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Ayahuasca-Assisted Therapy for Addiction: Results from a Preliminary Observational Study in Canada

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Abstract: *Introduction*: This paper reports results from a preliminary observational study of ayahuasca-assisted treatment for problematic substance use and stress delivered in a rural First Nations community in British Columbia, Canada.

Methods: The "Working with Addiction and Stress" retreats combined four days of group counselling with two expert-led ayahuasca ceremonies. This study collected pre-treatment and six months follow-up data from 12 participants on several psychological and behavioral factors related to problematic substance use, and qualitative data assessing the personal experiences of the participants six months after the retreat.

Findings: Statistically significant ($p < 0.05$) improvements were demonstrated for scales assessing hopefulness, empowerment, mindfulness, and quality of life meaning and outlook subscales. Self-reported alcohol, tobacco and cocaine use declined, although cannabis and opiate use did not; reported reductions in problematic cocaine use were statistically significant. All study participants reported positive and lasting changes from participating in the retreats.

Conclusions: This form of ayahuasca-assisted therapy appears to be associated with statistically significant improvements in several factors related to problematic substance use among a rural aboriginal population. These findings suggest participants may have experienced positive psychological and behavioral changes in response to this therapeutic approach, and that more rigorous research of ayahuasca-assisted therapy for problematic substance use is warranted.

Keywords: addiction, ayahuasca, cocaine, substance dependence, substance use, harm reduction.

BACKGROUND

Ayahuasca is a psychotropic brew prepared from the Amazonian vine *Banisteriopsis caapi* and leaves of the bush *Psychotria viridis*. These plants contain, respectively, harmala alkaloids and dimethyltryptamine (DMT), which when ingested in combination orally induce several hours of a dream-like altered state of consciousness characterized by intense visual, auditory, ideational and emotional effects [1, 2]. The presumed biochemical mechanism of action for ayahuasca brews includes presence of beta-carboline monoamine oxidase inhibitors (harmala alkaloids) coupled with dimethyltryptamine, a compound that acts on specific serotonin receptors, particularly 5-HT_{2A} receptors [3, 4].

Ayahuasca has traditionally been drunk in ritual contexts by Amazonian indigenous and mestizo peoples for a variety of divinatory, magical, spiritual, aesthetic and other cultural purposes, including as a diagnostic aid and herbal remedy in folk healing practices [5]. In the late 20th and early 21st centuries, ayahuasca drinking became a transnational phenomenon through increased tourism to the Amazon, ceremonies regularly conducted by itinerant ayahuasqueros (i.e., individuals trained to administer ayahuasca within an Amazonian folk healing ritual context) in the global North, and a few Brazilian ayahuasca religions establishing active spiritual communities in countries around the world [6, 7]. The transnational expansion of ayahuasca has been accompanied by growing scientific interest in the brew's potential therapeutic or salutogenic value. Preliminary research has shown ayahuasca has promise for alleviating some mental disorders and for providing other long-term health and social benefits among regular drinkers of the brew in ritualized and religious community contexts [4, 8-11].

Importantly, the ritual use of ayahuasca does not typically produce health or psychosocial problems such as addiction [12-14]. Rather, ceremonial ayahuasca drinking has been correlated with lower amounts or severities of substance dependence. For example, Grob *et al*. [9] found that among a randomly selected group of União do Vegetal (or UDV, a Brazilian ayahuasca church) members, a majority reported a prior history of moderate to severe problems with alcohol or other drugs, but all had stopped using substances other than ayahuasca (including tobacco) after joining the church and attributed their improved health behaviors to ayahuasca drinking. The UDV subjects also reported less excitability and impulsivity, and more confidence and optimism compared with matched-control community members who did not use ayahuasca [9]. Fábregas *et al*. [13] examined addiction severity among 56 people belonging to two different Brazilian ayahuasca churches (UDV and Santo Daime), and found higher lifetime illicit drug use but lower past-month use of alcohol and no

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use of psychoactive drugs other than ayahuasca and cannabis in the last 30 days, compared with matched controls from the community. In interviews with 32 members of a U.S.-based chapter of the Santo Daime church, Halpern *et al*. [10] found that, of 24 who reported past substance abuse or dependence, all but two were in sustained remission and all five with prior alcohol dependence attributed their recovery to participation in the church's rituals. However, all these studies involve subjects who are regular and committed members of religious communities, so it remains unclear whether fewer reported substance use problems can be attributed to the ayahuasca drinking rather than being a church member.

The use of ayahuasca as a remedy to help overcome drug addictions is a fundamental aspect of treatment programs at Takiwasi, a therapeutic community based in Tarapoto, Peru [15]. The Takiwasi approach incorporates various aspects of traditional Amazonian folk medicine (including the use of various medicinal jungle plants, in addition to ayahuasca), communitarian residence and psychotherapy. Similarly, in the state of Amazonas, Brazil, the *Instituto de Etnopsicología Amazónica Aplicada* (or IDEAA) runs a treatment program that combines the ritual use of ayahuasca with complementary psycho-social rehabilitation methods [16]. Although these programs claim improved health outcomes for patients who complete them, neither has been evaluated with sufficient scientific rigor to provide definitive evidence of the success of their approaches. Nevertheless, evidence from members of Brazilian ayahuasca churches, as well as claims of treatment success from Takiwasi and IDEAA, has led researchers to speculate on possible neurochemical, psychological or transcendent mechanisms of ayahuasca's purported therapeutic action [3, 4, 17, 18].

