Psychedelic Expectancies and Post-traumatic Stress Disorder Symptoms

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PSYCHEDELIC EXPECTANCIES AND POSTTRAUMATIC STRESS DISORDER SYMPTOMS

by

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A Thesis
Submitted to the University at Albany, State University of New York
In Partial Fulfillment of
the Requirements for the Degree of
Master of Arts

University at Albany
Department of Psychology
Spring 2024
Abstract

Millions of Americans struggle with posttraumatic stress disorder (PTSD) every year. Though typical treatments work for some, patients often drop out of treatment. Given that patients are often retelling their traumatic experiences, or confronting stimuli and situations that are relevant to the experience, psychotherapy for PTSD can be psychologically demanding and intensive. These factors provide a further understanding for the high rates of PTSD treatment attrition. Psychedelic assisted psychotherapy (PAP) is a potential option to mitigate these concerns. Preliminary research on PAP has revealed effective and promising results. However, questions about PAP and their public perception remain. Furthermore, treatment expectancies, or an individual’s expectation of treatment efficacy, may help inform treatment efforts. The current study examined expectancies related to psychedelic use and PTSD symptoms. A total of 434 individuals participated in the study and completed measures via an online survey. Paired sample t-tests revealed that several expectancy means differed significantly from each other, with expectancies for numbing receiving the highest score and reexperiencing receiving the lowest score. A zero-inflated negative binomial regression indicated that, in general, participants expected psychedelics to slightly worsen their overall symptoms. Additionally, participants experiencing greater PTSD symptoms reported more negative expectancies. However, results varied when looking at specific expectancy groups, with some findings indicating more positive expectancies. Overall, these findings offer various implications; however, the field needs more research to fully understand the facets that influence psychedelic use expectancies.
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Introduction

Approximately six percent of Americans will struggle with posttraumatic stress disorder at some point in their life (American Psychiatric Association, 2013). A traumatic experience prompts PTSD and can include symptoms such as vivid flashbacks of the traumatic event, feelings of distress, and elevated physiological and dissociative responses linked to either internal or external cues related to the event (American Psychiatric Association, 2013). PTSD can impair daily functioning and impact overall quality of life (Jellestad et al., 2021; Vogt et al., 2017). Worldwide, exposure to trauma is prevalent; however, the United States has one of the highest rates, with an estimated 70% of respondents reporting exposure to at least one traumatic episode in a recent World Mental Health Survey (Benjet et al., 2016). Given the prevalence of trauma exposure and PTSD in the United States, developing effective treatment methods for those struggling with the disorder becomes highly urgent. Currently, the FDA approves only two selective serotonin reuptake inhibitors (SSRIs) for treating PTSD, sertraline and paroxetine. Psychotherapy and pharmacological treatments are often the standard treatment; however, clients find them ineffective, with individual studies finding dropout rates as high as 65% in a recent meta-analysis (Lewis et al., 2020).

Given the high rates of treatment dropout, exploring additional treatment options for PTSD would be fruitful. Psychedelic-assisted therapy is a potential and effective option. Psychedelics are psychoactive substances known for their spiritual, physical, emotional, and perceptual effects (Krediet et al., 2020; Reiff et al., 2020). Researchers classify psychedelics into numerous categories depending on their chemical makeup and mechanism of action (Garcia-Romeu et al., 2016; Kelmendi et al., 2022). These classifications include classic psychedelics, which involve psilocybin, lysergic acid diethylamide (LSD), mescaline, and N,N-
dimethyltryptamine (DMT), as well as entactogens such as 3,4-methylenedioxymethamphetamine (MDMA), and dissociative anesthetics like ketamine (Garcia-Romeu et al., 2016).

The medicinal use of psychedelics traces back thousands of years, specifically in indigenous communities (Michaels et al., 2018). Members of indigenous groups have used the substances for both religious and healing purposes (Garcia-Romeu et al., 2016; Michaels et al., 2018). More recently, researchers have been exploring the potential therapeutic effects of psychedelics, studying them in combination with psychotherapy. Research related to psychedelic-assisted psychotherapy (PAP) has generated positive results. A recent review reported findings that indicated symptom alleviation in depression and cancer-related anxiety through the combination of psychotherapy and psilocybin use (Reiff et al., 2020). Additionally, recent randomized clinical trials have indicated that MDMA-assisted psychotherapy effectively treated adults with PTSD and significantly reduced symptoms (Mitchell et al., 2021; Mithoefer et al., 2019).

