Subliminal Priming with Positive Auditory Stimuli Significantly Improves Self-Esteem and Emotional Well-Being

Andrew J. Funk, Lorelei Tucker, Karen Vieira, and Terri Bowman

ABSTRACT

This retrospective study investigated the effect of positive auditory masked subliminal priming on 535 adult and child patients who presented for treatment at the Brain Wellness Spa (BWS) in Australia between the years of 2018 and 2021. Patients were assessed prior to first treatment session, using 7 self-administered questionnaires: a 33-question assessment of their state of being, a 10-question evaluation of emotion, a 12-question survey of long-term state, the Depression Anxiety Stress Scale-21, the Penn State Worry Questionnaire, the Rosenberg Self-Esteem Scale, and the Brief Aggression Questionnaire. Subjects were then exposed to either 12 or 14 weekly treatment sessions composed of 25-minute masked subliminal auditory priming scripts. The scripts consisted of dozens of affirmational statements aimed at decreasing the subjects’ stress to emotional triggers and promoting psychological and emotional resilience. Patients were unaware of the subliminal messages underlying the music (auditory mask) during each treatment session. Patients completed identical questionnaires as follow-up after either their 11th or 13th treatment session. Statistical analysis of pre- and post-treatment questionnaires revealed significant improvement in subjective reports of self-esteem, depression, anxiety, stress, worry, and state of being. Despite these positive conclusions, results need to be interpreted taking into consideration the study limitations. However, based upon these conclusions, repetitive masked subliminal auditory priming therapy needs to be further investigated with larger sample sizes.

Keywords: Auditory, depression, self-esteem, subliminal messaging.

I. INTRODUCTION

Self-esteem plays a vital role in contributing to a person’s success [1]. Research has established that self-esteem significantly influences key life outcomes, including career success, interpersonal relationship quality, favorable regard by peers, scholastic achievement, adaptive coping skills, and a feeling of personal well-being [2].

The importance of an individual’s self-esteem can hardly be overstated. Self-esteem is negatively correlated with depression, anxiety, stress, and self-destructive behavior [3]. A study of 1,149 Vietnamese secondary school students also reported that low self-esteem is linked to anxiety, depression, scholastic stress, and suicidality. The association of low self-esteem with these factors significantly impacted the students’ quality of life. The prevalence of low self-esteem in this population studied was 19.4% [1].

Though seemingly an elusive concept to define, self-esteem is generally described as a person’s self-perception of their worth to others. Self-esteem is an internalized social barometer that a person uses to track the extent to which they are valued interpersonally [4].

Apart from having a mere consensual definition of self-esteem within the discipline of psychology, clinicians can operationalize self-esteem by measuring it accurately in patients. The Rosenberg Self-Esteem Scale (RSES) is one such assessment tool. The RSES is one of the most widely utilized scales for evaluating self-esteem. Research has shown that the RSES is a reliable metric for establishing a person’s level of self-esteem. In fact, it showed strong internal consistency and repeatability in a study conducted on 420 university students in Spain [5].

Although self-esteem significantly determines future life consequences, many researchers posit that an individual’s self-esteem is not a fixed trait throughout one’s lifetime [6]. On the contrary, when researchers from the University of Georgia and Texas studied 138 undergraduate psychology students, they found that a person’s self-esteem is changeable, and a person may not be entirely cognizant of this fact [7]. Researchers from Harvard and the University of Toronto have also concluded that environmental factors can evoke changes in a person’s self-esteem [8].

The malleability of a person’s self-esteem is particularly relevant to the current COVID-19 pandemic. Since environmental factors can alter self-esteem, it is not surprising that [9] found that the COVID-19 lockdown was significantly associated with higher social media usage and lower RSES self-esteem scores in 2,601 females aged 14-35 years living in Spain between May 2019 and May 2020.
Just as researchers identified that self-esteem decreased during the COVID-19 pandemic, they have also found that depression, anxiety, stress, and self-destructive behavior have increased during this time. This mirrors previous studies that correlated self-esteem with depression, anxiety, stress, and self-destructive activity. A Canadian study compared two groups of pregnant females. One group (n=496) was assembled before the COVID-19 pandemic, while the other (n=1,258) was recruited during the pandemic in April 2020 [10]. This study revealed that the pandemic cohort was significantly more likely to exhibit clinical depression and anxiety than the pre-pandemic group [10].