In Canada, First Nations and Aboriginal peoples have been disproportionately affected by illnesses and social problems that are the legacies of colonialism and consequent territorial and cultural dislocation [19], including substance dependence (although considerable variation in epidemiology of addiction exists across this heterogeneous sub-population) [20]. However, current approaches to treating addictions—especially to alcohol and cocaine—continue to be of limited success [21], despite decades of research. Dr. Gabor Maté, a Canadian physician specialized in addictions medicine and experienced in working with Aboriginal people [22], became interested in the potential value of ayahuasca as an adjunct to group therapy in 2009. He began conducting occasional multi-day "Working with Addiction and Stress" retreats in partnership with ayahuasqueros from Peru and British Columbia (the retreat team), reporting positive outcomes for participants from the general Canadian population with a variety of psychological health conditions and illness severities. The retreat team refined the structure, pacing and other elements of their approach over the course of several retreats conducted with mostly non-aboriginal Canadian participants in 2009 and 2010. This allowed the retreat team to establish procedures for enhancing interpersonal rapport and creating a coherent therapeutic context prior to the sessions conducted with the First Nations participants observed in this study.

The retreat team's work with ayahuasca came to the attention of a rural aboriginal First Nations band in southwestern British Columbia, which invited the team to conduct retreats for community members with substance dependence or other habitual behavioral problems, such as problem gambling. The band's health office was interested in exploring whether a traditional indigenous practice from South America might help address some of the past trauma and consequent health issues that its community members were experiencing and that Western medical and legal approaches have not been reliably effective at curtailing.

Following the decision to provide this treatment to members of the community, the band's health office offered the authors of this article (the research team) an opportunity to conduct an observational study of the retreats in order to more systematically document and assess the effects of the treatment. Funding for the study was secured through philanthropic donations to the Multidisciplinary Association of Psychedelic Studies (MAPS) and through an anonymous donor. In February 2011, members of the research and retreat teams met with the band Council and band Elders to discuss the retreats and obtained their consent for the study. At the request of the band leadership, the band's health office agreed to closely monitor participants for any adverse psychological or other reactions following the retreats. Subsequently, two retreats were conducted, one in June 2011 and the other in September 2011.

PURPOSE

The objective of this research was to assess the impact that this form of ayahuasca-assisted group therapy may have on several measures of mental and behavioral health related to addiction. The primary outcomes of interest relate to the ability of participants to consciously and consistently make choices that promote long-term psychological, emotional, and physical well-being rather than acting compulsively on immediate urges based on conscious or unconscious emotional needs and/or unhealthy psychological patterning (i.e., addiction) [22]. We posited that this novel form of therapy could enhance the ability of participants to make conscious healthy choices and resist unhealthy urges by eliciting improvements in several attributes related to problematic substance use [21].

Specifically, we collected data to assess the following propositions:

- that participation in the ayahuasca ceremonies in the context of the "Working with Addiction and Stress" retreats would be associated with improvements in mindfulness, emotional regulation, personal empowerment, hopefulness and quality of life in study participants; and,
- that participation in the retreats would be associated with reductions in problematic substance use.
- Semi-structured interviews conducted six months after the retreats provided additional qualitative data from participants' reflections on the outcomes of their experiences.

METHODS

Observational Study Procedures

Ethics review and approval was provided by the Institutional Review Board Services (IRBS), an independent research ethics review board. The band's health office notified the community of the retreats and recruited potentially eligible participants. Twelve participants were recruited for the first retreat in June 2011 with six new participants recruited for the September retreat; all were members of the same coastal First Nations band and most were residents of the community. Approximately two weeks prior to each retreat, a member of the research team contacted registered participants and asked if they would be willing to participate in the research study. After expressing interest, all potential participants were informally screened for inclusion criteria (voluntary attendance and the ability to communicate in English), and exclusion criteria (under age 18; have drunk ayahuasca in the past; taking selective serotonin reuptake inhibitor or monoamine oxidase inhibitor medications; currently experiencing psychosis or have experienced a psychotic break in the recent past). The latter two exclusion criteria pertained not to the research methodology *per se*, but to safety precautions relating to potential medical contraindications from the pharmacokinetics of ayahuasca, and so had already been initially screened by the retreat team.

Those who met the criteria for participation (n = 18) were invited to attend a group orientation session at the band's health office several hours before the start of the retreat. At the group orientation, inclusion/exclusion criteria were formally verified, written consent (after further explaining purpose, procedures and potential risks/benefits of the research) was obtained, and initial self-administered surveys were conducted to collect baseline data on a number of psychological and behavioral factors related to problematic substance use. The particular psychometric instruments used in this study—the *Difficulty in Emotion Regulation Scale* (DERS), the *Philadelphia Mindfulness Scale* (PHLMS), the *Empowerment Scale* (ES), the *Hope Scale* (HS), the *McGill Quality of Life* survey (MQL), and the *4 Week Substance Use Scale* (4WSUS)—all measure aspects of psychological health that relate in some way to problematic substance use; more explicit rationales for their inclusion are discussed in detail below.

Immediately following the end of the retreats, the *State of Consciousness Questionnaire* (SOCQ) was administered to participants to assess the nature and intensity of their ayahuasca experiences. Two weeks after the completion of the retreat, the six baseline instruments were re-administered (for the first follow-up at two weeks, the 4WSUS was modified to assess substance use during the previous 14 days). Participants were subsequently contacted again four weeks following the retreats, and monthly thereafter for five months, for further data collection using the same six measures. Additionally, at the urging of several study participants, the research team added a short semi-structured interview, subsequent to amended ethics approval, as part of the final follow-up session to collect qualitative data about participant experiences and impressions during and after the retreats (Table **1**).

A total of seven post-retreat follow-up assessments were conducted, most in person in a group setting at the band's health office. In cases where the participant was not living in the community or otherwise unable to attend the in-person follow-up session, follow-ups were conducted by telephone, and occasionally the instruments were completed by the participant on their own time and returned to the research team. A $20 gift certificate to a grocery store was offered to every participant for each follow-up session, and meals were provided at in-person sessions.

Observational Study Instruments and Rationales for their Use

Difficulty in Emotion Regulation Scale (DERS) is a validated 36-item questionnaire designed to assess the degree to which subjects are able to engage in goal directed behavior and refrain from impulsive behavior when confronted with negative emotion and that has acceptable test/retest reliability; therefore, it is suitable for use in evaluations of substance dependence treatment [23].

