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Article

Patterns of Psychedelic Use in Italy: Insights from the Global Psychedelic Survey

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Abstract: Background: Epidemiological data on psychedelic use in Italy is limited. In this study, Italian responders in the Global Psychedelic Survey 2025 were subanalyzed to describe patterns of use, motivations, subjective experiences, and health correlates. Methods: Adults (≥21 years) with lifetime psychedelic exposure, residing in or born in Italy or San Marino, were surveyed in a web-based, cross-sectional design. Descriptive analyses examined sociodemographics, substance use

histories, motivations, intense experiences, changes in other substance use, and healthcare engagement. Results: Among 731 participants (mean age 37.4 ± 11.3 years; 59.8% male; 70.0% urban), 90.1% reported lifetime regular-dose psychedelic use, most commonly psilocybin (77.3%), MDMA (69.5%), LSD (67.0%), and ketamine (46.3%). Polysubstance exposure was common, with 83.3% reporting use of ≥2 psychedelics. Lifetime alcohol, cannabis, and nicotine use exceeded 90%, and 36.0% reported a substance-related problem. Past-year psychedelic use was reported by 76.7%, with the majority using once to a few times per year. 58.4% reported lifetime microdosing. Motivations were predominantly non-clinical. Intense experiences were often rated positive or mixed. Self-reported reductions in alcohol (45.9%) and tobacco (34.9%) were frequent. Conclusions: These findings provide the first large-scale characterization of psychedelic use patterns among a highly engaged Italian-affiliated psychedelic community. Patterns of consumption were generally intermittent, often embedded within polysubstance use contexts, and were primarily motivated by personal growth. Although many respondents reported positive experiences and reductions in other substance use, these observations require confirmation in longitudinal research.

Keywords: psychedelics; polysubstance use; epidemiology; harm reduction; Italy; global psychedelic survey

1. Introduction

In recent years, there has been a global resurgence of interest in the scientific and therapeutic potential of psychedelic substances, a phenomenon often referred to as the "psychedelic renaissance" [1]. This renewed attention follows a decades-long hiatus in psychedelic research since the 1970s, driven by legal prohibition and sociopolitical stigma. Today, classic serotonergic psychedelics such as psilocybin, dimethyltryptamine **(**DMT**)** and lysergic acid diethylamide (LSD), as well as the empathogen 3,4-methylenedioxymethamphetamine (MDMA) and the dissociative anesthetic ketamine, are once again being explored as promising tools for the treatment of psychiatric disorders such as Treatment Resistant Depression [2–4], anxiety disorders [5], substance use disorders [6,7], PTSD [8,9] and other conditions[10–12], with a continuously evolving evidence of safety and efficacy [13]. Beyond randomized clinical trials, emerging real-world evidence from compassionate use and early access programs further suggests potential therapeutic benefits under structured and supervised conditions, contributing to the translational momentum of the field [14]. Together, these findings have facilitated the potential re-integration of psychedelic research into mainstream psychiatry and informed regulatory developments, including the designation of psilocybin, MDMA, and related compounds as "breakthrough therapies" by the U.S. Food and Drug Administration (FDA) [15], as well as increasing policy and clinical interest in their integration into European healthcare systems [16].

In parallel with advances in formal medical research, non-clinical psychedelic use has increased, particularly in jurisdictions characterized by decriminalization or partial legalization [17]. Motivations for use are highly heterogeneous and include curiosity, spiritual exploration, personal development, emotional insight, and informal self-treatment of psychological distress or various mental conditions [18]. Recent observational evidence indicates that contemporary psychedelic use occurs across a broad range of age groups and may be associated with both acute healthcare presentations and extended psychological difficulties [19,20]. The growing public interest in microdosing has further contributed to the normalization of psychedelic use outside clinical settings [17]. In the present study microdosing refers to the intentional use of sub-perceptual or minimally perceptible doses, typically taken with the aim of modulating mood, cognition, creativity, or well-being without producing a full psychedelic experience. By contrast, macrodosing refers to the use of perceptible doses capable of inducing marked alterations in consciousness, perception, emotion, and self-experience [21]. However, recent epidemiological evidence from the United States following policy liberalization highlights the need for caution. Analyses conducted after state-level legalization or decriminalization initiatives suggest measurable changes in patterns of use and healthcare presentations, raising concerns regarding unintended public health consequences [17,20–23].

Despite growing public interest in psychedelic substances, their use remains less socially normalized than that of other recreational drugs such as alcohol or cannabis. Consistent with their controlled legal status in many countries, psychedelic use most commonly occurs in informal or unsupervised settings rather than regulated environments, highlighting the need for prevention strategies, accurate scientific information about their effects, and harm-reduction initiatives [24].

Much of the available evidence on the epidemiology of psychedelic use comes from North America and other Anglophone countries, where both academic research and online surveys have been more active, offering insights into behavioral patterns, attitudes, and perceived benefits and harms associated with the use of these substances. However, this narrow geographic focus limits the global understanding of psychedelic use, particularly in non-English-speaking populations. In 2023, the Global Psychedelic Survey (GPS) collected data from over 6000 individuals in 85 countries, primarily from North America, Oceania, and Western Europe. Respondents reported on substances used, reasons for use, and sources of access [25]. While the GPS provided the first large-scale characterization of global psychedelic practices, its sample was disproportionately Anglophone, White, and urban, raising questions about the generalizability of the findings [26].

1.1. Psychedelics Use in Italy

Italy represents an underrepresented although relevant context in which to examine contemporary psychedelic use. Like most European countries, Italy maintains strict legal controls on classic psychedelic substances, and their non-medical use remains prohibited; at present, psychedelic substances (with the exception of ketamine) are not authorized for routine clinical use outside approved research settings. Consequently, systematic data on the prevalence and patterns of psychedelic consumption in the Italian population are extremely limited. Nevertheless, public and scientific interest in these substances has increased substantially during the past decade, in line with broader international developments associated with the contemporary psychedelic renaissance [1]. Although contemporary psychedelic use remains poorly documented, the Italian context is not entirely devoid of historical connections to psychedelics. Historical-ethnobotanical scholarship has documented the use of psychoactive mushrooms and other intoxicating plants in Italy, while the twentieth century saw growing interest in psychoactive substances through medical, scientific, and countercultural channels [27,28]. More recently, Italian public discourse has begun to incorporate the language of psychedelic-assisted therapy and clinical research, reflecting the broader international re-legitimation of psychedelics as objects of biomedical and psychiatric investigation [29]. While some recent studies in other European countries have begun to generate population-level data on psychedelic use, including a German national survey reporting lifetime psychedelic use in 5.0% of adults and past-six-month use in 0.7% [30], no comparable epidemiological data are currently available for Italy. Consequently, contemporary patterns of psychedelic use, user characteristics, motivations, and experiences within the Italian context remain largely unexplored. Despite growing public interest in psychedelic-assisted treatments and renewed scientific attention within the Italian psychiatric community (e.g., the first ongoing clinical trial for the treatment of Treatment Resistant Depression with psilocybin versus repetitive Transcranial Magnetic Stimulation; rTMS; EUCT number: 2024-519844-34-03), the lack of empirical data remains a barrier to informed policy and clinical discussion. To address this knowledge gap, the present study utilizes data from the Global Psychedelic Survey 2025 to characterize psychedelic use in the Italian population, providing the first detailed overview of psychedelic use among a large psychedelic-engaged sample of individuals residing in or originating from Italy and San Marino. The findings aim to inform national public health strategies and contribute to the broader international literature on psychedelic use.

1.2. Aims

The present study pursues two principal aims. First, to provide the first large-scale descriptive characterization of psychedelic use patterns, motivations, experiences, and health correlates in an Italian-speaking psychedelic-engaged population, addressing a documented gap in the European epidemiological literature. Second, to examine healthcare engagement in this population, with focus on predictors of disclosure of psychedelic use to primary healthcare providers, a relevant dimension of the patient-provider relationship.

2. Methods

2.1. Participants and Eligibility

To be eligible for inclusion in the present analysis, participants were required to meet the following criteria: (i) be aged 21 years or older; (ii) reside or being born in Italy or Repubblica di San Marino at the time of participation; (iii) report lifetime use of at least one psychedelic substance; and (iv) complete at least 70% of the survey items. No exclusion criteria were applied based on gender identity, ethnicity, health status, or frequency of psychedelic use.

2.2. Survey Instrument and Domains

The Global Psychedelic Survey 2025 (GPS 2025) is a cross-sectional, web-based study designed to examine patterns of psychedelic use, contextual factors, and associated psychological and health outcomes across diverse international populations. The present analysis focuses on respondents residing in Italy and San Marino who completed the Italian-language version of the survey. The study was conducted according to the guidelines of the Declaration of Helsinki. It was developed by a consortium of academic researchers and non-governmental organizations (NGOs) and deployed between 1 May and 21 May 2025. The study was reviewed by the Health Sciences and Behavioral Sciences Institutional Review Board at the University of Michigan (IRB-HSBS; protocol code HUM00268282; exemption determination date: 3 February 2025) and was deemed exempt from ongoing IRB review under Exemption 2(i) and/or 2(ii) at 45 CFR 46.104(d). Survey dissemination relied on a multi-channel, convenience-based recruitment strategy, including social media platforms, newsletters, community networks, and partner organizations specializing in harm reduction and psychedelic education. Standardized digital promotional materials were used to ensure consistency and reduce sampling bias. Participation was anonymous and voluntary, and electronic informed consent was obtained prior to survey access.

In the Italian context, the Società Italiana di Medicina Psichedelica (SIMEPSI), an interdisciplinary scientific NGO dedicated to advancing psychedelic research, oversaw the translation, back-translation, and validation of the Italian version of the Global Psychedelic Survey questionnaire to ensure linguistic accuracy, cultural appropriateness, and conceptual equivalence with the original instrument. In addition, SIMEPSI coordinated the dissemination of the survey across multiple Italian-speaking channels, including professional networks, academic and clinical communities, educational initiatives, and online platforms dedicated to psychedelic research, dissemination and harm reduction. This contribution was aimed at maximizing reach within the Italian-speaking population and enhancing the reliability and representativeness of the data collected from respondents residing in Italy and San Marino. The questionnaire was administered via the Qualtrics platform and comprised modular sections with adaptive branching logic. GPS-2025 was designed as a comprehensive instrument covering multiple domains related to psychedelic use and its individual and social correlates. Survey domains included demographic and sociocultural characteristics; lifetime and recent psychedelic use; patterns and contexts of use; motivations and intentions; substance-specific acute and long-term experiences; mental and physical health; use of other psychoactive substances; access and supply channels; harm-reduction and risk-mitigation practices; and knowledge, attitudes, and beliefs regarding psychedelics.

For the present analyses, we focused on a predefined subset of survey blocks, selected a priori in accordance with the study objectives and considerations of statistical robustness. Specifically, analyses included participant demographics, psychedelic use history and patterns, including lifetime and past-year use, age at first use, frequency, dosing levels, substances consumed, and patterns of regular-dose and microdose use. Analyses also included motivations for use, substance-specific experiences, social context of psychedelic use, co-use, intense psychedelic experiences, ongoing difficulties, major life changes, relative importance of psychedelics, physical and mental health indicators, behavioral addiction, psychedelic use disorder, multisensory sensitivity, sleeping disorders, affordability, hallucinations in the past 24 h, and testing services.

The following questionnaire blocks were not included in the present analyses: Indigenous perspectives, natural versus synthetic psychedelics, nitrous oxide, reproductive health, headaches and migraines; traumatic brain injury, ADHD, long COVID, retreats, imprinting and vivid visual imagery, music, entities, sexual satisfaction, and social media.

2.3. Data Analysis

Data analysis was conducted using Python-based workflow on the Qualtrics export of the Italian/San Marino sample. Analyses were restricted to the questionnaire blocks selected a priori for the present study. Given the descriptive nature of the study and its novelty as the first Italian-focused GPS analysis, we used summary statistics: absolute frequencies, percentages, means, standard deviations (SD) and medians. Percentages were calculated based on respondents within each block; for multiple-response items, percentages reflected participants selecting at least one option. Means, SDs, and medians were reported for continuous and ordinal variables. Free-text categories or response options with fewer than 10 participants were excluded from summary reporting to ensure stability of descriptive estimates. The study was conducted according to the guidelines of the Declaration of Helsinki, reviewed and approved by the University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board and deemed exempt under 45 CFR 46.104(d), Exemption 2(i) and/or 2(ii).

Healthcare Disclosure Analysis

To examine factors associated with disclosure of psychedelic use to healthcare providers, we conducted a binary logistic regression in the subsample of respondents reporting a regular primary care provider. Predictors were biological sex, age (continuous, mean-centered), education (dichotomized as below university degree versus university degree or higher), and self-rated psychedelic experience on a 0–10 scale (0 = no experience at all, 10 = extremely experienced; mean-centered). Odds ratios (ORs) and 95% confidence intervals were derived from Wald-based estimates. Statistical significance was set at $\alpha = 0.05$.

3. Results

Given the item-level structure of the questionnaire, not all participants provided valid data for every item. For each variable, the number of respondents with valid data (N) and the corresponding percentages are therefore reported.

3.1. Demographics, Sample Characteristics and Non-Psychedelics Substance Use

A total of 731 participants residing in or born in Italy or San Marino completed the survey. Regarding country of origin and residence, 694 participants (94.9%) were born in Italy. Of these, 606 (82.9% of the total sample) were also residing in Italy at the time of survey completion, whereas 88 (12.0%) were born in Italy but residing outside Italy. In addition, 36 participants (4.9%) were not born in Italy but were residing in Italy. One participant (0.1%) was born in San Marino. No participants were born in Italy and residing in San Marino, or born in San Marino and residing in Italy.

The mean age was 37.4 years (SD = 11.3, range 21 to 78). Most participants identified as male (59.8%, n = 437) or female (36.3%, 265), while 3.9% (29) identified as non-binary, transgender, or another gender identity.

Lifetime use of non-psychedelic substances was common in the sample. The most frequently reported substances were alcohol (98.8%), cannabis (97.5%), and tobacco or nicotine products (90.4%). Lifetime use was also commonly reported for cocaine (58.4%, n = 427) and unregulated stimulants (48.8%, n = 357). Benzodiazepine use was reported by 34.5% of participants (n = 252), while 22.8% (n = 167) reported unregulated opioid use. Prior use of prescription psychotropic medications included antidepressants (23.0%, n = 168), regulated opioids (14.2%, n = 104), prescribed stimulants (9.2%, n = 67), antipsychotics (8.5%, n = 62), and mood stabilizers (8.2%, n = 60). In addition, 17.5% (n = 128) reported lifetime use of sedatives or hypnotics, and 15.0% (n = 110) reported inhalant use.