Reference [11] found that the prevalence of post-traumatic stress symptoms was 7% in the most impacted areas of China 1 month after the COVID-19 outbreak, with women having significantly higher stress levels than men. Lastly, [12] concluded that COVID-19 pandemic lockdowns were associated with increased aggression. They analyzed aggression questionnaires of 5,928 adults from across the United States.

Since research suggests that environmental factors can alter self-esteem—and that the COVID-19 pandemic can lower it—it is also notable that treatment interventions can increase self-esteem. Scientists who studied 1,886 high school boys from the United States concluded that interventions aimed at altering a person’s self-esteem can indeed be effective—provided that the intervention targets a person’s specific self-esteem (in this case, related to academics). This alteration in self-esteem may also precipitate behavioral changes [13].

Reference [14] studied 168 males with a history of committing romantic partner violence. One cohort of men (n=61) underwent cognitive behavioral treatment for 16 weeks, while the other group (n=107) attended 12 weekly behavior modification workshop sessions. Both cohorts were administered the RSES. On average, self-esteem improved significantly in both groups and monthly physical aggression episodes fell.

The established link between self-esteem, stress, depression, anxiety, and self-destructive behavior—and the evidence that self-esteem changes can produce behavioral changes—inspired this study. Since past research indicates treatment can improve self-esteem, this study assessed the effects of subliminal therapy on self-esteem, stress, depression, anxiety, and self-destructive behavior.

Although initially contentious, it is now generally accepted that many emotional, cognitive, and perceptual events can occur in the brain despite a lack of conscious awareness of those neural events [15]. Neuroscientists define subliminal processing as bottom-up neural stimulation that is not sufficient to evoke extensive long-range axonal fibers within a global neuronal network. This results in weak activation of the brain, which quickly diminishes. However, [16] report that conscious attention to a task can amplify a subliminal stimulus. Therefore, this study utilized the effect of conscious attention on subsequent subliminal priming, being careful to construct a sensory environment with minimal extraneous stimulation, allowing each patient to focus on the subliminal auditory therapy.

Recent investigations reliably demonstrate that unconsciously detected stimuli can affect one’s cognition and actions. For example, even masked words that don’t evoke a conscious event cause subjects to extricate meaning from those words and process them at the motoric level. The neural substrates for processing conscious or unconscious stimuli are similar [17]. Beyond visual processing, [18] reported that sub-threshold auditory stimulation precipitated cerebral processing on a subliminal level as well. They experimented on 12 right-handed subjects with normal hearing using functional magnetic resonance imaging (fMRI). Using sub-threshold auditory signals, they evoked cerebral activity in the auditory cortex, anterior insula, anterior cingulate, and thalamus.

In addition, the effects of subliminal messaging on the brain do generalize beyond healthy subjects. Studies have demonstrated that subliminal stimulation can impact the cognition of patients diagnosed with a psychiatric illness, like anxiety or depression. However, subjects with increased levels of anxiety and depression responded less to subliminal priming than healthy subjects [19], [20].

Although research has illustrated that subliminal stimulation can evoke a neural response, the response’s duration must be addressed. If subliminal signaling and its behavioral effects decompose rapidly, the brain responding to subliminal masked primes may be moot. Early inquiry found that subliminal cues lacked persistent effects. In addition, previous subliminal priming produced no significant effect on the magnitude of priming [21]. Furthermore, [22] found that increasing the inter-stimulus interval between the prime and the target caused the effect of the subliminal information to dissipate even more. However, a shorter inter-stimulus interval—preferably 100 milliseconds—correlated to a greater effect of subliminal cues on the subject. So, not only did subliminal priming yield impersistent effects, if the interval between the presentation of the prime and target information was too great, the cue effect was further hampered. This present study avoided the dissipation effect of subliminal information—caused by an increased inter-stimulus interval—by only using masked auditory subliminal priming.

