



Article

Insights, Life Changes and Lifestyle Changes Reported by Individuals Consuming Ayahuasca in Naturalistic Settings: Nature, Frequency and Associations with Mental Health and Wellbeing

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Abstract: Background: In the context of increasing scientific interest in the potential therapeutic use of psychedelic agents and their underlying psychotherapeutic mechanisms, we undertake the first detailed assessment of insights and life and lifestyle changes associated with ayahuasca consumption. Methods: An international cross-sectional study of ayahuasca drinkers in a variety of settings was performed ($n = 8907$). Bivariate analysis and multivariate linear and logistic regressions were used to explore associations between a range of covariates and insights, life changes and lifestyle changes. The least absolute shrinkage and selection operator variable selection method (LASSO) was used to select the variables most relevant for inclusion in models assessing broader wellbeing and mental health associations. Results: Insights are almost universally reported as part of the ayahuasca experience and are highly valued by drinkers and strongly predictive of subsequent beneficial life and lifestyle changes. A range of personal, vocational, religious/spiritual and health-related life changes (attributed to ayahuasca) are also commonly identified, as are various beneficial lifestyle and health behavior changes. Demographic and ayahuasca drinking variables that are predictive of such phenomena are reported, along with associations between insights, life and lifestyle changes and perceived growth in psychological wellbeing and current mental health status (Kessler 10 and SF-12 MCS). Conclusion: Insights and subsequent life and lifestyle changes appear to have a central role in the transformative effects reported by individuals consuming ayahuasca, with these occurring across contexts of use and demographic groups.

Keywords: ayahuasca; psychedelics; mental health; insights; psychological wellbeing; psychotherapeutic processes; psychedelic therapy

1. Introduction

Ayahuasca is a traditional Amazonian botanical decoction, typically made with the stems of *Banisteriopsis caapi* and the leaves of *Psychotria viridis* or *Diplopterys cabrerana*. The resulting brew contains a synergetic combination of the powerful psychedelic DMT (N,N-Dimethyltryptamine) and several harmala alkaloids (most prominently, harmine, tetrahydroharmine and harmaline) that serve to make DMT orally bioavailable via MAO (monoamine oxidase) inhibition in the gut, as well as having their own psychoactive and therapeutic effects [1,2].

The traditional use of ayahuasca has continued, and in the mid-20th century the brew was embraced by several Brazilian syncretic Christian groups that went on to form churches based around the consumption of ayahuasca as a religious sacrament [3,4]. Recent decades have witnessed a further global expansion in its use via the growth of the Brazilian ayahuasca churches across North America, Europe and Australia; an expanding ayahuasca tourism sector in South America, particularly Peru, where Westerners are travelling in large numbers to take part in traditional ayahuasca ceremonies for therapeutic and spiritual purposes; and, finally, the growth of neo-shamanic ayahuasca ceremonies in Western countries that are taking place in alternative health and spirituality settings [5–7]. Across these contexts, ayahuasca continues to be used in a ceremonial fashion involving music, ritual and associated props [7–9].

In parallel with the increased interest in ayahuasca as a traditional medicinal and spiritual tool, there has been growing scientific interest in the potential for ayahuasca to be used as a clinical treatment for mental health and addictive disorders [2]. Non-clinical and clinical studies to date have reported beneficial effects relating to depression, anxiety and substance use [10–14], as well as a range of broader wellbeing improvements [15–17] and beneficial personality modulation [17,18]. Analysis of the short- and long-term safety of ayahuasca consumption also suggests an absence of cognitive impairment and psychological maladjustment or deterioration [19–21]. However, psychological side effects in the weeks after consumption are not uncommon, and although typically transient and mild, for a small proportion they can be enduring and require professional mental health support [22].

The mechanisms by which ayahuasca and related psychedelics may bring about therapeutic and wellbeing benefits is suggested to involve a synergistic combination of neurobiological and psychotherapeutic pathways [10]. Neurobiological mechanisms of note include increased neurogenesis and neuroplasticity [21,23]; modulation of brain network connectivity [24]; serotonergic, MAOI and anti-inflammatory effects [25]; and modulation of the amygdala and right insula, as well brain areas involved in emotional processing and interoception [26–29]. Brain network disruptions are hypothesized to reduce high-order cognitive control, thus enabling a bottom-up flow of information and allowing profound freedom with inner exploration and the development of new perspectives [30,31].

The psychotherapeutic processes proposed typically involve a combination of intrapersonal and transpersonal (extending beyond the individual or personal to encompass wider aspects of humankind, life, the psyche or the cosmos [32]) effects. The acute subjective spiritual experience has received significant attention and been correlated with a range of therapeutic outcomes [9,33,34]; however, a range of other therapeutic processes have also been hypothesized. In a recent systematic review of qualitative studies examining patient experiences in psychedelic research, Breeksema et al. [35] propose five types of therapeutic processes: insights, altered self-perception, feelings of connectedness, transcendental experiences (such as dissolving of the self, connection to greater forces or interconnectedness/unity with all life and things) and an expanded emotional spectrum. They note that insights were among the themes most commonly mentioned by patients and included insights into the self, disorders and their root causes and related behaviors, as well as relationships with friends, family and partners. A recent paper looking specifically at ayahuasca proposes five core psychotherapeutic elements: the first four of these—somatic effects, introspection and emotional processing, increased self-connection, and increased

spiritual connection and awareness—are suggested to together facilitate the fifth process, the gaining of insights and new perspectives [10].

The central place of insights within the ayahuasca experience has also been noted by other research, with common themes including insights related to self-understanding, early life and traumatic events, interpersonal dynamics, ethics and morals, vocation and life direction, and self-care and health behaviors [6,36–39]. Insights relating to philosophical and metaphysical topics, such as the oneness or interconnection of all things and a sense of connection with plants and animals, have also been noted [38,40]. Such insights and associated new perspectives are suggested to contribute to meaningful life changes [20,41], including changes in health behaviors, solving relationship issues and lifestyle behaviors [33,42–45]. As Shanon (p. 67, [38]) notes, these insights, new psychological understandings, life perspectives and worldviews “may result in actual, and at times radical, decisions and actions”. In this vein, there is even some debate regarding the potential for psychedelics to change religious beliefs, although the data to date have not proved conclusive [46,47].

Insights associated with other psychedelics have also been correlated with therapeutic benefit and behavior change, including reduced alcohol and tobacco use [48,49], mental health improvements and improved psychological flexibility [50–52]. Similarly, a recent systematic review and meta-analysis of traditional (non-psychedelic-assisted) psychotherapy reported the gaining of insights to be positively correlated with beneficial treatment outcomes [53]. Further, as Peill et al. [54] note, the gaining of insights is a key aim of many conventional psychological therapies, including psychodynamic and cognitive behavioral therapy, as well as certain types of meditation.

However, although personal insights and life changes are increasingly recognized as playing an important role in the therapeutic effects associated with ayahuasca (and other psychedelics), to date, most studies have utilized small samples in a single context of consumption and there has been no large-scale dataset enabling a detailed and systematic analysis of the nature, frequency and subjective effects of these phenomena. Hence, in this exploratory study, we utilize a large international dataset of ayahuasca drinkers across different contexts of consumption to investigate (i) the nature and frequency of insights and life changes associated with the ayahuasca experience; (ii) the perceived valence of any life effects associated with such insights and life changes; (iii) the predictors of such insights and life changes; and (iv) the influence of insights and life changes on wellbeing and mental health. We also explore the extent to which insights and life changes may vary across different contexts of consumption (traditional, religious and other contexts). In operationalizing the concept of insights, we are informed by the approach of Kounios and Beeman [55], who define an insight as “any sudden comprehension, realization, or problem solution that involves a reorganization of the elements of a person’s mental representation of a stimulus, situation, or event to yield a nonobvious or nondominant interpretation”. Such experiences are also usefully contrasted with typical analytical reasoning and problem solving and can (but will not always) include so-called “aha” moments, characterized by an experience of surprise and delight with a sudden new solution [55,56].

2. Materials and Methods

2.1. Study Design

The data used in this study were obtained via an anonymous online cross-sectional survey of ayahuasca drinkers who had consumed the brew in a variety of contexts, including traditional shamanic, religious, neo-shamanic/new age and other contexts. The survey instrument was translated into five languages other than English (Portuguese, Spanish, Czech, German and Italian) and used a non-random sampling strategy intended to maximize responses among a population that is hidden in most countries. Human Research Ethics Committee approval was obtained from the University of Melbourne (HREC number: 1545143.3). The survey was disseminated via websites and social media channels of the academic partners and their broader networks relating to ayahuasca, and no financial incentives were offered for participation. Survey translations were undertaken

from English to the target languages by bilingual translators who were native speakers of the target language and who possessed a good knowledge of ayahuasca. Reviews of these translations and back translations to English were then undertaken with discussion of problematic terms or concepts with the research team as required. See Perkins [33] for further details of the survey methodology.

A total of 10,836 individuals residing in over 50 countries who were at least 18 years of age and had consumed ayahuasca on at least one occasion took part in the survey. Partially completed responses were retained. However, for the current analysis, only participants who completed the life insights or life changes sections of the instrument ($n = 8907$) were included. The current study utilized respondents' demographic data, including lifetime mental health diagnoses, as well as data relating to insights, life and lifestyle changes and ayahuasca drinking variables described below.

2.2. Insights, Life and Lifestyle Change Variables

Ayahuasca insights were assessed via a question that provided a list of 15 commonly reported insights following the consumption of ayahuasca (see below). The participants were asked to identify any insight they had experienced during any of their ayahuasca drinking experiences or the "None of these" response. For each insight selected, a subsequent question asked respondents to assess the valence of that insight on their lives using a five-point scale: very negative (1), slightly negative (2), neutral/no effect (3), slightly positive (4), very positive (5). The life changes question utilized a similar format with a list of 15 commonly reported life changes attributed to ayahuasca plus the opposite life change where appropriate to minimize results bias (for example, "instigating, worsening problematic alcohol or drug use" was included as a pair with "reducing/ending problematic alcohol or drug use"). The respondents were asked to select any life changes to which their ayahuasca experiences had "been a significant contributor" or the "None of these option". For each life change selected, a subsequent question asked respondents to assess the valence of that life change on their lives using a five-point scale: very negative (1), slightly negative (2), neutral/no effect (3), slightly positive (4), very positive (5). An additional life change, change in religious/spiritual status, was obtained from a separate section of the survey. After the participants indicated their current religious/spiritual status (religious/spiritual/agnostic/atheist), they were then asked "Has this changed since first drinking ayahuasca?" and, for those who selected "yes", which option they would have selected prior to drinking ayahuasca.

The lifestyle changes question provided a list of eight areas in which changes have previously been reported after consuming ayahuasca and asked participants to identify whether they had experienced any change in these areas since drinking ayahuasca (a perception of causality was not required). Responses were on a five-point scale: much less so now (1), a bit less so now (2), no change (3), a bit more so now (4), much more so now (5). These lists of insights and life or lifestyle changes were developed following a review of the existing literature relating to ayahuasca, including the large qualitative study by Shanon [38].

2.3. Ayahuasca Drinking Variables

Respondents were asked about their ayahuasca drinking history and patterns of use as well as the different contexts in which they had consumed ayahuasca. The strength of the subjective spiritual experience associated with ayahuasca drinking was measured via two instruments. The single-item spirituality component of the Persisting Effects Questionnaire [57] was a six-point Likert scale that asked respondents to rate the personal spiritual significance of their ayahuasca experiences on a six-point scale, from not at all (1) to the single most spiritually significant experience of my life (6) (mean = 4.93, SD = 1.12). The second instrument used was an adapted version of the Short Index of Mystical Orientation (SIMO) [58]. The SIMO included nine spiritual experience items and asked respondents to rate, on a scale from 1 to 10, where 1 is "Not at all" and 10 is "very much", the extent

to which they had experienced these during any of their ayahuasca experiences. The nine items were summed to create a total score between 9 and 90 (mean = 68.94, SD = 17.13). The adapted SIMO displayed good internal consistency (Cronbach's $\alpha = 0.85$).

Challenging acute experiences in the form of extreme fear or panic were measured via a single item asking the respondents the extent to which they experienced "Feeling immense fear, panic, or that I was going mad or going to die" using a 1 to 10 scale, where 1 was "Not at all" and 10 was "Very much" (mean = 3.65, SD = 3.23). An "integration difficulties" variable captured the extent to which the respondents reported mental health or emotional challenges in the weeks and months after their ayahuasca consumption. This variable used four items from the Patient Health Questionnaire for Depression and Anxiety (PHQ-4) [59] as well as an additional five items reflecting challenges reported in the ayahuasca literature. The variable had a range from zero to nine depending on the number of integration difficulties selected (mean = 1.50, SD = 2.13) and displayed an acceptable level of internal consistency ($\alpha = 0.86$).