Full demographic details, relationship status, reporting area of residence, education level, employment status and perceived income are provided in Table 1.

Table 1. Demographic and socioeconomic characteristics of the study population (N = 731).

Variable	Category	N	%
Age (years)	Mean ± SD (range)	—	37.4 ± 11.3 (21–78)
Gender identity	Male	437	59.8
	Female	265	36.3
	Non-binary	17	2.3
	Transgender	4	0.6
	Other/prefer not to say	8	1.1
Assigned female at birth	Yes	288	39.4
	No	443	60.6
Area of residence	Urban	512	70.0
	Suburban	133	18.2
	Rural/remote	86	11.8
Relationship status	Single, never married	318	43.7
	Single, cohabiting with a significant other	78	10.7
	Domestic partnership/civil union	193	26.5
	Married	97	13.3
	Divorced or separated	39	5.4
	Widowed	3	0.4
	Not answered	3	0.4

Table 1. *Cont.*

Variable	Category	N	%
Education level	High school or less	233	31.9
	Bachelor's degree	186	25.4
	Master's degree	195	26.7
	Doctoral/professional degree	117	16.0
Employment status	Full-time employed	412	56.4
	Part-time employed	123	16.8
	Student	94	12.9
	Other (unemployed, retired, disability)	102	14.0
Perceived income	Very low/low	197	26.9
	Average	394	53.9
	High/very high	140	19.2

3.2. General Patterns of Psychedelic Use

The mean age of first psychedelic use was 24.3 years (SD = 8.2), with a median age of 22. First use typically occurred in early adulthood but with considerable variability among individuals: 459 participants (62.9%) reported first use before age 25, whereas 271 (37.1%) reported first use at age 25 or later (Figure 1).

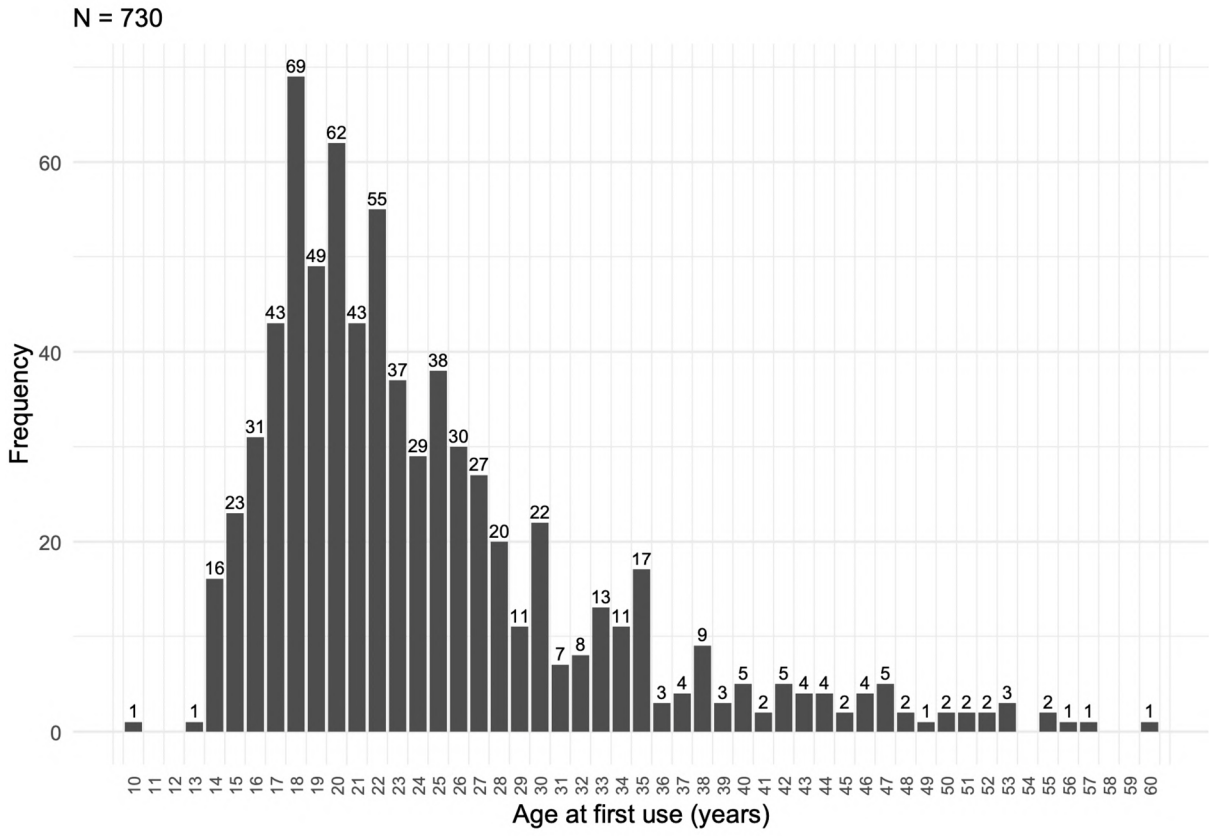


Figure 1. Distribution of age at first psychedelic use among participants (N = 730). The histogram shows the frequency of reported age at first use in years.

In the sample (N = 730), lifetime use of psychedelic substances, encompassing both regular dosing (i.e., doses producing full psychoactive effects) and microdosing (i.e., sub-perceptual doses), was most frequently reported for psilocybin (82.2%, n = 600), followed by MDMA/MDA (74.4%, n = 543), LSD (72.9%, n = 532), and ketamine 51.5% (n = 376). Intermediate prevalence was observed for DMT (30.3%, 221), Salvia divinorum (25.5%, n = 186), mescaline (23.3%, n = 170), synthetic phenethylamines (21.9%, n = 160), and ayahuasca (19.0%, n = 139). Lower prevalence was reported for other psychedelics (14.8%, n = 108), nitrous oxide (11.4%, n = 83), 5-MeO-DMT (10.7%, n = 78), synthetic tryptamines (8.5%, n = 62), and iboga/ibogaine (1.4%, n = 10).

Psilocybin was the most frequently reported first psychedelic substance (31.0%, n = 226), followed by MDMA/MDA (29.5%, n = 215) and LSD (26.0%, n = 190). Smaller proportions of participants reported ketamine (4.2%, n = 31), ayahuasca (2.5%, n = 18), or *Salvia divinorum* (2.3%, n = 17) as their first psychedelic experience. Psychedelic initiation with all other substances was less than 2% (Figure 2).

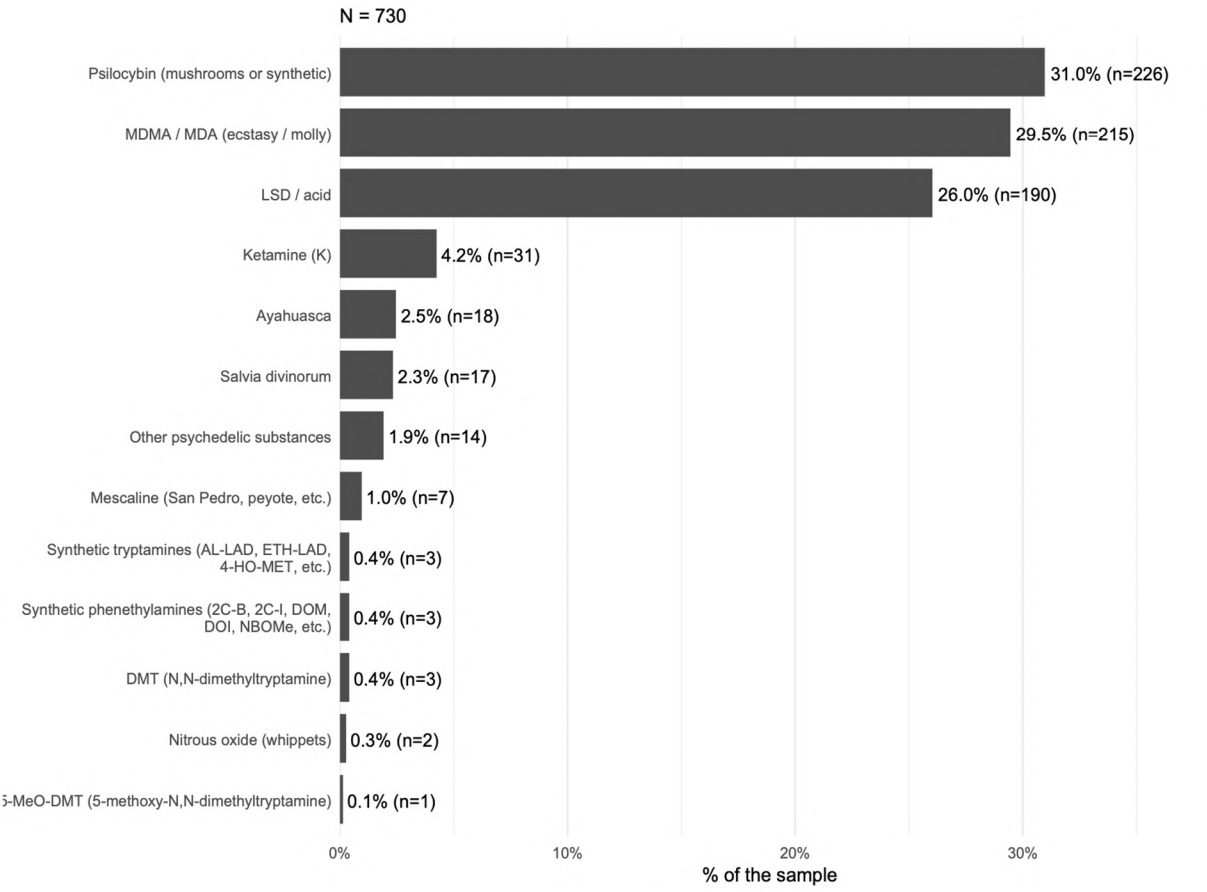


Figure 2. Lifetime use of individual psychedelic substances among participants (N = 730). Percentages reflect participants reporting use of each substance, including both regular dosing and microdosing.

In the past 12 months, 76.7% of respondents (n = 560) reported at least one episode of psychedelic use, while 23.3% (n = 170) reported no use (Figure 3). Among respondents (n = 730) endorsing multiple motivations for psychedelic use, the most frequently reported reasons were personal growth or self-exploration (84.9%, n = 620), curiosity (66.7%, n = 487), recreational purposes (65.9%, n = 481), increasing mindfulness (61.8%, n = 451), and enhancing general well-being (59.7%, n = 436). Religious or spiritual development was cited by 37.1% (n = 271), while improving productivity, motivation, or creativity was reported by 28.4% (n = 207). Mental health-related motives, such as using psychedelics to treat a mental health condition, were endorsed by 26.7% (n = 195), and relationship-oriented motives were similarly frequent (27.3%, n = 199). Less commonly reported reasons can be found in Figure 4.

Participants' self-rated knowledge of psychedelic substances, assessed on a 0–10 scale (0 = no knowledge; 10 = extremely high knowledge), had a mean of 7.29 (SD = 1.73) and a median of 8. Self-rated experience, measured on a parallel 0–10 scale (0 = no experience; 10 = extremely high experience), had a mean of 5.90 (SD = 2.38) and a median of 6. When estimating the proportion of their psychedelic experiences that were positive or negative (0–100% scale), participants reported that the majority of their experiences were positive, with a mean of 86.26% (SD = 13.93; median = 90%; n = 493). Negative experiences were less frequent, with a mean of 18.23% (SD = 17.85; median = 11%; n = 436).

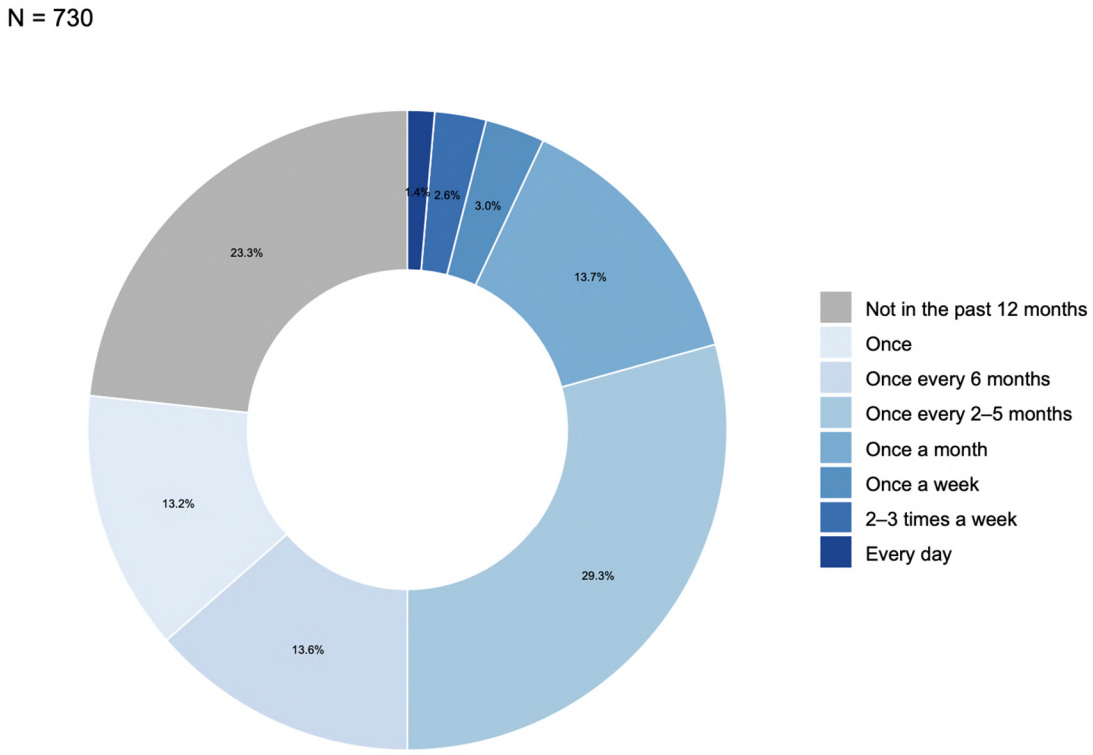


Figure 3. Frequency of psychedelic use in the past 12 months among respondents (N = 730). Most participants reported at least one use episode (76.7%, n = 560), with the majority using between once every 2–5 months and monthly.