Does the apparent ephemeral quality of subliminal priming mean it is clinically useless? This is not necessarily the case—it depends upon whether subliminal cueing is repeated over multiple sessions. When researchers observed the effect of subliminal priming dissipating, they were only observing the effect during a prior subliminal cue, followed by a subsequent one [21]. In contrast to this, [23] studied the effects of subliminal priming by subjecting participants to cues in three separate sessions over three days. This revealed dramatically different results than previous studies that only examined pre- and post-subliminal priming effects. Reference [23] found that participants performed significantly better on a course exam than participants who did not undergo subliminal priming sessions by undergoing three cueing sessions, followed by a practice test after each session. Furthermore, subjects took the exam 1-4 days following their three training sessions, revealing a pronounced effect duration. This practice effect may explain the disparate observations between researchers who claim subliminal cues are transient, and those that utilize priming to significantly alter behavior days later. The treatment intervention featured herein capitalized on the benefits of practice effects—delivering multiple treatment sessions to maximize the subliminal priming effect.

DOI: http://dx.doi.org/10.24018/ejmed.2022.4.6.1328
In addition to these findings, the researchers and others also concluded that subliminal priming effects endured over an extended period when participants received the stimuli multiple times [23], [24]. In this study, [24] recruited one hundred older people (mean age of 81) to study the effect of subliminal messaging on negative age stereotypes. They randomly assigned each cohort to an explicit age stereotype intervention or an implicit subliminal intervention. Participants performed one session per week for four weeks. When assessed three weeks later, those who received the subliminal intervention showed significant change in their negative age stereotypes compared to those that underwent extrinsic sessions. Not only does this underscore the benefit of repeated exposure, it also demonstrates the benefit of subliminal priming over overt messaging in altering perception.

Furthermore, [25] found that adaptive subliminal cues relevant to subsequent material significantly improved learning. This highlights the need for subliminal priming to evolve over time to promote efficacy. The treatment herein took advantage of this by altering each session's subliminal messaging to address a different belief, value, insecurity, perception, or pattern of behavior.

This present study represents the 15-year pinnacle of utilizing repeated subliminal therapy sessions to improve self-esteem, stress, anxiety, depression, self-destructive behavior, and other mental illnesses. So why such long-term focus on the unconscious brain? As [26] posit, conscious deliberation during choice selection may not always be beneficial, making subliminally oriented treatment potentially more useful for facilitating change. Dijksterhuis-a Dutch social psychologist-postulated in his deliberation-without-attention hypothesis that decisions free of attentive consideration are advantageous, partly because unconscious processing encompasses automatic deliberation over a much greater amount of information. The deliberation-without-attention hypothesis was validated in four separate investigations of consumer choice, both in the laboratory setting and among actual shoppers [26], [27].

Research supporting the usage of affirmative subliminal cueing to ameliorate mental illness is found in the classic study using the words, “Mommy and I are one,” by [28]. This investigation signaled the unconscious need to be unified with one’s childhood's “good mother”. In addition, [29] found similar efficacy with the following subliminal message, “Mommy and I are alike.” This message reduced anxiety in participants with high and medium levels of self-identity cohesion. Subjects with low levels of self-identity cohesion showed reduced anxiety with the message “Mommy and I are one” alone. Control messages had no impact on anxiety reduction in this study.

To our knowledge, our study is the first to analyze the effect of subliminal affirmative scripts consisting of multiple sentences in treatment sessions longer than 20 minutes. This retrospective case series aims to evaluate whether these scripts, delivered in 12 or 14 25-minute treatment sessions, could improve self-esteem, reduce stress and symptoms of anxiety and depression, and ameliorate self-destructive behavior.

II. METHODS

A. Participants

A total of 514 adult subjects (182 males, 332 females; 18-77 years of age, mean age = 41.7) and 21 child subjects (10 males, 11 females; 12-17 years of age, mean age = 15.0 years) were included in the study. The 535 subjects were selected from a patient population of 6,307 treated at the Brain Wellness Spa (BWS) in Australia between 2018 and 2021. Selection criteria included patients who received either 12 or 14 treatment sessions and completed post-treatment follow-up assessments after their 11th or 13th treatment session. Moreover, patients were excluded from the study for the following reasons: not completing post-treatment follow-up assessments; not submitting complete demographic information; or lacking consistent demographic information reporting between baseline and post-treatment assessments (n=5,772). In total, the final selection of patients for our study comprises only 8.5% of the total patient population. Strict selection criteria were necessary to preserve the quality of the study.