Three context-of-use categories, traditional, ayahuasca church and other, were obtained from a survey question that asked respondents whether they had used ayahuasca in a ceremony with "a traditional shaman" (traditional); with the UDV, Santo Daime or Barquinha ayahuasca churches (ayahuasca church); or in contexts with both traditional and non-traditional shamans/guides, non-traditional shamans/guides, or with no guide, whether in a ceremony/ritual or not (other).

The "safety and support" and "preparation score" variables were based on the average of four and two items, respectively, relating to these themes and were scored on a one-to-four-point scale: not at all (1), a small amount (2), moderately (3), very much (4) (safety and support mean = 3.72, SD = 0.65; preparation score mean = 3.07, SD = 1.01). These variables have been found to be predictive of a wide range of outcomes across different contexts of use (see [9]). Finally, the strength of the ayahuasca community was measured via a single item asking the respondents if they drink ayahuasca with a "close community or network of people", with the following range of responses: not at all (1), slightly (2), moderately (3), very much (4) (mean = 3.02, SD = 1.14).

2.4. Mental Health and Wellbeing Variables

Perceived growth in psychological wellbeing (PWG) associated with consuming ayahuasca (as at the day of survey completion) was measured via the Psychological Wellbeing Post-Traumatic Changes Questionnaire, which has 18 items rated on a five-point scale and across five domains: self-acceptance, autonomy, purpose in life, relationships, sense of mastery and personal growth [60]. The responses were summed to provide a total possible score between 18 and 90 (mean = 76.54, SD = 10.36). As previously described, this instrument was selected for its theoretically grounded approach to measuring change in psychological wellbeing resulting from an extreme event [9]. Individuals' perceptions of the effect of ayahuasca on their "life overall" was obtained using an 11-point single-item scale, which was scored from zero (extremely negative) to 10 (extremely positive) (mean = 9.94, SD = 1.51).

Current mental health at the time of survey completion was measured via the mental health component score (MCS) of the 12-item Short Form Survey (SF-12), with scores ranging from 0 to 100 and higher scores signifying better mental health (mean = 50.13, SD = 9.17) [61]; the Kessler-10 (K10) Psychological Distress Scale measured psychological distress, with possible scores from 10 to 50 and a higher number indicating greater psychological distress [62] (mean = 14.03, SD = 4.84).

Analysis Plan

Figure 1, below, provides an outline of the key outcome variables being explored and the relationships between them suggested by the existing literature. As indicated, self- and external insights are generally gained during the acute experience and may lead to life and lifestyle changes in the post-acute period as well as potentially influence mental

health and wellbeing directly. Similarly, associations between life and lifestyle changes and current mental health and wellbeing will also be explored. The current assessed valence of all insights and life and lifestyle changes reported will also be identified.

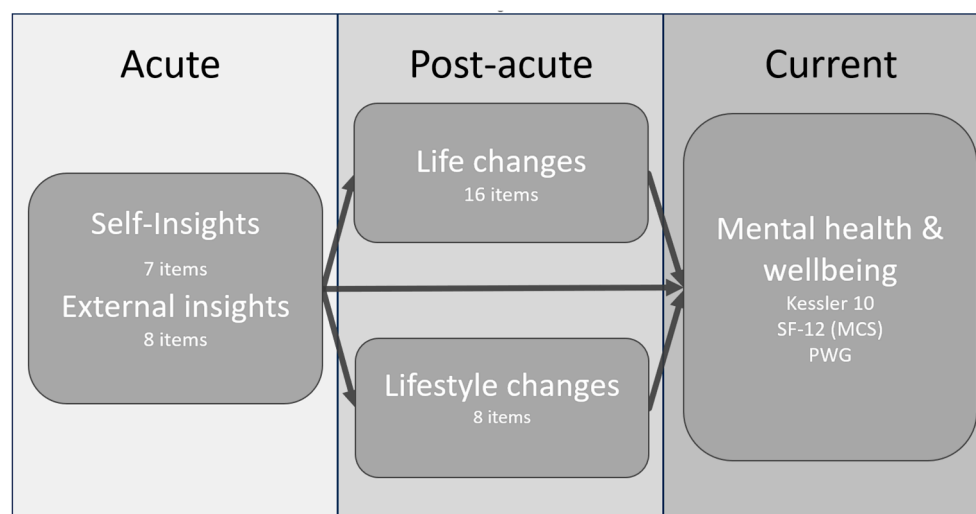


Figure 1. Analysis plan and key outcome variables path diagram.

2.5. Statistical Analyses

Spearman correlations were used to assess binary relationships, and multivariate models utilized linear regressions for continuous dependent variables and logistic regressions for binary dependent variables—all performed using STATA 16. Hierarchical regressions utilized the STATA hireg command [63]. Multicollinearity for multivariate models was assessed and found to be acceptable with VIF values of less than 4 and no Pearson’s or Spearman’s correlations greater than 0.7.

A Kaiser–Meyer–Olkin test was used to assess appropriateness for data reduction techniques using principal component analysis, subsequent to which exploratory factor analyses (EFAs) using the principal component factor method and varimax rotation were undertaken to identify relevant dimensions of the insight, life change and lifestyle change variable groups.

To identify the best subset of predictors in our final set of models (outcome variables: life effects, wellbeing change and current mental health status), we used the least absolute shrinkage and selection operator (LASSO) in STATA 16. Variable selection with LASSO is particularly useful when large numbers of potential predictors are involved and has been shown to typically be more accurate than using conventional methods, such as stepwise selection [64,65]. The approach estimates a penalization parameter, lambda, which is applied to the model parameters to minimize the degree of over-fitting while conducting variable selection and regularization [66]. Rather than using p values, as per traditional variable selection approaches, LASSO shrinks the absolute value of the magnitude of coefficients to zero by regularization. The approach was considered appropriate in this case due to the exploratory nature of the study and the large number of features potentially related to our four outcome variables of interest, and it was intended to identify robust and parsimonious models that minimize prediction error and maximize interpretability [67,68].

The data were first equally divided into training and validation datasets to be used for model development and evaluation. LASSO linear regression with 10-fold cross-validation was then used in the training dataset with both the cross-validation (with the Bayesian Information Criterion (BIC)) and adaptive selection methods. Testing in the validation dataset identified the cross-validation with the BIC selection method to be preferred based on maximizing R squared and minimizing mean squared error [64,65]. The demographic, ayahuasca drinking, insight, life change and lifestyle change features selected by LASSO were then added to separate multiple linear regression models for each outcome variable [68].

3. Results

3.1. Sample Characteristics

As shown in Table 1, the participants included in this analysis were 52.6% male, 47.15% female and 0.27% “other”, with a mean age of 40.65 years (SD = 12.2). A majority had a university education (63.6%), around 60% listed their current occupation as managers or professionals, and half were married or living with a partner. The participants were most commonly residents of Brazil (49.3%), followed by Europe (24.9%) and North America (15.5%), with another 5.3% of participants residing in other Latin American countries and 4.2% in Australia or New Zealand. Over one-third (37.9%) had at least one lifetime mental health diagnosis. There was a large variation in the number of lifetime ayahuasca uses, with 7.8% having only used ayahuasca on a single occasion, 12.1% having used it on two or three occasions, 8.7% on four or five occasions, and a further 10.2% on 6 to 10 occasions. Conversely, the highest use categories included 13.5% of participants who had used ayahuasca between 201 and 500 times and 13.1% of participants who had used ayahuasca over 500 times.

Table 1. Sample characteristics ^{a,b}.

Item	% (n)
Sex (n)	(8811)
Female	47.15
Male	52.58
Other	0.27
Age ^a (n)	(8781)
Mean age (SD)	40.65 years (12.20)
University education (n)	(8827)
Yes	63.59
Current occupation (n)	(8768)
Managers	16.16
Professionals	44.33
Technicians and trades workers	8.46
Community and personal service workers	11.28
Clerical and administrative workers	7.85
Sales workers	5.68
Machinery operators and drivers	1.05
Labourers and related	2.27
Never worked	2.92
Marital or partnership status	(8750)
Married	37.69
Living with partner	15.65
Divorced or separated	9.05
Widowed	0.85
Single	27.62
Partnered, not living together	9.14
Region of residence (n)	(8546)
Brazil	49.30
Other Latin American country	5.31
Europe	24.92
North America	15.50
Australia and New Zealand	4.24
Asia and Middle East	0.73
Lifetime mental health diagnosis (n)	(8275)
Yes	37.39
Number of times drunk in life (n)	(8438)
1	7.80
2–3	12.08
4–5	8.73
6–10	10.16
11–20	8.60
21–50	11.03
51–100	8.01
101–200	7.00
201–500	13.50
500+	13.08
Context of last use (n)	(8907)
Ayahuasca church	47.54
With a traditional shaman/guide	20.61
Other contexts	31.85

^a Percentages may not sum to 100.0% due to rounding; ^b “(n)” indicates valid (non-missing) sample for each item.

3.2. Frequency and Nature of Insights and Life Changes

3.2.1. Insights

The participants were asked to report the frequency and nature of the insights and life changes they experienced after consuming ayahuasca from the list of commonly reported insights. Almost all participants (98.1%) reported experiencing at least one insight (during the acute experience) from the 15 insights listed, which were worded as per the list below:

- New understandings of childhood events or situations;
- Understanding patterns and dynamics in your intimate relationships;
- New understandings of other family/personal relationships;
- New understanding of your own personality;
- Realisations about ethics or morals and your own conduct;
- Revelations about the purpose or direction of your life;
- Profound intellectual or philosophical ideas or insights;
- New understandings of your body, how it functions and how to take care of it or heal disease;
- A sense that everything and all events, even when seemingly unrelated, are somehow connected;
- An increased sense of connection to the natural world and feeling of kinship with plants and animals;
- An increased awareness and concern for social or environmental issues;
- A connection with plant spirits, guides or intelligence that can support your life;
- A sense of sacredness, a higher power or divine in the world;
- A sense that you are particularly close to, or have been chosen by, spirit/the divine/god in some way;
- A new understanding or acceptance of death and dying.

The mean number of insights reported was 9.07 (SD = 4.00), and the most frequently reported insights were related to: “your own personality” (reported by 81.8% of participants), “a sense of sacredness, higher power, or divine in the world” (77.3%) and “family/personal relations” (71.0%) (see Figure 2). Other commonly reported insights included the meta-physically oriented insight that all things and events are somehow connected (67.9%); insights about ethics, morals and your own conduct (66.2%); and life purpose/direction insights (66.0%). Insights about death and dying, personal connection to the natural world, intimate relationship dynamics and patterns, and childhood events and situations were all reported by just over 60% of participants. Intellectual and philosophical topics, social or environmental issues/concerns, insights about your own body function and care, and connection with “plant spirits” or “guides” were all also reported by 50% to 60% of the participants. The least commonly reported insight was feeling particularly close to or chosen by a spirit or the divine (34.1%).

The participants were then asked to assess the valence of life effects of any insights identified. All insights were perceived as having “very positive” life effects by a high proportion of respondents (74% to 88%), and with the inclusion of “slightly positive” life effects all insights were reported as having some level of positive life effect by between 91% and 97% of respondents (see Figure 3). Conversely, any negative life effects, either “slight” or “very” negative, were reported by a very small proportion of respondents. The lowest-reported negative life effects were for insights relating to body function and care, which only 0.06% identified as having a negative effect (slight or very), up to 0.81% for insights relating to social or environmental concerns. Other than those, the one insight to have more than 1% of respondents identifying any negative life effects was being close to or chosen by a spirit (1.3%).

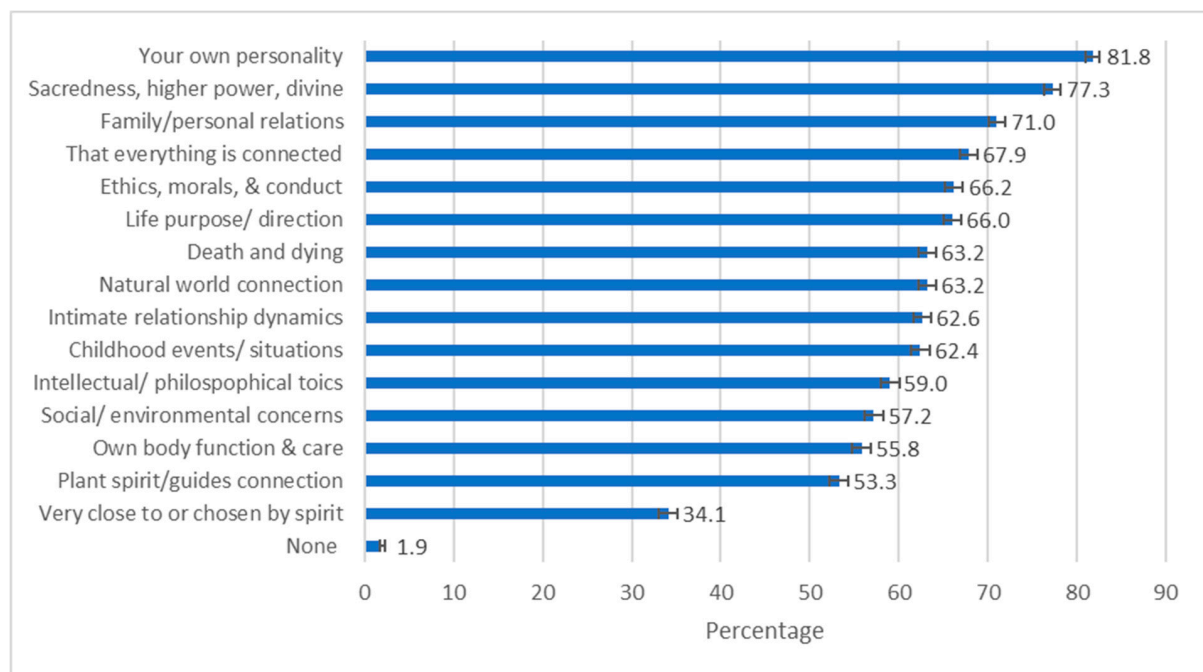


Figure 2. Insights reported after drinking ayahuasca (error bars = 95% CIs) ($n = 8715$).

