Development of the Enthusiastic Substance Use Attitudes Scale: Preliminary Evidence of a Novel Maintenance Factor

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Abstract

Expectancies, motives, and attitudes toward substance use are cognitive factors that partially account for substance use behaviors; however, existing measures tend to have monotonous phrasing, diverging from the enthusiastic attitude towards the perceived benefits of substance use exhibited by those who use substances. We aimed to create a brief, multidimensional measure to capture this nuance, which we called the Enthusiastic Substance Use Attitudes Scale (ESUAS). Undergraduate students (n = 198) between 18 to 62 (M_{age} = 19.15, SD = 3.65; 66.2% women; 71.71% White) completed the study. We used exploratory and confirmatory factor analyses to reduce a 90-item item pool based on a comprehensive search of social media, traditional media, and the scientific literature to an 18-item hierarchical bifactor model. This model contained nine specific factors, which are 1) sociability, 2) enjoyment, 3) boredom, 4) mental health, 5) relaxation, 6) life processing, 7) performance enhancement, 8) boredom, and 9) personal growth; two general factors, which are 1) substance-based emotion regulation and 2) substance-based assistance; and a higher-order single-factor factor above of the nine specific factors – resulting in twelve internally consistent empirically-supported scales. Further, the ESUAS demonstrated excellent and strong structural, convergent, divergent, incremental, and diagnostic validity. The ESUAS may be an effective tool for professionals to develop and measure a more ecologically valid view of those with SUDs, thereby developing understanding from the general public, advancing medicinal uses of illicit substances, and improving conceptualizations and treatments.

Keywords: perceived benefits, substance use, substance use disorder, attitude, treatment

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Substance use disorders (SUDs; i.e., prolonged substance use leading to significant functional impairment or distress; American Psychiatric Association, 2022) undoubtedly causes notable global public health burdens (Han et al., 2015; Maclean & Saloner, 2019; Whiteford et al., 2013), community and familial distress (Hoffmann & Cerbone, 2002; Tyo & McCurry, 2020; Wilkens & Foote, 2019), economic costs (Florence et al., 2021; Lund et al., 2019; Whiteford et al., 2016), and significant impairment of functioning (Harris et al., 2019; Henkel, 2011; Ramey & Regier, 2019), that affect individuals across cultures, geographic location, and demographic identities (e.g., Charles et al., 2015; Felner et al., 2020; Henderson & Dressler, 2020; Ólafsdóttir et al., 2018). Yet, only 11-12% of people who develop a SUD receive any SUD treatment annually (Han et al., 2015; Substance Abuse and Mental Health Services Administration, 2020). One potential contributing factor to this low SUD treatment rate may be that most people with SUDs, estimated to be around 95%, report having little desire to seek treatments, despite the notable functional impairment they may experience (Rogers et al., 2019). Although typical public information about substance use almost exclusively delineates negative consequences (Nieweglowski et al., 2019; Stone, 2022a, 2022b), there may be a disconnect from the socially-acceptable attitude towards substances compared to the attitudes of those who use substances. Thus, we aimed to characterize a potentially novel substance use maintenance factor – an enthusiastic attitude towards the perceived benefits of substance use – and create a brief, multidimensional measure for use in future research and clinical practice.

Stigmatizing, hostile, and negative attitudes towards using substances and those who use substances is prevalent in many cultures, and a major contributing factor to those attitudes may

be policies criminalizing substance use and those who use substances (Nieweglowski et al., 2019; Stone, 2022a, 2022b). Before the passing of the War on Drugs in the United States in the 1900s, many currently illicit substances were easily accessible at stores, and the general attitude towards substance use was forthright about the benefits and dangers known at the time. However, War on Drugs propaganda initiated and spread stigmatizing attitudes that illicit substance use and prescription misuse are harmful in any setting at any dose (e.g., "not even once"; The Paley Center in New York, 2022). These stigmatizing negative attitudes remain prevalent and have severe implications for those who use substances (see Crapanzano et al., 2019 and Yang et al., 2017, for systematic reviews). As such, a notable, apparent discrepancy between stigmatizing public health information and socially acceptable attitudes compared to the behaviors exhibited by those who use substances. As such, determining the justification for people using substances has been an essential scientific endeavor to explain this discrepancy and build treatments to target these maintenance factors.

Researchers have attempted to explain what causes people to use substances despite the consequences (see Votaw & Witkiewitz, 2021 for a review). Many of these explanations have excellent support, including socialization (Reed & Rountree, 1997; Studer et al., 2014), poverty (Gibbs et al., 2018; Thompson et al., 2013), mental illness (Groenman et al., 2017; Iqbal et al., 2019), stress or grief (Chaplin et al., 2018; Parisi et al., 2019), childhood maltreatment (Cicchetti & Handley, 2019; Simpson & Miller, 2002), and genetics (Deak & Johnson, 2021; Maher, 2022). However, these risk factors are mainly stable, limiting their ability to explain the volatility of substance use behaviors throughout one's lifetime (Friend et al., 2009; Fleury et al., 2016). Moreover, the prevalence of SUDs among individuals with these risk factors varies largely by sample in meta-analyses (e.g., Abate et al., 2021; Cragg et al., 2019). Thus, researchers focused

their work on constructs that change over time and are applicable to many individuals, regardless of their history and demographic characteristic (Leventhal & Schmitz, 2006) – such as cognitive constructs.

Three cognitive constructs have emerged as well-supported explanations and predictors of substance use behaviors, which are 1) expectancies, 2) motives, and attitudes. Expectancies are the anticipated effects of substance use (Biolcati & Passini, 2019; Hides et al., 2008), motives are the self-identified justifications for using substances (Biolcati & Passini, 2019; Hides et al., 2008), and attitudes are one's opinions and judgments about using substances (Ayu et al., 2022; Barkin et al., 2002; Jalleh et al., 2014). There are many measures in the literature with good psychometric support (e.g., DUDIT-E; Berman et al., 2007; Substance Use Motives Scale; Hides et al., 2008; Drug Attitudes Scale; Goodstadt et al., 1978); however, there are some notable limitations, such as the breadth of reasons assessed (e.g., the SUMS measure five motives; Hides et al., 2008), the limited generalizability across settings and substances (e.g., the DAS has different questions for 10 substances only; Goodstadt et al., 1978), and most of the attitude measures are antiquated and stigmatizing (e.g., the DAS; Goodstadt et al., 1978; Attitude to Drug Addicts Scale; Moodley-Kunnie, 1988; Substance Abuse Attitude Survey; Chappel et al., 1985; Attitude Measurement Questionnaire; Romney & Bynner, 1988). Thus, researchers may benefit from an updated, comprehensive measure applicable across substances and settings.

In addition to addressing these limitations, the existing measures for these constructs lack enthusiasm about how people speak about their perceived benefits of substance use, especially the dearth of scales assessing positive attitudes towards substance use. This enthusiasm about the perceived benefits of substance use is clear in written and spoken content, such as on social media and TV. For example, Item 17 of the DAS reads, “occasional use of opiates is okay,” (p.g.

5; Goodstadt et al., 1978), Item 4 of the SUMM reads, “because it makes me feel good” (pg. 4; Biolcati & Passini, 2019), and Item 1 of the DUDIT-E reads, “sleep better” (p.g. 362; Berman et al., 2007). Compared to the documented way individuals speak about substances on TV, such as “the Percocet give me energy, they give me confidence, they make me happy," from Intervention and “the parties in Detroit go crazy, they want top [ecstasy] none stop," from Drugs Incorporated. This discrepancy may not be negligible when attempting to explain why people use substances despite the typical negative attitudes towards substance use. As such, researchers and clinicians may lose essential information when using existing measures by not accounting for this enthusiastic attitude - a potential, notable ecological validity limitation.

In the current study, we aim to advance our understanding of substance use and SUDs by defining a new brief, multidimensional measure that captures this enthusiastic, positive attitude towards the perceived benefits of using substances. We hypothesized that this construct would have wide applicability because substances have different subjective effects and interact with one’s set and setting. Based on these variables, the perceived benefits may be more relevant for some than others. However, we hypothesized that these perceived benefits might be largely universal across settings and populations, given the consistent effects of substances and their relative availability. Most importantly, we aimed to capture this enthusiastic, positive attitude towards these perceived benefits to improve the ecological validity of the existing measures. As part of our attempt to characterize this construct, we aimed to use the findings to provide a well-supported, empirically-validated, open-source measure, which we named the Enthusiastic Substance Use Attitude Scale (i.e., ESUAS).

Method

Participants

Participants were undergraduate students (n = 266) from a Midwestern University who participated in the study for course credit. We displayed their demographic information in Table 1. We removed individuals who failed any of the three attention checks (e.g., please select moderately true; n = 33; 12.40%) or did not complete or completed the study twice (n = 35; 13.25%), resulting in a final sample of individuals (n = 198) who carefully attended to all the items. All data, scripts, and materials are on an Open Science Framework page, which can be accessed at the following link: https://osf.io/wkt9y/?view_only=670dfeaff2984594810753980db16d3e[1]

Procedure

We created a Qualtrics survey (Qualtrics LCC, Provo, UT, USA), including the 90 item-pool and other measures to examine validity. Participants found our study via the SONA System (SONA Systems, Ltd., Tallinn, Estonia) for the Department of Psychology in the Fall of 2022. Participants completed an informed consent, the study, and a debriefing. The entire study took up to 30 minutes. The Institutional Review Board approved this study at [REDACTED FOR MASKED REVIEW]. We used SPSS v28 (IBM Corporation, LLC, Armonk, NY, 2022) to conduct the analyses. Although some variables contain outliers, defined as two standard deviations above the mean, we did not eliminate them from the analyses because they were valid cases (i.e., not entered in error; Orr et al., 1991). The final sample contained no cases with missing data.