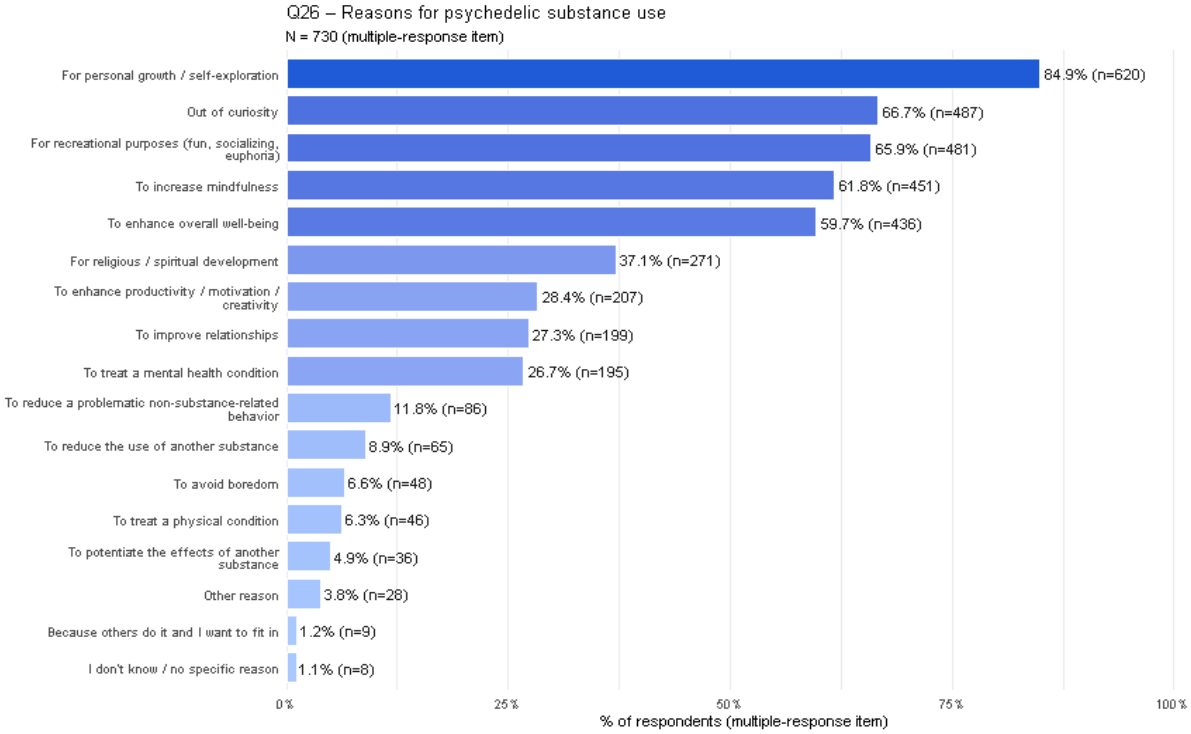


Figure 4. Motivations for psychedelic use among respondents (N = 730). Participants could select multiple reasons; percentages reflect the proportion endorsing each motive.

3.3. Regular-Dose: Prevalence, Patterns, Motivations and Contexts

Among respondents (N = 709), 90.1% (n = 639) reported lifetime regular-dose use of at least one psychedelic substance. Percentages for substance-specific lifetime regular-dose use were calculated using this subgroup (n = 639) as the denominator. Psilocybin was the most commonly reported substance (77.3%, n = 494), followed by

MDMA/MDA (69.5%, n = 444), LSD (67.0%, n = 428), and ketamine (46.3%, n = 296). Other substances reported (included DMT, *Salvia divinorum*, and ayahuasca) can be found in Figure 5.

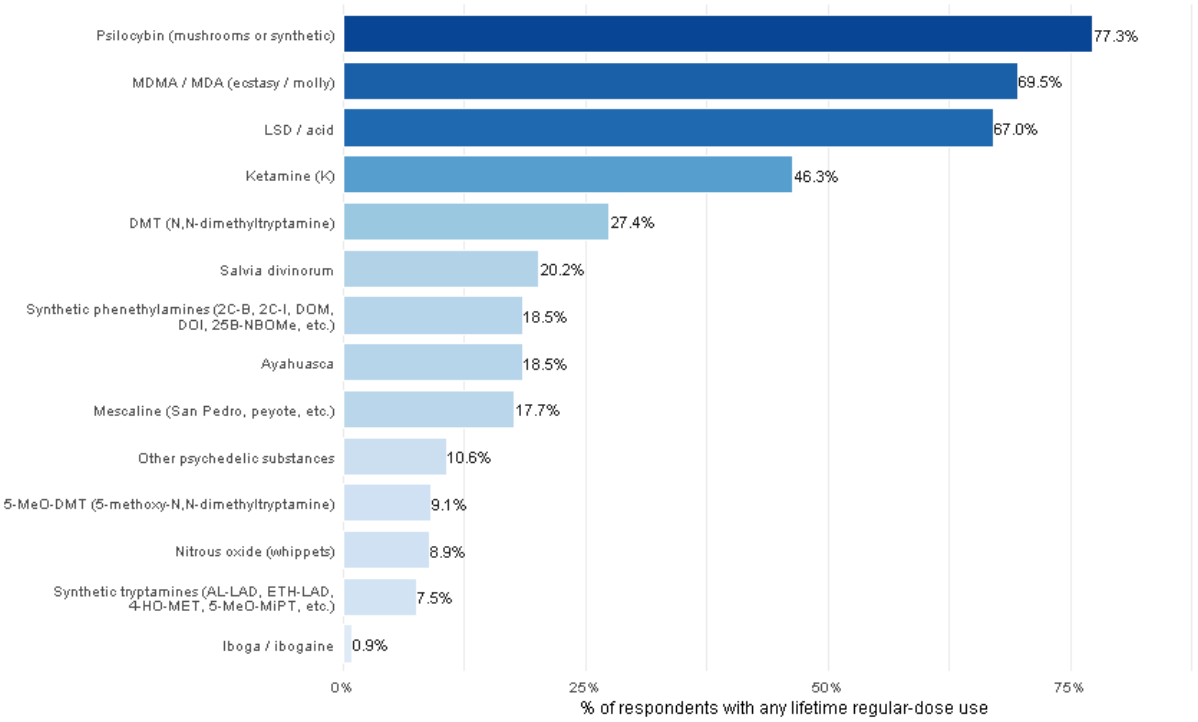


Figure 5. Regular-dose, lifetime use of individual psychedelic substances. Bars represent the percentage of respondents (N = 639) reporting lifetime use of each substance.

Regular-dose use most frequently involves multiple substances across the lifetime. Only 16.7% of respondents (n = 107) reported using a single psychedelic substance, whereas 83.3% (n = 532) reported lifetime use of two or more psychedelic substances. Notably, 60.7% (n = 388) reported using four or more substances. Among our sample (N = 627), n = 461 participants reported using at least one psychedelic substance at regular doses in the past 12 months. Among these users, psilocybin was the most commonly reported substance (61.4%, n = 283), followed by MDMA/MDA (48.8%, n = 225), LSD (47.7%, n = 220), and ketamine (36.9%, n = 170). Details for each substance and the distribution of past-year use patterns are presented in Table 2.

Table 2. Past-year regular-dose use of psychedelic substances among respondents (N = 461 past-year users). The table shows the number and percentage of users for each substance, along with the most common past-year use patterns. Percentages are listed before each category to indicate the relative frequency of no use, occasional use, or more frequent use.

Substance	n of Users	% of Past-Year Users	Most Common Use Pattern
Psilocybin	283	61.4	36.6% Single use
MDMA/MDA	225	48.8	27.3% Single use
LSD	220	47.7	30.0% Single use
Ketamine	170	36.9	17.5% Once every 6 months
DMT	72	15.6	No use (60.9%)
Ayahuasca	43	9.3	No use (71.6%)
Synthetic phenethylamines	45	9.8	No use (62.8%)
Mescaline	23	5.0	No use (82.9%)
Salvia divinorum	16	3.5	No use (92.1%)
Synthetic tryptamines	16	3.5	No use (61.7%)
5-MeO-DMT	15	3.3	No use (83.9%)
Nitrous oxide	13	2.8	No use (76.9%)
Iboga/ibogaine	2	0.4	No use (100%)
Other psychedelics	27	5.9	[Use patterns not specified]

Ketamine showed the highest relative proportion of more frequent regular-dose use among the substances with larger denominators (n = 286). Although 45.1% (129/286) reported no use in the past year, 13.3% (38/286) reported use once every 2 to 5 months, 4.2% (12/286) monthly use, 2.1% (n = 6) weekly use, 0.7% (n = 2) use two to three times per week, and 1.4% (n = 4) daily use.

Motivations for use also varied by substance, but the most consistently endorsed motives were personal growth/self-exploration and general well-being. Personal growth/self-exploration was the most prominent motive for ayahuasca (88.5%), psilocybin (80.3%), LSD (76.4%), mescaline (75.5%), DMT (74.1%), and 5-MeO-DMT (73.2%). Mindfulness and well-being-related motives were also frequently reported, particularly for psilocybin, LSD, ayahuasca, and mescaline. Spiritual or religious development was especially common for ayahuasca, and remained substantial for mescaline, 5-MeO-DMT, DMT, and psilocybin, highlighting the prevalence of a distinct motivational profile for these substances. By contrast, recreational motives were the predominant pattern for MDMA/MDA, synthetic phenethylamines, ketamine, and nitrous oxide, and were also common for LSD and psilocybin. Curiosity was frequently endorsed across substances, including synthetic tryptamines, *Salvia divinorum*, DMT, LSD, synthetic phenethylamines, and psilocybin. Mental health-related motives were reported across several substances but were generally less common than personal growth, mindfulness, or recreational motives. For further details refer to Figure 6.

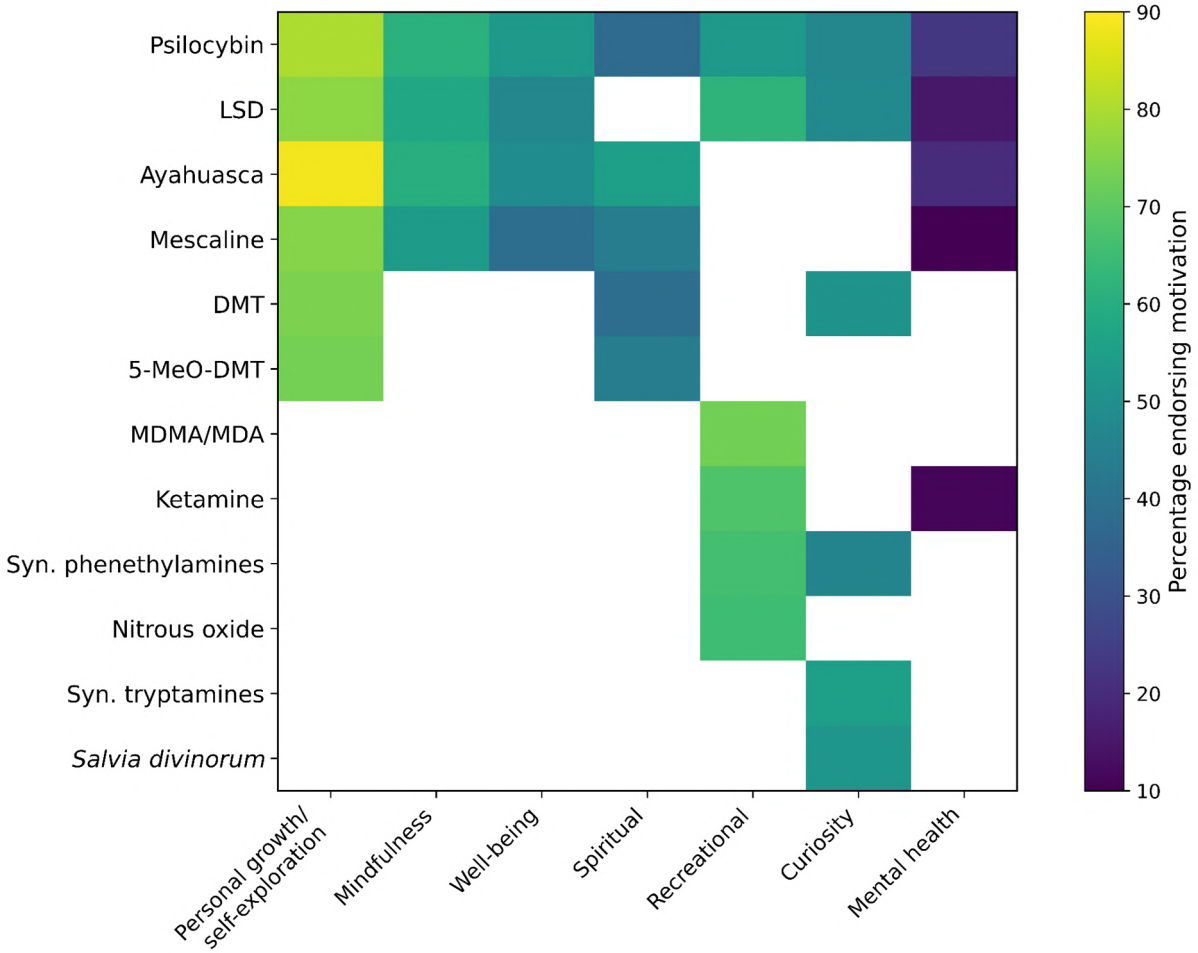


Figure 6. Motivations for regular-dose psychedelic use by substance. Heatmap showing the proportion of respondents endorsing specific motivations among those reporting lifetime regular-dose use of each substance. Cells display the percentage of respondents selecting each motivation, and color intensity reflects the same values. Percentages represent the proportion of respondents selecting each motivation among those reporting lifetime regular-dose use of the respective substance; multiple responses were allowed and therefore percentages do not sum to 100%.

Substance-specific social contexts and physical settings of regular-dose psychedelic use are presented in Supplementary Figures S1 and S2, respectively.

3.4. Microdosing: Prevalence, Patterns, Motivations and Contexts

Microdosing was less common than regular-dose use in the sample. Among respondents with available data (n = 669), 58.4% (n = 391) reported lifetime microdosing of at least one substance. Among these users (n = 391), psilocybin was the most commonly reported substance (67.0%, n = 262), followed by LSD (45.0%, n = 176), MDMA/MDA (23.8%, n = 93), and ketamine (22.3%, n = 87). Other substances were reported less frequently (Figure 7).