Rationale: Desires to regulate both positive and negative emotional states have long been recognized as important motivating factors for substance use [24]. More recently, research has illuminated details about the process of emotional regulation and in particular the role of emotional dysregulation in various forms of psychopathology, including substance dependence [25, 26]. In recent decades, evidence-based approaches that focus on improving emotion regulation have emerged as forms of treatment for substance dependence. For example, Dialectic Behavior Therapy (DBT) is a treatment modality that has been shown to reduce problematic substance use in some clients by teaching them basic skills related to the healthy regulation of emotions [27]. Also in recent years, scholars have documented that reduced *emotional intelligence*, a concept developed to assess various aspects of emotional functioning, is associated with more intensive tobacco smoking, alcohol consumption and illicit drug use [28]. As is the case with most of the factors assessed in this study, healthy emotion regulation is viewed as a protective factor while emotion dysregulation (e.g., chronic and automatic self-distraction when experiencing negative emotions such as fear) is considered a risk factor for problematic substance use.

Philadelphia Mindfulness Scale (PHLMS) is a 20-item validated instrument that assesses the two components of mindfulness posited to have salutary effects on substance dependence (awareness of the present moment and acceptance) and that has been used with various clinical and non-clinical subjects [29].

Rationale: Long-term substance use has been shown to negatively affect certain psychological and behavioral factors required for healthy functioning, including: attention and inhibitory control, the salience of and response to reward stimuli, and the ability to maintain perspective in response to strong emotional states [30]. Mindfulness training, with its focus on assisting substance users to be fully aware of the present moment and to cultivate acceptance of their emotions, can address the affective deficiencies sometimes associated with problematic substance use. A review of 51 published studies showed that mindfulness practice can

Table 1. Schedule of Application of Survey Instruments

	Orientation Meeting (Pre Treatment)	Immediately Following Last Session of the Retreat	Week 2	Week 4/ Months 2-6 (Total of 6 Assessments)	Month 6
DERS	X		X	X	
PHLMS	X		X	X	
MQL	X		X	X	
ES	X		X	X	
HS	X		X	X	
4WSUS	X		X	X	
SOCQ		X			
Qualitative interview					X

influence the brain, the autonomic nervous system, stress hormones, the immune system, and health behaviors including problematic substance use [31]. A more recent review of five controlled studies found that mindfulness training improved outcomes for substance dependent clients over control conditions by allowing them to: 1) accept unusual physical sensations that might be confused with withdrawal symptoms, 2) decentre from a strong urge and not act impulsively, 3) reduce the susceptibility to act in response to a drug cue, 4) maintain perspective in response to strong emotional states and decrease dysfunctional avoidance, and 5) increase the saliency of natural reinforcers [32]. Several empirically validated forms of treatment for substance dependence and mood disorders are based on or incorporate mindfulness training, including: mindfulness-based relapse prevention [33], mindfulness-based stress reduction [34], Acceptance and Commitment Therapy (ACT) [35], Dialectical Behaviour Therapy (DBT) [36], and Cognitive Behavioral Therapy (CBT) [37]. Further, since aspects of the group counselling provided by the retreat team during the workshops are specifically directed at enhancing present-moment awareness and acceptance of participants, this measure was included to assess the mindfulness of participants before and after the intervention to assess improvement and see if it was correlated with reductions in substance use.

Empowerment Scale (ES) is a 28-item questionnaire assessing psychological and social empowerment over five dimensions: self-efficacy/self-esteem, power/powerlessness, affecting change, optimism/control over future, righteous anger, and group/community action. The scale was constructed through a process involving consumers of mental health services and demonstrates acceptable internal consistency [38]. Several of the scale's sub-factors (i.e., self-efficacy/self-esteem, power/powerlessness, community activism, and optimism-control over the future) have been shown to be associated with patterns of problematic substance use.

Rationale: Psychological and social empowerment have been identified as effective components of prevention and health promotion interventions due to their ability to: 1) increase a sense of personal control, and 2) enhance beliefs in the ability of people to act to change their own lives [39]. The issue of empowerment appears to be particularly important for those who have experienced trauma [40]. Following this logic, elements directed at enhancing empowerment have been incorporated into substance use prevention and addiction treatment programs for marginalized youth (including American Indian youths), women who have experienced trauma, and marginalized ethnic minorities [41-44]. We included empowerment as an independent factor in this observational study of participants drawn from a First Nation band, due specifically to the documented inter-generational trauma that this population has experienced over the last several generations and the documented relationship between trauma, powerlessness and problematic substance use [45].

Hope Scale (HS) is a 12-item psychometric questionnaire providing a behaviorally relevant measure of hopefulness by assessing the presence of successful agency (goal-directed determination) and pathways (planning of ways to meet goals) in study participants.

Rationale: Although there is some debate as to whether depression and substance dependence are directly causal to one another or whether they simply share common etiological roots, their co-occurrence is widely acknowledged. Specifically, epidemiological research consistently verifies that depression is relatively common among substance dependent individuals, and problematic substance use is relatively common among those with a primary diagnosis of depression [46]. The association between hopelessness and substance dependence is so fundamental, in fact, that in their work to identify basic personality traits associated with increased risk of substance use problems, researchers from Canada and elsewhere identify "hopelessness" as one of four main at-risk personality traits [the others are anxiety sensitivity, sensation seeking and impulsivity) [47]. At the same time, hopefulness—here defined in terms of agency (goal-directed determination) and pathways (planning of ways to meet goals)—has been shown to be a protective factor against psychological problems such as depression and behavioral problems such as substance dependence, and so was included in the study to assess changes in these measures stemming from participation in the "Working with Addiction and Stress" retreats.

McGill Quality of Life (MQL) survey is a 17-item questionnaire that has been validated for use with clinical palliative care patients assessing quality of life along four

subscales: physical symptoms, psychological symptoms, outlook on life, and meaningful existence.