Moreover, this study didn’t discriminate based upon outcome, but merely completion of post-treatment evaluation. As such, treatment-resistant patients were included. This study was composed of BWS patients from multiple locations: one clinic in Stirling, another clinic in Perth, and then remotely within the homes of patients who participated in at-home therapy. Of the 535 study participants, 494 were treated exclusively in the clinic, 27 received treatment entirely at home, and 14 were treated at home and in the clinic. We utilized remote therapy because much of this study occurred during the COVID-19 pandemic. Multiple stay-at-home orders in Australia forced clinicians to adapt to treatment and utilize remote care when patients were restricted to their homes.

Informed consent was obtained directly from all adult participants included in the study. For the children, a parent or guardian of each child granted permission for the child to be treated and studied. The cohort of patients in this study had varied occupations and backgrounds, including students, teachers, business owners and managers, nurses, doctors and veterinarians, mechanics, builders, engineers, journalists, and unemployed patients. The clinic conducted a detailed medical history assessment for each patient.

B. Primary Outcomes

Self-administered questionnaires: A 33-question assessment of their state of being, a 10-question evaluation of emotion, a 12-question survey of long-term state, the Depression Anxiety Stress Scale-21 (DASS-21), the Penn State Worry Questionnaire (PSWQ), the Rosenberg Self-Esteem Scale (RSES), and the Brief Aggression Questionnaire (BAQ).

1) Assessment of State of Being

Patients rated the severity of each state of being on a scale ranging from 1 to 10, with 1 being mild and 10 being severe. They rated the following 33 states according to this scale: stress, anxiety, depression, flatness, moodiness, tension, worry, confusion, loss of clarity, fatigue, fear, grief, insomnia, anger, aggression, hate, jealousy, sadness, emotional reactivity, suffering, misery, shame, guilt,
frustration, having negative thoughts, procrastination, lack of motivation, negative attitude, negative thinking, lack of confidence, low self-esteem, self-hatred, and memory loss.

2) **Evaluation of Emotion**

Patients reported their frequency of various emotions using the following scale: 1, never; 2, rarely; 3, occasionally; 4, frequently; 5, very frequently. The 10 self-assessed emotions were: loneliness, isolation, unhappiness, desperation, inability to cope with life, hopelessness, feeling unloved, feeling unwanted, feeling like giving up on life, and feeling as if they will never have a better life.

3) **Survey of Long-Term State**

Patients answered the following 12 questions with a yes or a no answer-pertaining to their long-term state: Are you unable to appreciate yourself?; Are you stressed by going to work?; Do you worry about money?; Do you feel exhausted from daily activity?; Are you unable to complete daily tasks?; Do you feel emotionally distant for no reason?; Do you become impatient or intolerant for no reason?; Are you unable to maintain a social life?; Are you unable to maintain enjoyment of life?; Are you unable to love yourself?; Are you unable to alter your current circumstances?; and Do you feel like you are living up to your success potential?

4) **Depression Anxiety Stress Scale-21 (DASS-21)**

Patients Subjects completed the DASS-21, which is a 21-component self-administered evaluation that measures three maladaptive emotional states: anxiety, depression, and stress. The DASS-anxiety portion tests fear, panic, and physiological incitement; the DASS-Depression portion measures poor mood, self-esteem, and motivation; and the DASS-stress section assesses irascibility and tension. The DASS-21 is the truncated 21-item rendition of the complete 42-item questionnaire. Patients denoted the extent to which all 21 statements were applicable to them over the previous week, using a 4-point scale; higher number indicates greater levels of anxiety, depression, or stress. The DASS-21 takes approximately 5 to 10 minutes to finish [30]. Each negative emotional state was scored and assigned a classification of either normal, mild, moderate, severe, or extremely severe regarding either anxiety, depression, or stress. The DASS-21 may factor into the diagnosis of either anxiety or depression, but it is not a diagnostic tool per se [31].

5) **Rosenberg Self-Esteem Scale (RSES)**

Our subjects took the RSES, with 10 self-assessment items to evaluate self-esteem. Answers range from 1 (strongly disagree) to 4 (strongly agree). Five components pertain to positive self-esteem (e.g., “I feel that I have a number of good qualities”), while five items apply to negative self-esteem (e.g., “I certainly feel useless at times”) [32].

6) **Brief Aggression Questionnaire (BAQ)**

The BAQ is a 12-item self-assessment tool that evaluates the following four domains: physical aggression, verbal aggression, anger, and hostility. Our respondents assessed three statements per domain, answering on a scale from 1 (extremely uncharacteristic of me) to 5 (extremely characteristic of me). The BAQ is an abridged 29-item Buss-Perry Aggression Questionnaire (BPAQ), allowing for accurate yet expedient aggression assessment [34].