Recent microdosing was common among lifetime microdosing users. Among respondents with valid data (n = 385), 64.9% (n = 250) reported microdosing in the past 12 months. Psilocybin again represented the most frequently reported substance (64.8%, n = 162), followed by LSD (31.2%, n = 78), ketamine (17.6%, n = 44), and MDMA/MDA (14.4%, n = 36). Detailed distributions of past-year microdosing prevalence and substance-specific frequency patterns are presented in Table 3.

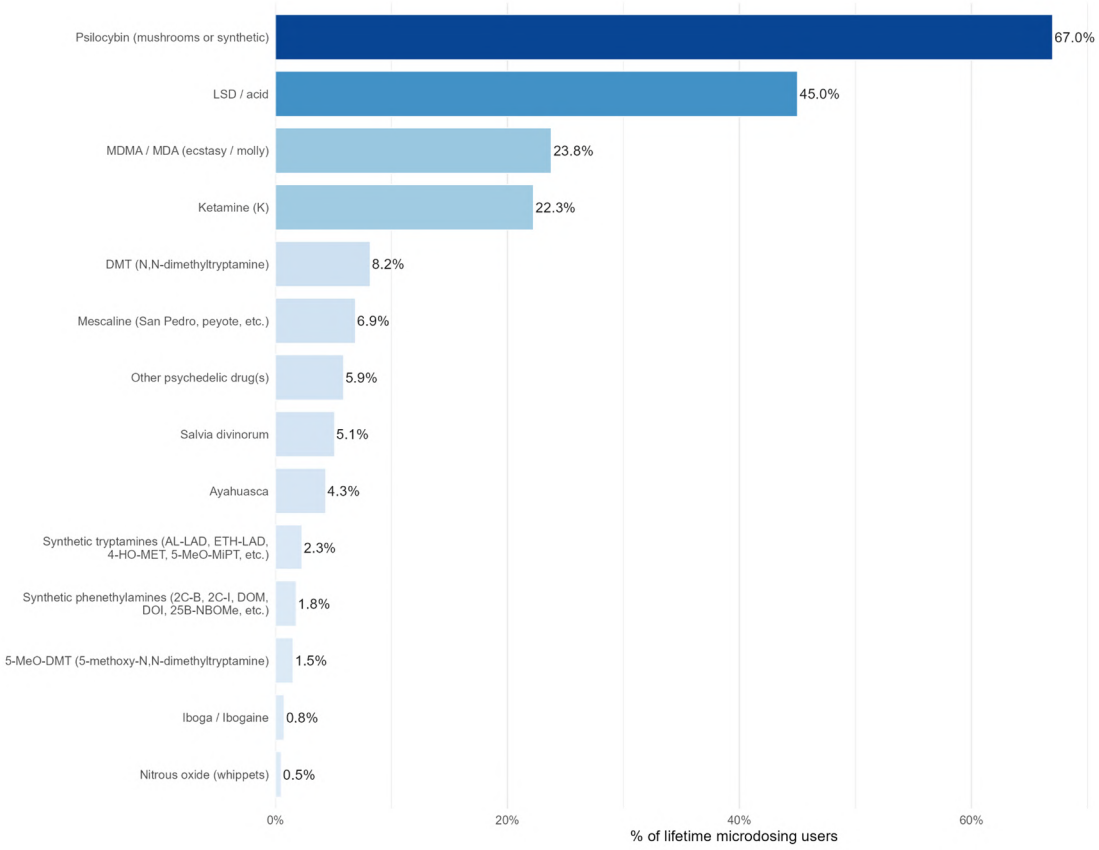


Figure 7. Substances reported for lifetime microdosing among respondents who indicated any lifetime microdosing (n = 391). Bars represent the percentage of respondents reporting microdosing of each substance.

Table 3. Past-year microdosing prevalence and frequency patterns by substance. Percentages for substance prevalence are calculated among respondents reporting microdosing in the past 12 months (n = 250). Percentages reflect multiple-response selections. Note. Frequency patterns are shown only for substances with sufficient responses for meaningful descriptive reporting.

Substance	n of Users	% of Past-Year Users	Most Common Use Pattern(s)
Psilocybin	162	64.8	30.2% One day on, two days off; 25.9% < once every 2 months; 1.9% Daily
LSD	78	31.2	34.6% < once every 2 months; 12.8% One day on, two days off; 12.8% Monthly
Ketamine	44	17.6	Frequency patterns not reported due to limited responses

Table 3. *Cont.*

Substance	n of Users	% of Past-Year Users	Most Common Use Pattern(s)
MDMA/MDA	36	14.4	69.4% < once every 2 months; 8.3% Monthly
DMT	12	4.8	—
Other psychedelics	11	4.4	—
Mescaline	10	4.0	—
Salvia divinorum	7	2.8	—
Ayahuasca	5	2.0	—
Synthetic phenethylamines	5	2.0	—
Synthetic tryptamines	4	1.6	—
Iboga/ibogaine	1	0.4	—
5-MeO-DMT	0	0	—
Nitrous oxide	0	0	—

Substance-specific motivations for microdosing differed by substance. For LSD (n = 169), the most commonly endorsed motives were increasing general well-being (40.2%, n = 68) and personal growth or self-exploration (38.5%, n = 65). For MDMA/MDA (n = 86), recreational motives were clearly predominant (58.1%, n = 50), followed by improving general well-being (25.6%, n = 22). For psilocybin microdosing (n = 255), the most frequently endorsed motives were increasing general well-being (51.4%, n = 131), personal growth or self-exploration (45.9%, n = 117), and enhancing mindfulness (34.9%, n = 89) (Figure 8).

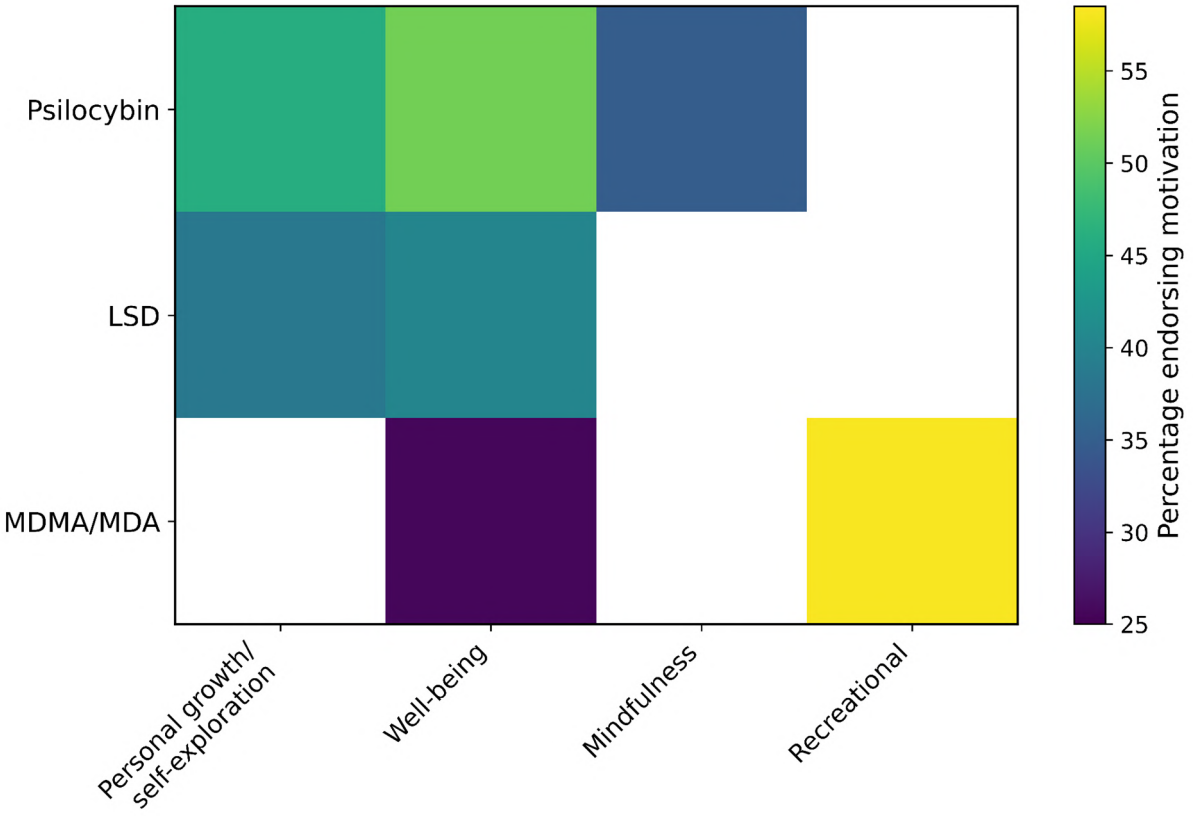


Figure 8. Motivations for microdosing by substance. Heatmap showing the proportion of respondents endorsing specific motivations among those reporting microdosing of each substance. Color intensity represents the percentage of respondents selecting each motivation. Psilocybin and LSD microdosing were primarily associated with well-being and personal growth motives, whereas MDMA/MDA microdosing was predominantly motivated by recreational purposes. Multiple responses were allowed.

Microdosing was most commonly reported in natural environments, during inward-focused activities such as meditation, during leisure time, and in social contexts. Detailed distributions of microdosing-related activities and contexts are presented in Supplementary Figure S3. Past-year microdosing showed a non-significant sex difference, with a higher proportion among women than men (37.7% vs. 30.7%, $p = 0.065$). Although this finding remains exploratory, it may indicate sex-related variation in engagement with sub-perceptual psychedelic dosing.

3.5. Social Context

Perceived social attitudes toward psychedelics varied substantially across social groups. Regarding opinions about psychedelics in general (N = 643), friends were most often perceived as favorable (73.0%, n = 469), followed by partners (47.9%, n = 308), whereas families were more often perceived as unfavorable (54.3%, n = 349). Employers were most frequently perceived as non-applicable (37.6%, n = 242) or unknown (19.4%, n = 125), and when an opinion was perceived, it was more often unfavorable (29.4%, n = 189) than favorable (6.1%, n = 39).

A similar pattern was observed for perceived opinions about the respondent's personal psychedelic use (N = 641). Friends were most often perceived as favorable (68.1%, n = 437), with relatively low perceived opposition (6.2%, n = 40). Partners were also more often perceived as favorable (48.2%, n = 309) than unfavorable (11.7%, n = 75), although a substantial proportion was non-applicable (27.8%, n = 178). In contrast, families were more frequently perceived as unfavorable (36.6%, n = 235) than favorable (13.7%, n = 88), and 27.9% (n = 179) reported that their family did not know about their psychedelic use. For employers, responses were dominated by non-applicable (34.0%, n = 218), and unfavorable responses (20.9%, n = 134) were more common than favorable ones (4.7%, n = 30) (Figure 9).

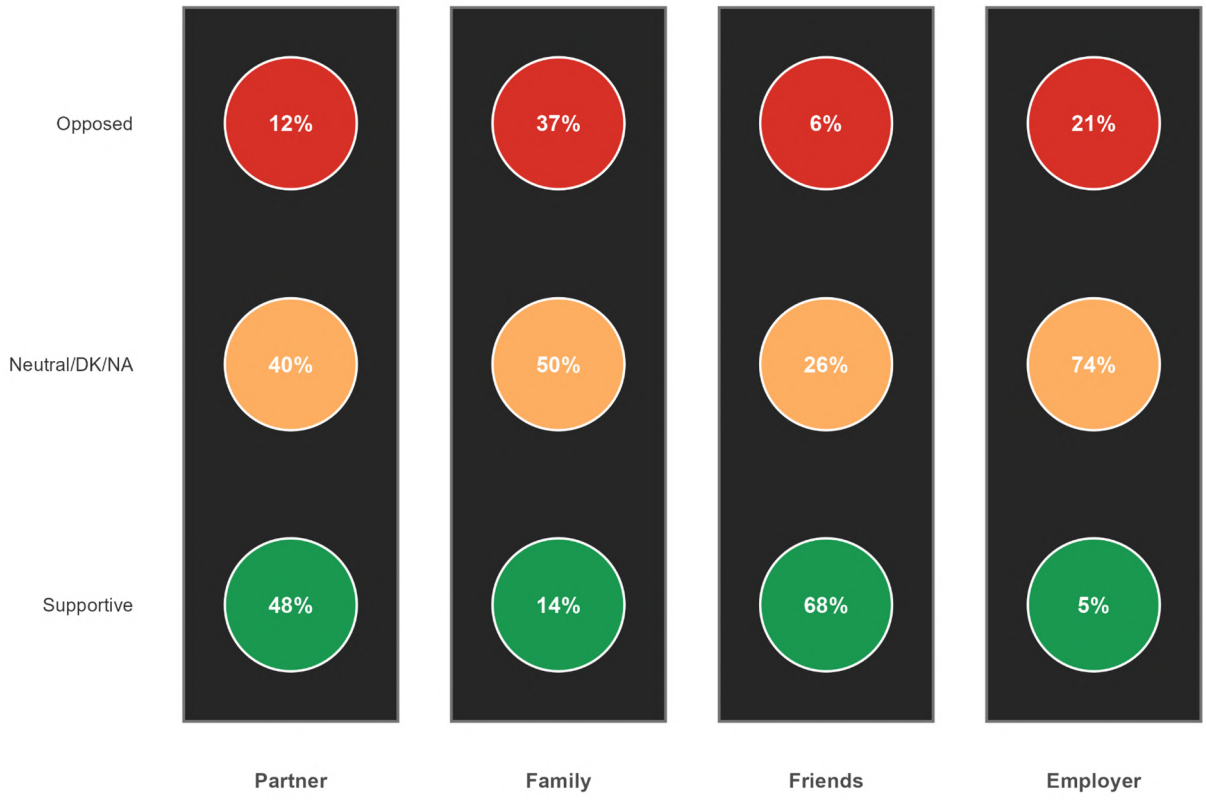


Figure 9. Perceived attitudes of close social contacts toward respondents' personal psychedelic use. Bars show the proportion of respondents reporting supportive, neutral/uncertain, or opposed views among different social groups, including partners, family members, friends, and employers.

Perceived social stigma was more often reported as decreasing than increasing over the previous two years. Despite this, stigma still affected some respondents' use. Details are shown in Figure 10.