Measures

[1] Anonymous view-only like; will be replaced with public link if accepted.

Note that we displayed all descriptive statistics in Table 2. All the measures demonstrated excellent descriptive statistics, except the agreeableness subscale of the BFI-10-R and the psychological and physical subscales of the WHOQOL-Bref due to low internal consistency. An analysis of skewness and kurtosis revealed no non-normal distributions, defined as an absolute value of skewness of greater than two or an absolute value of kurtosis greater than 7 (West et al., 1995).

Table 1

Demographic characteristics

Demographics	Sample
Mean Age (*SD*)	19.15 (3.65)
Range	18 - 62
Gender	
Women	131 (66.2%)
Men	60 (30.3%)
Nonbinary	6 (3.0%)
Prefer not to say	1 (0.5%)
Race	
White	142 (71.7%)
Asian	4 (2.0%)
Black	47 (23.7%)
Indian	1 (0.5%)
Native American	1 (0.5%)
Pacific Islander	1 (0.5%)
Prefer not to say	2 (1.0%)
Ethnicity	
Non-Hispanic	177 (89.4%)
Hispanic	21 (10.6%)
DAST Classification	
No Risk	12 (6.1%)
Low Risk	89 (44.9%)
Moderate Risk	81 (40.9%)
Substantial Risk	14 (7.1%)
Severe Risk	2 (1.0%)

Note. n = 198. We removed some participants for failing any of the attention checks, DAST = Drug Abuse Screening Test.

Table 2

Measure descriptive data

Measure	α	IIC	*M*	*SD*	γ	κ	Min	Max
DAST	.63	-	2.81	1.83	.80	0.53	0	9
DUDIT	.83	-	10.07	7.45	1.16	1.17	0	37
SWLS	.90	-	22.90	6.80	-0.28	-0.53	5	35
PSU Monthly	-	-	2.01	1.17	1.13	1.43	0	7
PSU Weekly	-	-	1.45	0.86	1.38	1.94	0	5
PSU Daily	-	-	0.99	0.63	0.87	3.22	0	4
WHOQOL-Bref								
Psychological	.53	-	3.08	0.49	0.04	-0.20	12	30
Physical	.48	-	3.38	0.55	0.01	-0.16	14	31
Environment	.82	-	3.65	0.66	0.01	-0.14	14	40
Relationships	.61	-	3.76	0.81	-0.51	-0.03	3	15
DRES								
Acceptance	.92	-	14.07	5.68	0.72	-0.07	6	30
Goal-Directed	.82	-	14.66	4.15	-0.06	-0.23	5	25
Impulse Control	.82	-	13.64	4.10	0.26	-0.42	6	27
Unawareness	.69	-	16.21	5.22	0.15	-0.62	6	29
Emotion Regulation	.87	-	18.25	6.39	0.39	-0.74	8	34
Clarity	.77	-	12.47	3.65	0.10	-0.56	5	21
BFI-10-R								
Conscientiousness	.80	.67	8.41	1.71	-1.61	3.33	2	10
Agreeableness	.21	.12	7.20	1.78	-0.20	-0.55	3	10
Neuroticism	.84	.73	7.95	2.21	-1.07	0.37	2	10
Openness	.80	.66	7.52	1.82	-0.76	0.43	2	10
Extraversion	.79	.65	6.99	2.39	-0.46	-0.89	2	10

Note. n = 198. DAST = Drug Abuse Screening Test, DUDIT = Drug Use Disorder Identification Test, SWLS = Satisfaction with Life Scale, PSU = Polysubstance Use, WHOQOL-BREF = World Health Organization Quality of Life - Brief, DRES = Difficulty Regulating Emotions Scale, BFI-10-R = Big Five Inventory-10 Revised, α = Cronbach's alpha, IIC = inter-item correlations, *M* = mean score, *SD* = standard deviation, γ = skewness, κ = kurtosis, Min = lowest score reported, Max = highest score reported.

Demographic Form

Participants completed a demographic form at the beginning of the study, which included questions assessing age, gender, race, ethnicity, and the number of substances used monthly, weekly, and daily.

Drug Abuse Screener Test – Ten Item (DAST-10)

The DAST-10 is a brief, unidimensional measure of the severity of a general substance use disorder (Skinner, 1982). Participants rated ten items on a dichotomous yes or no scale, such as Item 1 (p. 365; "Have you used drugs other than those required for medical purposes"). Higher scores indicate more problems and dependence on a wide variety of substances. Researchers can then categorize individuals into five risk groups from *no risk* (0), *low risk* (1-2), *moderate risk* (4-5), *substantial risk* (6-8), and *severe risk* (9-10). The DAST-10 has demonstrated excellent psychometric properties, including sensitivity and specificity (Skinner, 1982).

Drug Use Disorders Identification Test (DUDIT)

The DUDIT is a unidimensional, general measure of substance use disorder severity for many substances (Berman et al., 2002, 2007). Participants rated 11 items on various five- and three-point scales, such as Item 2 (p. 1; "do you use more than one type of drug on the same occasion"; Berman et al., 2002). Higher scores reflect more severity of a substance use disorder and problems. The scale has demonstrated consistently excellent psychometric properties across multiple studies (see Hildebrand, 2015, for a literature review).

Satisfaction with Life Scale (SWLS)

The SWLS is a unidimensional, brief measure of an individual's subject assessment of their satisfaction with their life (Diener et al., 1993; Pavot et al., 1991). Participants rated five items, such as Item 3 (p. 152; "so far I have gotten the important things I want out of life"; Pavot et al., 1991) on a 7-point scale from *strongly disagree* (1) to *strongly agree* (7). The scale has consistently demonstrated excellent psychometric prosperities (see Pavot et al., 1991 for a literature review).

Difficulty with Emotion Regulation Scale (DERS)

The DERS is a multidimensional measure of various aspects of difficulties regulating emotions, including: 1) not accepting emotions, 2) not engaging in goal-directed behaviors, 3) impulse control difficulties, 4) unawareness of emotions, 5) emotion regulation difficulties, and 6) lacking emotional clarity (Gratz & Roemer, 2004). Participants rated 18 items on a 5-point scale from *almost never* (1) to *almost always* (5), such as Item 23 (p. 48; "when I am upset, I feel out of control"). Higher scores indicate more difficulty with regulating emotions. The measure has good concurrent, construct, and structural validity and the psychometric properties allow for individual subscales or a total score.

The World Health Organization Quality of Life – Bref (WHOQOL-BREF)

The WHOQOL-BREF is an abbreviated version of the World Health Organization Quality of Life-100 scale designed to measure individuals' quality of life dimensions (World Health Organization, 1996). Participants rated 26 items on various 5-point Likert-type scales, such as Item 5 ("How much do you enjoy your life?"). We excluded the single-item subscales and used the remaining four subscales to reduce redundancy, which are: 1) physical quality of life, 2) psychological quality of life, 3) environmental quality of life, and 4) relationship quality of life. The scale has demonstrated strong psychometric properties and has been translated into multiple languages.

Big Five Inventory – 10 – Revised (BFI-10-R)

The BFI-10-R (Stone et al., 2022) is a psychometrically improved version of the BFI-10 (Rammstedt & John, 2007), which is a subset of the BFI-44 (John et al., 1991; John & Srivastava, 1999). Individuals rated items corresponding to each of the Big Five personality traits (i.e., conscientiousness, agreeableness, neuroticism, openness to experiences, and extraversion),

such as Item 3 (p. 1037; “I see myself as someone who has a forgiving nature”; Stone et al., 2022) on a Likert-type scale from *strongly disagree* (1) to *strongly agree* (5). The BFI-10-R demonstrated strong structural validity, excellent convergent and divergent validity, good criterion validity, and strong internal consistency.

Thematic Analysis

The thematic analysis followed a modified six-step method, as outlined in Nowell et al. (2017), because we adapted the method to multiple data sources. We used two strategies of obtaining the data, which were 1) searching for terms directly or 2) examining media likely to contain relevant information (e.g., watching the TV show Drugs Incorporated). We used similar terms across data sources, which contained a term related to a benefit, such as *benefits*, *pros*, *positive*, and *good effects*, with a term for substances, such as *substance use*, *substances*, *drugs*, *drug use*, or a specific substance, such as *weed*, cannabis, *alcohol*, or *heroin*. After looking through the available sources to familiarize ourselves, we began creating initial codes and trying to define themes. We started by searching literature databases (e.g., GoogleScholar and PsychInfo) to find sources of perceived substance use benefits from professional perspectives. Then we searched the social media websites Twitter, Instagram, Quora, Reddit, Facebook, and TikTok to document individual reports of perceived substance use benefits. Finally, we used YouTube and Google, to examine traditional media, such as news reports, TV shows, movies, and other websites potentially reporting these perceived benefits. We noted the ways that different sources spoke about the perceived benefits. Upon completing the search, generating codes, and searching for themes, we identified nine well-defined potential themes, which were: 1) sociability, 2) enjoyment, 3) physical health, 4) mental health, 5) relaxation, 6) personal

growth, 7) performance enhancement, 8) boredom, and 9) life processing.[2] We define the themes in Table 3, including examples and sources.