C. Procedure

1) **Assessment**

Although the seven self-administered questionnaires measured a substantial amount of information vis-a-vis emotions, traits, behavior, and states of being, this present study utilized these assessments retrospectively to establish baseline and post-treatment metrics of self-esteem, stress, anxiety, depression, and aggression. These five were assigned as dependent variables in our within-subject design study. This experimental design assigns each participant as their own control by providing baseline data before initiating treatment. The patients were then exposed to a treatment intervention of either 12 or 14 25-minute masked subliminal therapy sessions, delivered at either the BWS in Perth, Stirling, or the patient’s home. This study was unblinded: therapists read scripts registered at an unconscious level to the patient each session; patients were never aware of the exact words, but they knew they were receiving positive subliminal priming scripts masked by relaxing music. Every script’s theme varied each week. The therapist introduced the weekly topic to the patient one day prior to each treatment session via email. Each week’s theme was also posted online for any current or prospective patient to peruse.

Subjects also completed assessments regarding their personal history, medical history, and prescription and other drug use prior to the first session. Subjects (n=535) completed all assessments again after their 11th or 13th treatment session.

2) **Treatment**

Each treatment session began with a 25-minute consultation, followed by a 25-minute auditory subliminal priming treatment session, and ended with a 10-minute post-treatment portion. Each appointment lasted approximately 60 minutes. Patients received one session per week for either 12 or 14 weeks. Treatment followed the same protocol for each patient, regardless of history or medical diagnosis.

The specific treatment protocol consisted of the presentation of sub-threshold auditory suggestion stimuli as full-sentence verbal scripts read by the therapist. The scripts consisted of dozens of sentences that served as subliminal instructions to the patient. The therapist read one set of subliminal instructions, telling the patient to engage their negative emotions, memories, and thoughts, followed by another set of instructions to then feel relaxed and safe in the presence of these negative emotions, memories, and thoughts. Scripts were maintained at a sub-threshold level with noise-canceling headphones worn by the patient. The headphones were set at 20% volume, filtering out 80% of all auditory noise. This ensured that the patient couldn’t hear the scripts read by the therapist. In addition, an auditory mask in the form of relaxing music was played synchronously with the verbal scripts to further obscure the subliminal priming messages. Unfortunately, noise cancellation technology was unavailable for patients receiving treatment at home. However, the musical auditory mask ensured that patients could not hear any complete sentences of the scripts, with only intermittent single words being audible.

The goal of the subliminal scripts was to decrease stress to emotional triggers, while also facilitating the patient in strengthening their psychological and emotional processing. A different script was read for each weekly treatment session.
Each script focused on a separate theme, aimed at subliminally altering the perception and behaviors related to each topic. Table I lists each weekly subliminal script’s theme. For patients who only received 12 treatment sessions, session 2 and session 3 were omitted.

### Table I. Theme of Each Masked Subliminal Auditory Script Used for Weekly Treatment Sessions

<table>
<thead>
<tr>
<th>Weekly Session</th>
<th>Script Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Feeling distressed and overwhelmed by daily challenges</td>
</tr>
<tr>
<td>2</td>
<td>Beliefs that may limit life success</td>
</tr>
<tr>
<td>3</td>
<td>Self-critical thoughts and opinions</td>
</tr>
<tr>
<td>4</td>
<td>Overcoming fears</td>
</tr>
<tr>
<td>5</td>
<td>Openness to change</td>
</tr>
<tr>
<td>6</td>
<td>Replacing negative bias with positive bias</td>
</tr>
<tr>
<td>7</td>
<td>Redesigning beliefs and values</td>
</tr>
<tr>
<td>8</td>
<td>Drafting positive mental narratives</td>
</tr>
<tr>
<td>9</td>
<td>Childhood insecurities</td>
</tr>
<tr>
<td>10</td>
<td>Improving self-perception</td>
</tr>
<tr>
<td>11</td>
<td>Reprogramming default patterns of behavior</td>
</tr>
<tr>
<td>12</td>
<td>Mental illness and worry about money</td>
</tr>
<tr>
<td>13</td>
<td>Emotional patterns of behavior</td>
</tr>
<tr>
<td>14</td>
<td>Reinforcing new behavior</td>
</tr>
</tbody>
</table>

During each subliminal priming session, the patient lay in a semi-recumbent supine position. Patients also wore an eye mask during the auditory portion of the therapy session to remove extraneous visually evoked potentials. In addition to obscuring the auditory scripts, the headphones allowed each patient to focus on their auditory therapy. As stated previously, conscious focus on the subliminal therapy was employed to amplify the subliminal stimuli’s effects, per [16].