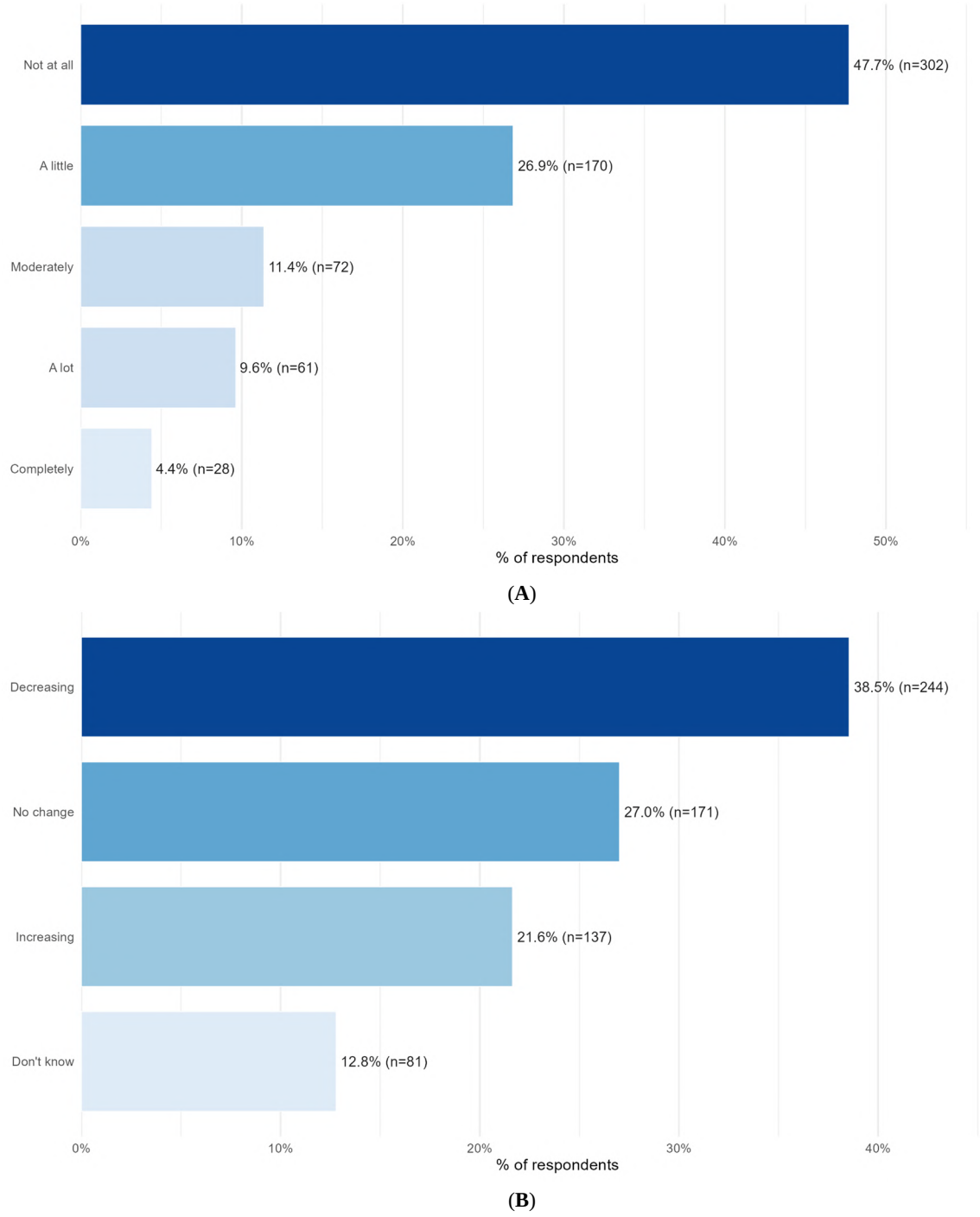


Figure 10. Perceived social stigma related to psychedelic use. Panel (**A**) shows respondents' perceptions of how social stigma toward psychedelic use has changed over the previous two years (N = 633). Panel (**B**) shows the reported impact of stigma on respondents' personal psychedelic use (N = 633).

3.6. Co-Use

Co-use of other substances within the 2-h window before, during, or after psychedelic use varied across substances, as shown in Figure 11. We acknowledge that this 2-h window captures both concurrent and near-concurrent use, which may differ pharmacologically. Co-use was most common for MDMA/MDA (75.2%, 310/412), ketamine (72.6%, 199/274), and LSD (67.9%, 279/411), and it was also frequent for synthetic phenethylamines (58.3%, 70/120), psilocybin (53.1%, 255/480), nitrous oxide (54.5%, 36/66), and DMT (47.1%, 81/172). By contrast, co-use was less common for mescaline (37.5%, 51/136), *Salvia divinorum* (35.5%, 50/141), 5-MeO-DMT (27.4%, 17/62), ayahuasca (21.9%, 25/114), and ibogaine (11.1%, 1/9). Among respondents who provided at least one valid response regarding reasons for co-use (multiple response, N = 414), the most frequently endorsed purpose was intensifying the psychedelic experience (58.7%; n = 243), followed by prolonging the

duration of the experience (39.9%; n = 165) and attenuating the comedown phase (28.3%; n = 117). Additional reasons included reducing anxiety (18.1%; n = 75) enhancing visions (16.7%; n = 69), stabilizing mood (15.9%; n = 66), attenuating next-day disturbances (9.7%; n = 40), preserving serotonin (8.5%; n = 35), and reducing nausea (7.2%; n = 30).

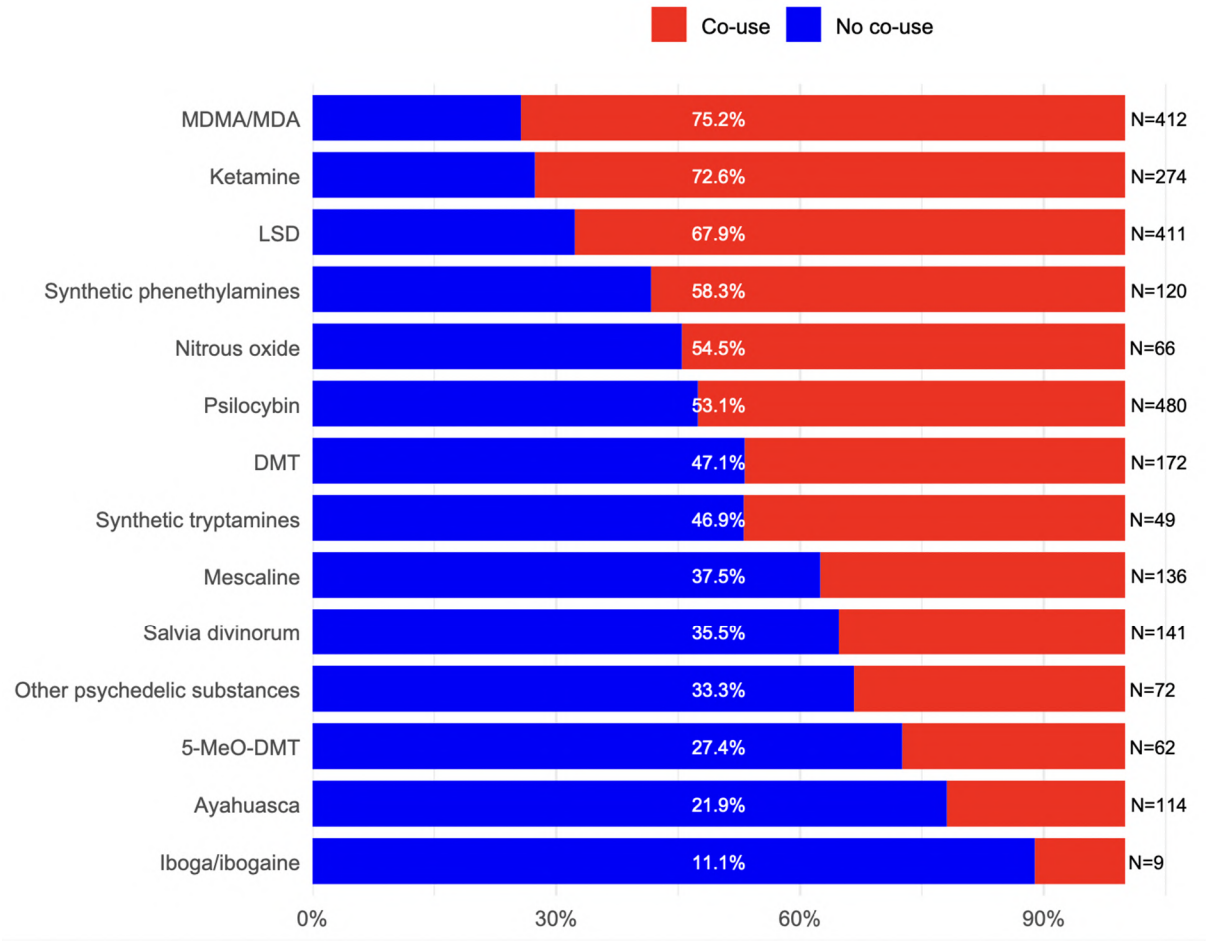


Figure 11. Co-use of other substances within a 2-h window before, during, or after psychedelic use, by substance. Bars represent the proportion of respondents reporting co-use versus no co-use for each psychedelic substance. Percentages are calculated among respondents reporting use of each substance (substance-specific N shown in the figure, multiple response allowed).

Psychedelic Use Disorder

Among respondents (N = 499), indicators of potentially problematic psychedelic use were assessed using a brief set of screening items adapted from commonly used substance-use screening tools (e.g., questions about feeling guilty about use, wanting to cut down, being annoyed by criticism from others, or using substances early in the morning). The most commonly endorsed item was having been annoyed by others' criticism of psychedelic use (37.9%, n = 189), followed by feeling guilty or uneasy about use (23.8%, 119/499), feeling a need to cut down (17.2%, n = 86), and early-morning use (12.8%, n = 64).

Among respondents who endorsed at least one screening item and provided substance-specific information (multiple response, N = 118), MDMA/MDA was most frequently identified as the substance associated with problematic use (40.7%, n = 48), followed by ketamine (34.7%, n = 41) and LSD (22.0%, n = 26). Other substances were less frequently reported, including psilocybin (10.2%, n = 12), synthetic phenethylamines (e.g., 2C-B and related compounds; 5.9%, n = 7), ayahuasca (4.2%, n = 5), synthetic tryptamines (3.4%, n = 4), nitrous oxide (2.5%, n = 3), and isolated reports of DMT (0.8%, n = 1), 5-MeO-DMT (0.8%, n = 1), and Salvia divinorum (0.8%, n = 1). No respondents identified iboga/ibogaine or mescaline as substances associated with problematic use, Figure 12.

A small number of respondents also reported other substances in open-ended responses, most commonly cannabis-related products, as well as isolated mentions of cathinones, cocaine, dextromethorphan, alcohol, and hashish.

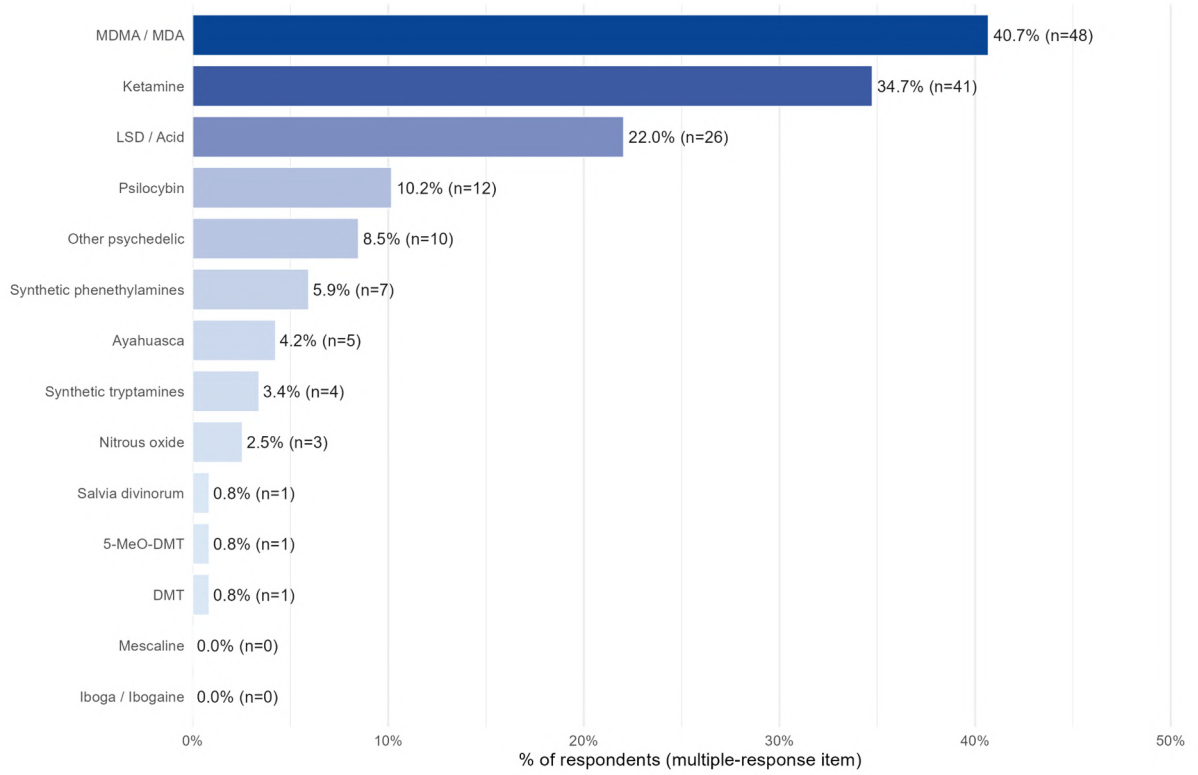


Figure 12. Substances Associated with Problematic Psychedelic Use (N = 118).

3.7. Intense Psychedelic Experiences

Among respondents with valid data (n = 560), 90.5% (n = 507) reported having experienced at least one intense psychedelic experience. Psilocybin (45.9%, n = 231) and LSD (43.1%, n = 217) were most frequently involved, followed by MDMA/MDA (20.9%, n = 105), ketamine (15.1%, n = 76), DMT (14.7%, n = 74), and ayahuasca (13.7%, n = 69) (multiple response, n = 503). Subjective intensity ratings were high (mean = 8.14, SD = 1.97; median = 8.00; n = 499) on a 0–10 scale. Scores on the Awe Experience Scale [31] (range 12–84) were similarly elevated (mean = 64.46, SD = 11.53; median = 66.00). For context, this corresponds to approximately 5.38 on the original 7-point response scale, exceeding the mean scores reported in the AWE-S validation samples (4.98 and 4.93), potentially reflecting the present study's focus on participants' most intense psychedelic experiences. Item-level responses (total respondents: N = 504) indicated strong experiences of awe and connectedness, with many respondents strongly agreeing that they felt in the presence of something vast (59.9%, n = 302), connected to everything (56.3%, n = 284), in contact with something greater than themselves (55.6%, n = 280), or in communion with living beings (51.0%, n = 257). The most intense experiences were typically described as positive (53.6%, n = 270) or mixed (43.8%, n = 221), while exclusively negative experiences were rare (2.6%, n = 13). Correspondingly, perceived changes in personal well-being (N = 245) were predominantly positive (86.2%, n = 211), with negative changes reported infrequently (4.0%, n = 10).