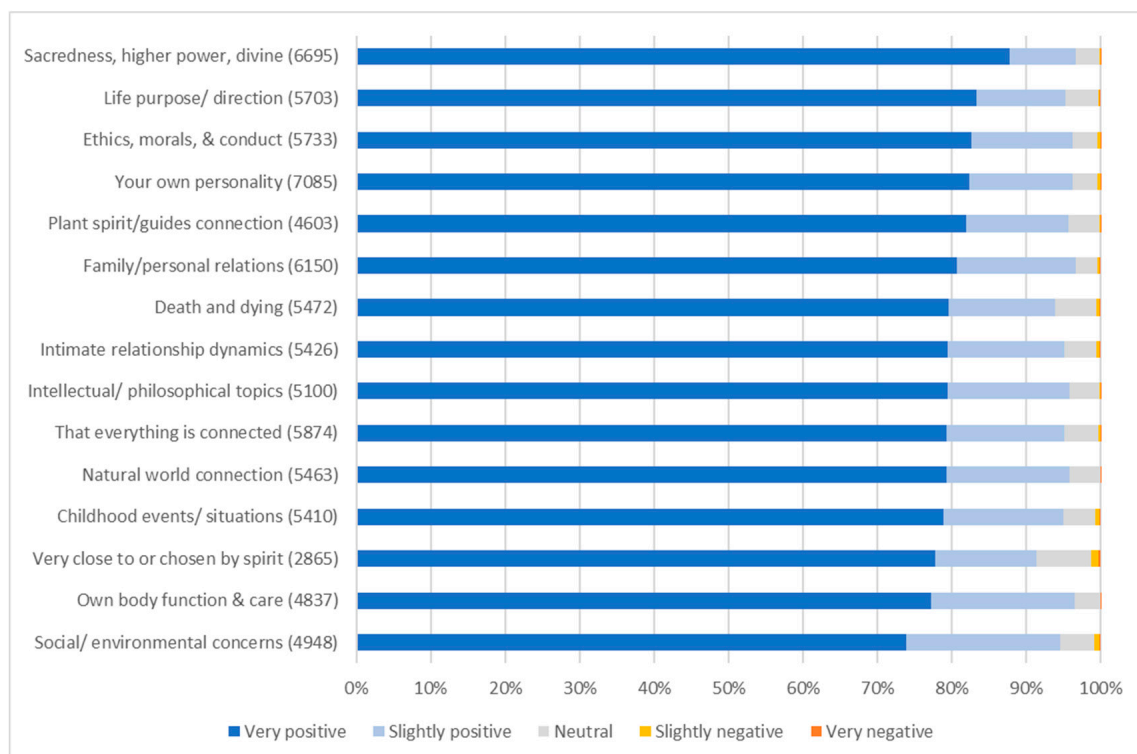


Figure 3. Perceived life effects of insights reported, very negative to very positive (number of respondents in brackets).

In relation to “very positive” life effects, this rating was most commonly selected for “a sense of sacredness, higher power, or divine in the world” (87.8%), followed by insights regarding life purpose/direction (83.3%); ethics, morals and your own conduct (82.6%); your own personality (82.3%); plant spirits/guides (81.9%); and family/personal relations (80.7%). Insights regarding death and dying, intimate relationships, intellectual or

philosophical topics, the sense that everything is connected, connection to the natural world, childhood events and situations, being close to or chosen by spirit, and your own body function and care were all identified as having very positive life effects by between 75% and 80% of individuals. Interestingly, insights relating to social environmental concerns had the lowest (although still high) very positive life effects rating of 73.8%. Overall, the proportion of individuals who gained insights and their perceptions of the resulting life effects were highly favorable.

3.2.2. Life Changes after Drinking Ayahuasca

In addition to the insights above, which typically occur during the acute ayahuasca experience, the participants were also asked about whether they had experienced any specific life changes or lifestyle changes after using ayahuasca.

Life changes were presented as a list of 15 life changes commonly reported anecdotally plus changes in spiritual/religious status obtained from a separate survey question. Almost 90% (89.2%) of the participants reported at least one life change, and the average number of life changes was 3.10 (SD = 2.41). As shown in Figure 4, the most frequently reported life change was a change in religious/spiritual status, by 56.5%, followed by the healing of a long-standing personal conflict or rift, which was reported by 42.7% of respondents; increased involvement in environmental or social causes (39.9%); abstaining from alcohol or drugs (32.6%); changing career direction or employment (32.1%); and commencing study in a new area (29.5%). Around one-quarter of the participants reported reducing or ending problematic alcohol or drug use; deciding or having an increased desire to have, or having, a child; or starting a new intimate relationship. Around one in six participants identified changing the place or city in which they lived, ending an intimate relationship or starting their own business, and around 6% reported that their ayahuasca experiences had contributed to creating a major new personal rift or conflict. A very small proportion reported a decreased desire to have a/another child (1.9%), decreased involvement with environmental or social causes (1.3%), or the instigation of or worsening problematic alcohol or drug use (0.6%).

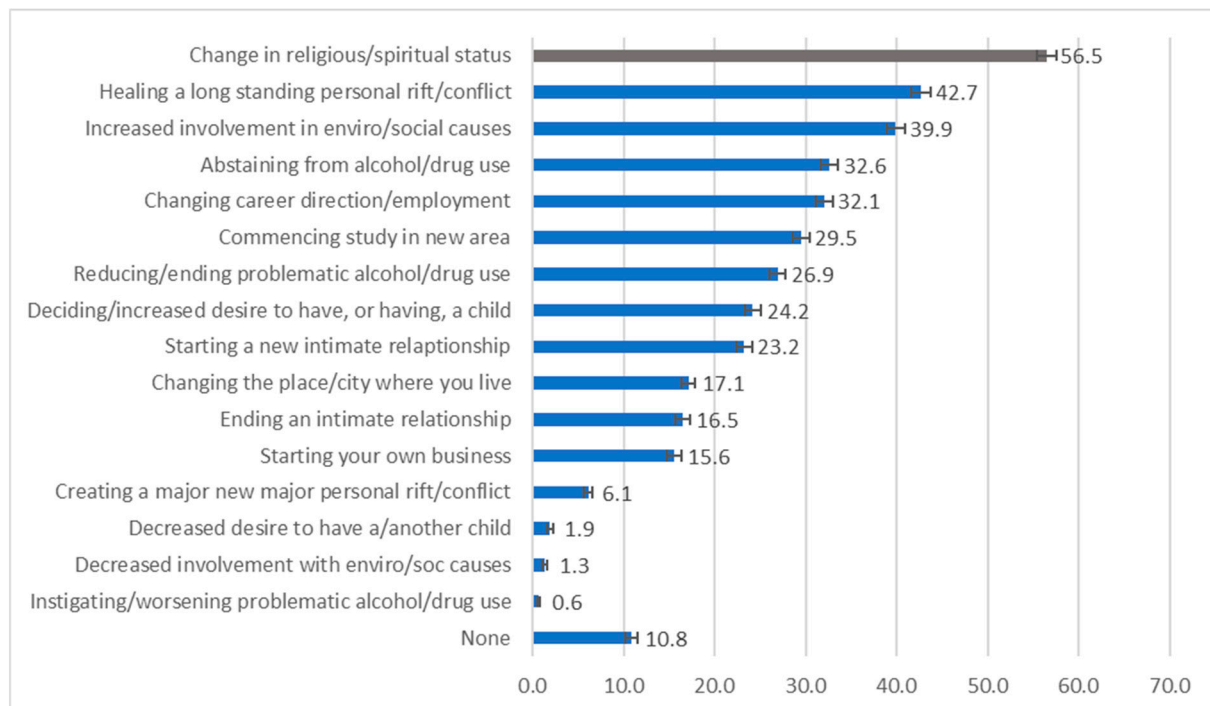


Figure 4. Proportion of people reporting specific life changes after drinking ayahuasca to which their ayahuasca experiences were a significant contributor (error bars = 95% CIs) ($n = 8907$).

The participants were then asked to rate the valence of these changes (other than religious/spiritual status changes) on their lives, with 11 of 15 items having at least 70% very positive ratings and 90+% positive ratings when slightly positive was included. As shown in Figure 5, abstaining from alcohol/drug use was the most positively perceived change, with 91.8% of the participants reporting very positive effects, followed by reducing/ending problematic alcohol/drug use (82.9%), commencing study in a new area (80.6%), healing a longstanding personal rift or conflict (80.4%), and starting a new intimate relationship (79.3%). Starting your own business; deciding on an increased desire to have, or having, children; changing career direction or employment; increased involvement in environmental or social causes; ending an intimate relationship; and changing the place or city in which you live were all reported to have a very positive effect by between around 70% and 75% of respondents selecting these life changes. For all of these 11 changes except 1, very negative ratings were between 0% and 0.46%, while slightly negative ratings were between 0.03% and 1.4%. The exception was ending an intimate relationship, which had 2.8% of people reporting this to be very negative and a further 2.5% reporting it to be slightly negative.

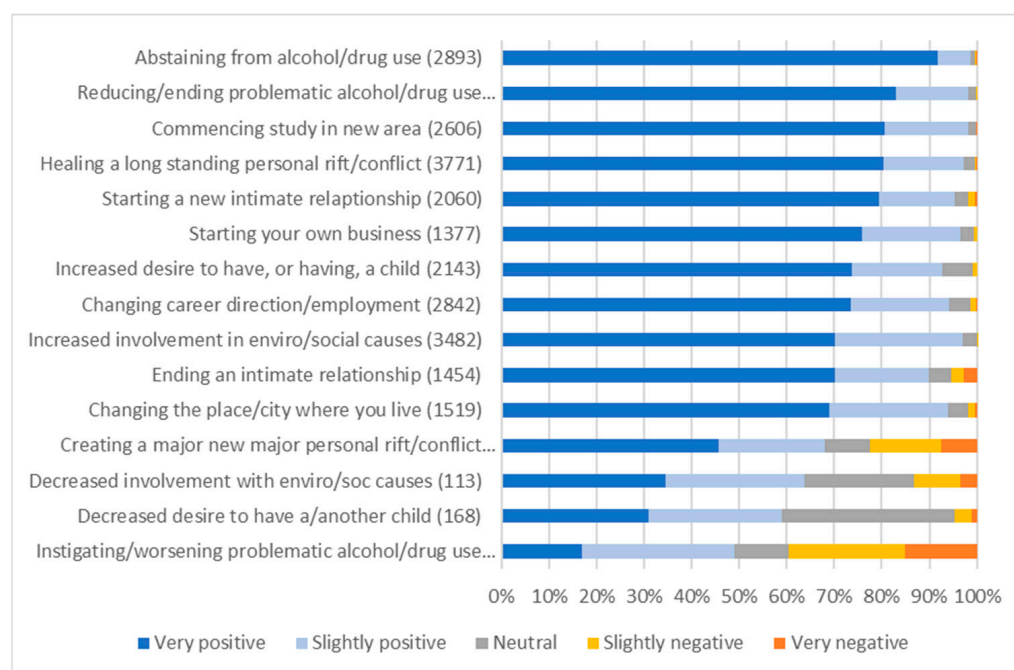


Figure 5. Perceived life effects of insights reported, very negative to very positive (number of respondents in brackets).

Four other variables were perceived as very positive by less than half of the respondents. Creating a major new personal rift was identified as very positive by 45.7%, but the total positive assessment, when slightly positive ratings were included (67.9%), was substantially higher than the total negative rating of 22.6%. Decreased involvement with environmental and social causes and a decreased desire to have a or another child were only reported as being very positive by around one-third of respondents, but a majority still reported some positive effects (around 60%) and relatively small proportions reported any negative effects (13.3% and 4.8%, respectively) for each of these. Finally, instigating or worsening problematic alcohol or drug use was reported as having any positive effect by 49% of respondents ($n = 26$) and any negative effect by 39% of respondents ($n = 21$). Notably, only very small proportions of people (between 0.6% and 6.1%) experienced these four life changes, making negative perceptions very rare.