### D. Analysis

Descriptive data are reported as number, mean, standard deviation, distribution, normality, and percentage. Histogram plotting was employed to visually analyze for normal distribution. D’Agostino-Pearson’s K-squared test was used to statistically calculate normality of data sets. Comparisons of data were calculated using paired sample T-tests, as appropriate. A p value less than 0.05 was considered significant. All analyses were performed using Python 2.7.14 software (Anaconda, Inc., Austin, TX, USA).

### III. Results

We hypothesized that the patients (n = 535) would display significantly different levels of self-esteem, stress, anxiety, depression, and aggression after subliminal therapy, compared to baseline reporting. Self-assessment scores from each patient were used for statistical analysis. The null hypothesis of our study was that subliminal therapy would produce no significant alteration in any of these five dependent variables.

We analyzed the 33-question assessment of state of being, 10-question evaluation of emotion, DASS-21, PSWQ, RSES, and the BAQ for visual normality using histogram plotting, statistical normality using D’Agostino-Pearson’s K-squared test, and paired sample T-testing. The DASS-21 was divided into its three components of depression, anxiety, and stress to analyze separately. The 12-question survey of long-term state was excluded from analysis because total scores were not available at publication.

### Table II. The D’Agostino-Pearson’s K-squared Test for Normality, Applied to All Baseline Pre-Treatment Self-Assessment Total Scores

<table>
<thead>
<tr>
<th>Self-Assessment Type</th>
<th>K² Statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>33-Question Assessment of State of Being</td>
<td>13.16</td>
<td>0.001</td>
</tr>
<tr>
<td>10-Question Evaluation of Emotion</td>
<td>24.24</td>
<td>5.45 x 10⁻⁶</td>
</tr>
<tr>
<td>DASS-Depression</td>
<td>87.90</td>
<td>8.39 x 10⁻²⁰</td>
</tr>
<tr>
<td>DASS-anxiety</td>
<td>42.50</td>
<td>5.92 x 10⁻¹⁶</td>
</tr>
<tr>
<td>DASS-stress</td>
<td>36.30</td>
<td>1.31 x 10⁻⁶</td>
</tr>
<tr>
<td>PSWQ</td>
<td>64.10</td>
<td>1.21 x 10⁻¹⁴</td>
</tr>
<tr>
<td>RSES</td>
<td>1.60</td>
<td>0.45</td>
</tr>
<tr>
<td>BAQ</td>
<td>26.53</td>
<td>1.73 x 10⁻⁶</td>
</tr>
</tbody>
</table>

Histogram plotting and subsequent visual analysis, revealed only the baseline 10-question evaluation of emotion and the baseline RSES (total scores) as appearing normally distributed (Fig. 1 and Fig. 2). The total score histograms of the other self-assessments are not included since they appeared abnormally distributed upon visual inspection. However, histogram plotting is only a rudimentary and preliminary analysis of normality. Therefore, the D’Agostino-Pearson’s K-squared test was applied to all baseline data (total scores) of all self-assessments mentioned above (Table II).
This omnibus test for normality uses mathematical modifications of both skewness and kurtosis to calculate a K² statistic. This statistic possesses an approximate chi-squared distribution, with two degrees of freedom, under the condition of normality [35]. The Python software function scipy.stats.normaltest determines not only the K² statistic, but also calculates the p value of the D’Agostino-Pearson test by using a two-sided chi-squared probability test. The null hypothesis of the D’Agostino-Pearson test is that a sample is representative of a normal distribution. When a p value greater than 0.05 is returned, the null hypothesis is retained, and that distribution is regarded as normally distributed [35]-[37]. Only baseline RSES total scores returned a p value greater than 0.05 (0.45), demonstrating normality. Paired sample T-test of baseline mean total scores revealed the following: 33-question assessment of state of being, as compared to post-treatment, was significantly different (p=9.23 x 10⁻¹⁸⁷); 10-question evaluation of emotion was significantly different than post-treatment (p=1.24 x 10⁻¹²⁷); DASS-Depression total scores were significantly different than post-treatment (p=8.70 x 10⁻¹⁰); DASS-anxiety total scores were significantly different than post-treatment (p=1.60 x 10⁻⁶⁰); DASS-stress total scores were significantly different than post-treatment (p=1.51 x 10⁻¹⁰⁷); PSWQ total scores were significantly different compared to post-treatment (p=2.95 x 10⁻⁷); RSES total scores were significantly different compared to post-treatment (p=2.91 x 10⁻⁶⁸); and BAQ total scores were significantly different from post-treatment (p=1.34 x 10⁻⁵⁴) (Table III).