A subset of participants reported challenging experiences (multiple response, n = 245). The most common features included mental or sensory overload (63.7%, n = 156), concerns about not being the same after the experience (44.9%, n = 110), concerns about mental or physical health (44.1%, n = 108), ego dissolution (42.0%, n = 103), confrontation with difficult personal issues (41.6%, n = 102), and social paranoia (39.2%, n = 96).

Despite these difficulties, outcomes were largely perceived as beneficial. Among respondents with valid data (n = 497), 38.6% (n = 192) reported that positive aspects clearly outweighed negative ones, and 29.6% (n = 147) reported substantial benefits with mostly positive effects. Balanced positive and negative outcomes were reported by 21.9% (n = 109), whereas negative-dominant (7.8%, n = 39) or entirely negative (2.0%, n = 10) outcomes were less frequent. Reported beneficial consequences (multiple response, N = 483) most frequently included gaining insight into difficult life problems (44.1%, n = 213), overcoming personal fears (42.2%, n = 204), experiencing a sense of unity (39.3%, n = 190), resolving difficult situations or emotions (35.0%, n = 169), and confronting long-standing psychological or physical trauma (24.0%, n = 116). External support following challenging experiences was reported by 33.2% (n = 164). Among those who received support, most considered it effective (88.4%, n = 145). A detailed summary of the characteristics, subjective features, and outcomes of respondents' most intense psychedelic experience is provided in Table 4.

Table 4. Characteristics, subjective features, and outcomes of respondents' most intense psychedelic experience. Percentages are calculated using valid responses for each item.

Domain	Variable	N	%/Mean (SD)
Prevalence of intense experiences	Experienced ≥1 intense psychedelic experience	507/560	90.5%
Substances involved	Psilocybin	231/503	45.9%
	LSD	217/503	43.1%
	MDMA/MDA	105/503	20.9%
	Ketamine	76/503	15.1%
	DMT	74/503	14.7%
	Ayahuasca	69/503	13.7%
Subjective intensity	Intensity rating (0–10)	499	8.14 (1.97)
	Awe Experience Scale (12–84)	504	64.46 (11.53)
Awe-related experiences	Felt in presence of something vast	302/504	59.9%
	Felt connected to everything	284/504	56.3%
	Contact with something greater than oneself	280/504	55.6%
	Communion with living beings	257/504	51.0%
Overall experience valence	Positive	270/504	53.6%
	Mixed	221/504	43.8%
	Negative	13/504	2.6%
Perceived well-being change	Positive	211/245	86.2%
	Negative	10/245	4.0%
Challenging features	Mental or sensory overload	156/245	63.7%
	Concern about not being the same afterward	110/245	44.9%
	Concern about mental or physical health	108/245	44.1%
	Ego dissolution	103/245	42.0%
	Difficult personal issues confronted	102/245	41.6%
	Social paranoia	96/245	39.2%
Overall outcome evaluation	Positive aspects clearly outweigh negatives	192/497	38.6%
	Mostly positive effects	147/497	29.6%
	Balanced positive/negative	109/497	21.9%
	Mostly negative	39/497	7.8%
	Entirely negative	10/497	2.0%
Reported benefits	Insight into life problems	213/483	44.1%
	Overcoming personal fears	204/483	42.2%
	Sense of unity	190/483	39.3%
	Resolving difficult emotions/situations	169/483	35.0%
	Confronting long-standing trauma	116/483	24.0%
Support after challenging experience	Received external support	164/494	33.2%
	Support perceived as effective	145/164	88.4%

Among respondents with valid data (multiple response, N = 497), a minority reported persistent multi-sensory sensitivity symptoms lasting at least three months during the previous 12 months. Sensitivity to sounds was the most frequently reported symptom (19.7%, n = 98), followed by frequent sensitivity to bright lights (16.7%, n = 83) and sensitivity to odors (9.3%, n = 46). The majority of respondents (71.8%, n = 357) reported none of these symptoms.

During a typical psychedelic experience, changes in sensory intensity were commonly reported across modalities. Increased intensity was most frequently reported for sound (77.1%, n = 383) and touch (76.1%, n = 378), followed by light (52.3%, n = 260) and smell (41.6%, n = 207). In contrast, no change in intensity was reported by 44.9% (n = 223) for light, 55.3% (n = 275) for smell, 19.1% (n = 95) for sound, and 20.5% (n = 102) for touch. Decreases in intensity were rare across all modalities, ranging from 2.8% (n = 14) for light to 3.8% (n = 19) for sound.

Patterns for perceived pleasantness were broadly consistent with the reported increases in sensory intensity. Sensory experiences were more often described as becoming more pleasant rather than unpleasant during psychedelic experiences. Increased pleasantness was most frequently reported for sound (76.7%, n = 381) and

touch (74.2%, n = 369), followed by light (53.7%, n = 267) and smell (38.0%, n = 189). No change in pleasantness was reported by 41.9% (n = 208) for light, 57.1% (n = 284) for smell, 19.5% (n = 97) for sound, and 22.9% (n = 114) for touch. Reports of sensory experiences becoming unpleasant were uncommon across modalities, ranging from 2.8% (n = 14) for touch to 4.8% (n = 24) for smell.

3.8. Persistent Difficulties Lasting More Than 24 H after the Acute Effects

Among respondents who endorsed at least one difficulty lasting more than 24 h after psychedelic effects (n = 379), the most commonly reported difficulties were depressive feelings (53.0%, n = 201) and existential difficulties (50.1%, n = 190). Other frequently reported difficulties included a sense of disconnection from other people (42.0%, n = 159), derealization (41.7%, n = 158), and depersonalization (38.0%, n = 144). Lower proportions were observed for reduced self-esteem (28.8%, n = 109), cognitive problems such as confusion or memory difficulties (28.2%, n = 107), sleep problems including nightmares (27.7%, n = 105), anxiety and/or panic attacks (26.1%, n = 99), disappointment or dissatisfaction toward non-psychedelic life experiences (18.2%, n = 69), and persistent visual distortions (12.7%, n = 48). Across all difficulties, the most common affirmative duration category was less than one week. For example, symptoms lasting less than one week were reported by 40.6% (n = 154) for depressive feelings, 31.9% (n = 121) for disconnection from others, 28.8% (n = 109) for derealization, 26.9% (n = 102) for depersonalization, and 26.1% (n = 99) for existential difficulties. Nevertheless, longer durations were also reported. Difficulties lasting more than one month were most frequent for existential difficulties (12.9%, n = 49). Difficulties lasting more than one year were rare, with the highest proportions reported for existential difficulties (5.8%). For further details refer to Figure 13.

Among respondents asked whether a specific substance was typically associated with these persistent difficulties (n = 376), most reported that no particular substance was involved (68.1%, n = 256), whereas MDMA/MDA (9.8%, n = 37) and LSD (8.0%, n = 30) were the substances most commonly identified when a specific association was reported. Regarding the setting typically associated with persistent difficulties, the most commonly reported context was a large public event, party, or rave (22.3%, n = 84), followed by a familiar indoor setting such as one's own home or a friend's home (13.6%, n = 51). More than half of respondents selected none of the listed settings (57.2%, n = 215).

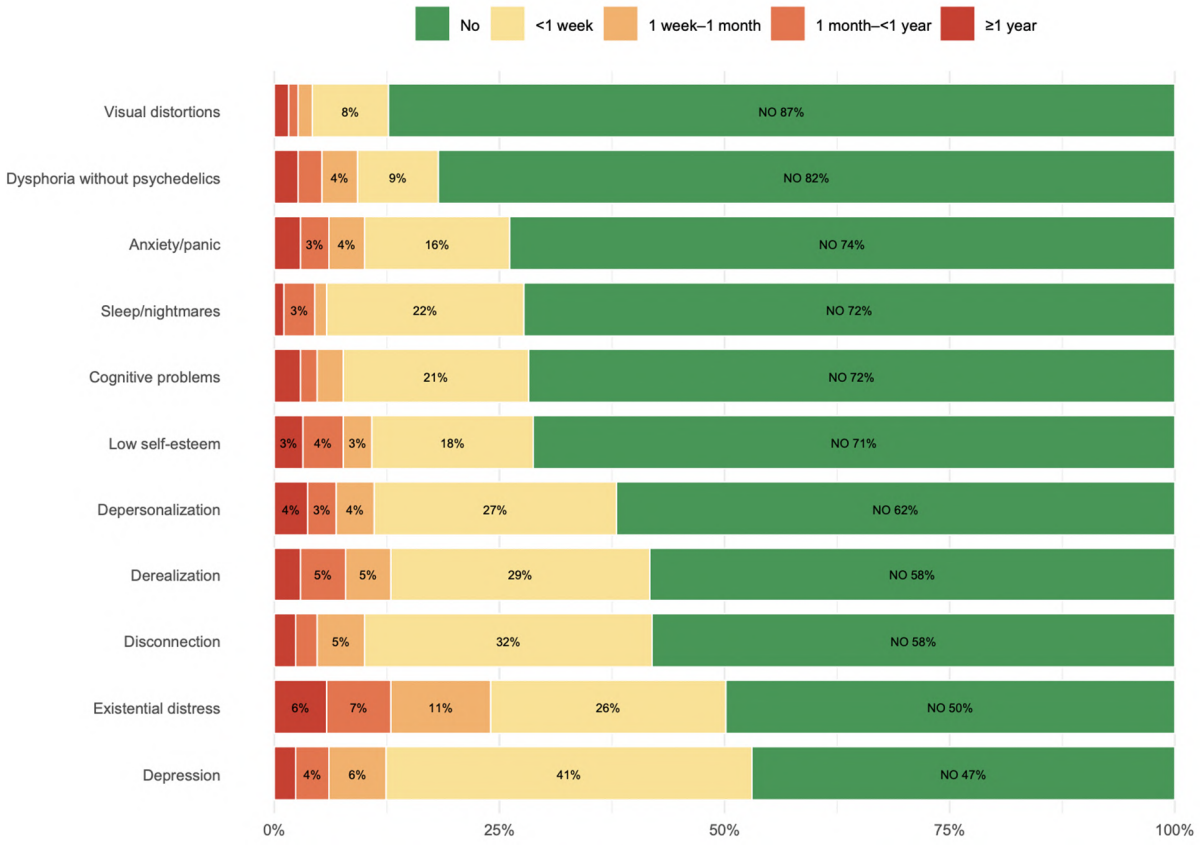


Figure 13. Self-reported occurrence and timing of adverse psychological or perceptual effects outside of psychedelic use. Horizontal stacked bars show the proportion of respondents reporting whether specific symptoms occurred after psychedelic use and, if so, the approximate time since last occurrence (<1 week, 1 week–1 month, 1

month–<1 year, ≥1 year), or no occurrence. The denominator includes respondents reporting at least one affirmative response within the block (N = 379).

Symptom-specific perceived severity was generally concentrated in the lower categories ("not at all severe" or "somewhat severe") for most symptoms, including disconnection from others (79.6%, 125/157), depressive feelings (76.4%, 152/199), derealization (77.6%, 121/156), depersonalization (79.6%, 113/142), sleep problems (79.8%, 83/104), cognitive problems (91.5%, 97/106), persistent visual distortions (95.8%, 46/48), and disappointment toward non-psychedelic experiences (70.6%, 48/68). By contrast, existential difficulties showed a broader severity distribution, with 46.6% (88/189) rated as moderately to extremely severe, and reduced self-esteem also showed a higher burden, with 31.5% (34/108) rated as moderately to extremely severe (Figure 14).

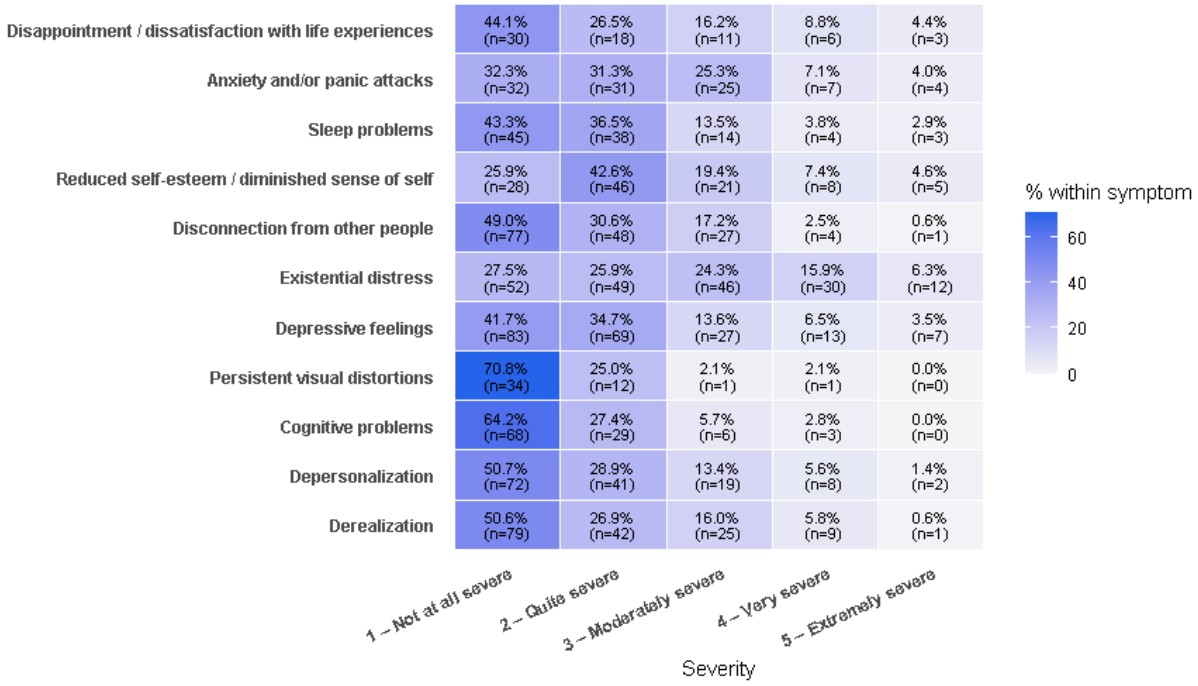
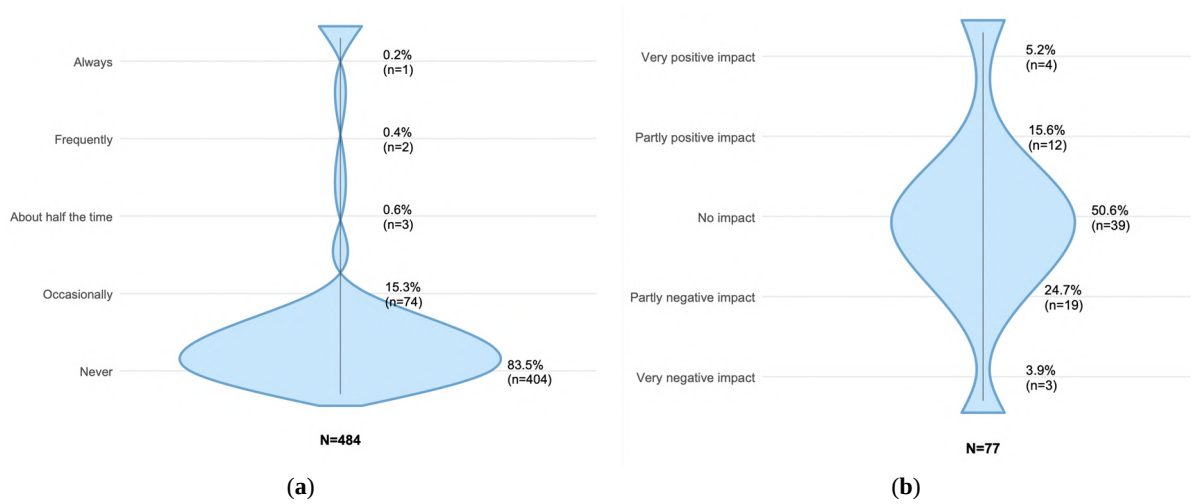