Next, we had the themes examined by a panel of four independent individuals with doctoral training in Clinical Psychology and experience with substance use treatments. The experts scrutinized each theme independently and reported utility on a scale from 0 = not necessary, 1 = useful, but not essential, to 2 = essential. We calculated the Content Validity Indices following equations recommended by Polit and Beck (2006). The item-level (i.e., theme) content validity index (I-CVI) was one for all domains except for physical health, which had an I-CVI of .75. The scale-level content validity index (S-CVI) using the average method is .97, and .90 using the universal agreement method. These results suggest that all nine themes have utility. However, when examining universal agreement on themes that were essential, no theme received universal agreement. This discrepancy suggests that the expert understanding of the enthusiastic attitude toward perceived substance use benefits is generally defined, but the clear and concrete components, and those needed for a universal agreement and strong content validity, may not be present or well-defined in the literature. As such, the authors retained all nine themes.

We then created items for each theme based on the information gathered from the initial searches, using phrasing that demonstrated enthusiasm and confidence. We reviewed the item for these characteristics, then narrowed the items down to ten items per domain to reduce fatigue effects in the participants while maximizing the potential to have a range of items to best capture the theme, resulting in a final pool of 90 items.

[2] There was a tenth theme that we defined at this stage titled “coping,” which comprised individuals using substances to manage stressful life situations and unpleasant emotions, but we integrated this into the other themes due to high similarities and weak boundaries.

Table 3

Thematic analysis the self-reported benefits of using substances and demonstrations of the enthusiastic attitude

Domain	Description	Common Substances	Quote or Example	Source
Sociability	The promotion of sociability by using substances to make friends or find a sense of community.	alcohol, cannabis, stimulants	An individual thanking and showing gratitude to their friend for stopping by their apartment to give them cannabis.	Facebook
Enjoyment	Enjoying the subjective effects of substances.	alcohol, opioids, cannabis	"The percocet give me energy, they give me confidence, they make me happy"	Intervention TV Show
Physical Health	Self-medicating physical health (e.g., reducing pain or fatigue).	opioids, stimulants, sleeping aids	"Self-management of pain was common among [people who use heroin] who reported moderate-to-extreme pain"	Google Scholar
Mental Health	Reducing the symptoms of mental health issues (e.g., anxiety or trauma).	alcohol, dissociatives, benzodiazepines	A person tweeting about their social anxiety and how they need to drink to even consider spending time with friends because of their social anxiety.	Twitter
Relaxation	Enhancing relaxation to unwind after stressful situations (e.g., work).	opioids, nicotine, sleeping aids	"A feeling of relaxation was reported by 39.4% of 439 youth who had inhaled from a cigarette"	PsychInfo
Personal Growth	Reaching one's potential and become a subjectively better person	stimulants, cannabis, hallucinogens	Someone mentioning how they can better set life goals after using cannabis.	TikTok
Performance Enhancement	Enhancing one's ability to perform better and promote endurance.	stimulants, cannabis, benzodiazepines	A person posting a picture of work out equipment with a caption mentioning how they love a certain caffeinated supplement to improve their workouts.	Instagram
Boredom	Reducing the monotony of daily life and enhancing engagement with experiences.	stimulants, cannabis, empathogens	"The parties in Detroit go crazy, they want top [ecstasy] none stop"	Drugs Incorporated TV Show
Life Processing	Developing a better understanding of one's life or society.	hallucinogens, dissociatives,	An individual wrote about how when they used psilocybin, they were able to better see the ways that their own behaviors contribute to their dissatisfaction with life.	Reddit

Note. n = 198. PsychInfo quotation from Ursprung et al., 2011 and Google Scholar quotation from Voon et al., 2014. Note that we described the content of the social media posts instead of providing the quote to protect peoples' identities given the sensitivity of the topic.

Results

Structural Validity

Item Selection

One of the goals of the ESUAS was to create a measure encompassing the nine domains identified in the thematic analysis and to keep the measure brief. To achieve this goal, we used a similar technique to the Multidimensional Psychological Flexibility Inventory validation study (MPFI; Rolffs et al., 2018). We used nine separate exploratory factor analyses (EFA) for the ten items in each subscale item pool. We forced extracted one factor to determine which items best capture the intended construct. We selected two items each from the top five items to keep the measure brief and to represent different aspects of the construct to reduce redundancy. The subscales contain ten items, resulting in a case-to-item ratio of 19.80:1, which meets the recommended minimum ratio of 5:1 to give an adequate sample size for reproducibility in a population (Hair et al., 2010). We used principal axis factoring, no rotation, and did not use cut-off criteria for loadings because we were aiming to select the items among the strongest loadings[3]. After conducting the EFAs, we arrived at a final selection of 18 items, representing nine domains with two items each as shown in Table 4. We had the four experts review these 18 items using the same method from the thematic analysis. All four independent experts agreed to retain all items, meeting all the appropriate criteria, except for three items, which received endorsements from three of the four experts. The scale-level content validity index (S-CVI) using the average method is .96, and .83 using the universal agreement method. This expert review suggested that all 18 items and the scale attained high and consistent expert endorsement for their usefulness and meeting the goals of the study, so we retained all 18 items.

[3] We still watched for poor loadings across items, but we did not encounter such an issue.

Table 4

Items and scoring of the Enthusiastic Substance Use Attitudes Scale

Sociability
1. Substances helps me make friends
2. I feel more confident around people because of substances
Enjoyment
3. Substances make me feel good
4. I enjoy using substances
Physical Health
5. I can do healthier things because of substances
6. Substances help me with my health problems
Mental Health
7. Substances help me cope with my mental illness better
8. Substances help me stay calm
Relaxation
9. Substances help make my relaxation time more relaxing
10. I am at peace when I use substances
Personal Growth
11. I can work towards the person I want to be more easily because of substances
12. Substances have positively shaped me into the person I am today
Performance Enhancement
13. Substances help me think more clearly
14. I feel more in control of my work when I use substances
Boredom
15. I enjoy escaping the monotony of daily life with substances
16. Substances help make regular activities more exciting
Life Processing
17. I have positive realizations about my life when I use substances
18. Substances help me understand my life better

Note. Items are rated on a scale from 1 = *not at all*, 2 = *a little bit*, 3 = *moderately*, 4 = *quite a bit*, and 5 = *very much*. Average the two items from each subscale to yield the 9 factors, average items 1, 2, 3, 4, 7, 8, 9, 10, 15, 16, 17, and 18 to yield the Substance-Induced Emotion Regulation subscale, average items 5, 6, 11, 12, 13, 14, and 17 items to yield the Substance Assistance subscale, and average all items to yield a total score.

The criteria for item loadings is 0.4 (Hair et al., 2010). Examining the scree plot revealed the potential for a single-factor (without elbow) and a two-factor solution (with elbow). We did not expect a two-factor solution, which appeared to contain a “substance-induced emotion

regulation" factor containing the boredom, enjoyment, relaxation, life processing, sociability, and mental health subscales. This factor appeared to describe individuals using substances to control their emotions by either inducing positive emotions (e.g., enjoyment and socializing), reducing negative emotions (e.g., reducing mental illness or stress to relax), or developing a better understanding of their life through processing their experiences. The other factor appeared to be "substance-based assistance," containing the physical health, performance enhancement, personal growth subscales, and one item from life processing subscales. This factor appeared to measure an individual use of substances to help them achieve their goals, function better in daily life, improve their physical capabilities, and be a subjectively better person.

Confirmatory Factor Analysis

We next attempted to determine the overall factor structures of the ESUAS, given the variability in models produced in the EFA, using confirmatory factor analyses (CFAs). We aimed to determine 1) which factor structures fit the data well and 2) which factor structure is the best explanation of the data. We conducted the CFAs in R v.4.2.2 (R Core Team, 2022) using the following packages: a) lavaan v.0.6-12 (Rosseel, 2012); b) lavaanPlot v.0.6.2 (Lishinski, 2021); c) semTools v.5-6 (Jorgensen et al., 2022); d) MVN v.5.9 (Korkmaz et al., 2014); e) semPower v.1.2.0 (Moshagen & Erdfelder, 2016); and f) devtools v.2.4.5 (Wickham et al., 2022). We used standard and robust diagonally weight least squares (DWLS) estimation because the data are ordinal, and these estimation techniques are robust against standard error inflation and violations of assumptions (e.g., multivariate outliers; DiStefano & Morgan, 2014; Mindrila, 2010). We tested a series of potential models, including a 1) single-factor model, 2) two-factor model (i.e., substance-induced emotion regulation and substance-based assistance), 3) nine-factor model, 4) two-level hierarchical models, 5) bifactor models, and 6) bifactor models with higher-order

factors.[4] We used a series of measures to assess model fit, as shown in Table 5, but primarily focused our decisions on local fit as assessed by large correlational residuals (absolute value greater than 0.10), as this method is a more conservative approach, and the outcomes are less affected by sample size and parameter estimate strength than the exact fit test and global fit indices (Kline, 2016).