Though preliminary research has produced promising results, questions about psychedelics remain. Given the efficacy of MDMA and psilocybin for treating psychiatric conditions, exploring the potential benefits of other psychedelics would be beneficial. Additionally, providing the public with more access to psychoeducation might help address the negative perceptions surrounding psychedelic use (Schlag et al., 2022). The stigma associated with psychedelic use might be influencing these negative perceptions, such as the idea of psychedelics being dangerous or the misconception that experiencing a ‘bad’ or traumatizing trip is extremely likely (Bradstreet et al., 2014; Peritore, 2022). Recent reviews of the literature have indicated that serious adverse events throughout psychedelic assisted psychotherapy studies are extremely rare. Most times, adverse events consist of temporary feelings of anxiety, slightly
elevated heart rate and blood pressure, as well as nausea, vomiting, and headaches (Rucker et al., 2018). These studies report no long-term health effects as a result of participating in these studies thus far (Bender & Hellerstein, 2022). Additionally, classic psychedelics have a low potential for misuse, as physical and psychological dependence are unlikely (Rucker et al., 2018; Peritore, 2022). Though ‘challenging trips’ might occur, qualitative studies indicate that they are not as severe as the media portrays them. Many study participants have reported finding these trips to be ultimately rewarding (Carbonaro et al., 2016; Gashi et al., 2021). Of note, as with any substance, experiences vary depending on dosage or drug purity (Peritore, 2022). Current psychedelic studies take place in controlled and medically supervised environments using pure substances (Peritore, 2022). Screening procedures for these studies also follow strict guidelines and exclude potential participants who endorse severe pathology. Given these circumstances, data on how psychedelics impact those with more severe psychological disorders are rare (Bender & Hellerstein, 2022). Ultimately, more work related to psychedelic-assisted psychotherapy might alleviate the public’s negative perceptions related to psychedelics. Data on a fuller range of participants could prove illustrative.

Investigating treatment expectancies related to psychedelic assisted therapy would help inform treatment efforts. Treatment expectancies relate to an individual’s expectation of treatment efficacy (Meyer et al., 2002). Expectancies and treatment outcomes covary throughout the psychotherapy literature (Meyer et al., 2002; Greenberg et al., 2006; Delsignore & Shnyder, 2007). Positive treatment expectancies, or the expectation that treatment will work, also seem to influence additional mechanisms that further facilitate positive treatment outcomes, such as treatment engagement (Meyer et al., 2002). Ultimately, when clients believe that the treatment will be effective, they participate more actively, which in turn leads to more beneficial outcomes.
and greater reductions in symptoms (Meyer et al., 2002; Greenberg et al., 2006). Literature related to expectancies and PTSD treatment have revealed a similar sentiment. Recent studies and literature reviews underscore consistent links between positive expectancies and greater reductions in PTSD symptoms (Price et al., 2015; Gallagher et al., 2020). Given these findings, assessing expectancies related to psychedelic assisted therapy for PTSD is of great importance.

We focused on assessing expected effects of psychedelics on individual PTSD symptoms to address their magnitude and specificity. Previous studies have also investigated expectancies related to psychedelic use. Similar to the current study, prior investigations focused on PTSD symptoms and marijuana expectancies (Earleywine & Bolles, 2014). Their results indicated that U.S. veterans expected marijuana to improve their overall PTSD symptoms (Earleywine & Bolles, 2014). More specifically, veterans reported greater expectancies related to re-experiencing, or intrusive, symptoms, followed by hyperarousal, avoidance, and numbing symptoms (Earleywine & Bolles, 2014). Researchers have also investigated psychedelic use expectancies for symptoms of depression. In a study focused on psilocybin expectancies, researchers found that participants expected greater psilocybin-associated relief for symptoms related to hopefulness, depressed mood, and happiness compared to symptoms like sleeplessness, lack of focus, and loneliness (Earleywine et al., 2023). These results mirrored a previous study that investigated participant-reported effects of ayahuasca use on depressive symptoms (Gilbert et al., 2021). Research of this kind help inform our future treatment methods, especially at a time where much is unknown.

Methods

Participants
We recruited participants through Amazon’s MTURK using the survey title “Hallucinogen Use and Opinions.” A total of 443 individuals (273 (61.6%) self-identified as Female) passed attention checks and completed the study survey. Due to the statistical analyses conducted, we removed 9 participants from the dataset due to univariate and multivariate outliers. Therefore, we included a total of 434 participants in the analyses. Participant ages ranged from 18 to 68 (Mean = 33.01, SD = 10.71). Age was significantly and positively skewed (.92) but improved after a square root transformation (.61). The sample included White (317; 73%), Black/African American (31; 7.1%), Asian (34; 7.8%), Latinx (29; 6.7%), Multiracial (16; 3.7%), and Indigenous (5; 1.2%) participants, as well as two (.5%) participants who selected “other race.” Distributions related to race and ethnicity are typically low in power, and this dataset was no exception. Given this predicament, we categorized participants from historically marginalized backgrounds together (117; 27%). Education ranged from some high school to an advanced degree (Modal, median, and mean = Some college (131; 30.2%) followed by Bachelor’s degree (123; 28.3%)). Given the small sample size in some education levels, we dichotomized education at Associate’s or less (234; 53.9%) and Bachelor’s or more (200; 46.1%). We centered binary demographic variables and recoded them using -0.5 and 0.5 values (Kraemer & Blasey, 2004). We considered male participants, those who reported White as their race, and participants who completed an Associate’s or lower degree reference groups and labeled these values -0.5. The local IRB approved all study procedures.