Figure 14. Perceived severity of persistent difficulties following psychedelic experiences. Heatmap showing the distribution of self-reported severity ratings for different persistent difficulties lasting more than 24 h after psychedelic use. Severity was rated on a five-point scale ranging from 1 ("not at all severe") to 5 ("extremely severe"). Values represent the percentage of respondents reporting each severity level within each symptom category, with counts shown in parentheses. Color intensity represents the percentage of responses within each symptom category.

The extent to which these difficulties were perceived as part of an extended healing process varied markedly according to the type of symptomatic distress. This interpretation was strongest for existential difficulties (n = 189), for which 52.4% (n = 99) endorsed "very" or "completely" and 77.2% (n = 146) endorsed at least "moderately." Moderate-or-higher endorsement of a healing-process interpretation was also common for depersonalization (54.3%, 77/142), reduced self-esteem or diminished sense of self (52.8%, 57/108), anxiety and/or panic attacks (51.5%, 51/99), derealization (49.9%, 78/156), disconnection from others (47.8%, 75/157), and depressive feelings (45.2%, 90/199). In contrast, sleep problems (26.0%, 27/104), cognitive problems (13.2%, 14/106), and persistent visual distortions (14.6%, 7/48) were less often framed as part of an extended healing process, and were more often rated as "not at all" in this respect (53.8%, 56/104; 68.9%, 73/106; and 66.7%, 32/48, respectively).

Hallucinations persisting more than 24 h after the end of psychedelic effects were uncommon (N = 484). Most respondents reported never experiencing this (83.5%, n = 404), while 15.3% (n = 74) reported occasional occurrences. More frequent patterns were rare (1.2% combined) and can be found in Figure 15a. The impact on life among respondents who reported hallucinations (N = 77) is shown in Figure 15b.



(**a**) (**b**)

Figure 15. Frequency and perceived impact of hallucinations persisting beyond the acute psychedelic experience. (**a**) shows the frequency of hallucinations lasting more than 24 h after psychedelic effects (N = 484). (**b**) presents the perceived impact of such experiences among respondents who reported them (N = 77), ranging from very negative to very positive.

3.9. Major Life Changes

Among respondents who reported at least one psychedelic-influenced life change (n = 532), the most frequently reported psychedelic-related life changes involved goals (44.0%, n = 234), values (41.9%, n = 223), religion or spirituality (40.2%, n = 214), and substance use (38.0%, n = 202). Across domains, these changes were generally evaluated positively. Among those who reported a change in a given domain, the proportion rating changes as quite or very positive was particularly high for values (94.1%, n = 209/222), and religion or spirituality (93.5%, n = 200). Similarly high positive evaluations were observed for dietary habits (91.5%, 107/117), hobbies (91.4%, 85/93), and goals (90.6%, 212/234). Positive ratings were also common for social activities (88.9%, 128/144), political views (87.0%, 60/69), substance use (83.7%, 169/202), and occupation or work (81.5%, 101/124). Changes in relationship status or partnership were evaluated more variably, although positive ratings still predominated (69.6%, 32/46), Figure 16.

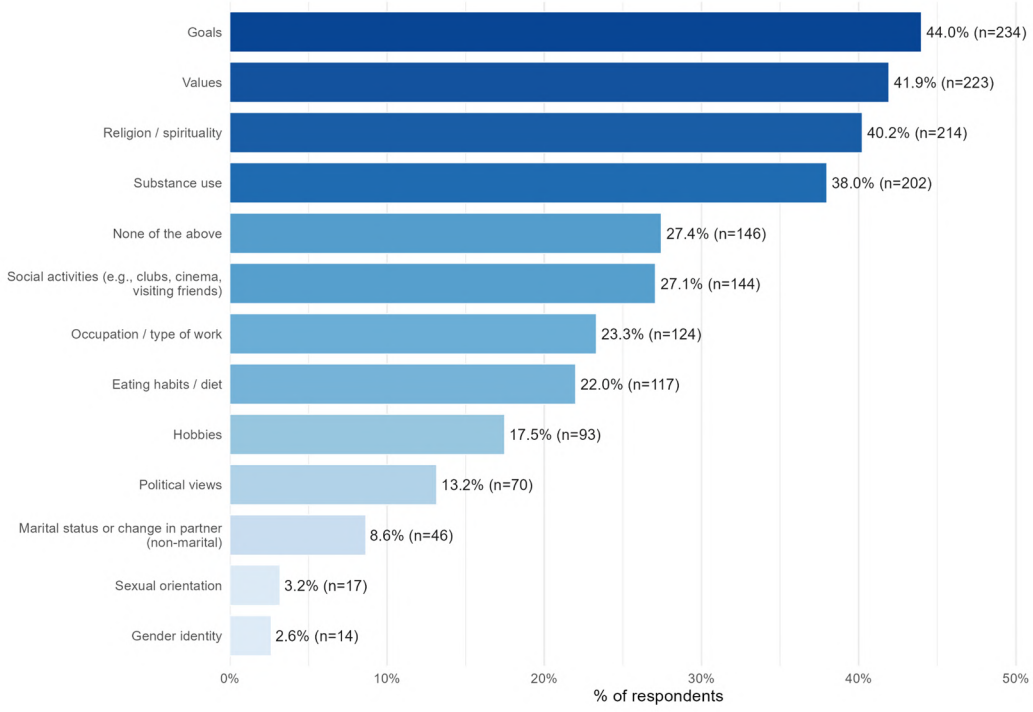


Figure 16. Important life changes influenced by psychedelic experiences (Q234). Among 532 respondents (multiple responses allowed), the most commonly reported domains of change were life goals (44.0%), personal values (41.9%), and religion/spirituality (40.2%), followed by substance use (38.0%).

Ratings of the importance of major life experiences, relationships, and practices (0–10 scale) were generally high, with median values between 7 and 9. The highest mean ratings were assigned to relationships with a partner or spouse (mean = 8.58, SD = 2.02), relationships with friends (mean = 8.22, SD = 1.96), and living a healthy lifestyle (mean = 7.88, SD = 2.06). Relationships with parents, having children, and contributing to a better world were also rated highly (means = 7.29–7.51). Personal psychedelic experiences or practices were rated as relatively important (mean = 7.25, SD = 2.39), at a level comparable to several other life domains. Lower mean ratings were observed for work or employment (mean = 6.78, SD = 2.54) and spiritual or religious practices (mean = 6.00, SD = 3.29).

3.10. Therapeutic Use for Health Conditions, and Treatment-Related Changes

Among respondents who reported at least one motivation for trying psychedelics to address a physical or mental symptom/condition (multiple response, N = 155), the most frequently endorsed motives were that traditional treatments had failed or were ineffective (47.1%, n = 73), consistency with personal beliefs or cultural practices (45.8%, n = 71), and dislike of traditional treatments (36.1%, n = 56).

For physical health conditions or symptoms reportedly treated with psychedelics (multiple response, N = 36), the most commonly endorsed categories were chronic pain (52.8%, n = 19), headache/migraine (36.1%, n = 13), and sleep disorders (30.6%, n = 11).

For mental health conditions or symptoms reportedly treated with psychedelics (multiple response, N = 144), the most frequently endorsed conditions were depression or low mood (72.9%, n = 105) and anxiety (71.5%, n = 103). Other relatively common categories included substance use disorder/dependence/withdrawal (31.2%, n = 45), PTSD (24.3%, n = 35), obsessive-compulsive disorder (22.2%, n = 32), and ADHD (20.8%, n = 30) Lower proportions were reported for eating disorders (15.3%, n = 22), autism spectrum disorder (11.8%, n = 17), bipolar disorder (9.7%, n = 14), personality disorders (9.7%, n = 14), and psychotic disorders (3.5%, n = 5), as showcased in Figure 17.

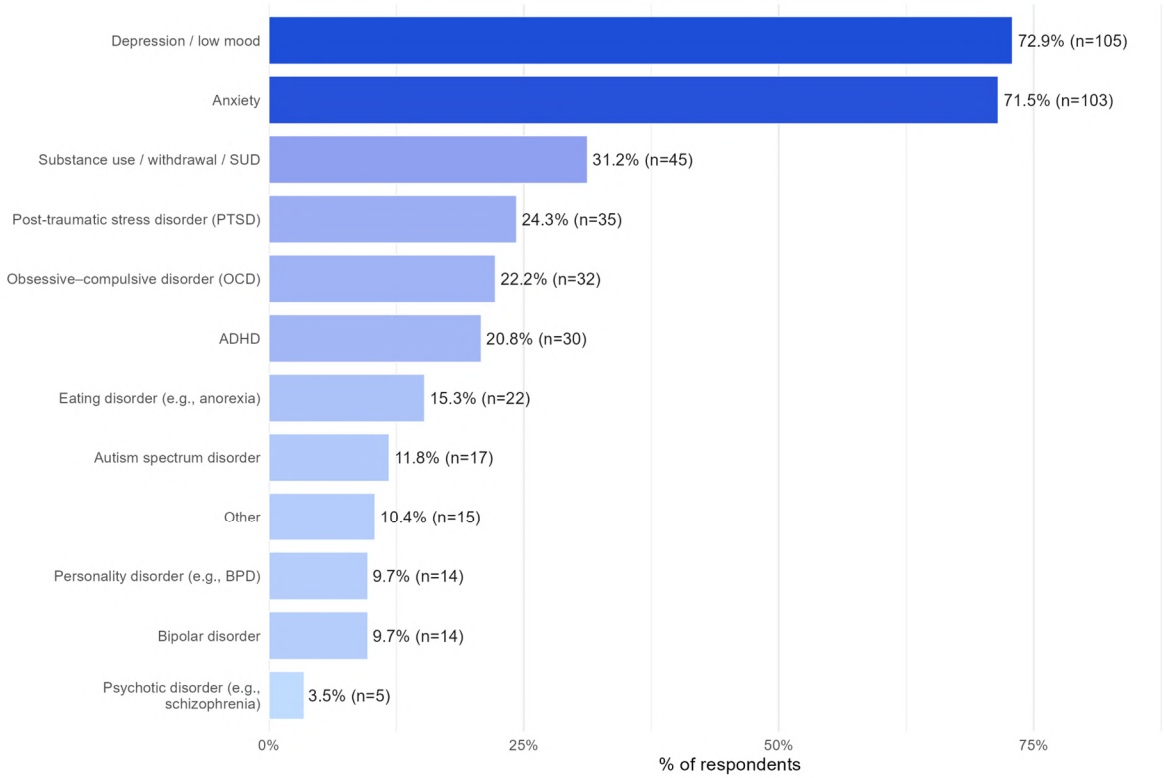


Figure 17. Mental health conditions reportedly treated with psychedelics. Distribution of self-reported mental health conditions or symptoms for which respondents reported using psychedelics therapeutically (multiple responses allowed; N = 144). Depression or low mood and anxiety were the most frequently endorsed conditions, followed by substance use disorder/withdrawal, post-traumatic stress disorder (PTSD), obsessive–compulsive disorder (OCD), and attention-deficit/hyperactivity disorder (ADHD). Lower proportions were reported for eating disorders, autism spectrum disorder, bipolar disorder, personality disorders, and psychotic disorders. Bars represent the percentage of respondents endorsing each condition, with counts shown in parentheses.

Ratings of change lasting more than two weeks after psychedelic use for the primary treated condition (N = 150 for each domain) indicated predominantly positive changes across domains. The combined proportion reporting either a mild or major positive change was 85.3% (n = 128) for attitudes toward life, 86.6% (n = 130) for attitudes toward self, 82.6% (n = 124) for mood, 70.7% (n = 106) for socialization, 75.3% (n = 113) for behavior, and 76.0% (n = 114) for spirituality.

When asked whether psychedelic use had been helpful for the mental health condition(s) treated (N = 144), 91.0% (n = 131) reported that it had been helpful, while 9.0% (n = 13) reported that it had not. Among respondents reporting valid data on the typical duration of mental health benefits (N = 130), the most frequently endorsed category was several months but less than one year (32.3%, n = 42), followed by several weeks but less than one month (21.5%, n = 28) and more than two years (17.7%, n = 23). Overall, 54.6% (n = 71) reported benefits lasting at least several months. When asked which aspect of life was most influenced by the condition treated therapeutically with psychedelics (N = 152), the most frequently endorsed domain was negative emotions and stress (30.9%, n = 47), followed by perception of self/others and social interactions (25.7%, n = 39), and positive emotions and motivation (18.4%, n = 28). Among respondents with valid data on regular contact with a usual healthcare professional (n = 520), 47.7% (n = 248) reported regularly seeing a reference professional (e.g., general practitioner), whereas 52.3% (n = 272) did not.

