about, vivid dreamlike state?

Falling asleep during the day: During the last month how often you had, or been told about, falling asleep during the day?

Morning fatigue (on awakening): During the last month how often you had, or been told about, morning fatigue (on awakening)?

Constant unexplained fatigue: During the last month how often you had, or been told about, constant unexplained fatigue?

3.13 Eating Habits

Eat too much (abnormal) within 2 hours: Do you often eat within any 2-hour period what most people would regard as an unusually large amount of food?

Twice a week (eat within 2 hours): If yes, has this been as often, on average, as twice a week for the last 3 months?

Make myself vomit: In the last 3 months have you often made yourself vomit in order to avoid gaining weight?

Use laxatives > 2x recommended dose: In the last 3 months have you often taken more than twice the recommended dose of laxatives in order to avoid gaining weight?

Fasted for > 24 hours: In the last 3 months have you often fasted (not eaten anything at all for at least 24 hours) in order to avoid gaining weight?

Exercise for > 1hour after binge eating: In the last 3 months have you often exercised for more than an hour, specifically to avoid gaining weight after binge eating?

Twice a week (avoid weight gain): If yes (vomit, laxatives, fasted or exercise), were any as often, on average, as twice a week?

3.14 Tobacco

First smoking after wake up: How soon after you wake up do you smoke your first cigarette?

Unable to stop smoking: Do you find it difficult not to smoke in places where you shouldn't, such as in church, on the bus, in school or at the library?

Unwilling to give up: Which cigarette would you be the most unwilling to give up (first in the morning or any of the others)?

Amount: How many cigarettes per day do you smoke?

Smoke more early: Do you smoke more frequently during the first hours after waking than during the rest of the day?

Smoke when sick: Do you still smoke if you are so sick that you are in bed most of the day?

3.15 Alcohol

Frequency: How often do you have a drink containing alcohol?

Amount: How many alcoholic drinks do you have on a typical day when you are drinking?

Drink six or more: How often do you have six or more drinks on one occasion?

Unable to stop drinking: How often have you found you were not able to stop drinking once you had started?

Morning drinking: How often have you needed a first drink in the morning to get yourself going after a heavy drinking session?

Feel guilty after drinking: How often have you had a feeling of guilt or remorse after drinking?

Unable to remember: How often have you been unable to remember what happened the night before because you had been drinking?

Cause injury: Have you or someone else been injured because of your drinking?

Concerned by others: Has a relative, friend, doctor or other health worker been concerned about your drinking and suggest you to cut down?

3.16 Marijuana

Frequency: How often do you smoke marijuana?

Duration: For how many years have you smoked marijuana?

Amount: How many joints/cones/bongs, on average, do you smoke?

3.17 Recreational Drugs

Amphetamines (now): How regularly do you consume amphetamines?

Ecstasy (now): How regularly do you consume ecstasy?

Cocaine (now): How regularly do you consume cocaine?

Heroin (now): How regularly do you consume heroin?

Other (now): Do you consume other substance (please specify)?

Amphetamines (past): In the past, how regularly have you consumed amphetamines?

Ecstasy (past): In the past, how regularly have you consumed ecstasy?

Cocaine (past): In the past, how regularly have you consumed cocaine?

Heroin (past): In the past, how regularly have you consumed heroin?

Other (past): In the past, have you consumed other substance (please specify)?

3.18 CNS Surgery

Area: On what area of the body did you undergo surgery?

Reason: For what reason did you undergo surgery?

Age: At what age did you undergo surgery?

3.19 Physical Trauma

Area: Did you receive a physical injury to your head, spine, or both?

Age: At what age did you receive this injury?

Impact Injury: Was the physical injury as a result of an impact after traveling at speed? For example, a motor vehicle accident, high-speed bicycle accident, high-speed downhill skiing accident etc

Velocity: How fast were you traveling prior to impact?

Unconscious: Did you lose consciousness at all as a result of this accident?

Time: If yes, for how long did you lose consciousness?

Amnesia: Are there gaps in your memory from before and/or after the accident?