Measures

PTSD Symptoms We used the Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C; Weathers et al., 1994) to assess PTSD symptoms. The PCL-C comprises 17 items rated on a five-point Likert scale ranging from 1 (Not at all) to 5 (Extremely). Cronbach’s alpha was
.95. Scores ranged from 16 to 85 (Mean = 41.52, SD = 17.59). Additionally, a prior confirmatory factor analysis on PCL scores in U.S. veterans indicated a four-factor structure, and therefore we computed factor scores for each subscale (Mansfield et al., 2010). Scores for each subscale averaged from 1 to 5. We used average single-item scores for each subscale due to the variation of item numbers in each subscale (Mansfield et al., 2010). Average item scores were 2.27 (SD = 1.13) for Reexperiencing, 2.63 (SD = 1.32) for Avoidance, 2.46 (SD = 1.18) for Numbing, and 2.55 (SD = 1.11) for Hyperarousal. Internal consistency was high for all subscales (Cronbach’s alpha = .91 for Reexperiencing, .82 for Avoidance, .87 for Numbing, and .85 for Hyperarousal).

**PTSD Expectancies** An additional PCL-C assessed for psychedelic expectancies by preceding the questions with the following statement: “Hallucinogens would make each of the following…” Participants rated expectancy items on a seven-point Likert scale ranging from -3 (Much worse) to 3 (Much better). Cronbach’s alpha was .96. Expectancy scores ranged from -51 (indicating psychedelics made symptoms worse) to +51 (indicating psychedelics greatly improved symptoms). The mean score was -8.42 (SD = 22.49), indicating that, on average, participants expected symptoms to worsen with psychedelic use slightly. Average scores for expectancy subscale items were -.77 (SD = 1.6) for Reexperiencing Expectancies, -.23 (SD = 1.57) for Avoidance Expectancies, -.19 (SD = 1.44) for Numbing Expectancies, and -.63 (SD = 1.46) for Hyperarousal Expectancies. Internal consistency was high for all expectancy subscales (Cronbach’s alpha = .95 for Reexperiencing Expectancies, .86 for Avoidance Expectancies, .90 for Numbing Expectancies, and .89 for Hyperarousal Expectancies).

**Psychedelic Use** We asked participants if they had ever used hallucinogens or psychedelic drugs to assess psychedelic use. If participants answered “Yes” (229; 52.8%) we
then asked them to indicate the number of times they used different types of psychedelics in their lifetime. MDMA was the most reported psychedelic, with a mean of 20.39 (SD = 73.90), followed by LSD, with a mean of 14.60 (SD = 61.94). As with the demographic variables, we also centered the lifetime psychedelic use variable using -.5 and .5 values (Kraemer & Blasey, 2004). We considered participants who reported never using psychedelics as the reference group and labeled these values -.5.

Trauma Experience We asked participants if they had experienced trauma with the following question: “Have you ever experienced a trauma? A trauma, by definition, is a psychological, emotional response to an event or an experience that is deeply distressing or disturbing.” If participants answered “Yes” (281; 64.7%) we then asked them to indicate the type of trauma if they felt comfortable doing so. The most common types of traumas were sexual assault (104; 24%) and traumatic loss (100; 23%), followed by domestic violence (81; 18.7%).

Data analysis Before conducting analyses, we assessed the sample for univariate and multivariate outliers. We assessed univariate outliers by standardizing total PTSD symptom and expectancy scores. We removed cases above 3, as well as those below -3 (Osborne, 2012). As a result, we found and dropped one fringelier case. We removed a total of eight multivariate outlier cases based on Mahalanobis distance. We first ran a series of one-sample t-tests to determine whether mean expectancy subscale scores differed from zero. We conducted paired t-tests to determine whether participants anticipated greater psychedelic-associated relief for some PTSD symptoms than others. Additionally, given the prevalence of MDMA and ketamine in the current literature, we ran independent t-tests to determine whether total and subscale expectancies differed based on reported use of these psychedelics. We ran five t-tests for each of the two psychedelics,
including the total expectancy scores, as well as the expectancy scores for each of the four subscales. Due to the number of analyses and large sample size, we used a modified Bonferroni approach to balance power and Type I error (Wilcox, 2013). We assigned each category of analyses a family-wise error rate of $p < .05$. Therefore, the six paired t-tests required $p$ values of .0083 (0.05/6) to qualify as significant. Lastly, the independent t-tests required $p$ values of .01 (0.05/5) to qualify as significant.