Rationale: There is theory and some evidence that quality of life and wellness can influence substance dependence patterns, with higher life quality posited to be a protective and rehabilitative factor and lower quality of life posited to be a risk factor, especially for relapse [48, 49]. In this study, quality of life is interpreted as both an independent factor potentially influencing patterns of substance use, and a dependent variable that we predict would increase when the wholly independent factors (emotional regulation, mindfulness, hopefulness and empowerment) increased. It was chosen for this study because it includes existential elements related to mattering (i.e., the meaning of life) as well as measures of physical and psychological well-being [50]. The existential aspect is important for this study given the reported effects of ayahuasca on subjective perceptions of the meaning and nature of existence [51].

4 Week Substance Use Scale (4WSUS) is an 11-item questionnaire based on the World Health Organization's Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) questionnaire that screens for the hazardous use of various legal and illegal psychoactive substances, including prescription drugs.

Rationale: The ASSIST questionnaire is a valid and reliable screen for problematic substance use [52], which has been employed in prevalence studies in several countries, including Canada [53, 54]. The 4WSUS is the main behavioral outcome variable for this study. We modified the 4WSUS slightly to assess use over the past two weeks rather than the past four weeks for the first follow-up so that shorter-term changes in substance use patterns could be identified. Like the ASSIST, the 4WSUS measures problematic substance use by assessing the levels and patterns of use of various substances (i.e., alcohol, tobacco, cannabis, opiates, depressants, hallucinogens, inhalants, and prescription drugs) and several related elements, including the frequency and intensity of cravings for use and also harms resulting from the subject's substance use. In our findings, we report on substance use two ways: 1) did the participant report using the substance at baseline and at six months (yes/no)?; and 2) did the 4WSUS scores for each participant change significantly from baseline to month six?

In addition to collecting data using the instruments described above, immediately following completion of the retreats, the *States of Consciousness Questionnaire* (SOCQ), which assesses the nature and intensity of experiences during the two ayahuasca ceremonies, was administered to all participants in a group setting. Data from the SOCQ is not included in this analysis, but will be reported on in future papers.

In summary, we selected the various psychological and behavioral instruments listed above based on a holistic interpretation of the bio-psycho-social-spiritual model of human behavior, trauma and substance dependence. Our model identifies four inter-related factors that have been shown to affect patterns of substance use (i.e., emotional regulation, mindfulness, empowerment and hopefulness), one factor that is both a potential influencer of patterns of substance use and an outcome measure that explicitly includes existential elements (McGill Quality of Life), and the main outcome measure that assesses problematic substance use (4WSUS).

After hearing from a number of participants that the questionnaires and surveys were not capturing the totality of their experience, the study team sought and was granted ethics approval to add a short semi-structured interview as part of the seventh follow-up session to collect qualitative data about their experience of the retreat in their own words. The interviews focused on three questions:

1. Did the stress and addiction retreat have any impact on your life (Y or N)?
2. On a scale of one to ten, with one being extremely negative and ten being extremely positive, how would you rank the effects of the stress and addiction retreat on your life?
3. Please describe how this experience a) impacted your connection to yourself, others, and nature or spirit; b) affected your substance use; c) differed from past drug treatments or therapies.

The questions about connection were asked to capture the participant's experiences that were not addressed in the survey instruments we had pre-selected, but arose in discussions during the retreats and follow-ups.

Statistical Analysis Procedures

Scale scores were calculated for the following measures: *mindfulness, empowerment, emotional regulation, hopefulness* and *quality of life* (which included five sub-scales: overall quality of life [one question], physical symptoms, psychological symptoms, outlook, and meaning). Missing values were imputed by using the mean of the valid responses when fewer than 20% of the questions were missing for each scale of a participant. Imputations were necessary for less than 5% of questions overall, so should not substantially affect the statistical validity of the analysis.

The *Four Week Substance Use Survey* (4WSUS) was used to assess problematic substance use. Scores were based on three questions assessing frequency and patterns of substance use, desire to use (cravings), and harm from use. Due to variation in the timing of the follow ups, the time frame assessed by the substance use survey also varied: at baseline participants were asked about their substance use in the past four weeks, in the first follow up they were asked about substance use in the past two weeks, and for the rest of the six post-treatment follow ups the retrospective time frame was again extended to four weeks. The 4WSUS scoring ranges from 0-39 (with the exception of tobacco, which ranges from 0-31), with higher values indicating more problematic use. As the 4WSUS questions did not all use the same scale for each item, no imputations were done.

Since the same participants were measured in each phase of the study, a one-group repeated-measures ANOVA was conducted on each of the scale measures—*emotional regulation*, *mindfulness*, *empowerment, hope* and all *quality of life* subscales—to statistically assess any changes over time. In order to retain the highest number of completed cases in the analyses, the means of the second and third, the

fourth and fifth, and the sixth and seventh survey scale scores were aggregated to deal with missing follow-up surveys; this provided five temporal data points in total for each subject and each scale. The baseline and first follow-up were not aggregated, as the majority of participants completed these. When using a repeated-measures design, an important assumption is that of sphericity (the variances between all possible pairs are equal). Sphericity was tested using Mauchly's W; if Mauchly's $W < 0.05$, then we concluded that significant differences exist between the variance of differences, and sphericity was not met. If sphericity was not met, corrections were applied to the degrees of freedom using one or a set of correction methods [55]. Further, if a measure showed significant differences between time points, a trend analysis was conducted. Finally, as four participants received the intervention twice (n=4), a second repeated-measures ANOVA was conducted, which included an interaction term between having done the study twice and the scale scores over time.

Additionally, the semi-structured interviews were recorded and transcribed for subsequent analysis. Answers to the first two questions were quantified, and content analysis was conducted on answers to the third question to identify information useful for interpreting the quantitative findings.

THE INTERVENTION: "WORKING WITH ADDICTION AND STRESS" RETREATS

The retreats involved participants assembling for four consecutive days and three nights in the band's longhouse (traditional community ceremonial space), which had been blessed by band elders in preparation for these special events. The longhouse was prepared by spreading cedar boughs over the large dirt floor, similar to preparations for the band's traditional Coast Salish dance rituals [56], which take place over the winter months.