3.20 Overall Health

- OH01:** Over the past few weeks have you been troubled by headaches?
- OH02:** Over the past few weeks have you been troubled by feeling irritable or cranky?
- OH03:** Over the past few weeks have you been troubled by poor memory?
- OH04:** Over the past few weeks have you been troubled by pains in your arms or legs?
- OH05:** Over the past few weeks have you been troubled by feeling nervous or tense?
- OH06:** Over the past few weeks have you been troubled by muscle pain after activity?
- OH07:** Over the past few weeks have you been troubled by waking up tired?
- OH08:** Over the past few weeks have you been troubled by rapidly changing moods?
- OH09:** Over the past few weeks have you been troubled by fainting spells?
- OH10:** Over the past few weeks have you been troubled by nausea?
- OH11:** Over the past few weeks have you been troubled by arms or legs feeling heavy?
- OH12:** Over the past few weeks have you been troubled by feeling unhappy or depressed?
- OH13:** Over the past few weeks have you been troubled by gas or bloating?
- OH14:** Over the past few weeks have you been troubled by fevers?
- OH15:** Over the past few weeks have you been troubled by back pain?
- OH16:** Over the past few weeks have you been troubled by needing to sleep longer?
- OH17:** Over the past few weeks have you been troubled by prolonged tiredness after activity?
- OH18:** Over the past few weeks have you been troubled by sore throat?
- OH19:** Over the past few weeks have you been troubled by numb or tingling sensations?
- OH20:** Over the past few weeks have you been troubled by feeling constantly under strain?
- OH21:** Over the past few weeks have you been troubled by joint pain?
- OH22:** Over the past few weeks have you been troubled by weak muscles?
- OH23:** Over the past few weeks have you been troubled by feeling frustrated?
- OH24:** Over the past few weeks have you been troubled by diarrhea or constipation?
- OH25:** Over the past few weeks have you been troubled by poor sleep?
- OH26:** Over the past few weeks have you been troubled by getting annoyed easily?
- OH27:** Over the past few weeks have you been troubled by everything getting on top of you?
- OH28:** Over the past few weeks have you been troubled by dizziness?
- OH29:** Over the past few weeks have you been troubled by feeling tired after rest or relaxation?
- OH30:** Over the past few weeks have you been troubled by poor concentration?
- OH31:** Over the past few weeks have you been troubled by tired muscles after activity?
- OH32:** Over the past few weeks have you been troubled by feeling lost for words?
- OH33:** Over the past few weeks have you been troubled by losing confidence?

OH34: Over the past few weeks have you been troubled by being unable to overcome difficulties?

OH35: Have you recently thought that you should cut down on alcohol or addictive drugs?

OH36: Have you recently had a friend, doctor or relative suggest that you should cut down on alcohol or addictive drugs?

3.21 Well-being 1

WA01: I found it hard to wind down.

WA02: I was aware of dryness of my mouth.

WA03: I couldn't seem to experience any positive feeling at all.

WA04: I experienced breathing difficulty (e.g., excessive rapid breathing breathlessness in the absence of physical exertion).

WA05: I found it difficult to work up the initiative to do things.

WA06: I tended to over-react to situations.

WA07: I experienced trembling (e.g., in the hands).

WA08: I felt that I was using a lot of nervous energy.

WA09: I was worried about situations in which I might panic and make a fool of myself.

WA10: I felt that I had nothing to look forward to.

WA11: I found myself getting agitated.

WA12: I found it difficult to relax.

WA13: I felt down-hearted and blue.

WA14: I was intolerant of anything that kept me from getting on with things.

WA15: I felt I was close to panic.

WA16: I was unable to become enthusiastic about anything.

WA17: I felt I wasn't worth much as a person.

WA18: I felt that I was rather touchy.

WA19: I was aware of the action of my heart in the absence of physical exertion.

WA20: I felt scared without any good reason.

WA21: I felt that life was meaningless.

3.22 Well-being 2

WB01: During conversation with others, I am sensitive to any change in expression or mannerism in people I am in discussion with.

WB02: I am unaware of the very subtle feelings of others.

WB03: I can sense the mood of a group that I get involved with and discuss unspoken feelings.

WB04: I recognize my emotions through the physical changes in my body such as stomach churning when I experience fear or light headedness when I am highly elated.

WB05: I always try to put myself into the place of those I am in conversation with.

WB06: People often tell me that I am a sensitive and understanding person.

WB07: I usually take the initiative and introduce myself to strangers.

WB08: I get enormous satisfaction by getting people to like me.

WB09: I find it difficult to persuade people to see my point of view.

WB10: I try to have close relationships with people.

WB11: I always seek to join various social groups.

WB12: I find it difficult to make new friends.

WB13: I tend to compromise in order to preserve a friendship.

WB14: In social situations I have the ability to alter my behavior or tone when I consider it appropriate to do so.

WB15: I am always very satisfied with the way I look and act.

WB16: I respond best to positive feedback about myself.

WB17: I prefer critical comments about my performance or appearance.

WB18: When receiving negative comments about myself, I look for positive things to counter balance those comments.

WB19: I try not to strive too hard in case my efforts to achieve certain goals are wasted.

WB20: Things go wrong mainly because of events that are outside my control.

3.23 Personality Profile

PP01: When tackling problems I generate a lot of ideas (both good and bad).

PP02: I am often quick to find fault with ideas -- my own and those of others.

PP03: I frequently become attached to doing things in a particular way.

PP04: I see failure as an opportunity to learn.

PP05: I can find novel ways of doing things that are not obvious to most people.

PP06: I am able to deal effectively with multiple complex tasks.