Additionally, we ran a zero-inflated negative binomial regression analysis that included theoretically relevant predictors to determine whether they predicted expectancies related to PTSD symptoms and psychedelic use. Zero-inflated negative binomial regression models address count data with excessive zeros. These models combine the use of logistic regression, for the zero-inflated portion, and negative binomial regression, for the count data portion that does not include zeros. We chose this model design given the distribution of the lifetime psychedelic use predictor variable (Atkins & Gallop, 2007). Unlike standard linear regression models, this regression model handles count data with excessive zeros, as well as overdispersion, efficiently while also providing a precise understanding of the underlying processes producing the data. We anchored psychedelic treatment expectancies to 0 to run the analyses. We also tested for overdispersion using a Poisson regression. We conducted a dispersion test on RStudio, which pointed to significant overdispersion, indicating a negative binomial regression model would be more appropriate. Afterward, we ran a negative binomial model and a zero-inflated negative binomial model, and Vuong’s Test provided support for the latter model (Vuong, 1989). Lastly, we conducted additional regression analyses to determine whether the relative importance of predictors changed across the four PTSD symptom categories compared to the total PTSD symptom score. We conducted analyses on RStudio and SPSS.
Results

Differences among expectancies:

One sample t-tests indicated that all mean expectancy scores differed significantly from zero \( (t_s(434) = -10.05 \text{ to } -2.74, \text{ all } ps < .05) \), with effect sizes ranging from \( d = 1.44 \) to 1.60. Paired sample t-tests revealed that several expectancy means differed significantly from each other, with expectancies for numbing receiving the highest score \( (M = -0.20, SD = 1.44) \) and reexperiencing receiving the lowest score \( (M = -0.78, SD = 1.60) \); See Table 1). These results indicate that participants believed psychedelics would slightly worsen their PTSD symptoms, with expectancies for some symptoms, such as reexperiencing and hyperarousal, being worse than others.

Table 1
Differences among expectancies for PTSD symptoms

<table>
<thead>
<tr>
<th>PTSD Symptoms</th>
<th>Mean (SD)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Re-Experiencing</td>
<td>-.78 (1.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Hyperarousal</td>
<td>-.63 (1.46)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Avoidance</td>
<td>-.23 (1.57)</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Numbing</td>
<td>-.2 (1.44)</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* \( p < .008 \). Expectancies ordered lowest (least expected relief) to highest.

Expectancies & psychedelic-specific findings

Much of the current literature on PAP focuses on MDMA and ketamine. Given this situation, we ran additional analyses to examine whether prior use of these two psychedelics influenced expectancies. We ran independent sample t-tests to compare expectancies in participants who reported using ketamine or MDMA and participants who reported never using either psychedelic.

Expectancies & MDMA use. Independent samples t-tests compared expectancies in participants who reported prior MDMA use and participants who reported never using MDMA.
Total expectancy scores differed in that participants who reported never using MDMA \((M = -10.81, SD = 21.70)\) had greater negative expectancies than those who reported using MDMA previously \((M = -1.87, SD = 23.40)\), \(t(432) = -3.72, p < .001\). Three subscales also differed across groups, with participants who reported never using MDMA \((Ms = -.94 \text{ to } -.31, SDs = 1.42 \text{ to } 1.57)\) reporting greater negative reexperiencing, hyperarousal, and numbing symptom expectancies than those who reported using MDMA previously \((Ms = -.30 \text{ to } .15, SDs = 1.44 \text{ to } 1.58)\), \(ts(432) = -3.02 \text{ to } -3.73, ps < .01\).

**Expectancies & ketamine use.** Additional independent samples t-tests compared expectancies in participants who reported prior ketamine use and participants who reported never using ketamine. Total and subscale scores differed across these groups. Those who used ketamine previously expected slight relief of their overall PTSD symptoms \((M = .98, SD = 21.62)\); those who reported never using ketamine expected psychedelics to worsen their overall symptoms \((M = -9.43, SD = 22.38), t(432) = -2.87, p < .01\). Expectancies for reexperiencing symptoms also differed. Participants who have never used ketamine \((M = -.85, SD = 1.59)\) reported greater negative reexperiencing symptom expectancies than those who had used ketamine in the past \((M = -.06, SD = 1.50), t(51.35) = -3.22, p < .01\). Lastly, expectancies for hyperarousal symptoms differed as well. Participants who reported never using ketamine \((M = -.69, SD = 1.45)\) reported greater negative hyperarousal symptom expectancies than those who had used ketamine in the past \((M = -.04, SD = 1.37), t(432) = -2.81, p < .01\).

**Bivariate relations:**

Correlations among PTSD symptoms, expectancies, age, sex, race, psychedelic use, and education level appear in Table 2. PTSD symptoms were positively associated with psychedelic treatment expectancies, sex (Male = -.5), and lifetime psychedelic use, and negatively associated
with age and education level. Psychedelic treatment expectancies were also positively associated with lifetime psychedelic use, and negatively associated with age. Age was positively associated with education level and negatively associated with race. Race was negatively associated with lifetime psychedelic use and positively associated with education level. These results indicate that White participants reported using psychedelics more often than participants from historically marginalized backgrounds. Lastly, education level was negatively associated with psychedelic use, indicating that participants who reported lower education levels reported higher rates of psychedelic use.

Table 2
Correlations among PTSD symptoms, expectancies, age, sex, race, psychedelic use, and education.