Participants resided at the longhouse for the full length of the retreat, with meals prepared on-site by a local caterer and in accordance with the traditional strict dietary requirements of Shipibo (Peruvian Amazonian indigenous) ayahuasca ceremonies. This included restrictions on meat, sugar, alcohol, salt and other strong seasonings. Members of the research team were invited to be present as observers throughout the retreat, including the ayahuasca ceremonies.

The retreats incorporated two ayahuasca ceremonies, one on the second and one on the third evening, led by a Shipibo master ayahuasquero and three (non-aboriginal) Canadian apprentice ayahuasqueros. While not overtly religious events, ayahuasca ceremonies in the Peruvian indigenous tradition typically have the solemnity of a serious spiritual practice [57]. The retreat team provided the ayahuasca brew, which had been ritually prepared according to Shipibo customs. At various intervals during the four days, the retreat team led group talk therapy sessions to elicit personal reflection and insights about traumatic life experiences and consequent emotional and psychological responses, including compulsions such as dependent substance use.

Day 1 of the Retreat

Participants arrived in the mid-afternoon and laid down mattresses and bedding in a circle. After dinner, the retreat team arrived and was greeted by a local First Nations spirit-keeper with songs of welcome, strength and courage for the participants, healers and the research team. A round of introductions then took place, after which the retreat team explained the process that was about to take place over the next few days.

Day 2, Morning/Afternoon

The retreat team arrived at about 10 a.m. After a silent meditation, the retreat team led a discussion to elicit reflection by participants about their addictions or compulsive behaviours—loosely resembling Prochaska *et al.*'s stages of changes and decisional balance for problem behaviors [58]—which provided an opportunity for individuals to re-conceptualize their own addictions beyond personal weaknesses or shortcomings.

Beyond the self-introspection that was encouraged the first morning, the group setting created a sense of shared empathy and understanding, and a safe space for forthcoming exploration into the multi-generational trauma endured by retreat participants. The afternoon continued with further psychosomatic (e.g. breathing, meditation) exercises and group sharing/counseling.

Day 2, Evening

After dinner and a sweat lodge ceremony, all participants gathered back in the longhouse to share their intentions for the ayahuasca ceremony. At approximately 9: 00 p.m. participants sat or lay on their beds in the large darkened room, and were individually invited to sit in front of the master ayahuasquero to drink a small glass (50-100 millilitres) of ayahuasca, after which all light sources were shut off. After about an hour of silence, the ayahuasqueros began to chant *icaros* (traditional chants believed to assist in healing), which continued for the duration of the experience (4-5 hours). During the ceremony, some participants purged (i.e., vomited, a common and not necessarily adverse effect of ayahuasca) and each participant was invited to sit in front of the ayahuasquero to receive a *soplada*, a chant (sung in Shipibo, Quechua or Spanish) selected for that individual and accompanied by blowing of perfume or *mapacho* (Amazonian tobacco) smoke on them. At approximately 3:00 a.m., the ceremony ended, the retreat team left for the night, while participants slept in the longhouse under the supervision of the observers from the band's health office.

Day 3

The next morning began with unstructured dialogue about the previous evening's experience among participants during breakfast, followed by a more formal debrief with the retreat team. The second ayahuasca ceremony took place on the third night with all participants present, although

(over the course of the two different retreats) one of the twelve participants chose not to drink ayahuasca on the second night.

Day 4

There was a final debrief on the morning of the last day of the retreat, and the first retreat ended with the participants presenting the retreat team leaders with gifts. All participants left the site of the retreat before noon, with the band's health office agreeing to monitor them for any potential adverse after-effects.

RESULTS – PSYCHOSOCIAL AND SUBSTANCE USE MEASURES

The results we report are from the twelve participants who attended at least one retreat and had no missing data when all imputations were done and when we combined the second and third, fourth and fifth, and sixth and seventh. Of the 18 participants originally recruited, two ultimately chose not to participate in the retreats, one left following the first night due to a pre-existing health condition, and three others completed the retreats and some of the follow-ups but had missing data. Additionally, while some participants suggested they had some initial difficulty in incorporating the retreat experience into their day-to-day lives, there were no serious adverse health or psychological consequences reported to either the research team or the band's health office after the retreats. For the twelve who were retained in the study, *mindfulness, empowerment, hopefulness, quality of life-meaning,* and *quality of life-outlook* showed statistically significant improvements over time ($p<.05$). While *emotional regulation, quality of life-overall* and *quality of life-psychological* all showed improvements, these changes were not statistically significant (Table **2**).

Quality of life-meaning showed a significant linear component and also a quadratic component: it increased from baseline at the first follow up and then decreased before increasing again consistently after the third data point (Fig. **1**), whereas *mindfulness* and *hope* had a significant linear component indicating continued increase over time (Figs. **2**, **3**). As such, we suggest that improvement in these psychosocial and behavioral measures immediately following the retreats and over the 6 month follow-up period could be interpreted as contributing to alleviation of problematic substance use following ayahuasca-assisted therapy for problematic substance use.

Figs. (**1-3**) show the changes in average scale scores for *quality of life-meaning, mindfulness,* and *hopefulness* over the study period. The reliability of the psychosocial scales at baseline ranged from Cronbach's alpha = 0.408 to 0.929, with both hope and mindfulness having alphas lower than 0.700, which is typically used as the cut-off to determine good internal validity for a psychometric measure.

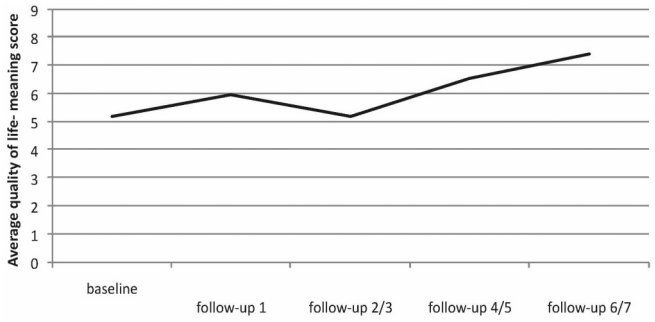


Fig. (1). Average quality of life-meaning score.