The perceived life effect of a change in religious or spiritual status was not obtained; however, we undertook further analysis of the differences between religious or spiritual status prior to first consuming ayahuasca and at the date of completing the survey. This

indicated that there was a significant difference ($X^2(9, n = 6360) = 2.2 \times 10^3, p = 0.000$) in religious or spiritual status, with the proportion of people defining themselves as spiritual increasing from 51% to 81%, the proportion identifying as agnostic dropping from 18% to 5%, those identifying as religious dropping from 17% to 9%, and the proportion identifying as atheist dropping from 14% to 5%. Figure 6 identifies the changes between different categories and shows that in the prior religious agnostic and atheist groups around 70% identified as spiritual after ayahuasca consumption, with only around one-quarter or less still identifying with their previous status (see Figure 6).

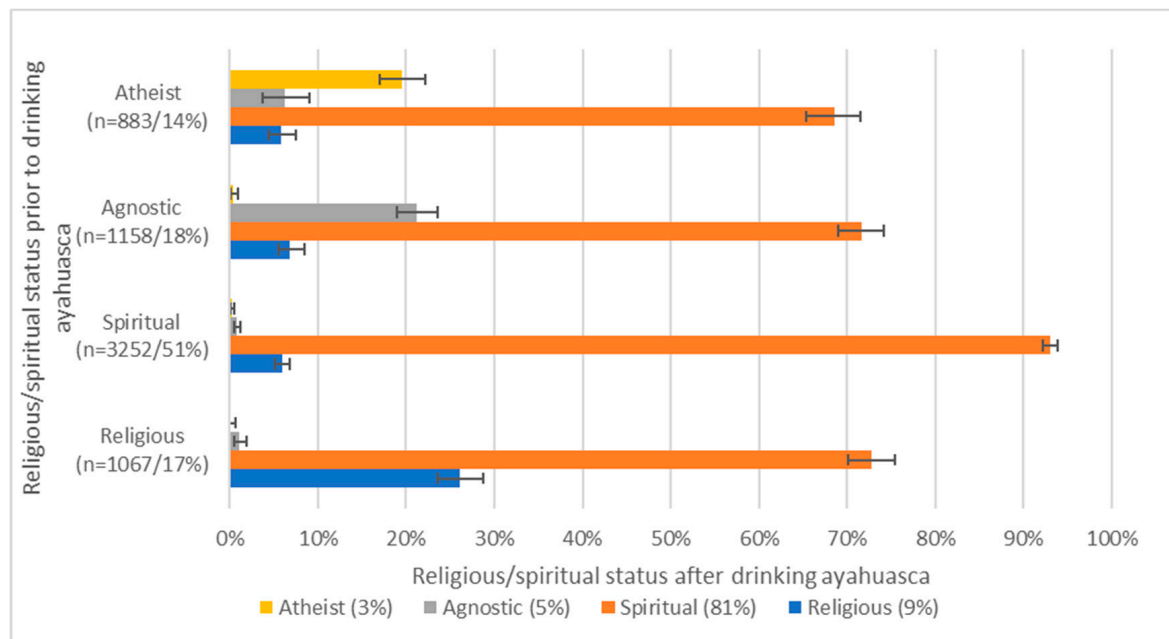


Figure 6. Religious/spiritual status prior to and after drinking ayahuasca (error bars = 95% CIs) ($n = 6360$).

3.2.3. Lifestyle Changes after Drinking Ayahuasca

Respondents were also asked to identify whether they had experienced any change in eight lifestyle or health behaviors since consuming ayahuasca (see Figure 7). Taking care of your physical health was the activity that was most commonly reported to be undertaken “much more” since consuming ayahuasca, by just over 50% of respondents. Between 48% and 44% of respondents reported engaging in spiritual practices, such as meditation or prayer, spending time in nature, or eating a healthy diet, “much more”. Just over one-third reported being much more connected to their creativity (artistic, physical or intellectual) or feeling much more comfortable and confident with their sexuality. Around one-quarter reported being much more likely to do physical exercise. By contrast, around 4.4% were much more likely to be eating meat and 22.8% were much less likely. All other activities were rarely reported to be undertaken less or much less, while three activities were more likely to be reported to have undergone no change (eating meat (44.4%), doing physical exercise (38.9%), and feeling comfortable and confident with your sexuality (35.9%)) than any increase or decrease.

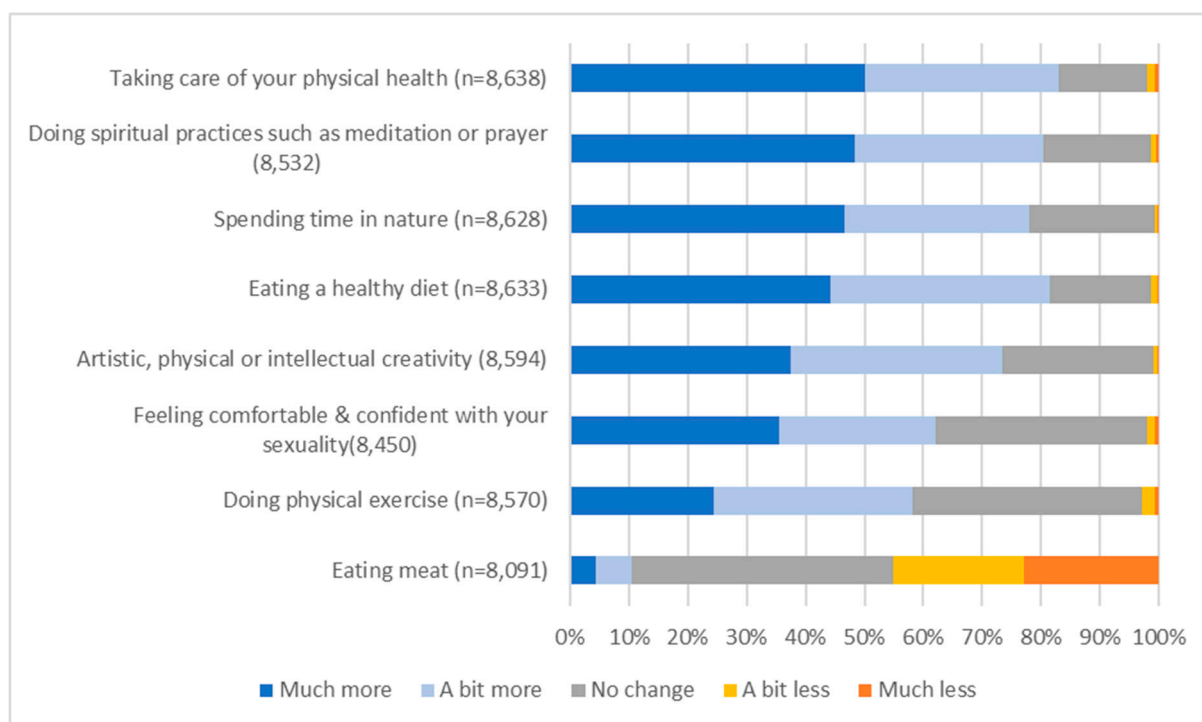


Figure 7. Reported changes in eight lifestyle domains since consuming ayahuasca.

3.3. Correlations between Insights and Life and Lifestyle Changes

To explore relationships between insights attained during the acute experience and subsequent life or lifestyle changes, Spearman's rank correlations were computed between the insights and life and lifestyle changes reported. A significance level of $p < 0.0001$ was used to adjust for the high number of comparisons ($24 \times 15 = 360$). However, as most correlations remained significant but weak, only correlations of 0.2 or above are reported (and bolded) in Table 2, all of which are positive correlations. The total number of life/lifestyle changes that each insight was correlated with (above 0.2) is reported, as is the corresponding number of insight correlations for each life/lifestyle change.

As per Table 2, insights relating to *body function and care* had the highest number of correlations with life or lifestyle changes (11 of 23 life/lifestyle changes), the strongest of which were for caring for physical health ($\rho = 0.32, p < 0.001$) and eating a healthy diet ($\rho = 0.30, p < 0.001$). This insight was also associated with all other lifestyle changes other than eating meat, abstaining from alcohol and drug use, and the less directly related life changes of increased environmental/social cause involvement, healing a personal rift and commencing study in a new area.

Insights relating to *life purpose or direction* was the insight item equally next most frequently correlated with life and lifestyle changes (10 of 23) and most strongly correlated with creativity ($\rho = 0.37, p < 0.001$) and spiritual practices ($\rho = 0.24, p < 0.001$). This insight was also associated with all lifestyle changes other than eating meat and doing exercise. It was also the only insight correlated with career direction or employment change, as well as being correlated with study in a new area and increased involvement with environmental or social causes. Insights relating to *ethics, morals and your own conduct* were also associated with 10 of the 23 life or lifestyle changes, most strongly with abstaining from alcohol or drug use ($\rho = 0.27, p < 0.001$) and involvement with new environmental or social causes ($\rho = 0.27, p < 0.001$). It was also the only insight associated with a change in religious/spiritual status, reduced problematic alcohol or drug use, and desire to have another child, as well as being associated with five of the eight lifestyle changes.

Table 2. Spearman correlations between insights and life and lifestyle changes.

Life or Lifestyle Changes	Insights															
	Childhood Events	Intimate Relationships	Family/ Personal Relationships	Own Personality	Ethics, Morals and Conduct	Life Purpose /Direction	Intellectual/ Philosophical Topics	Body Function and Care	Connection of All Things	Natural World Connection	Plant Spirits/Guides	Sense of Sacredness Divine	Death and Dying	Social/ Environmental Issues	Close to/Chosen by Spirit	No. of Correlations > 0.2
Ending intimate relationship	0.12	0.18	0.09	0.10	0.11	0.09	0.08	0.11	0.12	0.10	0.11	0.08	0.09	0.08	0.08	0
Starting intimate relationship	0.15	0.20	0.15	0.13	0.16	0.16	0.12	0.17	0.11	0.05	0.11	0.14	0.14	0.15	0.09	1
Career/employment	0.17	0.17	0.14	0.14	0.15	0.23	0.19	0.19	0.14	0.16	0.17	0.12	0.14	0.16	0.15	1
Starting own business	0.13	0.13	0.11	0.10	0.12	0.16	0.13	0.15	0.08	0.08	0.11	0.10	0.11	0.11	0.13	0
Study in new area	0.17	0.18	0.17	0.15	0.18	0.22	0.20	0.21	0.14	0.10	0.13	0.15	0.15	0.20	0.12	3
Healing personal rift	0.26	0.26	0.24	0.18	0.18	0.18	0.15	0.20	0.16	0.14	0.15	0.14	0.15	0.16	0.12	4
New major personal rift	0.05	0.08	0.08	0.05#	0.06	0.04^	0.08	0.08	0.07	0.08	0.09	0.04^	0.06	0.05#	0.09	0
New environmental/social causes	0.18	0.17	0.19	0.15	0.27	0.23	0.21	0.24	0.16	0.15	0.17	0.21	0.19	0.45	0.11	6
Reduced environmental/social causes	0.02^	0.03^	0.03^	0.00^	0.00^	0.03^	0.02^	0.04^	0.03^	0.05#	0.04#	0.01^	0.03^	−0.02^	0.06	0
Place/city of residence	0.12	0.12	0.12	0.09	0.11	0.15	0.13	0.14	0.12	0.13	0.14	0.10	0.10	0.11	0.12	0
Want/have a/another child	0.16	0.15	0.16	0.13	0.20	0.16	0.11	0.16	0.10	0.01^	0.06	0.14	0.14	0.16	0.08	1
Not wanting a/another child	0.03^	0.03^	0.00^	0.02^	0.01^	0.03^	0.05^	0.02^	0.05	0.06	0.06	0.01^	0.05#	0.04#	0.05	0
Reduced alcohol/drug abuse	0.14	0.14	0.14	0.12	0.21	0.13	0.12	0.18	0.11	0.11	0.12	0.13	0.13	0.15	0.10	1
Increased alcohol/drug abuse	0.01^	0.00^	−0.01^	0.01^	0.02^	0.01^	0.01^	0.00^	−0.02^	0.02^	0.03^	−0.02^	0.01^	0.01^	0.04^	0
Abstaining from alcohol/drugs	0.16	0.17	0.18	0.13	0.27	0.20	0.13	0.20	0.11	−0.01^	0.05	0.20	0.19	0.22	0.04#	5
Change in religious/spiritual status	0.10	0.08	0.12	0.09	0.20	0.14	0.08	0.14	0.08	0.01^	0.04^	0.17	0.15	0.18	0.05	1
Caring for physical heath	0.18	0.16	0.18	0.14	0.24	0.22	0.13	0.32	0.12	0.07^	0.11	0.19	0.16	0.26	0.10	4
Eating a healthy diet	0.18#	0.15	0.16	0.13	0.21	0.21	0.16	0.30	0.14	0.12	0.16	0.20	0.16	0.27	0.12	5
Eating meat	−0.04	−0.08	−0.02^	−0.06	−0.02^	−0.04#	−0.08	−0.10	−0.09	−0.16	−0.12	−0.05	−0.05	−0.11	−0.08	0
Doing exercise	0.10	0.09	0.10	0.08	0.16	0.15	0.08	0.20	0.06	0.01^	0.04^	0.10	0.08	0.19	0.03^	1
Time in nature	0.17	0.11	0.15	0.12	0.22	0.21	0.12	0.22	0.13	0.14	0.17	0.18	0.16	0.27	0.12	4
Spiritual practices	0.18	0.16	0.15	0.13	0.21	0.24	0.16	0.23	0.17	0.13	0.19	0.24	0.17	0.24	0.16	5
Creativity	0.20	0.18	0.18	0.16	0.23	0.27	0.26	0.27	0.16	0.15	0.19	0.20	0.18	0.27	0.15	7
Comfort with sexuality	0.19	0.20	0.15	0.13	0.18	0.21	0.15	0.25	0.10	0.11	0.15	0.15	0.18	0.21	0.13	4
No. of correlations > 0.2	2	3	1	0	10	10	3	11	0	0	0	5	0	9	0	

All correlations significant at $p < 0.0001$, other than: # = $p < 0.001$, ^ = > 0.001 .