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PTSD Symptoms</td>
<td>41.52 (17.59)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2. Expectancies</td>
<td>-8.42 (22.49)</td>
<td>.17**</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>3. Age (transformed)</td>
<td>5.68 (0.90)</td>
<td>.15**</td>
<td>-1.11*</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>4. Sex</td>
<td>.12 (0.49)</td>
<td>.12**</td>
<td>-.08</td>
<td>.06</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>5. Race</td>
<td>-.23 (0.44)</td>
<td>-.01</td>
<td>.01</td>
<td>—</td>
<td>-.16**</td>
<td>-.07</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>6. Psychedelic Use</td>
<td>.03 (0.50)</td>
<td>.10*</td>
<td>.31**</td>
<td>.01</td>
<td>-.06</td>
<td>-.09</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>7. Education Level</td>
<td>-.04 (0.50)</td>
<td>—</td>
<td>.13**</td>
<td>.06</td>
<td>.17**</td>
<td>-.07</td>
<td>.10*</td>
<td>-.01</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

PTSD = Post-traumatic stress symptoms checklist, Civilian version; Expectancies = Anticipated psychedelic-induced relief for PTSD symptoms; Psychedelic Use = Self-reported lifetime psychedelic use.

Links to total psychedelic treatment expectancies

We conducted a zero-inflated negative binomial regression model with total expectancy scores as the outcome variable and PTSD symptoms, age, sex, race, lifetime psychedelic use, and education level as predictors. Based on the zero portion, PTSD symptoms was the only significant predictor, \( b = -.04, z = -2.40, p = .02, e^b = .96, e^b \text{ 95\% CI}[.93, .99]. \) Neither age, \( b = -
.04, $z = -1.15$, n.s., nor sex, $b = .84$, $z = 1.67$, n.s., nor race, $b = .53$, $z = 1.20$, n.s., nor psychedelic use, $b = 4.29$, $z = 1.21$, n.s., were significant predictors of the zero-inflation (Table 3). The odds ratio for PTSD symptoms, .96, was less than one by .04. This indicates that expectancies decreased by 4% with every additional unit increase in PTSD symptoms. Ultimately, these results indicate that participants experiencing greater PTSD symptoms reported more negative expectancies.

Table 3
Predicting psychedelic treatment expectancies from PTSD symptoms, age, sex, race, education level, and lifetime psychedelic use.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimate</th>
<th>SE</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTSD Symptoms</td>
<td>-.04</td>
<td>.02</td>
<td>.96</td>
<td>.93</td>
<td>.99</td>
</tr>
<tr>
<td>Age</td>
<td>-.04</td>
<td>.24</td>
<td>.96</td>
<td>.60</td>
<td>1.55</td>
</tr>
<tr>
<td>Sex</td>
<td>.84</td>
<td>.50</td>
<td>2.31</td>
<td>.87</td>
<td>6.18</td>
</tr>
<tr>
<td>Race</td>
<td>.53</td>
<td>.44</td>
<td>1.69</td>
<td>.72</td>
<td>4</td>
</tr>
<tr>
<td>Education</td>
<td>.51</td>
<td>.44</td>
<td>1.66</td>
<td>.71</td>
<td>3.92</td>
</tr>
<tr>
<td>Lifetime Psychedelic Use</td>
<td>-.81</td>
<td>.47</td>
<td>.44</td>
<td>.18</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Note. *$p < .05$.

Links to psychedelic treatment expectancy subscales

We conducted additional regression analyses to determine whether the relative importance of predictors changed across the four PTSD symptom categories as compared to the full PTSD symptom score. We ran standard linear regression analyses with each of the expectancy subscale scores as the outcome variable and relevant PTSD symptom subscale scores, age, sex, race, lifetime psychedelic use, and education level as predictors. Tests of normality were significant for each subscale, however, the skewness of the expectancy scores were small (.24 for reexperiencing, -.15 for avoidance, -.21 for numbing, and .09 for
hyperarousal) and these tests are often significant with samples greater than 50, even if deviations from normality are small (Osborne, 2012).

Reexperiencing Symptoms. The regression analysis for reexperiencing symptoms was significant \((F(6, 427) = 11.82, p < .01)\). Age \((\beta = -.20, t(427) = -2.42, p < .05, \text{standardized } \beta = -.11)\), education level \((\beta = .45, t(427) = 3.07, p < .01, \text{standardized } \beta = .14)\), reexperiencing subscale scores from the PTSD symptom questionnaire \((\beta = .16, t(427) = 2.49, p < .05, \text{standardized } \beta = .12)\), and lifetime psychedelic use \((\beta = .97, t(427) = 6.70, p < .001, \text{standardized } \beta = .30)\) had significant main effects on expectancy scores related to reexperiencing symptoms (Table 4). The overall model fit was \(R^2 = .14\).