The results revealed that seven models fit well according to the exact fit test and global fit indices. However, only five of those models demonstrated excellent local fit. Of those five models, two models contained an inappropriately large number of nonsignificant parameter estimates, leaving three plausible models that demonstrated excellent fit across all three criteria, which were a 1) hierarchical bifactor model with one general factor (Hierarchical Bifactor – 1 GF), 2) a hierarchical bifactor model with two general factors (Hierarchical Bifactor – 2 GF), and 3) a nine-factor model. The DWLS estimation methods and model degrees of freedom eliminate the traditional methods of determining the best fitting model, which are a chi-square difference tests or comparing AICs and BICs. Therefore, we further examined the model descriptive statistics to determine which well-fitting models perform the best.

We examined the explained variability in the items and factors, internal consistency, and the strength of item loadings, shown in Table 6. All three models demonstrated excellent descriptive statistics, but the nine-factor model demonstrated the strongest loadings and highest internal consistency. However, the hierarchical bifactor model addresses the three higher-order factors found in the EFAs. Between the two hierarchical bifactor models, Hierarchical Bifactor - 2 GF demonstrated notably better descriptive statistics. Thus, among these final models, the only model that demonstrated excellent global fit, local fit, significant and strong parameter estimates,

[4] We tested a three-level higher order model that was empirically underidentified and did not converge, so we removed it from the analyses.

high explained variability in the factors and items, excellent internal consistency, and the ability to account for higher-order factors is the Hierarchical Bifactor – 2 GF, as displayed in Figure 1. This final model suggests that the ESUAS. contains 12 calculatable scores, which are the nine single-domain scores, the substance-induced emotion regulation score, the substance-based assistance scores, and a total score.[5,6]

Descriptive Statistics, Internal Consistency, and Sensitivity

We reported the scale descriptive statistics in Table 7. The internal consistency for the domain scores was excellent, Cronbach's αs = .79 - .92, and the inter-item correlations (IIC) confirm the high α estimates despite each scale only containing two-items, *r*s = .66 - .86. The internal consistency for the substance-induced emotion regulation scale, α = .93, substance-based assistance scale, α = .90, and the total score, α = .94, were all excellent (Taber, 2017). All items, domain scores, and higher-order scales had negligible skewness, γs = 0.21 - 1.92, and kurtosis, κs = -1.09 - 2.95 (West et al., 1995). We conducted bias-corrected and accelerated bootstrapped one-sample one-tailed t-test to examine if the domain and higher-order scores are significantly higher than the available minimum (i.e., the participant selected does not apply to me at all for all items in the scale) to demonstrate sensitivity to endorsement. All tests were significant, suggesting that this population strongly endorses every score in the ESUAS Post-hoc power analyses revealed a power of > 99.99%, including for the weakest effect (i.e., substance-based assistance), Cohen's d = 0.83.

[5] Researchers may consider interpretations of the higher-order scores in the context of the nine single-domain scores, as models without the nine subfactors did not fit the data well.

[6] Note that post-hoc power analyses for confirmatory factor analyses differ from correlational-based hypothesis testing. The excellent model fit greatly deflates power. A low observed power means that the data-model misspecification is so minor that one would need a very large sample to detect it. In this study, we would need a sample of over 900 participants to detect this misfit, which is an unnecessarily large sample size given the standards for assessing model fit. Data-model misfits this small are likely insignificant and negligible, so increasing the sample size to detect a misfit this small is likely a Type II error.

Table 5

Global Fit Indices, Local Fit Estimates, Power, and Loading Significance of the Confirmatory Factor Analyses by Model

Sample	χ^2	*df*	*p*-value	χ^2/df	CFI	TLI	RMSEA	90% CI LL	90% CI UL	*p*-value	SRMR	LM	Power	Sample	NSL
Single-Factor	283.80	135	< .001	2.10	.967	.963	.075	.063	.087	< .001	.118	24%	99%	119	0
Two-Factor	139.80	133	.326	1.05	.999	.998	.016	< .001	.039	.997	.077	12%	68%	240	0
Nine-Factor	**21.08**	**99**	**> .999**	**0.21**	**1.00**	**1.03**	**< .001**	**< .001**	**< .001**	**> .999**	**.030**	**0%**	**11%**	**1,493**	**0**
Hierarchical - 1 HOF	175.95	126	.002	1.40	.989	.987	.045	.028	.060	.697	.091	21%	83%	188	0
Hierarchical - 2 HOF	73.66	124	> .999	0.59	1.00	1.01	< .001	< .001	< .001	> .999	.053	7%	33%	447	0
Bifactor - 1 GF	32.48	81	> .999	0.40	1.00	1.01	< .001	< .001	< .001	> .999	.021	0%	9%	2,054	10
Bifactor - 2 GF	26.58	80	> .999	0.33	1.00	1.01	< .001	< .001	< .001	> .999	.019	0%	7%	4,102	14
Hier. Bifactor - 1 GF	**108.03**	**107**	**.454**	**1.01**	**1.00**	**1.00**	**.007**	**< .000**	**.037**	**.997**	**.037**	**0%**	**15%**	**924**	**1**
Hier. Bifactor - 2 GF	**106.91**	**107**	**.483**	**1.00**	**1.00**	**1.00**	**< .001**	**< .000**	**.037**	**.998**	**.037**	**0%**	**15%**	**924**	**1**

Note. n = 198. Confirmatory factor analyses of the tested models. The bolded models demonstrated superior fit and contained almost exclusively significant loadings. The nine-factor model demonstrated the best fit but is limited to only the nine subscales; the best model that offers both fit and complexity (ability to use the nine factors, two higher-order factors, and the general factor, is the Hierarchical Bifactor Model with Two General Factors. Note that this list is not exhaustive because some models did not converge. HOF = higher-order factor, GF = general factor, and Hier = hierarchical. Models labeled 1 (e.g., 1 GF) means that the ESUAS total score is the higher-order factor (for the hierarchical models), as the explanatory factor (for the bifactor models), or on top (higher-order) of the nine subfactors (for the hierarchical bifactor models). The models labeled 2 (e.g., 2 GF) follow the same pattern but the factors are the substance-induced emotion regulation (SIER) and substance-based assistance (SBA) factors. *df* = degrees of freedom, CFI = Comparative Fit Index, TLI = Tucker-Lewis Index, RMSEA = Root Mean Square Error of Approximation, CI = confidence interval, LL = lower limit, UL = upper limit, SRMR = Standardized Root Mean Square Residual, LM = local misfit, as evinced by the percentage of correlational residuals greater than the absolute values of .10 out of all model implied residuals (Kline, 2016), power = post-hoc power analyses, sample = required sample to reach 80% power, NSL = the number of non-significant loadings (one-tailed *p*-values < .05).

Table 6

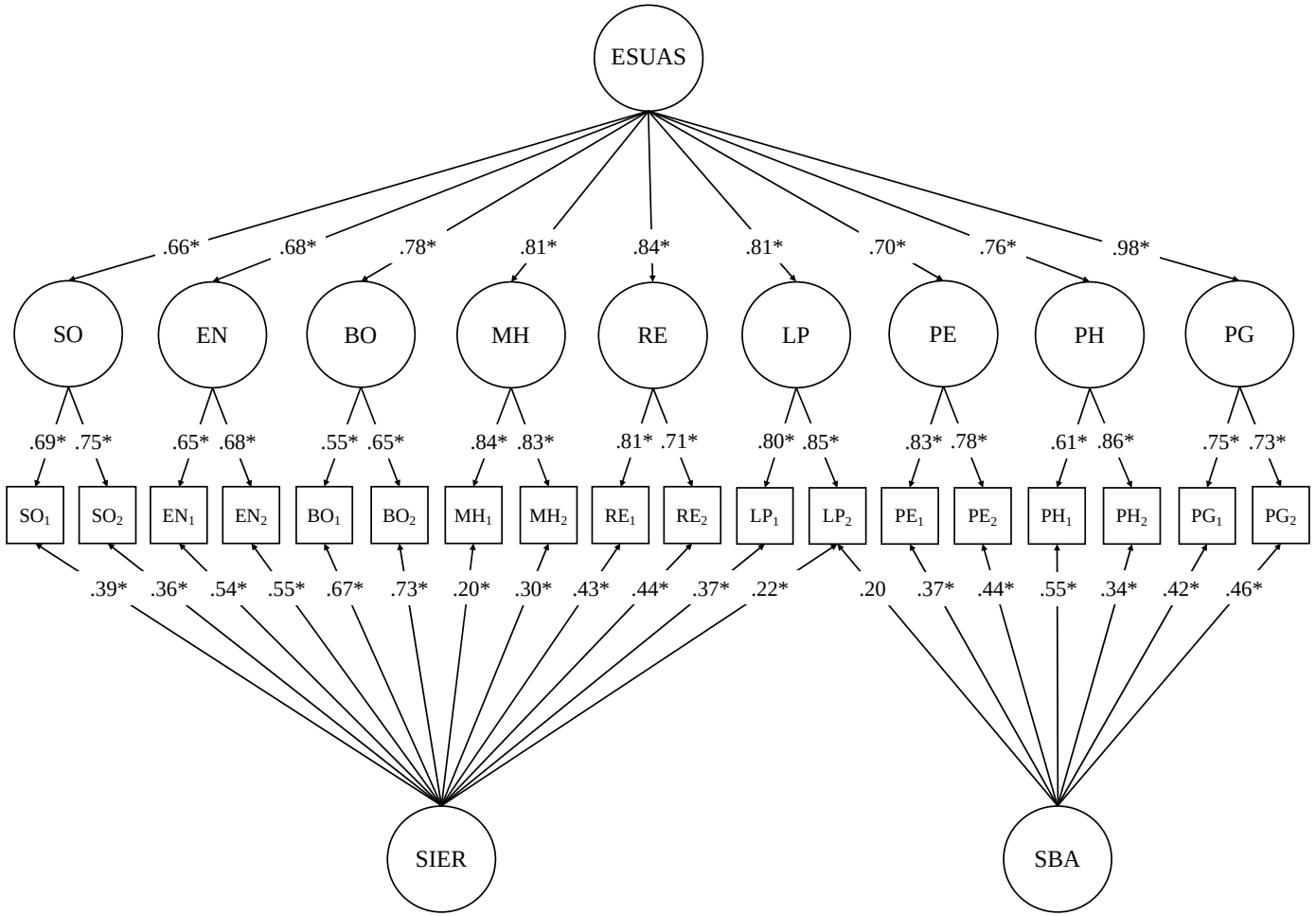
Item and Factor Comparisons for the Three Retained Models