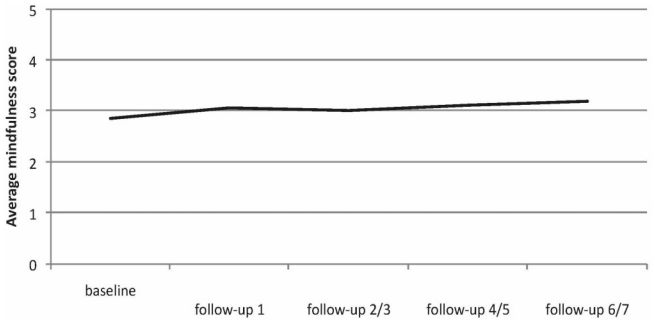


Fig. (2). Average mindfulness score.

Table **3** shows the proportion of participants (among those who completed the seventh follow-up) who reported using each type of substance in the four weeks prior to baseline and the four weeks prior to the seventh (six-month) follow-up. As with the psychosocial scales, the follow-ups were aggregated so that the means of follow-up two and

Table 2. Results of Repeated-Measures ANOVA – Psychosocial Scales

Scale	F Score	P Value	n	Cronbach's Alpha
hope	3.14	.023	12	0.456
empowerment	5.07	.002	10	0.702
mindfulness	2.76	.041	11	0.408
emotional regulation	1.96	.124	9	0.929
quality of life- overall	2.05	.105	11	n/a
quality of life- psy	2.52	.055	12	0.736
quality of life- meaning	4.36	.005	12	0.879
quality of life- outlook	4.43	.004	12	0.925

*Sphericity is assumed as Mauchly's W is > .05 for all measures.
[a]Lower scores equal greater emotional regulation.

three, four and five as well as six and seven were used. These data indicate that alcohol, tobacco and cocaine were used by fewer participants in the four weeks preceding the seventh and final follow up than in the four weeks before attending the retreat (baseline). The past-month use of cannabis and opiates showed no change in use during the study. One participant reported using hallucinogens during the last 4 weeks of the study, resulting in an increase in the proportion of users from baseline of 9.1%.

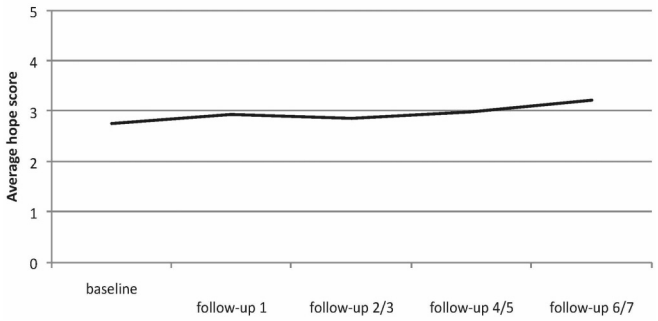


Fig. (3). Average hope score.

Table 3. Proportion of those who Responded that they had Used a Substance at Baseline and the Last Follow-Up, of those who Completed the 7th Follow-Up

Substance	Proportion that had Used at Baseline (%)	Proportion that had Used at Last Follow-Up (%)
	n = 11	n = 11
Tobacco	81.8	63.6
Alcohol*	50	20
Cannabis	45.5	45.5
Cocaine*	60	0
Amphetamine	0	0
Inhalants	0	0
Sedatives	18.2	18.2
Hallucinogens	0	9.1
Opioids	9.1	9.1

* n= 10; 1 participant did not answer the question at one phase.

Fig. (**4**) shows changes in the 4WSUS scores measuring changes in participants' levels and patterns of use, cravings and substance-related harm for the substances used by at least 40% of the participants at baseline—tobacco, alcohol, cannabis and cocaine. 4WSUS scores decreased for all substances except cannabis, with statistically significant reductions documented for problematic cocaine use over the study period.

RESULTS – SEMI-STRUCTURED INTERVIEWS

Interviews were conducted with eleven study participants at the seventh data collection session to collect additional qualitative information about the effects they felt the retreats had on their lives. All eleven participants who completed the semi-structured interviews said that the retreats had some impact on their lives, and when asked to rank the experience of the retreats on a scale from 1 (extremely negative) to 10 (extremely positive), the mean was 7.95 (n = 11), with eight participants ranking it as 8 or higher, and no one ranking it below 5.

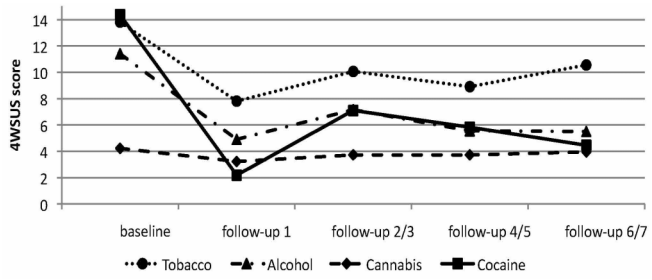


Fig. (4). Changes in 4WSUS scores for tobacco, alcohol, cannabis and cocaine.

The following quotations are excerpts from interviews with participants responding to questions about a) the impact of the retreats on their relationship with themselves, others, and with nature or spirit; b) how the retreats affected their use of substances; and c) how the retreat experience differed from other types of treatments or therapies they had encountered.

Connection with Self

S1 (male, age 30): "With my last experience with the ayahuasca, I really faced myself. Like, my fear, my anger. Which really, I think is a big part of my addictions. Like, running away from myself pretty much. And I think I overcame that in the ceremonies. That was a pretty big deal for me . . . I wish I was introduced to it [ayahuasca] like twenty years ago. It could have saved me a lot of time and trouble."