Table 4
Predicting reexperiencing symptom expectancies from reexperiencing symptoms, age, sex, race, lifetime psychedelic use, and education level.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Estimate</th>
<th>SE</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>LL</td>
<td>UL</td>
</tr>
<tr>
<td>Reexperiencing Symptoms</td>
<td>.16</td>
<td>.07</td>
<td>.03</td>
<td>.29</td>
</tr>
<tr>
<td>Age</td>
<td>-.20</td>
<td>.08</td>
<td>-.36</td>
<td>-.04</td>
</tr>
<tr>
<td>Sex</td>
<td>-.21</td>
<td>.15</td>
<td>-.50</td>
<td>.09</td>
</tr>
<tr>
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<td>.17</td>
<td>-.20</td>
<td>.45</td>
</tr>
<tr>
<td>Education</td>
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<td>.16</td>
<td>.75</td>
</tr>
<tr>
<td>Lifetime Psychedelic Use</td>
<td>.97</td>
<td>.14</td>
<td>.68</td>
<td>1.25</td>
</tr>
</tbody>
</table>

Note. *p < .05.

Avoidance Symptoms. The regression analysis for avoidance symptoms was significant \((F(6, 427) = 6.14, p < .001)\). Avoidance subscale scores from the PTSD symptom questionnaire \((\beta = .20, t(427) = 3.57, p < .001, \text{standardized } \beta = .17)\) and lifetime psychedelic use \((\beta = .66, t(427) = 4.47, p < .001, \text{standardized } \beta = .21)\) had significant main effects on expectancy scores related to avoidance symptoms (Table 5). The overall model fit was \(R^2 = .08\).
Table 5
*Predicting avoidance symptom expectancies from avoidance symptoms, age, sex, race, lifetime psychedelic use, and education level.*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Estimate</th>
<th>SE</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td></td>
<td>LL</td>
<td>UL</td>
</tr>
<tr>
<td>Avoidance Symptoms</td>
<td>.20</td>
<td>.06</td>
<td>.09</td>
<td>.32</td>
</tr>
<tr>
<td>Age</td>
<td>-.08</td>
<td>.09</td>
<td>-.24</td>
<td>.09</td>
</tr>
<tr>
<td>Sex</td>
<td>-.07</td>
<td>.15</td>
<td>-.38</td>
<td>.23</td>
</tr>
<tr>
<td>Race</td>
<td>-.08</td>
<td>.17</td>
<td>-.41</td>
<td>.26</td>
</tr>
<tr>
<td>Education</td>
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<td>.15</td>
<td>-.09</td>
<td>.50</td>
</tr>
<tr>
<td>Lifetime Psychedelic Use</td>
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<td>.15</td>
<td>.37</td>
<td>.95</td>
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</tbody>
</table>

_Note.* *p < .05.

*Numbing Symptoms.* The regression analysis for numbing symptoms was significant (F(6, 427) = 9.10, *p < .001). Age (β = -.18, *t*(427) = -2.40, *p < .05, standardized β = -.11), numbing subscale scores from the PTSD symptom questionnaire (β = .20, *t*(427) = 3.54, *p < .001, standardized β = .17), and lifetime psychedelic use (β = .69, *t*(427) = 5.32, *p < .001, standardized β = .24) had significant main effects on expectancy scores related to numbing symptoms (Table 6). The overall model fit was *R*² = .11.

Table 6
*Predicting numbing symptom expectancies from numbing symptoms, age, sex, race, lifetime psychedelic use, and education level.*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Estimate</th>
<th>SE</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td>LL</td>
<td>UL</td>
</tr>
<tr>
<td>Numbing Symptoms</td>
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<td>.09</td>
<td>.31</td>
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<tr>
<td>Age</td>
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<td>-.33</td>
<td>-.03</td>
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<tr>
<td>Sex</td>
<td>-.10</td>
<td>.14</td>
<td>-.37</td>
<td>.17</td>
</tr>
<tr>
<td>Race</td>
<td>-.07</td>
<td>.15</td>
<td>-.36</td>
<td>.23</td>
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<tr>
<td>Education</td>
<td>.08</td>
<td>.14</td>
<td>-.19</td>
<td>.35</td>
</tr>
<tr>
<td>Lifetime Psychedelic Use</td>
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<td>.13</td>
<td>.43</td>
<td>.96</td>
</tr>
</tbody>
</table>

_Note.* *p < .05.
Hyperarousal Symptoms. The regression analysis for hyperarousal symptoms was significant \((F(6, 427) = 7.42, p < .001)\). Only lifetime psychedelic use \((\beta = .75, t(427) = 5.50, p < .001\), standardized \(\beta = .26\)) had a significant main effect on expectancy scores related to hyperarousal symptoms (Table 7). The overall model fit was \(R^2 = .09\).

Table 7

Predicting hyperarousal symptom expectancies from hyperarousal symptoms, age, sex, race, lifetime psychedelic use, and education level.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Estimate</th>
<th>SE</th>
<th>95% CI</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
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<td>Hyperarousal Symptoms</td>
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<td>-.03</td>
<td>.22</td>
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<tr>
<td>Age</td>
<td>-.11</td>
<td>.08</td>
<td>-.27</td>
<td>.04</td>
</tr>
<tr>
<td>Sex</td>
<td>-.26</td>
<td>.14</td>
<td>-.53</td>
<td>.02</td>
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<tr>
<td>Race</td>
<td>.02</td>
<td>.16</td>
<td>-.28</td>
<td>.33</td>
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<tr>
<td>Education</td>
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<td>.14</td>
<td>-.04</td>
<td>.51</td>
</tr>
<tr>
<td>Lifetime Psychedelic Use</td>
<td>.75</td>
<td>.14</td>
<td>.48</td>
<td>1.02</td>
</tr>
</tbody>
</table>

Note. *\(p < .05\).