Factor	Hierarchical Bifactor - 1 GF				Hierarchical Bifactor - 2 GF				Nine Factors			
	EVC	R^2	Ω	ASL	EVC	R^2	Ω	ASL	EVC	R^2	Ω	ASL
SO	66.22%	34.1%	.795	.661	78.66%	44.1%	.796	.721	-	-	.795	.812
EN	72.03%	54.1%	.850	.730	59.75%	46.6%	.850	.665	-	-	.850	.860
PH	58.70%	43.2%	.868	.656	72.81%	57.5%	.858	.733	-	-	.837	.845
MH	41.63%	20.8%	.871	.558	91.64%	65.1%	.862	.833	-	-	.900	.868
RE	46.84%	53.3%	.865	.598	75.05%	70.4%	.866	.756	-	-	.864	.872
PG	28.31%	97.1%	.850	.458	74.07%	96.9%	.858	.740	-	-	.850	.860
PE	61.43%	32.4%	.900	.707	79.66%	48.5%	.898	.805	-	-	.896	.901
BO	74.67%	78.9%	.919	.821	42.79%	61.4%	.919	.602	-	-	.916	.929
LP	56.77%	30.3%	.967	.666	85.76%	66.3%	.878	.641	-	-	.861	.869
SIER	-	-	.927	.649	27.88%	-	.933	.432	-	-	-	-
SBA	-	-	.899	.611	21.86%	-	.902	.396	-	-	-	-
ESUAS	43.55%	-	.935	.558	-	-	.969	.781	-	-	-	-
Gen Fac	43.55%	-	1.00	.558	24.87%	-	.962	.419	-	-	-	-
Level 1	56.29%	-	.913	.650	73.35%	-	.930	.722	-	-	.970	.868
Level 2	-	-	.847	.634	-	-	1.00	.781	-	-	-	-
Model	55.02%	49.4%	.935	.589	64.54%	61.9%	.972	.608	-	-	.970	.868

Note. n = 198. Descriptive statistics for the three retained models, including the variability explained by the model, internal consistency, and degree of standardized loading strengths. A model comparison reveals the model with the best descriptive statistics is the nine-factor model. However, this model does not support the use of the total and some sub-scale scores. Among the two hierarchical bifactor models, which do support the total and all sub-scale scores (i.e., SIER and SBA), the Hierarchical Bifactor - 2 GF model outperforms the Hierarchical Bifactor - 1 GF model, despite having similar fit assessments. GF = general factors, SO = sociability, EN = enjoyment, PH = physical health, RE = relaxation, PG = personal growth, PE = performance enhancement, BO = boredom, LP = life processing, SIER = substance-induced emotion regulation, SBA = substance-based assistance, ESUAS = enthusiastic attitude toward substance use, Gen Fac = general factor(s), Level 1 = sub-constructs in the hierarchical model, Level 2 = higher-order constructs in the hierarchical model, Model = model-wide statistics, EVC = the explained common variance in the items by the factors, R^2 = explained variability in the factors by the items, Omega = factor internal consistency, ASL = average standardized loadings. We placed a (-) where there could be a statistic in the table, but that statistic is not calculatable, meaningful, or appropriate given the model specifications.

Figure 1

Path Diagram of the ESUAS Factor Structure that Offers the Best Explanation of the Data



Note. Path diagram of the ESUAS factor structure that offers the best explanation of the data with completely standardized parameter estimates and one-tailed *p*-values. This model contains excellent global fit, local fit, significant and strong parameter estimates, high explained variability, and excellent internal consistency. We eliminated these variances and error terms from the figure for ease of interpretation, *$p < .05$.

Table 7

Descriptive statistics by item and subscale

Items	Item Descriptive						Subscale Descriptive Statistics									
	M	*SD*	γ	κ	Min	Max	Domain	α	IIC	*M*	*SD*	γ	κ	Min	Max	Cohen's *d*
SO_1	2.01	1.24	0.95	-0.27	1	5	Sociability	.79	.66	4.24	2.33	0.87	-0.21	2	10	1.40*
SO_2	2.23	1.32	0.72	-0.68	1	5										
EN_1	2.98	1.25	0.01	-1.09	1	5	Enjoyment	.85	.86	5.68	2.35	0.21	-0.89	2	10	2.00*
EN_2	2.69	1.27	0.37	-0.93	1	5										
PH_1	1.7	1.18	1.70	1.75	1	5	Physical Health	.83	.71	3.43	2.18	1.67	1.86	2	10	1.12*
PH_2	1.73	1.18	1.58	1.45	1	5										
MH_1	2.19	1.50	0.88	-0.76	1	5	Mental Health	.86	.81	4.68	2.72	0.82	-0.65	2	10	1.36*
MH_2	2.48	1.40	0.56	-0.97	1	5										
RE_1	2.03	1.25	0.96	-0.27	1	5	Relaxation	.86	.79	4.12	2.40	0.92	-0.32	2	10	1.30*
RE_2	2.1	1.31	0.97	-0.31	1	5										
PG_1	1.62	0.96	1.59	1.87	1	5	Personal Growth	.85	.72	3.27	1.85	1.53	1.59	2	10	1.23*
PG_2	1.66	1.02	1.57	1.78	1	5										
PE_1	1.97	0.12	1.16	0.32	1	5	Performance Enhancement	.90	.81	3.86	2.34	1.26	0.52	2	10	1.23*
PE_2	1.89	1.25	1.31	0.53	1	5										
BO_1	1.92	1.28	1.17	0.04	1	5	Boredom	.92	.84	3.93	2.47	1.18	0.14	2	10	1.19*
BO_2	2.02	1.29	1.08	-0.04	1	5										
LP_1	1.58	1.01	1.91	2.95	1	5	Life Processing	.86	.75	3.34	1.95	1.58	1.81	2	10	1.20*
LP_2	1.77	1.07	1.37	1.07	1	5										

Higher-Order Scales Descriptive Statistics

Scale	α	*M*	*SD*	γ	κ	Min	Max	Cohen's *d*
SIER	.93	25.99	11.37	0.84	0.02	12	60	1.23*
SBA	.90	12.14	6.19	1.44	0.14	7	33	0.83*
Total	.94	36.56	15.23	0.87	-0.06	18	79	1.21*

Note. $n = 198$. *M* = mean score, *SD* = standard deviation, γ = skewness, κ = kurtosis, Min = lowest score reported, Max = highest score reported, α = Cronbach's alpha, IIC = inter-item correlation, SIER = substance-induced emotion regulation, SBA = substance-based assistance, SO = sociability, EN = enjoyment, PH = physical health, RE = relaxation, PG = personal growth, PE = performance enhancement, BO = boredom, LP = life processing, Cohen's *d* = effect size from bias-corrected and accelerated bootstrapped (1000 samples) one-sample one-tailed *t*-test. We provided IIC because Cronbach's alpha is not appropriate for two-item scales (Ensinga et al., 2013), $*p < .05$.