Insights relating to *social and environmental issues* were also correlated with eight changes at or above $\rho = 0.2$, with the strongest of these being increased involvement with environmental and social causes ($\rho = 0.45$, $p < 0.001$). This insight item was also associated with study in a new area, abstaining from alcohol and drugs, and all lifestyle changes other than eating meat and doing exercise. Insights relating to *having a new sense of sacredness or the divine in the world* were associated with five life changes, most strongly spiritual practices ($\rho = 0.24$, $p < 0.001$), and *intellectual or philosophical insights* and *intimate relationship* insights were associated with three changes each, most strongly, creativity ($\rho = 0.26$, $p < 0.001$) and healing a personal rift ($\rho = 0.26$, $p < 0.001$), respectively.

Some other insights and changes were also correlated in rationally connected pairs, including healing a personal rift with insights relating to childhood events, intimate relationships and family personal relationships and starting a new intimate relationship with insights relating to intimate relationships. Interestingly, insights about one's own personality were not associated with any life or lifestyle changes, which was also the case for insights relating to the connection of all things, connection to the natural world, plant spirits or guides, and death and dying and insights relating to being close to or chosen by spirit. Similarly, the life or lifestyle changes of ending an intimate relationship, starting your own business, creating a new personal rift, changing a place/city of residence and eating meat were not correlated with any insights at or above $\rho = 0.2$. Not wanting another child and increased problematic drug or alcohol use were not significantly correlated with most insights at any level. Interestingly, religious/spiritual status change was only associated with the sense of sacredness/divine insight type at a low level ($\rho = 0.17$, $p < 0.001$) and was not significantly associated with natural world connection.

3.3.1. Multivariate Analysis

Dimensions Analysis—Insights, Life Changes and Lifestyle Changes

Prior to undertaking the multivariate analysis, data reduction via principal component analysis was undertaken. The first step in this process involved the use of a Kaiser–Meyer–Olkin test for the life insight, life change and lifestyle change groups to determine their appropriateness for principal component analysis. The results, 0.92, 0.77 and 0.84, respectively, indicated that principal component analysis was appropriate.

Exploratory factor analysis using principal component analysis with varimax rotation was then undertaken for the life insights group and yielded two components, which we labelled as “self-insights” (childhood events; intimate relationships; family/personal relationships; own personality; ethics, morals and conduct; life purpose/direction; and body function and care) and “external insights” (intellectual/philosophical, connection of all things, natural world connection, plant spirits/guides, sense of sacredness/divine, death and dying, social/environmental issues, and being close to/chosen by a spirit). Both components displayed a good level of internal consistency ($\alpha = 0.80$ and 0.79 , respectively), as assessed by Cronbach's alpha [69].

The life changes group yielded four components (career/employment direction change, starting own business, studying in a new area and changing place/city of residence), (abstaining from alcohol/drugs, wanting/having a/another child, religious/spiritual status change, new environmental/social cause involvement and reduced alcohol/drug abuse), (ending an intimate relationship, starting a new intimate relationship, creating a new personal rift and healing a personal rift) and (reduced environmental/social cause involvement, increased alcohol/drug abuse and reduced desire to have a/another child). However, none of these had an acceptable level ($\alpha > 0.70$) of internal consistency ($\alpha = 0.48$, 0.51 , 0.43 and 0.17 , respectively). As a result, no components were selected for use from this group.

Finally, the lifestyle change group yielded two components. Component one included caring for physical health, eating a healthy diet, doing exercise, time in nature, spiritual practices, creativity and comfort with sexuality, while the second included just eating meat. Component one displayed an acceptable α value of 0.82 and was retained, while component two, eating meat, was discarded from further analysis.

Multivariate Models—Predictors of Insights, Lifestyle and Life Changes

Linear regressions were used to identify predictors of the two insight variables, self-insights and external insights (Table 3). These models included demographic variables and a range of ayahuasca drinking variables (including patterns of use, context of use and aspects of the acute subjective experience). The results, presented in Table 3, show a similar pattern of predictors for both insight variables, including negative associations with age and being female and positive associations with having a university education, number of lifetime mental health diagnoses, number of times that ayahuasca had been used and both spirituality variables (PEQ-S and SIMO).

Table 3. Linear regression models predicting self- and external insights.

	Self-Insights (<i>n</i> = 6775)		External Insights (<i>n</i> = 6775)	
	B (SE)	<i>p</i>	B (SE)	<i>p</i>
Age (decades)	−0.23 (0.02)	0.000	−0.05 (0.02)	0.011
University education	0.23 (0.05)	0.000	0.16 (0.05)	0.001
Female	−0.1 (0.05)	0.028	−0.16 (0.05)	0.001
LT mental health diagnoses ^a	0.21 (0.02)	0.000	0.14 (0.02)	0.000
Number of times drunk	0.21 (0.01)	0.000	0.12 (0.01)	0.000
PEQ-S	0.3 (0.02)	0.000	0.37 (0.02)	0.000
SIMO	0.03 (0.00)	0.000	0.04 (0.00)	0.000
Extreme fear	0.00 (0.01)	0.851	0.01 (0.01)	0.430
Support and safety	−0.01 (0.04)	0.786	−0.01 (0.04)	0.759
Preparation score	0.19 (0.03)	0.000	0.14 (0.03)	0.000
Context—ayahuasca church ^b	−0.18 (0.08)	0.020	−0.69 (0.07)	0.000
Context—other ^b	0.17 (0.06)	0.008	0.01 (0.06)	0.841
Ayahuasca community	0.24 (0.03)	0.000	0.15 (0.03)	0.000
Years since drunk	−0.02 (0.01)	0.003	0.00 (0.01)	0.476

^a Number of lifetime mental health diagnoses; ^b vs. drinking in a traditional context.

Feeling better prepared and the strength of the ayahuasca drinking community were also both positively associated with self-insights and external insights. Finally, the number of years since ayahuasca had been used was not associated with external insights but was negatively associated with self-insights, albeit with a very slight (0.02) reduction in the number of insights for each year since last consumption (which equates to one less insight being reported after 50 years).

The models in Table 4 present the predictors of lifestyle change (based on the average lifestyle change variable score), utilizing the same independent variables as in Table 3 plus integration difficulties which occurred in the weeks and months following the acute experience. Hierarchical regression analysis was used to compare the addition of self-insights and external insights in Model 2, and this was found to significantly improve the explanatory power (R^2 Diff. Model 2 – Model 1 = 0.050, $F(2,6709) = 237.178$, $p = 0.000$); hence, Model 2 with the insight variables included was preferred.

Table 4. Hierarchical linear regression models predicting lifestyle change.

	Lifestyle Change (Model 1) (<i>n</i> = 6725)		Lifestyle Change (Model 2) (<i>n</i> = 6707)	
	B (SE)	<i>p</i>	B (SE)	<i>p</i>
Age (decades)	−0.04 (0.01)	0.000	−0.02 (0.01)	0.000
University education	−0.04 (0.01)	0.003	−0.05 (0.01)	0.000
Female	0.05 (0.01)	0.000	0.06 (0.01)	0.000
LT mental health diagnoses ^a	0.03 (0.01)	0.000	0.01 (0.01)	0.046
Number of times drunk	0.05 (0.00)	0.000	0.04 (0.00)	0.000
PEQ-S	0.06 (0.01)	0.000	0.03 (0.01)	0.000
SIMO	0.01 (0.00)	0.000	0.01 (0.00)	0.000
Extreme fear	−0.01 (0.00)	0.000	−0.01 (0.00)	0.000
Integration difficulties	−0.01 (0.00)	0.000	−0.01 (0.00)	0.000
Support and safety	0.02 (0.01)	0.036	0.02 (0.01)	0.035
Preparation score	0.03 (0.01)	0.000	0.01 (0.01)	0.071
Context—ayahuasca church ^b	0.02 (0.02)	0.297	0.05 (0.02)	0.011
Context—other ^b	0.01 (0.02)	0.505	0.00 (0.02)	0.923
Ayahuasca community	0.04 (0.01)	0.000	0.02 (0.01)	0.000
Years since drunk	0.00 (0.00)	0.572	0.00 (0.00)	0.946
Insights—self			0.05 (0.00)	0.000
Insights—external			0.03 (0.00)	0.000

^a Number of lifetime mental health diagnoses; ^b vs. drinking in a traditional context.

Greater lifestyle change was associated with being younger, not having a university education, being female and having a higher number of lifetime mental health diagnoses, although the latter was marginally significant ($p = 0.046$). Of the ayahuasca drinking variables, the number of times used, both spirituality variables, the support and safety at the place of use, drinking with an ayahuasca church, and drinking with a strong ayahuasca community, in addition to the number of self- and external insights, were all positively associated with lifestyle change. Experiencing extreme fear and the number of integration difficulties in the weeks and months after consuming ayahuasca were both negatively associated with lifestyle change. Support for preparation, drinking in other contexts (versus a traditional context) and the number of years since ayahuasca had been consumed were all not significantly related to lifestyle change.

Multivariate logistic regression models were then used to examine the associations between the predictors and the reported life changes individually using the same set of independent variables as in Lifestyle Change Model 2 (see Table 5). Across the 16 life changes, the self-insight variable was most consistently found to predict change, and this positively predicted 12 of the 16 life change types at a high level of significance (all p values <0.001). Increases in the odds of these life changes ranged from 9% (new involvement in social or environmental causes) to 39% (healing a longstanding personal rift). Life changes that were not predicted by self-insights were reduced involvement with social and environmental causes, religious/spiritual status change, not wanting to have a/another child, and beginning or worsening problematic alcohol or drug use. The external insight variable positively predicted 12 of the 16 life changes, mostly corresponding to those predicted by the self-insight variable, but with several of these having lower odds ratios or a lower level of significance. Differences included external insights not significantly predicting ending an intimate relationship or healing a longstanding personal rift but positively predicting religious/spiritual status change and not wanting to have a/another child. The external insight variable also had a substantially higher odds ratio predicting involvement in envi-

ronmental and social causes, compared with the self-insight variable (OR = 1.39, 95% CI: 1.34, 1.35 vs. OR = 1.09, 95% CI: 1.05, 1.13).

Drinking with an ayahuasca church was significantly associated with 11 of the 16 life changes, but, interestingly, in different directions. For six of these, drinking with an ayahuasca church was negatively associated, including reductions of 70% in the odds of not wanting a/another child, 54% for changing career direction or employment, 45% for starting your own business, 43% for changing the city or place of residence, 38% for ending a relationship, and 22% for healing a longstanding personal rift. By contrast, drinking with an ayahuasca church was associated with a 40% increase in the odds of new involvement in environmental or social causes and wanting or having a/another child. It was also associated with 49% increased odds of reducing problematic alcohol or drug use, a 67% increase in the odds of religious/spiritual status change, and a 125% increase in the odds of abstaining from drugs or alcohol (OR = 2.25, 95% CI: 1.85, 2.74).

Integration difficulties were positively associated with nine life changes, with the greatest change being a 25% increase in the odds of increased alcohol/drug abuse for each integration difficulty reported, 21% for creating a new personal rift, 18% for reduced environmental or social cause involvement, and an 11% odds increase (for each additional integration difficulty) for not wanting a/another child. Significant odds increases of between 5% and 10% (for each additional integration difficulty) were present for moving city or place of residence, ending an intimate relationship, starting an intimate relationship, changing career or employment direction, and beginning studying in a new area, perhaps reflecting the inevitable challenge associated with major life events. Integration difficulties also reduced the odds of new involvement in environmental and social causes by 3%.