Discussion

PTSD impacts the lives of millions in the United States each year. Preliminary studies reveal support for PAP as a promising treatment for PTSD, however, we have limited knowledge regarding the general public’s thoughts of PAP. Recreational use or informal attempts at therapeutic use can prove ill-advised. Naturalistic experiences with psychedelics vary in setting dramatically. They also often do not include the key preparation and integration sessions (Schlag et al., 2022). Generally, stigma related to psychedelic use and other negative perceptions are common (Schlag et al., 2022). Our current findings seem to support this sentiment. Participants expected psychedelics to worsen their PTSD symptoms slightly, on average. Psychotherapy research has often linked expectancies to treatment outcomes; these expected effects of psychedelics might work comparably. Given the ubiquitous connection between expectancies
and treatment outcomes, understanding public expectations regarding psychedelic-related treatments becomes crucial (Frank, 1959; Constantino et al., 2011; Zilcha-Mano et al., 2018).

Our findings indicated that participants expected psychedelics to exacerbate their PTSD symptoms on average. The mean expectancy scores displayed a significant deviation from zero, indicating that participants generally anticipated a degree of symptom modification, in this instance, leaning towards a slightly unfavorable change. Some expectancy subscale means also differed significantly from others, indicating that participants expected psychedelics to worsen some symptoms more than others. Specifically, participants expected more adverse effects for re-experiencing and hyperarousal symptoms, followed by avoidance and numbing symptoms. Of note, participants involved in our study were not part of formal psychedelic assisted therapy, as far as we know. These participants came from a general sample in which some reported prior psychedelic use while others reported never using psychedelics.

Overall, PTSD symptoms were the only significant predictor of psychedelic treatment expectancies. Participants with greater PTSD symptoms reported greater negative expectancies than those with less severe PTSD symptoms. In sum, as an individual’s PTSD symptoms increased, so did their negative psychedelic treatment expectancies. Nevertheless, significant predictors varied depending on the specific expectancy symptom group in question. Concerning psychedelic treatment and expectancies for reexperiencing symptoms, age, education level, reexperiencing subscale scores and lifetime psychedelic use were all significant predictors. Positive relations emerged between education level and expectancies, reexperiencing symptom scores and expectancies, as well as lifetime psychedelic use and expectancies. This result indicates that as education level and reexperiencing symptom scores increased, so did psychedelic treatment expectancies related to reexperiencing symptoms. Additionally,
participants who reported using psychedelics at least once in their lives reported greater psychedelic treatment expectancies related to reexperiencing symptoms. Therefore, individuals who reported higher education levels, experienced greater reexperiencing symptoms, and had used psychedelics in the past expected more relief related to their reexperiencing symptoms from psychedelic treatment. Conversely, an inverse relation emerged with age. This result suggests that younger participants reported more positive expectancies while older participants reported more negative expectancies related to reexperiencing symptoms.

These results were somewhat similar to expectancies for numbing symptoms, in which numbing subscale scores, age, and lifetime psychedelic use significantly predicted expectancies. Here, an inverse relationship with age was also evident, as younger participants reported more positive expectancies related to psychedelic use and numbing symptoms. The relations between numbing subscale scores and numbing symptom expectancies, as well as lifetime psychedelic use and numbing subscale scores were positive, indicating that participants who reported greater numbing symptoms and prior psychedelic use expected greater relief from their numbing symptoms after using psychedelics. Avoidance subscale scores and lifetime psychedelic use were both significant predictors related to avoidance symptom expectancies. These relationships were also positive, meaning that participants who reported greater avoidance symptoms and prior psychedelic use expected greater relief from their avoidant symptoms after using psychedelics. Lifetime psychedelic use was the only significant predictor related to hyperarousal symptom expectancies. This relationship was also positive, indicating that participants who reported prior psychedelic use expected greater relief from their hyperarousal symptoms after using psychedelics. Of note, at the individual subscale level, relationships between symptom subscale scores and symptom expectancies were positive, but when looking at total PTSD scores and total
expectancy scores, the relationship was negative. Ultimately, this result means that when looking at total PTSD scores, participants with greater symptoms expected psychedelics to slightly worsen their total PTSD symptoms, but when looking at individual symptom groups, participants with greater subscale scores expected greater relief in those symptoms after using psychedelics.