Construct Validity

We then tested whether the subscale and total scores appeared to measure the intended construct measured using bivariate Pearson correlations. We displayed all construct validity correlations in Table 8.[7] The results revealed that ESUAS subscales and scale scores appear to be measuring the intended construct. Regarding convergent validity, the ESUAS subscales and scale score significantly positively correlated with the measures of substance use and substance use disorders (viz., DUDIT, DAST, and polysubstance use), suggesting that the ESUAS is capturing variability related to substance use and substance use disorders. Further, although individuals use substances to regulate their emotions and help them function, all the significant correlations between the ESUAS and the SWLS were negative, suggesting that using substances, although helpful, may not lead to a subjective good life. We confirmed this effect using the WHOQOL-BREF, where individuals use substances to help them, but it may not lead to a good quality of life. In fact, environment and psychological quality of life are negatively related to the ESUAS, suggesting that people may use substances when they have poor mental health and live in a poor environment. Individuals may also use substances to help them because they have low satisfaction with life and quality of life.[8] Moreover, the ESUAS subscale and scales significantly positively correlated with many of the DERS subscales, primarily the difficulty with goal-directed behaviors, poor impulse control, and emotion regulation challenges, suggesting that emotion regulation difficulties somewhat explain why individuals use substances to regulate

[7] With the current sample size of 198, an a priori power analysis determined that these correlations must be greater than, $r = .199$ to reach 80% power, which is a small effect size for human-subjects medical research (Mukaka, 2012) and using empirically derived interpretations (Lovakov & Agadullina, 2021). The average power of the correlations, $k = 32$, that fall below this cut-off is 60%, with 53.1% for the weakest correlation, $r = .14$, Thus, although our chances of making a Type II error are higher among the very weak correlations, many of the most notable correlations (e.g., total score and DUDIT) having power well over 99.99%. Thus, we have a sufficient sample size for reasonably small correlations and to stabilize our estimates (Schönbrodt & Perugini, 2013).

[8] Given that the data are cross-sectional, it is not possible to determine causation. Thus, interpretations beyond a simple relationship are speculative and can go in either direction or be affected by other, unmeasured variables.

their emotions and promote goal-directed behavior. Finally, regarding divergent validity, many correlations that should not correlate with the ESUAS were non-significant, including unawareness of emotions, relationship quality of life, and conscientiousness. Thus, the ESUAS subscales and total score appear to measure the intended constructs. We further show this construct validity in Figure 2.

Diagnostic Validity

Discrimination

Individuals who develop a substance use problem may be more likely to report that substances are beneficial in some way, even if it is just withdrawal alleviation (captured by our physical subscale). We tested this hypothesis using BCa bias-corrected bootstrapped independent samples t-tests of the ESUAS total score and replicated the results between two measures of substance use problems. The DUDIT (i.e., a score of eight or higher; Hildebrand, 2015) and DAST-10 (i.e., a score of six or higher; Skinner, 1982) have cut-off criteria for dichotomizing those who are at a high risk of having substance use problems and those who are at a low risk of adaptive impairments from their substance use. We displayed the results in Table 9. Across every subscale and total score of the ESUAS, individuals that the DUDIT and DAST-10 place in the high risk of having substance use problems category reported that they find substances to be much more beneficial than those who are low risk.

Table 8

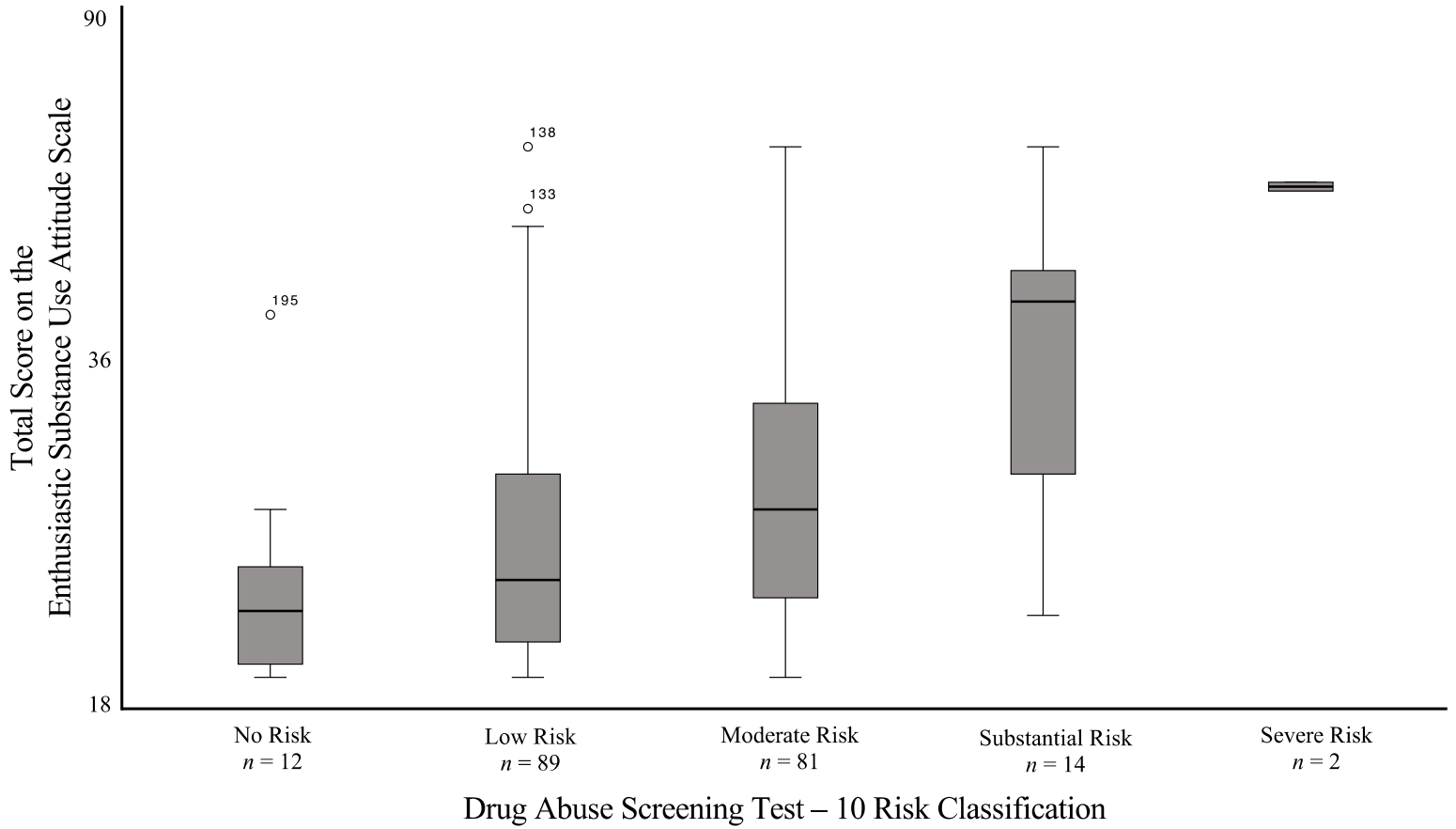
Construct validity of subscale scores

Measure	SO	EN	PH	MH	RE	PG	PE	BO	LP	SER	SAS	TO
DAST	**.46**	**.43**	**.16**	**.42**	**.37**	**.27**	**.19**	**.50**	**.39**	**.54**	**.25**	**.48**
DUDIT	**.45**	**.45**	**.34**	**.41**	**.43**	**.45**	**.41**	**.46**	**.45**	**.54**	**.46**	**.57**
SWLS	**.43**	.05	-.07	**-.31**	**-.16**	**-.15**	-.07	**-.18**	**-.19**	**-.21**	**-.11**	**-.19**
PSU Monthly	**.42**	**.40**	**.24**	**.49**	**.47**	**.31**	**.24**	**.46**	**.40**	**.55**	**.30**	**.52**
PSU Weekly	**.27**	**.35**	**.25**	**.47**	**.37**	**.35**	**.28**	**.40**	**.38**	**.47**	**.34**	**.47**
PSU Daily	.11	**.16**	**.32**	**.33**	**.30**	**.32**	**.36**	**.23**	**.31**	**.30**	**.38**	**.36**
WHOQOL-Bref												
Psychological	-.05	-.04	-.07	**-.20**	-.09	-.13	-.11	-.12	**-.18**	**-.15**	-.11	**-.15**
Physical	.01	.02	.04	-.07	.00	.01	.05	-.05	-.03	-.03	.04	.00
Environment	-.06	-.03	.01	**-.19**	**-.16**	-.10	-.10	**-.20**	**-.17**	**-.17**	-.07	**-.15**
Relationships	-.05	.07	.00	-.01	.08	.01	.09	.00	-.02	.02	.04	.03
DRES												
Acceptance	.09	.00	.07	.11	-.02	.01	-.01	.02	.02	.05	.03	.05
Goal-Directed	**.27**	**.17**	.07	**.20**	**.23**	.13	**.15**	**.27**	.14	**.27**	.13	**.25**
Impulse Control	**.23**	**.23**	**.14**	**.25**	**.23**	**.23**	**.16**	**.33**	.31	**.33**	**.20**	**.32**
Unawareness	-.01	.02	.01	-.01	-.03	-.01	.01	.01	.01	.00	.01	.00
Emotion Regulation	**.17**	.12	.12	**.34**	**.17**	**.14**	.09	**.23**	**.21**	**.26**	.13	**.25**
Clarity	.10	.11	-.01	**.22**	.06	.02	-.09	**.23**	.13	**.18**	-.03	.12
BFI-10-R												
Conscientiousness	-.05	.01	.05	.04	.10	-.05	-.02	.04	-.04	.03	-.01	.02
Agreeableness	-.11	**-.15**	-.05	.02	-.05	-.12	-.11	-.10	-.12	-.10	-.11	-.11
Neuroticism	.00	-.12	.04	**.16**	.02	-.02	.00	.03	.03	.03	.01	.03
Openness	.00	.03	**.15**	-.01	.07	**.15**	.06	.04	.11	.05	.13	.08
Extraversion	.01	**.17**	**.18**	.13	.13	.12	.11	.12	.08	.14	**.15**	**.16**

Note. n = 198. Cell color approaches black shading as the correlation strength reaches ± 1. Bolded correlations indicate a two-sided $p < .05$. DAST = Drug Abuse Screening Test, DUDIT = Drug Use Disorder Identification Test, PSU = Polysubstance Use, WHOQOL-BREF = World Health Organization Quality of Life - Brief, DRES = Difficulty Regulating Emotions Scale, BFI-10-R = Big Five Inventory-10 Revised, SIER = substance-induced emotion regulation, SBA = substance-based assistance, SO = sociability, EN = enjoyment, PH = physical health, RE = relaxation, PG = personal growth, PE = performance enhancement, BO = boredom, LP = life processing, TO = total score.