S2 (female, age 41): "[The retreat] affected my life in giving me another chance at life rather than being stuck in my addiction and just living for my addiction. . . . I realize that I deserve a better life and I love myself. And I have more respect for myself. And the honesty that, just being honest with myself and others, had a major impact . . . [Ayahuasca] really opened my eyes. It was like I was shut down [before drinking ayahuasca]. My mind and my eyes were shut down to everything. After the retreat I felt like a brick was lifted off of my shoulders and I was just feeling free."

Connection with Others

S3 (male, age 56): "It's opened up where I felt I had a door closed to allow and to be, to allow my close family members inside me. It's a . . . I can't describe it right now but, I see the changes in my grandkids' response towards me, and they are always like, want to be around, around me and my wife so, it's lots to tell you there. Safety I guess, from our change."

S5 (male, age 51): "With my relationships, I think it's coming a lot better with my family now. Because I wasn't really seeing my family. I just wanted to stick by myself, but nowadays I'm spending more time with my family now."

Connection with Spirit and Nature

S6 (female, age 19): "A week or two after [the retreat] I was just waking up every morning at like five, six in the morning and going outside and . . . I just sat and stared at the trees and the wind for like two hours, I would sit outside and it was just beautiful. I've never noticed it that much ever in my life. And after I had the ayahuasca it was just amazing, the connection with nature."

S7 (female, age 49): "I got my spirit back, for one. Nature, like it's saying "wake up and smell the coffee." Like it's so beautiful outside, and where was all that all this time? You know, I was just living [with] a black cloud over me. And the black cloud's been removed basically. Because life is a lot nicer than it ever was. You know? I go spirit bathing every morning."

Substance Use

S2 (female, age 41): "Before the ceremony I was struggling with my addiction, crack cocaine, for many years. And when I went to this retreat, it more or less helped me release the hurt and pain that I was carrying around and trying to bury that hurt and pain with drugs and alcohol. Ever since this retreat I've been clean and sober. So it had a major impact on my life in a positive way . . . My family is back in my life. My daughter is back at home. And, we are getting closer and closer every day as time goes on."

S3 (male, age 56): "No cravings whatsoever for the crack cocaine or drinking, whatsoever. It's pretty strong that Ayahuasca as far as removing that craving, that desire, that habit, or however you want to describe it, for me it's not even there."

Differed from Past Treatment or Therapies

S1 (male, age 30): "I had no sense of spirituality before really, coming clean and sober even while I was going through, like AA and NA. They tell you to reach your higher power or whatever. I thought that was a bunch of bull. But after the retreats I've really opened up to spirituality big time. I smudge every night before bed. I pray. I, you know, I say thanks to whatever is out there, you know?"

S8 (male, age 55): "Other treatments [for my addiction] sort of like scraped the surface as they say. This one got deep, deep into myself, which I've never admitted to or confronted I guess you could say in the other treatments. And this was just a mind-bending experience, boy! [laughs]. I can't believe what I saw and who I talked to, like my mom and my dad and my granddaughter who are in the next world there [i.e., have passed away]. And it really, really touched me deeply and I think about that every day."

As these comments from participants illustrate, the semi-structured interviews proved useful in increasing our understanding of how the "Working with Addiction and Stress" retreats and the incorporation of ayahuasca ceremonies affected the lives of participants in the short and medium term, while also highlighting the limitations of purely quantitative methods in studying the subjective impacts of this kind of therapy. A more comprehensive analysis and discussion of the qualitative results of this study and the States of Consciousness Questionnaire will be the subject of a future publication.

DISCUSSION

We found that participating in the "Working with Addiction and Stress" retreats correlated with improvements in several cognitive and behavioral states—including enhanced mindfulness, personal empowerment and hopefulness—which we hypothesized may be associated with recovery from problematic substance use. Participating in the retreats also correlated with improvements in *quality of life* (meaning and outlook), and subjective feelings of connection with self, others, spirit and nature. The results also suggest that this form of ayahuasca-assisted group therapy may be associated with reductions in substance use, particularly reductions in problematic cocaine use. The changes in substance use reported by participants by the end of the study period—that is, that cocaine, alcohol and tobacco use declined, whereas cannabis, sedative and opiate use did not—may reflect the fact that in some cases the latter substances were medically prescribed. Some participants reported being in a methadone maintenance program (which was not a criterion for exclusion from the study) and others reported using medical cannabis under the recommendation of a physician. Of note is the fact that cocaine and alcohol were identified as the substances of primary concern by the majority of participants.

These findings suggest that this novel form of treatment may facilitate positive health changes, including reduced problematic cocaine use, in a rural aboriginal population. The entheogenic use of ayahuasca may have functional effects similar to those of peyote, which is used ceremonially by aboriginal members of the Native American Church without any evident psychological or cognitive deficits [59], and has historically been incorporated into addiction treatment interventions for aboriginal populations [60]. Our findings are also consistent with scientific evidence on the utility of psychedelic substances—such as LSD, mescaline and psilocybin—as therapeutic agents for treating addiction and catalysts for personal transformation [61-64]. It may be that ayahuasca can function to increase the personality trait of openness, demonstrated experimentally to be a correlation of mystical or spiritual experiences induced by psilocybin (a close analog of one of ayahuasca's psychoactive chemical constituents, DMT) [65]. In light of the limited success of currently available medical treatments for treating substance dependence in aboriginal populations, further research efforts, including randomized controlled trials, are necessary to determine whether and how ayahuasca might be added to available approaches for treating drug or other addictions.

This study of ayahuasca-assisted group therapy has a number of limitations. The small-scale observational study design was limited to eighteen convenience sample participants who self-identified as having an interest in participating in the retreats, with 2 who ultimately chose not to attend the retreats, one drop-out on the second day of the first retreat, and three whom the researchers lost contact with during the six-month follow-up period. This limited number, along with the absence of any matched controls, makes it impossible to assign direct causality to the treatment or to determine whether the findings may be generalizable to other

populations. Also, the study was not designed to assess the relative effects of the group therapy work, other ancillary potentially therapeutic elements (spirit baths, sweat lodges), the pharmacological action of the ayahuasca, or the psychodynamic context of the retreats combining these various elements, and did not track whether participants were involved in other forms of treatment during the follow-up period. Further, all substance use measures were based on self-report, and could not be verified by independent means, such as urine or blood toxicology screens.