These findings deviate from a previous study in which researchers investigated expectancies related to PTSD symptoms and cannabis use (Earleywine & Bolles, 2014). In the cannabis study, participants generally expected greater relief from their PTSD symptoms after using cannabis and this relief was more prevalent in expectancies related to reexperiencing and hyperarousal symptoms (Earleywine & Bolles, 2014). Our findings were the complete opposite; participants generally expected psychedelics to slightly worsen their PTSD symptoms, and this effect was especially prevalent in expectancies related to reexperiencing and hyperarousal symptoms. Nevertheless, upon looking at individual symptom groups, for reexperiencing, numbing, and avoidance symptom expectancies, those who reported greater symptom severity expected more positive outcomes from psychedelics. Current perceptions of the substances in question differ vastly and can potentially explain these disparate findings. Marijuana use is more common, with some states approving legalization (Kilmer & MacCoun, 2017). In contrast, researchers continue to study psychedelics, the FDA has only authorized therapeutic use of a few of them, and prohibitions are more widespread (Lamkin, 2022).

These mixed findings suggest various implications; however, the field needs more research to fully understand the facets that influence psychedelic use expectancies. Our findings may indicate that individuals with less severe PTSD symptomatology are better suited for psychedelic treatment, while those with more significant symptoms may experience more negative outcomes, however, we cannot guarantee these effects. Additionally, a lack of
psychoeducation may also contribute to these results. This general sentiment reveals a need for psychoeducation as studies have indicated that adverse medical outcomes are often minimal in regulated research settings, and current empirical studies do not provide evidence for most psychological risks often present in the media (Schlag et al., 2022). A lack of psychoeducation can lead individuals to overlook beneficial treatments, which would be a disservice to those struggling with PTSD given the sometimes-low treatment success rates, as well as the alarming drop-out rates (Haagen et al., 2015; Lewis et al., 2020). In addition to psychoeducation, expectancies related to treatment outcomes are often an indicator of actual outcomes, which suggests that more research and replication studies on this topic would be beneficial (Meyer et al., 2002; Price et al., 2015). Given concerns about a replication crisis, meaning that attempts at replication often fail, even with prediction intervals in mind, we emphasize cautious interpretation for our results as well (Patil et al., 2016; Malich & Munafò, 2022). Some have argued that low statistical power is to blame, emphasizing the importance of rigorous research study design and methodology (Maxwell et al., 2015). In addition to issues with replicability, psychedelic research is especially susceptible to additional concerns such as self-selection bias. Self-selection bias relates to the idea that participants who volunteer for research studies may differ significantly from those who choose not to participate (Karos et al., 2018). Researchers worry that those who volunteer for psychedelic studies may already have an interest in psychedelics and may ultimately be more prone to experience positive effects, potentially biasing study findings (Carhartt-Harris & Goodwin, 2017; Johnstad, 2021). Researchers have voiced these concerns and have also argued a greater need for inclusivity and overall diversity in the samples that are participating in these studies (Pilecki et al., 2021; Argento et al., 2022). If study samples are not fully representative, then generalizing study results to the population is not
feasible or ethical. Given that our survey title included the word “hallucinogen,” we understand the possibility of the title contributing to self-selection bias in our sample. However, we found that our sample was almost even regarding psychedelic use in that 47.2% of participants reported never using psychedelics.

Ultimately, these concerns underscore the need for more research on psychedelics, especially given the recent randomized control trials suggesting that PAP could benefit many. Recent reviews have continued to lend support for psychedelic assisted therapy as a successful treatment for PTSD (Jumaili et al., 2022; Ragnhildstveit et al., 2022). Researchers studying ketamine have found it to be an efficient, effective, and well-tolerated treatment for PTSD as well (Dadabayev et al., 2020; Feder et al. 2021). A recent review of 26 studies that investigated ketamine as a treatment for PTSD found that ketamine produced rapid clinical improvements and great symptom reduction (Ragnhildstveit et al., 2022). The authors also found that participants were generally able to tolerate ketamine well, as investigators did not report any severe adverse reactions and the most common side effect was temporary dissociation, which typically resolved itself within a couple of hours (Ragnhildstveit et al., 2022). Another review that focused specifically on randomized clinical trials produced similar findings and also found that ketamine alleviated additional symptoms related to substance misuse, depression, and chronic pain, which are all often comorbid with PTSD (Jumaili et al., 2022). Given the frequency of treatment dropout when discussing PTSD, these findings are promising.

This study was not without limitations that suggest further directions. For starters, our sample was predominantly White. Expectancies could have varied if we had assessed a more inclusive and diverse sample. Additionally, the current study relied solely on self-report measures, which have a history of shortcomings, especially concerning substance use (Johnson
We conducted the fully anonymous study online to alleviate any potential self-report bias. However, our study title may have contributed to self-selection bias, which is an additional limitation. Although online survey studies have several issues, we included a number of attention-check questions and removed participants who failed these checks.

Given these mixed findings and study limitations, additional research is necessary to comprehend the factors influencing psychedelic treatment expectancies and the relevant symptoms that participants may believe will improve or worsen after use. Investigating whether certain types of trauma influence expectancies would also be informative. Overall, psychedelics have received vast attention from the scientific community throughout the past few years. Nevertheless, the field needs more research to fully understand the public’s view of these promising substances and their treatment effects. Further work on improving the expectations of potential clients for PAP, especially given these perceptions of psychedelics on their own, certainly seems warranted.
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