Figure 2

Total Score on the ESUAS by DAST-10 Risk Categorization



Note. n = 196. Box and whisker plot the composite scores on the ESUAS grouped by DAST-10 risk categorization. The top and bottom sides of the boxes are the 25th and 75th quartiles, respectively. The horizontal line that splits the box is the median, and the error bars represent the minimum and maximum scores. The white circles indicate participant outlier score.

ROC Analysis

We conducted a receiver operating characteristic (ROC) analysis to determine the diagnostic validity of the total score of the ESUAS, given its excellent discriminant validity. We used the DUDIT cut-off as 8 to separate those with a substance use problem from those without, as the DUDIT is the "gold standard" measure of substance use problems. The ROC analysis model quality was high, as evinced by a 73% accurate categorization, significantly higher than 50% or random assignment. The area under the curve was significantly large, AUROC = .788, SE = .032, $p < .001$. Given this AUROC, the post-hoc power for this test is over 99.99%. The cutoff suggested by the ROC was 27 or higher (or nine or higher if 0 = *not at all*), which indicated problematic use is likely. The sensitivity of this cutoff was 83.8%, and the specificity was 60.9%. These results suggest that using the ESUAS with a cutoff score of 27 or higher can accurately identify many cases of problematic substance use (i.e., low false negatives) but may result in some false positives, which may be more acceptable for measures of psychopathology.

Incremental Validity

We finally examined the incremental validity of the ESUAS in explaining unique variability using four-level hierarchical linear regressions (HLR), one for the DUDIT (i.e., the gold-standard measure of SUDs) and one for monthly polysubstance use (mPSU). We compared the ESUAS to other well-established correlates of SUDs, including facets of emotion regulation difficulties (DRES; Step 1), Big Five personality traits (BFI-10-R; Step 2), and quality of life domains (WHOQOL-Bref; Step 3). In Step 4, we added the ESUAS total score to assess the degree of shared and unique variability explained in our dependent variables.

Table 9

Elevated risk related to finding perceived substance use benefits

Measure	Risk Category	DAST-10	Cohen's *d*	DUDIT	Cohen's *d*
Sociability	Low	4.14 (2.23)	1.41*	3.54 (2.00)	0.60*
	High	6.75 (2.27)		4.88 (2.42)	
Enjoyment	Low	5.56 (2.25)	1.47*	4.60 (2.01)	0.98*
	High	7.88 (2.00)		6.66 (2.19)	
Physical Health	Low	3.32 (2.09)	0.83*	2.80 (1.55)	0.57*
	High	4.75 (2.72)		4.00 (2.50)	
Mental Health	Low	4.52 (2.64)	1.17*	3.68 (2.23)	0.74*
	High	7.31 (2.57)		5.57 (2.81)	
Relaxation	Low	4.07 (2.31)	1.04*	3.26 (1.83)	0.72*
	High	5.94 (3.11)		4.90 (2.59)	
Personal Growth	Low	3.16 (1.75)	0.67*	2.46 (1.04)	0.92*
	High	4.75 (2.38)		4.00 (2.09)	
Performance Enhancement	Low	3.74 (2.25)	1.06*	2.98 (1.50)	0.76*
	High	5.19 (2.88)		4.65 (2.65)	
Boredom	Low	3.72 (2.26)	0.79*	3.05 (1.89)	0.72*
	High	7.19 (2.79)		4.72 (2.65)	
Life Processing	Low	3.32 (1.89)	0.88*	2.79 (1.30)	0.66*
	High	6.00 (2.88)		4.11 (2.46)	
SIER	Low	25.33 (10.60)	0.63*	20.93 (8.81)	0.95*
	High	41.06 (12.04)		30.84 (11.61)	
SBA	Low	10.22 (5.20)	1.50*	8.24 (3.17)	0.87*
	High	14.69 (6.91)		12.65 (6.32)	
Total	Low	35.55 (14.16)	1.35*	29.17 (10.83)	1.05*
	High	55.75 (16.64)		43.49 (15.64)	

Note. $n = 198$. *M* (*SD*) for the risk categories across the Drug Abuse Screening Test - 10 (DAST-10) and the Drug Use Disorders Identifications Test (DUDIT). SIER = substance-induced emotion regulation, SBA = substance-based assistance, Cohen's *d* is the average effect size from BCa bias-corrected bootstrapped (1000 samples) two-sample t-test, *$p < .05$

The ESUAS attains incremental validity if it explains unique variability in the dependent variables above and beyond the difficulties regulating emotions, Big Five personality traits, and quality of life domains. The incremental validity is substantial if the ESUAS accounts for all the variability in other correlates as evinced by nonsignificance once we add the ESUAS.

The analyses did not violate any assumptions, including multicollinearity, DUDIT: VIFs < 3.55, mPSU: VIFs < 3.59), heteroscedasticity as evinced by uniform plots of the standardized predicted and standardized residual values, linearity as evidenced by uniform P-P plots, and there were no multivariate outliers, DUDIT: Cook's Distance < 0.11, mPSU: Cook's Distance < .13. Post-hoc power analyses suggested that both HLRs were well-powered (DUDIT: > 99.0%; mPSU: > 87.1%). We displayed the results in Table 10. In Step 1, poor impulse control emerged as the only significant correlate for the DUDIT, and no component of the DRES significantly correlated with mPSU. In Step 2, the pattern of significant predictors remained the same as in Step 1 for the DRES; for the BFI-10-R, contentiousness, openness, and extraversion significantly correlated with the DUDIT, but only extraversion correlated with mPSU. The addition of the BFI-10-R significantly improved both the DUDIT, $p < .001$, and the mPSU, $p = .012$, models, DUDIT: $\Delta R^2 = 11.0\%$, mPSU: $\Delta R^2 = 7.0\%$, and the effects were small, DUDIT: Cohen's $f^2 = .144$, mPSU: Cohen's $f^2 = .081$. In Step 3, the addition of the WHOQOL-Bref did not significantly improve either the DUDIT, $p = .401$, or the mPSU, $p = .393$, models.

Finally, we added the ESUAS total score to the model in Step 4 to assess incremental validity. The addition of the ESUAS significantly improved both the DUDIT, $p < .001$, and the mPSU, $p < .002$, models. The ESUAS independently explained 17.5% additional variability in the DUDIT and 17.3% in mPSU than the variability explained by all other correlates in Step 3 – more than doubling the explained variability in mPSU. $R^2 = 15.6\%$, in Step 3 to, $R^2 = 33.0\%$, in

Table 10

Four-Step Hierarchical Linear Regressions Demonstrating the Incremental Validity of the ESUAS

Dependent Variable	DUDIT				Monthly Polysubstance Use			
Step	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4
DRES								
Acceptance	-.172	-.144	-.132	-.023	.017	.001	-.011	.090
Goal-Directed	.077	.113	.104	.036	.042	.081	.081	.018
Impulse Control	**.315**	**.262**	**.283**	.147	.184	.169	.167	.042
Unawareness	-.013	.044	-.023	.026	-.107	-.027	-.048	-.008
Emotion Regulation	.098	.064	.006	-.046	-.013	-.026	-.057	-.108
Clarity	-.026	.006	-.003	-.008	.125	.155	.173	.160
BFI-10-R								
Conscientiousness		**-.170**	-.158	-.186		.026	.025	-.004
Agreeableness		**.210**	**.225**	**.173**		.102	.089	.038
Neuroticism		.090	.067	.016		.007	-.018	-.060
Openness		-.148	**-.166**	-.086		-.028	-.012	.053
Extraversion		**.195**	**.206**	.121		**.214**	**.222**	**.151**
WHOQOL-Bref								
Psychological			-.001	-.106			.081	-.017
Physical			-.061	.016			-.102	-.023
Environment			-.076	.025			-.120	-.038
Relationships			-.072	-.096			.115	.068
ESUAS				**.487**				**.477**
Model Statistics								
R^2	12.8%	23.8%	25.4%	42.9%	6.7%	13.7%	15.6%	33.0%
Adjusted R^2	10.0%	19.2%	19.3%	37.8%	3.8%	8.6%	8.7%	27.1%
ΔR^2	-	11.0%	1.7%	17.5%	-	7.0%	1.9%	17.3%
ΔF	-	**5.32**	1.02	**55.06**	-	**3.01**	1.03	**46.82**
Cohen's f^2	-	.144	*n.s.*	.306	-	.081	*n.s.*	.260
Post-Hoc Power	-	99.0%	*n.s.*	> 99.99%	-	87.1%	*n.s.*	> 99.99%