The number of times that ayahuasca had been consumed was positively associated with 11 life changes, with odds increases of between 6% (reduced problematic alcohol drug use) and 20% (abstaining from alcohol or drugs) for each additional use category. The number of uses was not significantly associated with new alcohol and drug abuse, not wanting another child, or healing or creating a personal rift. The spirituality variables (PEQ-S and SIMO) were less predictive of life changes than other ayahuasca drinking variables. The former was positively associated with five life changes: career/employment direction change (as was SIMO), religious/spiritual status change (as was SIMO), healing a personal rift, and abstaining from alcohol or drugs, as well as a 29% reduction in the odds of beginning alcohol or drug abuse, while SIMO was positively associated with starting your own business and changing your place/city of residence.

Better perceived preparation was associated with increased odds of changing employment/career direction, healing a personal rift, abstaining from alcohol or drugs, and reducing alcohol and drug use. Other significant ayahuasca drinking variable associations included drinking in a context classed as “Other” (compared with traditional) being associated with a 30% increase in the odds of reduced alcohol or drug abuse and a 20% reduction in the odds of wanting a/another child; the strength of the ayahuasca community being associated with a 7% increase in new environmental/social cause involvement; and extreme fear being positively associated with a new personal rift (4% increase) and negatively (4% decrease) with new environmental and social cause involvement.

Table 5. Logistic regression models identifying predictors of life changes ($n = 6754$).

	Ending Intimate Relationship	Starting Intimate Relationship	Career /Employment	Own Business	Study in New Area	Healing Personal Rift	New Personal Rift	New Environ- mental/Social Causes	Reduced Environmen- tal/Social Causes	Place/City of Residence	Wanting/ Having a/Another Child	Not Wanting a/another Child	Reduced Alcohol/Drug Abuse	Beginning Alcohol/Drug Abuse	Abstaining from Alco- hol/Drugs	Religious/ Spiritual Status Change
% reporting change	16.5	23.2	32.1	15.6	29.5	42.7	6.1	39.9	1.3	17.1	24.2	1.9	26.9	0.6	32.6	56.5
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age (decades)	0.87 (0.82; 0.92) ***	0.77 (0.73; 0.81) ***	0.93 (0.88; 0.97) **	1.01 (0.95; 1.07)	0.88 (0.83; 0.92) ***	0.92 (0.88; 0.97) **	0.86 (0.78; 0.95) **	0.90 (0.86; 0.94) ***	0.92 (0.76; 1.12)	0.97 (0.91; 1.03)	0.60 (0.57; 0.64) ***	0.92 (0.78; 1.08)	0.85 (0.81; 0.90) ***	0.76 (0.56; 1.02)	0.89 (0.85; 0.94) ***	0.96 (0.91; 1.01)
University education	1.11 (0.96; 1.27)	1.28 (1.12; 1.46) ***	1.08 (0.97; 1.21)	0.87 (0.75; 1.00)	1.00 (0.89; 1.12)	1.01 (0.90; 1.12)	0.97 (0.78; 1.19)	1.09 (0.98; 1.23)	0.86 (0.57; 1.32)	1.05 (0.92; 1.21)	1.53 (1.34; 1.75) ***	0.84 (0.59; 1.19)	0.89 (0.79; 1.00)	0.65 (0.35; 1.19)	0.90 (0.80; 1.01)	0.96 (0.86; 1.08)
Female	1.55 (1.36; 1.77) ***	0.80 (0.71; 0.91) ***	0.84 (0.75; 0.94) **	0.82 (0.71; 0.95) **	0.97 (0.87; 1.09)	1.27 (1.15; 1.42) ***	1.14 (0.93; 1.39)	0.94 (0.85; 1.05)	0.88 (0.58; 1.33)	1.17 (1.03; 1.33) *	1.02 (0.90; 1.15)	1.2 (0.85; 1.71)	0.56 (0.50; 0.63) ***	1.11 (0.6; 2.04)	0.69 (0.62; 0.78) ***	0.81 (0.73; 0.9) ***
LT mental health diagnoses ^a	1.01 (0.95; 1.06)	1.09 (1.03; 1.14) **	1.10 (1.05; 1.15) ***	1.02 (0.96; 1.08)	1.07 (1.02; 1.12) **	1.14 (1.09; 1.19) ***	1.21 (1.12; 1.29) ***	1.04 (0.99; 1.09)	1.19 (1.04; 1.36) *	1.14 (1.08; 1.20) ***	1.01 (0.96; 1.07)	1.06 (0.94; 1.20)	1.57 (1.50; 1.65) ***	1.28 (1.07; 1.54) **	1.24 (1.18; 1.3) ***	1.09 (1.04; 1.15) ***
Number of times drunk	1.08 (1.04; 1.12) ***	1.18 (1.14; 1.22) ***	1.10 (1.07; 1.14) ***	1.12 (1.08; 1.17) ***	1.10 (1.07; 1.14) ***	0.99 (0.97; 1.02)	1.00 (0.94; 1.05)	1.12 (1.08; 1.15) ***	0.99 (0.89; 1.11)	1.14 (1.10; 1.18) ***	1.19 (1.15; 1.23) ***	0.94 (0.86; 1.03)	1.06 (1.03; 1.10) ***	1.00 (0.85; 1.18)	1.20 (1.16; 1.23) ***	1.18 (1.14; 1.21) ***
PEQ-S	1.00 (0.93; 1.07)	1.03 (0.96; 1.10)	1.07 (1.01; 1.13) *	1.07 (0.99; 1.16)	1.00 (0.94; 1.06)	1.09 (1.03; 1.15) **	0.96 (0.86; 1.07)	1.06 (1.00; 1.13)	1.08 (0.86; 1.35)	1.07 (1.00; 1.16)	1.05 (0.98; 1.13)	0.97 (0.8; 1.19)	1.06 (0.99; 1.13)	0.71 (0.54; 0.95) *	1.11 (1.04; 1.18) **	1.37 (1.29; 1.45) ***
SIMO	1.00 (1.00; 1.01)	1.00 (1.00; 1.00)	1.01 (1.00; 1.01) **	1.01 (1.00; 1.01) **	1.00 (1.00; 1.01)	1.00 (1.00; 1.01)	0.99 (0.99; 1.00)	1.00 (0.99; 1.00)	0.99 (0.98; 1.00)	1.01 (1; 1.01) **	1.00 (0.99; 1.00)	1.00 (0.99; 1.02)	1.00 (1.00; 1.00)	1.00 (0.98; 1.02)	1.00 (0.99; 1.00)	1.01 (1; 1.01) **
Extreme fear	1.03 (1.01; 1.06) **	0.99 (0.97; 1.01)	1.01 (0.99; 1.03)	1.00 (0.98; 1.03)	0.99 (0.97; 1.01)	1.00 (0.98; 1.02)	1.04 (1.00; 1.07) *	0.96 (0.94; 0.98) ***	1.03 (0.97; 1.10)	0.99 (0.97; 1.01)	0.99 (0.97; 1.01)	1.02 (0.96; 1.07)	1.01 (0.99; 1.03)	0.95 (0.86; 1.04)	0.98 (0.96; 1.00)	1.02 (1.00; 1.04) *
Integration difficulties	1.09 (1.06; 1.12) ***	1.06 (1.03; 1.09) ***	1.05 (1.02; 1.08) ***	1.02 (0.99; 1.06)	1.05 (1.02; 1.08) ***	1.00 (0.98; 1.03)	1.21 (1.16; 1.26) ***	0.97 (0.94; 1.00) *	1.18 (1.09; 1.28) ***	1.10 (1.06; 1.13) ***	1.01 (0.98; 1.05)	1.11 (1.03; 1.19) **	1.01 (0.98; 1.04)	1.25 (1.12; 1.40) ***	0.98 (0.95; 1.01)	1.01 (0.98; 1.04)
Support and safety	1.02 (0.90; 1.16)	1.03 (0.91; 1.17)	0.93 (0.84; 1.04)	0.95 (0.83; 1.09)	0.99 (0.88; 1.11)	0.97 (0.88; 1.08)	0.89 (0.74; 1.07)	1.04 (0.93; 1.16)	0.75 (0.54; 1.05)	0.90 (0.8; 1.02)	1.05 (0.92; 1.20)	0.99 (0.75; 1.31)	0.99 (0.88; 1.11)	0.82 (0.53; 1.27)	1.03 (0.91; 1.16)	0.98 (0.88; 1.09)
Preparation score	0.96 (0.88; 1.04)	1.01 (0.94; 1.09)	1.13 (1.06; 1.21) ***	1.02 (0.94; 1.11)	1.05 (0.98; 1.12)	1.08 (1.01; 1.15) *	1.08 (0.95; 1.23)	1.02 (0.96; 1.09)	1.04 (0.79; 1.35)	1.03 (0.95; 1.12)	1.00 (0.93; 1.08)	0.84 (0.68; 1.04)	1.10 (1.02; 1.18) *	0.8 (0.55; 1.16)	1.14 (1.07; 1.23) ***	0.96 (0.9; 1.02)
Context—ayahuasca church ^b	0.62 (0.49; 0.77) ***	0.92 (0.74; 1.13)	0.46 (0.38; 0.55) ***	0.55 (0.43; 0.69) ***	0.95 (0.79; 1.15)	0.78 (0.66; 0.93) **	0.76 (0.54; 1.06)	1.40 (1.16; 1.68) ***	0.67 (0.33; 1.33)	0.57 (0.46; 0.72) ***	1.40 (1.13; 1.73) **	0.31 (0.16; 0.59) ***	1.49 (1.22; 1.83) ***	0.54 (0.2; 1.49)	2.25 (1.85; 2.74) ***	1.67 (1.39; 2) ***
Context—other ^b	1.00 (0.84; 1.20)	0.81 (0.67; 0.97) *	0.90 (0.77; 1.04)	0.84 (0.69; 1.02)	1.03 (0.88; 1.22)	0.91 (0.79; 1.05)	1.15 (0.88; 1.50)	1.08 (0.92; 1.26)	0.99 (0.59; 1.69)	0.99 (0.82; 1.18)	0.81 (0.67; 0.99) *	1.1 (0.74; 1.64)	1.30 (1.1; 1.54) **	0.68 (0.33; 1.44)	0.98 (0.82; 1.17)	1.19 (1.03; 1.39) *
Ayahuasca community	1.01 (0.93; 1.09)	1.09 (1.01; 1.17) *	0.98 (0.92; 1.04)	1.06 (0.97; 1.14)	1.06 (1.00; 1.14)	1.00 (0.94; 1.07)	1.02 (0.91; 1.14)	1.07 (1.00; 1.14) *	1.01 (0.81; 1.27)	0.95 (0.88; 1.03)	1.07 (0.99; 1.15)	0.98 (0.82; 1.17)	1.00 (0.94; 1.07)	0.76 (0.55; 1.06)	1.04 (0.97; 1.11)	1.08 (1.01; 1.14) *
Years since drunk	1.01 (0.99; 1.03)	1.03 (1.01; 1.04) **	1.02 (1.01; 1.04) **	1.00 (0.98; 1.02)	1.01 (1.00; 1.03)	0.99 (0.98; 1.01)	1.01 (0.98; 1.04)	1.01 (0.99; 1.02)	1.01 (0.95; 1.08)	1.03 (1.01; 1.05) ***	1.01 (1.00; 1.03)	1.04 (0.99; 1.09)	0.97 (0.95; 0.99) **	1.05 (0.98; 1.13)	0.98 (0.97; 1.00)	0.99 (0.98; 1.01)
Insights—self	1.20 (1.14; 1.25) ***	1.22 (1.17; 1.27) ***	1.20 (1.16; 1.25) ***	1.22 (1.16; 1.28) ***	1.19 (1.15; 1.24) ***	1.39 (1.34; 1.44) ***	1.14 (1.06; 1.23) ***	1.09 (1.05; 1.13) ***	1.11 (0.97; 1.28)	1.14 (1.08; 1.19) ***	1.18 (1.13; 1.23) ***	1.05 (0.94; 1.17)	1.14 (1.1; 1.19) ***	1.08 (0.89; 1.31)	1.16 (1.12; 1.21) ***	1.01 (0.97; 1.04)
Insights—external	1.04 (0.99; 1.08)	1.06 (1.02; 1.10) **	1.09 (1.05; 1.13) ***	1.06 (1.02; 1.12) *	1.14 (1.1; 1.18) ***	1.02 (0.99; 1.06)	1.12 (1.04; 1.20) **	1.39 (1.34; 1.45) ***	1.07 (0.93; 1.23)	1.11 (1.06; 1.16) ***	1.08 (1.04; 1.13) ***	1.26 (1.11; 1.43) ***	1.09 (1.05; 1.13) ***	1.08 (0.88; 1.32)	1.10 (1.05; 1.14) ***	1.06 (1.02; 1.1) **

^a Number of lifetime mental health diagnoses; ^b vs. drinking in a traditional context; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Of the demographic variables, age was negatively associated with ten life changes (7% to 23% reductions in odds for each additional decade) and university education was positively associated with starting an intimate relationship (28% odds increase) and wanting a/another child (53% odds increase). There were some notable differences by sex, with females having significantly higher (55%) odds of ending an intimate relationship, healing a personal rift (27%), and changing their place or city of residence (17%) but lower odds of religious/spiritual status change (19%), reducing alcohol or drug abuse (43%), abstaining from alcohol and drugs (31%), starting an intimate relationship (20%), starting their own business (18%), or changing career or employment direction (16%). The data also indicated that the number of lifetime mental health diagnoses increased the odds of life changes for 11 of the 15 life change types, with the greatest effect being for reducing alcohol or drug abuse, for which each additional lifetime mental health diagnosis was associated with a 57% increase in the odds of this change being reported. The odds of abstaining from alcohol or drug use increased by 24%, but, by contrast, the odds of beginning alcohol or drug abuse also increased by 28%, noting, however, that this was an extremely rare life change reported by 0.6% of respondents. The number of lifetime mental health diagnoses was also associated with increased odds of creating a new personal rift (21%), reduced involvement in environmental or social cause involvement (19%), changing the place or city of residence (14%), healing a personal rift (14%), career direction or employment change (10%), starting an intimate relationship (9%), and commencing study in a new area (7%).