PP07: When making decisions I focus on eliminating risks.

PP08: I am generally prepared to take a risk if I think it will result in a higher gain.

PP09: I can easily accept that I cannot win all the time.

PP10: I would generally be satisfied with the following odds:

PP11: I enjoy reading.

PP12: I am/was active in sports.

PP13: I enjoy Art.

PP14: I enjoy science.

PP15: I watch television (average hours per week)

PP16: What kind of car would you most like to drive?

PP17: I have had the experience of knowing what someone else is thinking or feeling, even if they are out of touch by ordinary means.

PP18: Dreams can foretell the future.

PP19: Prayers will sometimes be answered.

PP20: Even though the body may die, the soul will continue to exist.

PP21: Some people can remember past lives.

PP22: I am comfortable making difficult decisions that impact (positively or negatively) on other people.

PP23: I am comfortable with people who are different from me.

PP24: I usually feel free to say what I think.

PP25: People ought to be more assertive.

PP26: I am gregarious.

PP27: I always balance decision making with how it affects others.

PP28: I tend to question the decisions of others.

PP29: I can choose to be unaffected by, or ignore, the distress of others

3.24 Early Stress

ES01: Were you born prematurely, or experience other birth complications?

ES02: Were you adopted?

ES03: Did you undergo major surgery or repeated hospitalization?

ES04: Did you experience a life-threatening illness or injury?

ES05: Did you experience sustained bullying or rejection by schoolmates?

ES06: Were you physically abused?

- ES07:** Were you sexually abused?
- ES08:** Were you emotionally abused?
- ES09:** Did you experience extreme poverty or neglect?
- ES10:** Did you witness first-hand a natural disaster such as earthquake, flood or fire?
- ES11:** Was your house destroyed by fire or other means?
- ES12:** Did you witness warfare?
- ES13:** Did your parents divorce or separate?
- ES14:** Were you separated for a long period from a parent, brother or sister?
- ES15:** Was there sustained conflict within your family?
- ES16:** Did one of your parents, a brother or sister die?
- ES17:** Did one of your parents, a brother or sister experience a life-threatening illness?
- ES18:** Did you witness domestic violence within your family?
- ES19:** Did you witness or experience some other traumatic event?
- ES20:** If yes, please specify:

3.25 Handedness (details)

- HA01:** Which hand do you use to write a letter legibly?
- HA02:** Which hand do you use to throw a ball to hit a target?
- HA03:** Which hand do you use to hold a racquet in tennis or squash?
- HA04:** Which hand do you use to hold a match while striking it?
- HA05:** Which hand do you use to cut with scissors?
- HA06:** Which hand do you use to guide a thread through the eye of a needle?
- HA07:** Which hand do you use at the top of a broom while sweeping?
- HA08:** Which hand do you use at the top of a shovel while moving sand?
- HA09:** Which hand do you use to deal playing cards?
- HA10:** Which hand do you use to hold a hammer and hit a nail into wood?
- HA11:** Which hand do you use to hold a toothbrush while cleaning your teeth?
- HA12:** Which hand do you use to unscrew the lid of a jar?
- HA13:** Handedness of biological father?
- HA14:** Handedness of biological mother?
- HA15:** Are there any one-handed actions you perform with your non-dominant hand? Please specify

3.26 Sleep History (details)

- SL01:** During the last month how often have you had, or been told about, snorting or gasping?
- SL02:** During the last month how often have you had, or been told about, loud snoring?
- SL03:** During the last month how often have you had, or been told about, breathing stops, choke or struggle for breath?
- SL04:** During the last month how often have you had, or been told about, frequent awakenings?
- SL05:** During the last month how often have you had, or been told about, tossing, turning or thrashing?
- SL06:** During the last month how often have you had, or been told about, difficulty falling asleep?
- SL07:** During the last month how often have you had, or been told about, legs feel jumpy or jerky?

SL08: During the last month how often have you had, or been told about, morning headaches?

SL09: During the last month how often have you had, or been told about, falling asleep when at work?

SL10: During the last month how often have you had, or been told about, falling asleep when driving?

SL11: During the last month how often have you had, or been told about, excessive sleepiness during the day?

SL12: During the last month how often have you had, or been told about, awaken feeling paralyzed, unable to move for short periods?

SL13: During the last month how often have you had, or been told about, find yourself in a vivid dreamlike state when falling asleep or awakening even though you know you're awake?

SL14: During the last month how often have you had, or been told about, Falling asleep during the day, particularly when you are not busy (not including planned naps)?

SL15: During the last month how often have you had, or been told about, morning fatigue (on awakening)?

SL16: During the last month how often have you had, or been told about, constant unexplained fatigue?

3.27 Traumatic Experience (details)

TE01: At what age did the incident occur?

TE02: Were you terrified?