Note. n =198. Standardized regression coefficients (β) of the four-step hierarchical linear regressions that demonstrate that the ESUAS explained significant variability above and beyond all DRES, BFI-10-R, and WHOQOL-Bref subscales. This effect is medium to large and well-powered, suggesting that the ESUAS has notable incremental validity over the well-documented correlates of substance use and substance use disorders. We used bias-corrected and accelerated bootstrapped estimates (1000 samples). Cell color shading darkens as the proportion of explained variability in the dependent variable approaches the maximum variability explained by the best predictor. This design allows for a visual representation of the variables pooling the most variability. DUDIT = Drug Use Disorder Identification Test, DRES = Difficulty Regulating Emotions Scale, BFI-10-R = Big Five Inventory-10 Revised, WHOQOL-BREF = World Health Organization Quality of Life - Brief, ESUAS = Enthusiastic Substance Use Attitudes Scale. Bolded correlations indicate a two-sided $p < .05$ and estimates in white represent the best predictor of the step, *n.s.* = no significance.

Step 4. These effects were medium to large, DUDIT: Cohen's f^2 = .306, mPSU: Cohen's f^2 = .260. Further, an analysis of the coefficients revealed that the ESUAS explained all of the variability previously significant correlates explained in Step 3, except for agreeableness for the DUDIT and extraversion for mSPU. However, the ESUAS had a much larger standardized coefficient than agreeableness in the DUDIT model, Agreeableness: β = .173, ESUAS: β = .487, and conscientiousness in the mPSU model, Conscientiousness: β = .173, ESUAS: β = 487. These findings suggest that the ESUAS demonstrated substantial incremental validity over the facets of difficulties regulating emotions, the Big Five personality traits, and quality of life domains.

Discussion

In the current study, we aimed to create a brief, multidimensional measure to characterize the enthusiastic attitude towards the perceived benefits of substance use to improve the limitations of the existing literature, specifically the ecological validity. We reduced a 90-item item pool based on a comprehensive search of social media, traditional media, and scientific literature to an 18-item hierarchical bifactor model. This model contained twelve highly internally consistent, calculatable scores, which are 1) sociability, 2) enjoyment, 3) boredom, 4) mental health, 5) relaxation, 6) life processing, 7) performance enhancement, 8) boredom, and 9) personal growth, 10) substance-induced emotion regulation, 11) substance-based assistance, and 12) a composite score. Further, the ESUAS demonstrated excellent and strong structural, convergent, divergent, incremental, and diagnostic validity. These psychometric analyses suggest that the ESUAS is a valid, internally consistent, and comprehensive measure of the many reasons individuals report benefiting from substance use.

Implications

There are several notable advantages to having the ESUAS to measure an enthusiastic attitude toward the perceived benefits. From a clinical perspective, this enthusiastic attitude towards perceived substance use benefits may be an essential risk or predisposing factor of SUDs, thereby expanding our conceptualizations of SUDs. Notably. the enthusiastic attitude towards perceived benefits, SUD symptomology, and polysubstance use positively correlate, suggesting that people with enthusiastic attitudes towards many perceived benefits may use multiple substances and have many problems from that use. Further, previous work supports the potential of a causal influence of the positive subjective benefits on substance use symptomology and problems. For example, researchers have found genetic influence on enjoying alcohol more than typical in families with alcohol use disorder histories (Schuckit, 2009). There is also high comorbidity with emotional disorders, so the motivation to use substances to self-medicate may cause more substance use problems (e.g., alcohol use in veterans with post-traumatic stress disorder; Harris et al., 2019). Finally, researchers may be able to test cognitive-behavioral interventions that target this attitude to provide balance or support and replace these substance-related benefits with non-substance alternatives as a newer avenue of treatment to improve existing outcomes (Stone, 2022a), which is in line with the growing harm reduction approach (Charlet & Heinz, 2017; Sherman et al., 2022; Stockings et al., 2016; Tiffany et al., 2012). Thus, there are countless clinical advantages to measuring this enthusiastic attitude with the ESUAS.

Beyond clinical psychological treatments, knowing about this construct provides important benefits. A prominent stigmatizing belief is that illicit substances and prescription misuse have little benefits and substantial negative consequences, which may contribute to a stereotype of those with SUDs as weak-minded, unintelligent, or irresponsible because they use or misuse, despite the “obvious harm” (Nieweglowski et al., 2019; Stone, 2022a, 2022b).

Researchers may incorporate empirical data on this enthusiastic attitude and the documented perceived benefits to reduce the stigma against those with SUDs by providing insight and balance to this stigmatizing narrative (Stone, 2022b; Van Boekel et al., 2013). Further, the veracity of the actual effects of the perceived benefits remains unclear, given the strong correlations with SUD symptomology. Some individuals likely have perceived benefits that lead to SUDs (e.g., to cope with trauma), and some might not (e.g., occasional use to relax). Ideally, self-reported benefits and the enthusiastic attitudes may encourage early work suggesting some illicit substances can treat some conditions (e.g., psilocybin [mushrooms] and MDMA [ecstasy] for trauma or ketamine for depression; Averill et al., 2020; Bird et al., 2021). Stigma has detrimental effects for people with SUDs, so addressing and providing contrary evidence is a worthwhile endeavor.

Limitations & Future Directions

Researchers must interpret these finds within the bounds of this study's limitations. For example, use of undergraduate students limits the ability to determine how the ESUAS generalizes to different populations. Although some studies have demonstrated that student samples are an adequate population for testing structural analyses, measuring psychometrics, and examining clinical constructs (e.g., Gao, 2020; Mahfouz et al., 2020; Renshaw & Hindman, 2017; Zhang et al., 2020), it is challenging to determine how the measure will behave across different settings, including prison, outpatient, residential, inpatient, and community settings. Another area for future research is using a longitudinal design to examine the predictive validity, test-retest reliability, and intervention sensitivity. Adding this measure to treatment and clinical trials may reveal how some interventions change one's attitude toward the perceived benefits of substance use (e.g., cognitive restructuring diminishing the perceived benefits of substance use).

Further, Additionally, we used a convenience sample which limited our sample size. To address this limitation, we bootstrapped all inferential tests, provided power analyses demonstrating sample size sufficiency, used a robust estimation method for the CFAs, and checked all assumptions. Most notably, the content validity assessments did not reach essentialness, suggesting that this construct may need further characterization refinement. This lack of content validity is typical for defining new constructs because the extent of the content of this construct remains unclear.

Conclusion

The purpose of the current investigation was to validate a brief measure of a largely uncharacterized new multidimensional enthusiastic attitude towards perceived substance use benefits. The results of our study suggest that an 18-item combination of the initial item pool provides excellent psychometric properties and measures a broad range of perceived benefits that have the potential for enthusiastic attitudes. The ESUAS may be an effective tool for professionals to develop and measure a more ecologically valid view of those with SUDs, thereby developing understanding from the general public, advancing medicinal uses of illicit substances, and improving conceptualizations and treatments. These advances may improve the experiences of those with SUDs, allowing them to advance quicker and easier toward remission and improving their functioning.

Declarations

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Biographical Note: Bryant M. Stone, Ph.D., is a postdoctoral fellow at the Johns Hopkins Bloomberg School of Public Health. His research program focuses on unconventional approaches to substance use disorders, including inclusive and synoptical pathogenesis perspectives (e.g., environmental or biological), alternative treatments (e.g., positive psychology and strengths-based treatments), understudied applications of mechanisms of behavioral change (e.g., behavioral economics and craving reductions), substance use stigma (e.g., within medicine or among policymakers), and policy change (e.g., harm reduction and prevention over punishment). He graduated with a Doctor of Philosophy in Clinical Psychology after completing his predoctoral internship at the Medical University of South Carolina in 2023. He has focused much of his research on developing an evidence base for legitimizing positive psychological interventions (e.g., character strengths or gratitude) as efficacious, cognitive behavioral interventions and their application to substance use disorders. In 2023, he released his therapy protocol titled, *The PPI Companion: Empirically Supported Positive Psychological Interventions for the Promotion of Well-Being*, You can learn more about his research on his ResearchGate, Google Scholar, ORCiD, by reviewing his current CV, or by contacting him directly at

contact@bryantstonephd.com. He strives to continue to dedicate his work to helping individuals use positive psychology to improve their life satisfaction and well-being.

Ethics approval: This study was approved by the Human Subjects Committee at Southern Illinois University (Protocol Number: 062422; Assurance Number: FWA00005334). All participants read and agreed to informed consent before participating in the current study.

Consent for publication: The author confirms that he is the sole contributor to the current work and has reviewed and agreed to its publication.

Availability of data, code, and material: All data, syntax, and materials are freely available on the Open Science Framework website: https://osf.io/wkt9y/?view_only=670dfeaff2984594810753980db16d3e

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