The datasets generated during and/or analyzed during the current study are available from the corresponding authors upon reasonable request.

### IV. DISCUSSION

Statistical analysis initially confirmed our hypothesis that patients (n = 535) would display significantly different levels of self-esteem, stress, anxiety, depression, and aggression after subliminal therapy. Moreover, this data initially exceeded our hypothesis, as patients also displayed significantly different levels after subliminal therapy regarding state of being, evaluation of emotion, and worry. However, one limitation was that this study was largely underpowered. Analysis for normal distribution of data demonstrated that the sample sizes were too small to be normative concerning all data except for baseline RSES total scores. Despite this, our statistical analysis is still largely valid, and much of our hypothesis can be confirmed. Even without normality, paired sample T-tests are robust against non-normative distributions of sample data when the dependent variables have a small correlation coefficient [38], [39]. Reference [39] reported that psychologists Dancey and Reidy consider Pearson correlation coefficients below 0.40 to be weak.

Our data revealed that correlation coefficients between our paired samples were less than 0.40 with state of being (0.29), DASS-Depression (0.33), DASS-anxiety (0.39), DASS-stress (0.30), and PSWQ (0.28). These weak correlation coefficients mean our paired sample T-tests maintain their robustness in identifying significant differences between pre- and post-treatment mean total scores vis-a-vis state of being, depression, anxiety, stress, and worry. Moreover, the data distribution was normative for baseline mean total scores for the RSES, so that paired sample T-test remains robust since it isn’t contingent upon its Pearson correlation coefficient (0.53). Regardless, since the mean total scores for emotionality and the BAQ have correlation coefficients equal to or larger than 0.40, the apparent significance initially signaled that paired sample T-tests must be disregarded since

### TABLE III: PAIRED SAMPLE T-TESTS OF MEAN TOTAL SCORES OF 33-QUESTION ASSESSMENT OF STATE OF BEING, 10-QUESTION EVALUATION OF EMOTION, DASS-DEPRESSION, DASS-ANXIETY, DASS-STRESS, PSWQ, RSES, AND BAQ BEFORE, AS COMPARED TO AFTER, TREATMENT

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>State of Being</th>
<th>Evaluation of Emotion</th>
<th>DASS-Depression</th>
<th>DASS-Anxiety</th>
<th>DASS-Stress</th>
<th>PSWQ</th>
<th>RSES</th>
<th>BAQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>180.88 (pre); 48.28 (post)</td>
<td>30.37 (pre); 17.50 (post)</td>
<td>9.61 (pre); 2.93 (post)</td>
<td>7.74 (pre); 2.58 (post)</td>
<td>11.41 (pre); 4.81 (post)</td>
<td>36.29 (pre); 25.01 (post)</td>
<td>25.13 (pre); 31.05 (post)</td>
<td>28.93 (pre); 23.28 (post)</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>64.36 (pre); 44.48 (post)</td>
<td>9.28 (pre); 7.11 (post)</td>
<td>5.68 (pre); 3.35 (post)</td>
<td>5.35 (pre); 3.13 (post)</td>
<td>5.10 (pre); 3.90 (post)</td>
<td>19.14 (pre); 9.34 (post)</td>
<td>6.05 (pre); 5.33 (post)</td>
<td>9.45 (pre); 7.16 (post)</td>
</tr>
<tr>
<td>95% CI</td>
<td>175.41, 186.34 (pre); 44.76, 52.31 (post)</td>
<td>29.58, 31.16 (pre); 16.98, 18.19 (post)</td>
<td>9.12, 10.09 (pre); 2.63, 3.20 (post)</td>
<td>7.29, 8.19 (pre); 2.27, 2.80 (post)</td>
<td>10.97, 11.84 (pre); 4.49, 5.15 (post)</td>
<td>34.66, 37.92 (pre); 24.31, 25.89 (post)</td>
<td>24.62, 25.64 (pre); 30.61, 31.51 (post)</td>
<td>28.13, 29.73 (pre); 22.70, 23.91 (post)</td>
</tr>
<tr>
<td>Pearson Corr. Coefficient</td>
<td>0.29</td>
<td>0.40</td>
<td>0.33</td>
<td>0.39</td>
<td>0.30</td>
<td>0.28</td>
<td>0.53</td>
<td>0.63</td>
</tr>
<tr>
<td>T Stat</td>
<td>45.72</td>
<td>32.29</td>
<td>27.79</td>
<td>23.93</td>
<td>28.14</td>
<td>13.80</td>
<td>-24.67</td>
<td>17.51</td>
</tr>
<tr>
<td>p value</td>
<td>9.23 x 10⁻¹⁸⁷</td>
<td>1.24 x 10⁻¹²⁷</td>
<td>8.70 x 10⁻¹⁰⁶</td>
<td>1.60 x 10⁻⁶⁰</td>
<td>1.51 x 10⁻¹⁰⁷</td>
<td>2.95 x 10⁻⁷</td>
<td>2.91 x 10⁻⁶⁸</td>
<td>1.34 x 10⁻⁵⁴</td>
</tr>
</tbody>
</table>