TE03: Did you feel helpless?

TE04: After the incident, did you keep remembering it even when you didn't want to?

TE05: After the incident, did you keep having bad dreams or nightmares about it?

TE06: After the incident, did you ever suddenly feel as though the incident was happening even though it wasn't?

TE07: Did you get very upset when you were reminded of it?

TE08: Did you sweat or did our heart beat fast or did you tremble when you were reminded of the incident?

TE09: After the incident, did you have trouble sleeping?

TE10: After the incident, did you feel usually irritable or lose your temper a lot more than usual for you?

TE11: After the incident, did you have trouble concentrating?

TE12: After the incident, did you become very much more concerned about danger or very much more careful?

TE13: After the incident, did you become jumpy or easily startled by ordinary noise or movements?

TE14: Did you deliberately try not to think about the incident?

TE15: Did you avoid places that reminded you of the incident?

TE16: After the incident, were you memory blank for all or part of the incident?

TE17: Did you suffer head injury as a result of the incident?

TE18: If you suffered head injury as a result of the incident, were you unconscious for more than 10 minutes?

TE19: After the incident, did you lose interest in doing things that were once important or enjoyable to you?

TE20: After the incident, did you feel more isolated or distant from other people?

TE21: After the incident, did you find you had more difficulty experiencing normal feelings such as love or affection toward other people?

TE22: After the incident, did you ever begin to feel that there as no point in thinking about the future anymore?

TE23: Of the problems you have indicated, how soon after the incident did these problems start to occur?

TE24: How long did you continue to have these problems after the incident?

TE25: When was the last time you had any of these problems a result of the incident?

TE26: Did you tell a doctor about the problems which occurred as a result of the incident?

TE27: Did you take medication, or use drugs or alcohol more than once for the problems which occurred as a result of the incident?

TE28: Did the problems which occurred as a result of the incident interfere with your life or activities a lot?

TE29: Have you ever been upset with yourself for having problems which occurred as a result of the incident?

TE30: Have the problems which occurred as a result of the incident ever kept you from going to a party, social event or meeting?

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5. Glossary

Acetylcholine:

A neurotransmitter in both the brain, where it may help regulate memory, and in the peripheral nervous system, where it controls the actions of skeletal and smooth muscle.

Cholinergic:

Refers to choline synapses. These synapses release choline, which is a chemical, along with acetate, that composes the neurotransmitter acetylcholine.

Dopamine:

A catecholamine neurotransmitter involved in attention, learning, movement, and reinforcement of behavior. It has an inhibitory or excitatory effect depending on which receptors it falls into. It is a precursor of norepinephrine and an alpha-adrenergic agonist. Dopamine-containing neurons in the substantia nigra of the brainstem project to the caudate nucleus and are destroyed in Parkinson's victims. Dopamine is thought to regulate emotional responses.

Dopaminergic:

Refers to the synapses that release the chemical dopamine.

Gamma-Amino Butyric Acid (GABA):

An amino acid transmitter in the brain whose primary function is to inhibit the firing of neurons.

Glutamate:

An amino acid neurotransmitter that acts to excite neurons. Glutamate probably stimulates N-methyl-D-aspartate (NMDA) receptors that have been implicated in activities ranging from learning and memory to development and specification of nerve contacts in a developing animal. Stimulation of NMDA receptors may promote beneficial changes, while overstimulation may be the cause of nerve cell damage or death in neurological trauma and stroke.

Hippocampus:

A structure in the forebrain, part of the limbic system. Seems to be involved in spatial and memory functions.

Neurotransmitter:

A chemical released by neurons at a synapse for the purpose of relaying information via receptors.

Norepinephrine:

A catecholamine neurotransmitter, produced both in the brain and in the peripheral nervous system. It seems to be involved in vigilance and arousal. We have a norepinephrine boost when we are scared, alert or when we encounter emergency.

Noradrenergic:

Refers to the synapses that contain norepinephrine.

Receptor Molecule:

A specific molecule on the surface or inside of a cell with a characteristic chemical and physical structure. Many neurotransmitters and hormones exert their effects by binding to receptors on cells.

Receptors:

Neurotransmitters are the key and receptors are the lock. Receptors are binding organelles of cells for receptors. Each neurotransmitter has a specific set of receptors. Cells have different receptors and number of receptors, depending where the cells are in the body. When a neurotransmitter binds with a receptor, receptors get activated and turn on a series of specific activities within a cell. These activities will have specific results, depending on the neurotransmitter. Some neurotransmitters will make the neuron hyperpolarize or it will depolarize the cell.

Serotonin:

A monoamine neurotransmitter believed to play many roles including, but not limited to, temperature regulation, sensory perception and the onset of sleep. Neurons using serotonin as a transmitter are found in the brain and in the gut. A number of antidepressant drugs are targeted to brain serotonin systems.