Additionally, it is possible that the intercultural bridging occasioned by the ceremonies may have introduced a confounding, although not necessarily undesirable, salutogenic effect to the retreats. The connection between the Shipibo Amazonian and North American indigenous peoples, in the context of the former sharing an important ceremonial healing practice, may have had positive therapeutic effects on its own, independent of the ayahuasca drinking. Either way, it is not possible from this study to make any claims whether the observed positive effects of ayahuasca-assisted therapy may be generalizable to other First Nations peoples in Canada, or to other aboriginal peoples elsewhere in the world.

Another limitation arises from the pharmacology of ayahuasca, a brew made from two plants that contain a number of alkaloids whose relative concentrations vary according to circadian timing of harvest and preparation [66, 67]. As there was no scientific chemical analysis of the brew drunk during the ceremonies at the retreats, and as participants received varying amounts (determined by the ayahuasqueros using traditional healing knowledge and criteria), it is not possible to know the amounts or relative concentrations of the psychoactive components ingested or whether any outcomes were dose dependent. Nevertheless, as the participants' qualitative interview reports suggest, the effects of the brew were characteristic of ayahuasca phenomenology and therefore do not suggest any concerns about its composition or potency. It must also be noted that one participant opted to drink ayahuasca only once during the retreat, however our analysis was unable to account for any differences between outcomes for this participant versus the rest who drank both nights.

Finally, one unforeseen limitation was that four individuals who participated in the first retreat also participated in the second; thus, one-third of 12 participants participated in two retreats, and two-thirds only one retreat. Given the small number of participants, and that the minor differences in outcomes of the repeat participants and of those who participated in only one retreat were not significant, no conclusion can be drawn from our data on the potential harms/benefits of additional treatments. Future research should include more participants, potentially with some doing one treatment and others doing two or more in order to determine whether there are harms/benefits to repeat treatments.

CONCLUSION

Our results suggest that this form of ayahuasca-assisted therapy for stress and addiction was correlated with statistically significant improvements in *mindfulness*, *empowerment*, *hopefulness* and *quality of life-outlook* and *quality of life-meaning*. It may also have contributed to statistically significant reductions in cocaine use. The findings of this research on ayahuasca-assisted treatment for addictions, although preliminary, corroborate those of previous studies showing salutogenic effects of ceremonial ayahuasca drinking.

Given the potential to decrease the personal suffering and social costs associated with addiction, further research on ayahuasca-assisted addictions treatment is warranted. Clinical trials with people who have had poor outcomes with conventional psychological or pharmacological addiction treatments would help determine which adjunct therapeutic approaches might produce the best outcomes for particular populations, and further our understanding of ayahuasca-assisted treatments for problematic substance use.

ADDENDUM – LEGAL STATUS OF AYAHUASCA IN CANADA

At the time that the retreats described in this study were conducted, Health Canada had provided a recommendation for approval "in principle" to exempt certain forms of ceremonial ayahuasca use from the Canadian *Controlled Drugs and Substances Act* [68]. The investigation into ayahuasca by Health Canada's Office of Controlled Substances between 2001 and 2008 found the potential risks to be minimal when the brew is used in traditional ceremonial contexts and participants carefully screened [69]. Despite this preliminary positive signal regarding the low risk potential and thus tolerability of ceremonial ayahuasca use, in November 2011 Health Canada reprimanded Dr. Maté and threatened him with legal action if he continued his work with ayahuasca as an addictions treatment [70]. In October 2012, against the 2008 recommendation of department staff, the federal Health Minister Leona Aglukkaq denied a request for legal exemption for ceremonial ayahuasca use. The Minister decreed that the Amazonian brew was an illicit preparation of controlled substances, and that tolerance for its ceremonial use would not be in the public interest [71].

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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APPENDIX

Table **4** shows that cocaine ASSIST scores, which combine assessments of frequency of use, desire to use and harm from use into a scale designed to assess severity of

problematic use, showed significant improvements between study follow-ups, while tobacco ASSIST scores improved marginally. Examining the tests of with-in subject contrasts for the cocaine ASSIST scores we find a significant (p = 0.003) linear component of cocaine over time.

Table 4. Results of Repeated-Measures ANOVA –ASSIST Scores

Scale	F Score	P Value	n
Tobacco*	2.54	.057	10
Alcohol**	2.74	.091	10
Cannabis*	1.21	.958	9
Cocaine**	7.96	.003	11

*Sphericity is assumed as Mauchly's W is > .05.
**Sphericity is not assumed as Mauchly's W is < .05; Greenhouse-Geisser adjustment is used to test significance; Huyh-Feldt adjustments confirms significance or non-significance at the .05 level.

Table **5** show the results of the analysis that examined the between group effects. There was no significant interaction between the groups and trend indicating no significant difference between the changes over time between those who participated in two retreats and those who participated in one. Overall quality of life and outlook showed significant between group effects with both these measures being lower in those who received two treatments. If those that received the treatment twice are removed from the analysis, the quality of life-overall measure is not significant (F=1.63, p=.199, sphericity assumed) and outlook is significant (F=3.22, p=.027, sphericity assumed). Due to the small number who had the treatment twice, analysis could not be conducted on this group alone as the n is too small to test the assumption of sphericity.

Table 5. Results of Repeated-Measures MANOVA Showing Significance of having Participated in One *vs* Two Retreats – Psychosocial Scales

Scale	Interaction p Value	Treatment p Value	Treatment Twice n	Treatment Once n
hope	.201	.629	4	8
empowerment	.500	.072	4	6
mindfulness	.322	.939	3	8
emotional regulation	.673	.769	3	6
Quality of life- overall	.218	.035	4	7
Quality of life- psy	.311	.409	4	8
Quality of life- meaning	.629	.079	4	8
Quality of life- outlook	.276	.001	4	8

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