3.3.2. Association with Perceived Wellbeing Growth and Current Mental Health Status

The final set of models utilized the least absolute shrinkage and selection operator (LASSO) with cross-validation selection to identify the best subset of predictors for each of the outcome variables of interest from the full list of insights, life changes and lifestyle changes. Separate LASSO models were run for each outcome variable. As this was an exploratory study, this approach was chosen to provide greater detail regarding the possible influence of these different sets of features on broader wellbeing and mental health, as well as their relative importance.

A total of 54 demographic, ayahuasca drinking, insight, life change and lifestyle change features were included in the LASSO variable selection procedure (see Table S1 for the full list of variables). Across the four outcome variables, an average of 21 predictors were selected, including 25 for overall life effects, 23 for PWG, 16 for the K10 and 19 for the SF12-MCS. Three of four possible demographic features were selected in at least one of the four models. Of the 11 ayahuasca drinking variables, only the preparation score and the number of years since ayahuasca was last drunk were not selected in any models. Seven of fifteen insights features were selected, and five of sixteen life changes were selected in at least one model. Of the eight lifestyle change features, only “eating meat” was not selected in any of the models.

Table 6 presents the standardized beta coefficients (and p values) to simplify the interpretation of the relative importance of the predictor variables for each of the four outcomes. For the overall life effects, integration difficulties ($\beta = 0.17$, $p < 0.001$), followed by the two spirituality variables (PEQ-S and SIMO) ($\beta = 0.15$ and $\beta = 0.13$, respectively; both $p < 0.001$) and number of times drunk ($\beta = 0.12$, $p < 0.001$), were the strongest predictors. This was followed by the strength of the ayahuasca drinking community two lifestyle variables (caring for physical health and sexuality comfort/confidence) and the life purpose/direction insight variable (beta = 0.08 to 0.11). Regarding experiencing extreme fear, five other lifestyle change variables (safety and support in the context of use, insights relating to your own personality, and a new personal rift (life change)) were in the next group of predictors (beta = 0.03 to 0.08). Two other life changes (abstaining from alcohol or drugs and religious/spiritual status change) were significantly associated with overall life effects, as were insights relating to family/personal relationships.

A different pattern was evident for PWG, where the lifestyle change sexuality comfort/confidence was by far the strongest predictor ($\beta = 0.18$, $p < 0.001$), followed by SIMO,

five other lifestyle changes, life purpose/direction insights and integration difficulties (negative) (β values between 0.08 and 0.12). Our second spirituality variable (PEQ-S), the close to/chosen by spirit insight, the strength of the ayahuasca community, the number of times drunk, extreme fear (negative), change in religious/spiritual status, safety and support, and abstaining from alcohol/drugs were all significantly related to PWG with beta values of 0.03 and 0.075. For the Kessler 10 (psychological distress), the integration difficulties variable was most strongly predictive ($\beta = 0.30$, $p < 0.001$), followed by the number of lifetime mental health diagnoses ($\beta = 0.18$, $p < 0.001$). The strength of the ayahuasca drinking community and the caring for physical health lifestyle change recorded beta values of 0.07 to 0.09, followed by the sexuality and spiritual practices lifestyle changes, SIMO, a new personal rift, and extreme fear (0.05 to 0.07) (all negatively associated with psychological distress except the last two). Three more lifestyle changes and the number of times drunk were significantly associated with negative beta values of 0.02 to 0.04. The life purpose/direction insight was the only insight variable selected by the LASSO procedure for this model, but this was not significant.

Finally, in the SF12-MCS model, integration difficulties and number of lifetime mental health diagnoses were the strongest predictors ($\beta = 0.26$ and $\beta = 0.14$, respectively; both $p < 0.001$), followed by the strength of the ayahuasca drinking community ($\beta = 0.11$, $p < 0.001$), SIMO ($\beta = 0.09$, $p < 0.001$), four lifestyle variables (sexuality comfort, caring for physical health, creativity and spiritual practices), extreme fear (negative) and drinking in an “other” context (versus traditional) (negative) (beta = 0.04 to 0.08). Life purpose/direction insights (the only insight variable significantly associated with either mental health variable) and the exercise lifestyle change were both positively significantly associated ($\beta = 0.03$, $p < 0.05$), while number of times drunk was not significantly associated in the SF12-MCS model. We also ran an additional LASSO process investigating predictors of physical health change using the SF12 Physical Health Component Score (PCS). The LASSO procedure selected four variables, one of which was the eating a healthy diet lifestyle change that was positively associated with better current physical health (based on the SF12-PCS) ($\beta = 0.07$, $p < 0.001$). The other three variables selected were age in decades ($\beta = 0.21$), number of lifetime mental health diagnoses ($\beta = 0.12$) and drinking with an ayahuasca church ($\beta = 0.09$)—all significant at $p < 0.001$.

Table 6. Linear regression models using LASSO-selected predictors of perceived life effect, wellbeing growth and current mental health.

	Overall Life Effect (<i>n</i> = 6502)		PWG (<i>n</i> = 6106) ^c		Kessler 10 ^d (<i>n</i> = 6492)		SF-12 (MCS) ^e (<i>n</i> = 6172)	
	Beta (SE)	<i>p</i>	Beta (SE)	<i>p</i>	Beta (SE)	<i>p</i>	Beta (SE)	<i>p</i>
DEMOGRAPHIC								
Age (decades)					−0.09 (0.04)	0.000	0.12 (0.09)	0.000
Female	0.03 (0.03)	0.010			0.04 (0.10)	0.000	−0.05 (0.20)	0.000
LT mental health diagnoses ^a	−0.04 (0.01)	0.000			0.18 (0.04)	0.000	−0.14 (0.09)	0.000
AYAHUASCA DRINKING								
Times drunk	0.12 (0.01)	0.000	0.06 (0.04)	0.000	−0.04 (0.02)	0.009	0.03 (0.05)	0.085
PEQ-S	0.13 (0.01)	0.000	0.08 (0.09)	0.000	−0.06 (0.05)	0.000		
SIMO	0.15 (0.00)	0.000	0.12 (0.01)	0.000			0.10 (0.01)	0.000
Extreme fear	−0.07 (0.00)	0.000	−0.05 (0.03)	0.000	0.06 (0.02)	0.000	−0.08 (0.03)	0.000
Integration difficulties	−0.17 (0.01)	0.000	−0.08 (0.04)	0.000	0.30 (0.03)	0.000	−0.26 (0.05)	0.000
Support and safety	0.03 (0.02)	0.001	0.03 (0.15)	0.002				
Context—ayahuasca church ^b							0.00 (0.34)	0.979
Context—other ^b			0.00 (0.21)	0.929			−0.04 (0.28)	0.006
Ayahuasca community	0.11 (0.02)	0.000	0.07 (0.1)	0.000	−0.09 (0.06)	0.000	0.11 (0.11)	0.000
INSIGHTS								
Family/personal relationships	0.02 (0.03)	0.033	0.04 (0.22)	0.000				
Own personality	0.03 (0.04)	0.002						
Ethics, morals and conduct	0.02 (0.03)	0.068						
Life purpose/direction	0.08 (0.03)	0.000	0.09 (0.21)	0.000	−0.02 (0.12)	0.074	0.03 (0.24)	0.017
Sense of sacredness/divine	0.02 (0.04)	0.132	0.00 (0.25)	0.870				
Death and dying			0.01 (0.21)	0.337				
Close to/chosen by spirit	0.02 (0.03)	0.144	0.08 (0.20)	0.000				
LIFE CHANGES								
New personal rift	−0.03 (0.06)	0.001			0.06 (0.21)	0.000		
New environmental/social causes			0.01 (0.19)	0.354			0.00 (0.22)	0.878
Another child	0.02 (0.03)	0.068	0.02 (0.21)	0.062				
Abstaining from alcohol or drugs	0.03 (0.03)	0.007	0.03 (0.20)	0.008				
Religious/spiritual status	0.03 (0.03)	0.009	0.04 (0.19)	0.000				
LIFESTYLE CHANGE								
Caring for physical health	0.09 (0.02)	0.000	0.11 (0.14)	0.000	−0.07 (0.08)	0.000	0.07 (0.17)	0.000
Eating a healthy diet	0.06 (0.02)	0.000	0.08 (0.15)	0.000	−0.03 (0.09)	0.047	0.02 (0.17)	0.144
Doing exercise							0.03 (0.14)	0.048
Time in nature	0.03 (0.02)	0.006	0.11 (0.13)	0.000	−0.03 (0.08)	0.023	0.02 (0.16)	0.242
Spiritual practices	0.06 (0.02)	0.000	0.09 (0.13)	0.000	−0.06 (0.08)	0.000	0.04 (0.15)	0.002
Creativity	0.04 (0.02)	0.001	0.11 (0.13)	0.000	−0.04 (0.08)	0.003	0.05 (0.15)	0.001
Comfort with sexuality	0.08 (0.02)	0.000	0.18 (0.11)	0.000	−0.06 (0.07)	0.000	0.07 (0.13)	0.000

^a Number of lifetime mental health diagnoses; ^b vs. drinking in a traditional context; ^c Psychological Wellbeing Growth (higher score = greater psychological wellbeing growth); ^d Kessler 10 Psychological Distress Scale (higher score = higher distress); ^e SF-12 Mental Health Component Score (higher score = better mental health).

4. Discussion

The growing interest in the potential therapeutic use of the traditional Amazonian brew ayahuasca (and related DMT-harmala alkaloid analogues) raises important questions about the potential psychotherapeutic processes that may be associated with the purported mental health, addiction and broader wellbeing benefits. As with other psychedelic substances, spiritual or mystical experiences appear to have a central role; however, increasing attention is now being paid to insights gained and related life and lifestyle changes [9,45,70–73]. Our exploratory study of 8907 ayahuasca drinkers across different contexts of consumption provides the first detailed systematic assessment of the nature, frequency and perceived valence of such phenomena associated with ayahuasca consumption.

In relation to insights, we found these to be almost universally reported as part of the ayahuasca experience, by over 98% of respondents, with an average number of insights of nine. The most commonly reported insight, by around 8 in 10 people, was “new understanding of your own personality”, followed by “a sense of sacredness, higher power, or divine in the world” and “new understandings of other family/personal relationships” by over 70% of respondents. The first and third of these insights appear to attest to ayahuasca’s reputation as a form of accelerated self-therapy, sometimes described as providing the equivalent of several years of psychotherapy within a single session, while the second is consistent with reports of the brew’s transformative spiritual effects [40,42,74]. A range of other personal, transpersonal and metaphysical insights were reported by over half of all respondents. Analysis of the perceived valence of the life effects of these insights identified overwhelmingly positive perceptions, with negative perceived effects very rarely reported. The insights most frequently reported to have a “very positive” life effect were a sense of sacredness, a higher power or the divine; life purpose or life direction insights; insights regarding ethics, morals and your own conduct; and insights relating to your own personality. The high value placed on the last two of these is interesting given ayahuasca’s renowned tendency for such insights to bring an individual’s own personal and moral failings sharply into focus [38,75]. Exploratory factor analysis using principal component analysis identified two factors in our group of 15 insights, “personal insights” and “external” insights.