DOI: http://dx.doi.org/10.24018/ejmed.2022.4.6.1328

Vol 4 | Issue 6 | December 2022
their distributions were judged not normal.

This present study used the Brief Aggression Questionnaire (BAQ) to quantify the risk of self-destructive behavior. The underlying rationale is that aggression relates to a wide array of self-destructive behavior such as substance abuse, antisocial conduct, and behavior disorder [40]. Furthermore, the BAQ is a valuable tool for measuring four aspects: hostility, anger, verbal aggression, and physical aggression [41]. The BAQ was also validated in five separate studies of nearly 4,000 subjects [34]. Considering this, the BAQ is an effective assessment tool for gauging aggression and the likelihood for self-destructive behavior. Nonetheless, the pre- and post-treatment mean BAQ total scores did not show a significant difference due to a large Pearson correlation coefficient negating the significant difference returned by the paired sample T-test.

The within-subjects design study utilized by this experiment also needs to be addressed. While some researchers advise against within-subjects design, Greenwald extols its merits [42]. He notes that the within-subjects design makes experimental results substantially more responsive to treatment effects than between-subjects design. Greenwald [42] also notes that a within-subjects design is ideal for studying practice effects. The APA Dictionary of Psychology [43] defines the practice effect as an alteration or improvement precipitated by repetition of activity. Our experiment studied repeated subliminal cueing of participants for multiple sessions. We also hypothesized that this practice effect would positively influence the outcome of our study. Therefore, a within-subjects study design was optimal for our investigational goals.

Studies have demonstrated that even while the brain is unconscious during sleep, events, sounds, and smells while sleeping were integrated and stored in long-term memory. This even affected waking behavior [44]-[47]. Our findings add to increasing evidence for the ability of the unconscious brain to internalize, integrate, and remember stimuli, and utilize this information in conscious behavior, affecting mood, emotion, and decision-making short- and long-term [48], [49].

V. CONCLUSION

Although low Pearson correlation coefficients buffered the negation of the significant difference signaled by several of the paired sample T-tests, this study was largely underpowered. A fully powered study with sufficiently large sample sizes bolsters the conclusions derived from the data and allows for Pearson correlation coefficients to be usable if large enough. Large correlation coefficients signal a strong association between samples and show that significant differences in sample sets are also strongly related. Future studies regarding repeated masked auditory subliminal priming should include larger sample sizes to be sufficiently powered across all metrics. This will provide normative data that does not have to draw conclusions from weak correlations.

Despite this, the positive results in this study indicate that repeated subliminal priming therapy is associated with improvements in self-esteem, depression, anxiety, stress, worry, and state of being. Considering these positive results, repetitive subliminal masked priming therapy is indicated for low self-esteem, depression, anxiety, high levels of stress, worry, and problems pertaining to state of being. This study’s promising results warrant further studies with larger sample sizes.

ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

REFERENCES