Our finding of a wide range of insights that are of high value to drinkers corresponds to findings reported in qualitative studies of ayahuasca drinkers. Shanon [40], drawing on his seminal 2002 qualitative study involving interviews with over 170 ayahuasca drinkers, states, “There is no question about it, ayahuasca induces personal insights, self-understanding, and novel psychological comprehension” [40]. Other authors have also noted the central place of insights in the ayahuasca experience for drinkers in general and those being treated for specific conditions, such as addiction and eating disorders [42,75,76]. Some of these studies also assist in understanding the high value ascribed to such insights. For example, insights related to a sense of sacredness, a higher power or the divine were described as facilitating an embracing of more non-material and spiritual aspects of life, providing greater meaning in individuals’ inner worlds, as well as being a resource for healing and a deep source of comfort [74,76]. Insights relating to self-awareness or self-understanding have also been reported to be among the most frequent themes mentioned by patients in clinical studies with other psychedelics, where they provide valued new understandings of a patient’s disorder, its root cause and life effects, as well as being considered a valued outcome of the treatment themselves [35].

Life and lifestyle changes were also frequently reported by ayahuasca drinkers. Around 90% of individuals reported at least one (often major) life change attributed to ayahuasca, most commonly the healing of a personal rift and greater involvement in social or environmental causes (around 40% each). Vocational changes relating to career, employment, study or starting a business were common, as were reductions in alcohol and drug use, starting/ending a relationship, and wanting or having a or another child. Rarely reported, but deserving of further attention, were creating a new personal rift (6%) and instigating or worsening alcohol or drug use (0.6%). Perceptions of the valence of these

life changes were strongly positive for all commonly reported changes, with over 70% of respondents rating these as very positive and over 90% rating them as positive. Lifestyle changes relating to positive health behaviors, self-care and self-connection/expression were also commonly reported to have occurred since consuming ayahuasca, by around 60% to 80% of respondents. Exploratory factor analysis identified a single lifestyle factor component with a good level of internal consistency.

We also found evidence of specific insights being associated with particular, often corresponding, life changes, for example, insights relating to life purpose or direction being associated with change in career/employment direction and study in a new area. However, interestingly, we also found four insight types (body function and care; life purpose/direction; ethics, morals and conduct; and social or environmental issues) to be associated with far greater numbers of life of lifestyle changes than other insight types.

While our study provides the first detailed quantitative assessment of the breadth, frequency and valence of such life and lifestyle changes among ayahuasca drinkers in naturalistic settings, many of the life change types are consistent with those identified in other, primarily qualitative, research. In a study of ayahuasca and smoking cessation in Brazil, Daldegan et al. [72] report the ayahuasca experience to facilitate meaningful personal insights and lasting behavioral change. Similarly, in a qualitative study in Peru, Wolff [44] notes ayahuasca drinkers intentionally keeping in mind personal insights or advice and applying these to daily life, including living more healthy lifestyles and solving relationship issues. Other studies have associated ayahuasca consumption with increased creativity (one of our identified lifestyle changes), the facilitation of new life orientations and worldviews, the improvement of relationships [76], and the shifting of maladaptive emotional, behavioral and cognitive patterns [74,75]. A US study of mixed naturalistic psychedelic users, including some ayahuasca/DMT users (13%), reported on changes in several health behaviors also reported in our study, in particular, change in diet (63% improved) and exercise (55% increased), which were somewhat less common than reported here (diet improved for 81% and exercise increased for 58%) [48]. Further, two recent ayahuasca studies have identified associations between ayahuasca ceremony participation and healthy lifestyles [45,73]. Such effects are also interesting to note in the context of weight gain and reduced moderate/vigorous exercise that have been associated with antidepressant medications [77,78].

A novel finding of our study is the range of commonly reported vocational changes and specific relationship-oriented changes, such as starting/ending relationships, healing/creating personal rifts and increased desire for parenthood, attributed to ayahuasca experiences. Our data also provide some important context for concerns raised by various authors relating to these and other major life decisions or changes in perspective reported after a psychedelic experience and the potential dangers of individuals unquestioningly implementing whatever they are “shown” [38,79–81]. As Girn et al. [80] note, to date, there had previously been no studies investigating the prevalence of psychedelic-induced “true” or useful insights versus “untrue” or detrimental insights. Ayahuasca-specific warnings on this topic are also reported, with Taussig [81] noting indigenous reflections on ayahuasca as potentially “a great deceiver” through which people can see “false things”, including perceptions of family or friends doing them harm, while Shanon [38] similarly notes that while ayahuasca can reveal truths, it can also “lie” and reflect dysfunctional or frivolous personal projections or desires. Our data indicate that for both insights and the common major life changes attributed to the brew, individuals overwhelmingly feel these to have had a highly positive effect on their lives. However, it is noteworthy, in light of the commentary above, that ending an intimate relationship was relatively more frequently perceived negatively (5.2%), while the infrequently reported life change of creating a new personal rift was perceived to have negative life effects by around a quarter of those reporting this, as well as being associated with greater current psychological distress based on the Kessler 10.

Again, our findings relating to life and lifestyle changes are also consistent with qualitative reports from clinical studies with other psychedelics, primarily psilocybin, that have

reported beneficial lifestyle changes beyond specific therapeutic endpoints of interest. These include improvements to diet and exercise; reduced alcohol consumption [82]; increased prosocial behaviors, such as volunteering; spending more time in nature; and joining community groups [49]. Acute insights have also been correlated with enduring therapeutic outcomes, including reduced symptoms of depression, anxiety and stress [54,80,83], with the diminishing of negative biases and increased psychological flexibility proposed as a possible pathway for such effects [54,84].

A further novel finding of this study is represented by the compelling data suggesting that the ayahuasca experience can lead to changes in religious or spiritual identification, with 56% of respondents reporting such changes. Further analysis of changes between such categories (religious/spiritual/agnostic/atheist) indicated an overwhelming shift toward the “spiritual” category, with, for example, only 19% of prior atheists and 26% of prior religious people continuing to define themselves this way after their ayahuasca experiences and most (69% and 73%, respectively) now identifying as spiritual. Shanon [38] notes the occurrence of religious and spiritual conversion among ayahuasca drinkers but provides no further detail. Griffiths and Hurwitz et al. [85], reporting on a sample of people who had a psychedelic “god encounter”, identify 25% of prior atheists in the ayahuasca sub-group ($n = 435$) as still defining themselves this way after the experience, which reflected greater change than the psilocybin (43% remained atheists), LSD (41%) and DMT (28%) sub-groups. Similarly, a study of individuals reporting entity encounters after smoked DMT use found significant reductions in individuals defining themselves as atheists or agnostic and a significant increase in the proportion of people reporting a belief in an ultimate reality, a higher power, God or a universal divinity [86], findings that align well with our identified changes. However, others have pointed out the non-generalizability of samples such as those used in the two studies above and argue that current evidence of religious belief change due to psychedelic use remains weak [47]. Our findings, of frequently occurring changes in religious/spiritual status across a large and diverse international sample, provide strong evidence for a movement away from atheist and religious identification to spiritual identification among ayahuasca drinkers, although, interestingly, this occurs alongside greater participation in spiritual practices, such as prayer or meditation, and an increased sense of sacredness, a higher power or the divine in the world.

Finally, our multivariate analysis provides a unique new understanding of the predictors and the broader life, wellbeing and mental health effects of insights, life changes and lifestyle changes. In relation to insights, the strength of the subjective spiritual experience, the number of times ayahuasca was consumed, the quality of preparation support and the strength of the ayahuasca drinking community were all predictive, as were lifetime mental health diagnoses—an encouraging flag for potential clinical use. Insights were, then, highly predictive of greater beneficial lifestyle change (as would be suggested by the literature discussed above), again, along with the strength of the spiritual experience, the number of times drunk and ayahuasca community strength, and had a positive association with lifetime mental health diagnoses and lifestyle change. Greater support and safety at the place of consumption was also positively associated, while extreme fear and integration difficulties were negatively associated. When it came to life changes, self- and external insight variables were the strongest and most consistent predictors across our 16 life change variables, with the strength of the spiritual experience being less important. The number of times drunk and the number of mental health diagnoses were also associated with most life changes, while there was some interesting variation in the odds of life change occurring in ayahuasca churches (versus traditional settings), which we suggest reflects institutional norms within these organizations.

Our LASSO variable selection procedure for models exploring broader life, wellbeing and mental health effects identified a subset of seven insights and five life changes, which were primarily associated with individuals’ overall reported life benefits or harms and growth in psychological wellbeing but not current mental health directly on either of our

measures (other than the life direction/purpose insight and creating a new personal rift life change). However, as we have previously reported [9], much of the mental health benefit associated with ayahuasca consumption variables appears to occur via improvements in psychological wellbeing (PWG). By contrast, our lifestyle change variables were strongly and consistently directly predictive of PWG and both mental health variables, in particular, change in “caring for physical health” and, interestingly, increased “comfort/confidence with sexuality”, which we posit is reflective of the increased self-connection, internal attunement and inherent self-worth suggested as core processes underlying transformative psychedelic experiences [10,87]. For people with sexual trauma, ayahuasca has been reported to have beneficial effects relating to body image, sexual identity, enhanced intimacy, releasing of cultural taboos, and the embracing of a more joyful and creative perception of sexuality, which may occur among ayahuasca drinkers more broadly [88].

Our study also has implications for drug and health policy and the regulation of ayahuasca and related DMT-harmala alkaloid preparations and the religious or spiritual groups that use these preparations. Specifically, although DMT is an internationally controlled drug and designated as a Schedule 1 substance in the United States (with comparable classifications elsewhere), indicating that it has no accepted therapeutic use and a high potential for abuse, our data suggest that consumers of ayahuasca experience broad and highly valued personal benefits. Interestingly, beyond personal wellbeing and mental health effects, these include positive reported changes in areas of high public health concern, including diet, exercise, and alcohol and drug use, as well as broader prosocial effects relating to environmental and social causes, with these effects having a relatively similar likelihood of occurring across contexts of use. Several research implications are also suggested, including the value of controlled clinical studies incorporating prospective measures of insights, life and lifestyle changes; further exploration of our proposed two-dimensional model of personal insights; and a more detailed analysis of the multidimensional spiritual and religious effects apparently associated with ayahuasca consumption. A particular methodological strength of this study is the very large and diverse international sample of ayahuasca drinkers who had consumed the brew in a range of different contexts, which enabled a comprehensive assessment of the nature, frequency, valence, and predictors of insights, life changes and lifestyle changes in a way that would not be possible in small interventional or observational studies. However, it is also important to note several limitations, including the non-random self-selected sample, which was likely to lead to a bias towards individuals who had more personally significant and or positive experiences and who were more motivated to spend time completing the lengthy survey. In addition, data collection was via anonymous self-report instruments, potentially introducing social desirability biases, and included retrospective assessment of some items, which may have occurred several years ago. However, in relation to the latter, the minimal influence of the years since ayahuasca was last consumed across the models used suggests that this did not substantially influence the results.

5. Conclusions

Overall, our results suggest a central role of insights and subsequent life and lifestyle changes in the therapeutic and wellbeing effects reported by individuals consuming ayahuasca. They also further elucidate the ways in which ayahuasca and related psychedelic substances may offer a unique and transformative clinical therapy. Unlike existing mental-health drug treatments, which commonly involve side effects, including emotional numbing, detachment, disconnection from self, reduced positive affect, sexual difficulties and weight gain [78,89], the therapeutic mechanisms associated with ayahuasca use appear to involve positive enhancement across these areas.

In relation to insights and life changes, we find that these may play an even greater role in reported therapeutic and wellbeing outcomes than subjective spiritual/mystical effects in some areas. Our results are also of value in informing potential clinical use of ayahuasca and related DMT-harmala preparations by guiding the optimization of conditions for the

generation of such effects, with several contextual variables shown to be of importance, in particular, the quality of the preparation support provided, the degree of perceived physical/emotional safety and support at the place of consumption, and the strength of the ayahuasca community (suggesting potential value in including group-based components). We also note the apparent importance of life purpose/direction insights and suggest these as a valuable connection point for therapeutic activity and support. Effective assistance with post-consumption integration difficulties is also desirable due to the negative association with beneficial lifestyle change. It is encouraging that individuals with more complex mental health profiles (based on number of diagnoses) appeared to gain even greater benefit in terms of the number of insights attained, beneficial lifestyle changes reported and the odds of reporting various life changes. While there are clear similarities with other psychedelic compounds, our own and other limited data that exist suggest that DMT-based products such as ayahuasca may generate more positive acute and long-term experiences and life changes [85]; however, this is an area requiring further research.

Finally, the range of beneficial and prosocial insights and life or lifestyle changes discussed, alongside the low adverse effect rate, provide important data for informing drug and health policy, and raise the intriguing possibility that psychedelic compounds used in therapeutic settings may provide a new class of interventions extending beyond mental health to intractable public health concerns relating to diet, exercise, alcohol and drug use, and other health behaviors, although we also caution that, while encouraging, the research in both these areas remains preliminary.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/psychoactives2040017/s1>, Table S1: Demographic, ayahuasca drinking, insight, life change and lifestyle change features were included in the LASSO variable selection procedure.

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