Among those who regularly saw a healthcare professional (N = 248), 26.6% (n = 66) reported having discussed psychedelics with that professional, while 73.4% (n = 182) had not. Among respondents who reported at least one reason for not discussing psychedelics with their healthcare professional (multiple response, N = 181), the most frequently endorsed reasons were concerns about stigma (50.8%, n = 92), not seeing any reason to discuss psychedelic use with the professional (45.9%, n = 83), believing the professional would not know how to integrate psychedelic use into medical care (43.1%, n = 78), preferring to keep psychedelic use private (40.3%, n = 73), and perceiving the professional as insufficiently knowledgeable about psychedelics (40.3%, n = 73). Among respondents who regularly saw a healthcare professional, comfort with sharing details about psychedelic use was low to moderate on a 0 to 10 scale (mean = 3.94, SD = 3.16; median = 3.00; N = 247). Perceived knowledge of the healthcare professional about psychedelics was also low (mean = 3.09, SD = 2.98; median = 2.00; N = 149).

Among respondents who reported the types of professionals from whom they had received mental health treatment (multiple response, N = 100), the most commonly endorsed professionals were psychotherapists (77.0%, n = 77), psychologists (56.0%, n = 56), and psychiatrists (54.0%, n = 54). Within this group, 81.0% (n = 81) reported having informed a mental health professional (e.g., counselor, psychotherapist, psychologist, psychiatrist, or therapist) about their psychedelic use, whereas 19.0% (n = 19) had not. Among those who had not disclosed their use (multiple response, n = 19), the most frequently reported reason was concern about stigma (42.1%, n = 8).

In a broader question regarding psychedelic use under the care or guidance of a therapist or healthcare professional (N = 514), only 10.1% (n = 52) reported having used psychedelics in such a supervised context, whereas 89.9% (n = 462) had not. Among respondents who reported guided use (n = 52), the presence of a professional was generally considered important for the overall outcome: 53.8% (n = 28) rated it as very important, 11.5% (n = 6) as important, and 19.2% (n = 10) as moderately important. Overall, 84.6% (n = 44) rated the professional's presence as at least moderately important. The distribution of respondents' reported likelihood of using psychedelics with trained therapeutic support if legally available is shown in Figure 18.

Changes in other therapeutic practices following psychedelic use for mental health treatment showed domain-specific patterns. For each modality, mindfulness/meditation most often increased (84.0%, n = 63/75), and physical activity also frequently increased (51.2%, n = 43/84). Prescription medication use most often decreased or was discontinued (72.0%, n = 41/57). Psychotherapy/counseling (total: N = 100) showed a mixed pattern, with 25.0% (n = 25) reporting increased use, 33.0% (n = 33) no change, and 42.0% (n = 42) decreased or discontinued use. Behavioral addictions were also examined. Among respondents with complete data (N = 501), 36.3% (n = 182) reported a lifetime history of at least one behavioral addiction. Relationship codependency and problematic internet use were the most frequently reported domains, followed by eating-related behaviors and pornography use. Duration patterns varied across domains, with several behaviors showing substantial proportions of long-term cases (Supplementary Figure S4a). Among the subset reporting psychedelic treatment for a behavioral addiction (n = 24), self-reported changes were predominantly favorable (Supplementary Figure S4b).

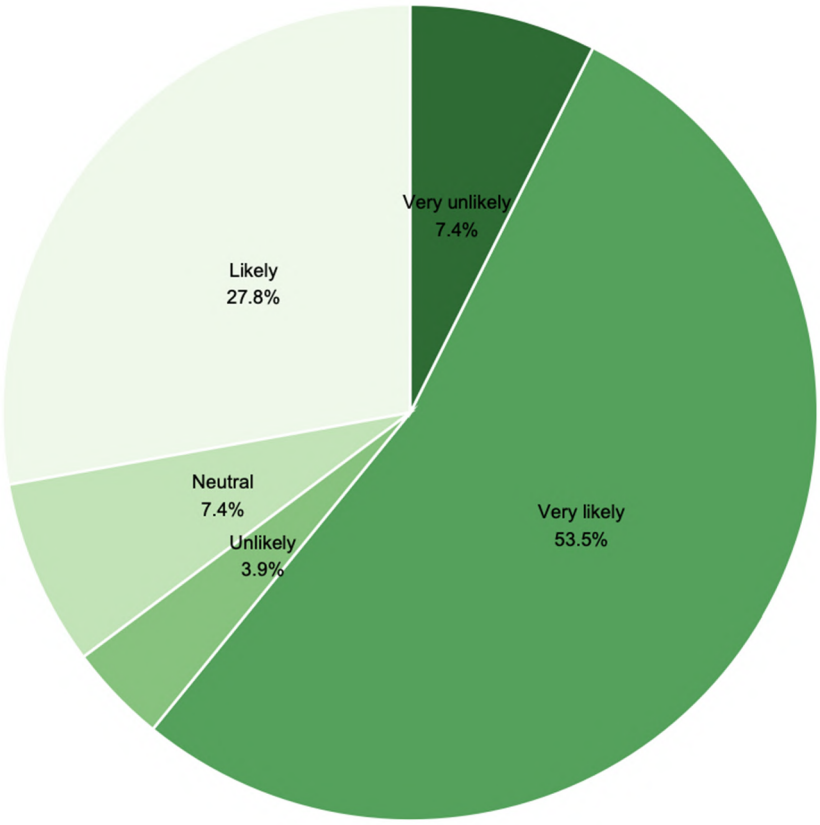


Figure 18. Likelihood of using psychedelics with trained therapeutic support if legally available. Distribution of respondents' reported likelihood of using psychedelics in a legally regulated therapeutic context with trained professional support (N = 460). Respondents indicated a positive inclination toward such use, with 53.5% reporting they would be very likely and 27.8% likely to use psychedelics under these conditions. Smaller proportions reported neutral (7.4%), unlikely (3.9%), or very unlikely (7.4%) intentions.

3.11. Substance Use Disorder

Among respondents with valid data (N = 508), 36.0% (n = 183) reported having received a diagnosis of a substance use disorder or having considered themselves as having had a problematic relationship with a substance, whereas 64.0% (n = 325) reported no such history. Substance-specific patterns and reported duration of problematic use are presented in Table 5.

Table 5. Self-reported lifetime problematic substance use and duration of problematic use by substance. Percentages for duration categories are calculated among respondents endorsing problematic use of each substance. Denominators vary due to missing responses.

Substance	N Reporting Problematic Use (% of Respondents)	<1 Year	1–5 Years	6–10 Years	>10 Years
Tobacco nicotine (N = 183)	135 (73.8)	4.9% (n = 9)	13.1% (n = 24)	14.2% (n = 26)	41.5% (n = 76)
Cannabis (N = 182)	115 (63.2)	7.7% (n = 14)	22.0% (n = 40)	8.8% (n = 16)	24.7% (n = 45)
Alcohol (N = 183)	86 (47.0)	10.9% (n = 20)	18.6% (n = 34)	6.6% (n = 12)	10.9% (n = 20)
Cocaine/crack (N = 118)	41 (34.7)	16.1% (n = 19)	10.2% (n = 12)	5.1% (n = 6)	3.4% (n = 4)
Non-regulated opioids (N = 53)	18 (34.0)	11.3% (n = 6)	15.1% (n = 8)	5.7% (n = 3)	1.9% (n = 1)

Changes in Use of Other Substances Following Psychedelic Use

Across substances, reductions were more frequently reported than increases. Cessation or reduction was most commonly reported for alcohol (45.9%; n = 210/458), tobacco or nicotine (34.9%; n = 144/413), cannabis (27.9%; n = 126/452), cocaine or crack (26.4%; n = 66/250), and antidepressants (28.6%; 30/105). Complete substance-specific distributions across cessation, reduction, no change, increased use, initiation, and non-use are presented in Supplementary Table S1.

Among respondents who reported at least one cessation or reduction (N = 296), psilocybin was most frequently identified as the psychedelic substance having the greatest impact (41.6%; n = 123), followed by LSD (26.4%; n = 78), ayahuasca (12.2%; n = 36), MDMA/MDA (8.4%; n = 25), ketamine (4.7%; n = 14), and DMT (2.0%; n = 6). Other substances were each reported by ≤2.0% of respondents.

Regarding the duration of reported reductions (N = 296), 19.6% (n = 58) reported reductions lasting more than 26 weeks. Shorter durations included 12–26 weeks (4.7%; n = 14), 5–11 weeks (6.8%; n = 20), 1–4 weeks (15.5%; n = 46), and less than one week (8.4%; n = 25). A plurality of respondents (44.9%; n = 133) reported no fixed pattern, indicating that the duration of reduced use depended on the substance and contextual factors.

Treatment seeking for alcohol-related problems was relatively uncommon. Among respondents reporting alcohol-related problems (multiple response, N = 86), 70.9% (n = 61) reported not having sought treatment. Traditional treatment modalities were reported by 14.0% (n = 12), while 16.3% (n = 14) reported having pursued psychedelic therapy.

Among those reporting traditional treatment (multiple response, N = 12), psychotherapy or counseling was the most frequently endorsed modality (83.3%, n = 10), followed by 12-step or peer support programs (25.0%, n = 3), pharmacological treatments (16.7%, n = 2), and community outpatient services (8.3%, n = 1). No respondents reported residential treatment.

3.12. Affordability and Testing Services

Annual spending on psychedelics (N = 496) was most commonly reported in the $1 to $100 range (45.0%, n = 223), followed by $101 to $1000 (32.9%, n = 163), while 18.8% (n = 93) reported $0 annual spending. Higher annual spending was uncommon (2.8%, n = 14 for $1001 to $5000, 0.6%, n = 3 for $5001 to $10000). Only 8.9% (n = 44) reported any spending on therapist- or professional-assisted psychedelic treatment, and very high expenditures were rare. Financial assistance to cover these costs was almost never reported (0.6%). Preferred access or purchase modalities for psychedelic substances are summarized in Supplementary Table S2.

Awareness of drug checking services or home testing kits was reported by 62.6% (n = 285), while 37.4% (n = 170) were not aware of such options. Among those aware (N = 285), actual use before consumption was generally infrequent: 67.0% (n = 191) reported never using testing services or kits, 16.1% (n = 46) rarely, 8.1% (n = 23) sometimes, 5.6% (n = 16) often, and 3.2% (n = 9) always. Among respondents who reported at least one testing modality (multiple response, N = 94), the most common were home test kits (68.1%, n = 64) and event-based testing services (51.1%, n = 48).

3.13. Predictors of Healthcare Disclosure

To characterize the individual-level correlates of disclosure, we fitted a binary logistic regression in the subsample of respondents who reported a regular primary healthcare provider and were male or female (N = 234; 64 disclosers, 170 non-disclosers). None of the predictors reached statistical significance. However, female sex was associated with a non-significant trend toward lower odds of disclosure (OR = 0.58, 95% CI [0.31, 1.09], p = 0.091). University-level education showed a non-significant trend toward higher disclosure odds (OR = 1.74, 95% CI [0.89, 3.40], p = 0.107). Age (p = 0.604) and psychedelic experience (p = 0.538) were not associated with disclosure. Full model results are presented in Supplementary Table S3.

4. Discussion

This study provides an initial large-scale characterization of contemporary psychedelic use in Italy and San Marino within a large Italian-speaking cohort of adults reporting lifetime exposure. The sample included 731 participants born in or residing in Italy or San Marino (mean age 37.4 years; 59.8% male). Overall, the findings describe a socially patterned and highly engaged user population whose psychedelic use is predominantly intermittent, largely embedded in informal social contexts, and mostly situated outside formal medical or regulated frameworks. The cohort showed extremely high levels of lifetime substance exposure. Alcohol (98.8%), cannabis (97.5%), and nicotine (90.4%) were nearly universal, while more than half reported lifetime cocaine use and almost

half reported unregulated stimulant exposure. Benzodiazepines, opioids, and various prescribed psychotropic medications were also reported by a notable proportion. These findings situate psychedelic use within broader patterns of polysubstance exposure rather than as an isolated phenomenon.

Taken together, these findings support the characterization of psychedelic use in our sample as predominantly experiential and event-based rather than continuous or compulsive, particularly with regard to classic serotonergic psychedelics, which are generally considered to have low dependence and abuse liability [32,33]. This interpretation is also consistent with survey-based evidence indicating that naturalistic psychedelic use is often infrequent and motivated by personal growth, self-exploration, or meaning-oriented goals rather than by patterns typical of continuously reinforcing substances [25,30]. Nevertheless, polysubstance exposure was extensive, with the vast majority of regular-dose users reporting experience with multiple psychedelic compounds.

Use contexts were predominantly social and non-clinical. Psychedelics were most commonly consumed with partners or small groups of friends in familiar indoor environments or natural outdoor settings. Certain substances showed distinct contextual patterns of use: ayahuasca was often consumed in retreat or guided ceremonial settings, whereas MDMA and ketamine were more frequently associated with parties or large social gatherings. Professional healthcare supervision was rare. Motivational patterns revealed an important divergence between clinical discourse and real-world use. The most common motivations across substances were personal growth, curiosity, emotional exploration, mindfulness, and general well-being. Recreational motives were common for MDMA and ketamine, whereas spiritual motives were particularly prominent for ayahuasca, mescaline, DMT, and 5-MeO-DMT. Explicit mental health treatment motives were present but less frequent. Together, these findings are consistent with the hypothesis that, outside clinical trials, psychedelic use in Italy is primarily organized around experiential, meaning-oriented, and self-exploratory goals rather than formal therapeutic pathways.

The prominence of spiritual motives for ayahuasca, mescaline, DMT, and 5-MeO-DMT may also reflect substance-specific cultural imaginaries. These compounds are commonly associated, in contemporary psychedelic discourse, with ceremonial, indigenous, shamanic, visionary, or nature-oriented frameworks, and this may influence the meanings users attribute to their experiences. In the Italian context, these patterns should be interpreted cautiously. The present data do not allow conclusions about broader national cultural attitudes toward psychedelics; however, they suggest that at least within this psychedelic-engaged sample, spiritual and meaning-oriented uses may be shaped by a combination of transnational psychedelic cultures, retreat-based practices, holistic wellness niches, and individual forms of secular or non-institutional spirituality. This is particularly relevant in a country where formal medical access to psychedelic-assisted therapy remains absent or highly restricted, potentially leaving informal, ceremonial, relational, and self-directed settings as the main contexts in which users explore the existential and transformative dimensions of these substances. The prominence of personal growth, mindfulness, and spiritual motivations suggests that many respondents engaged with psychedelics not solely as psychoactive substances, but as tools for self-exploration, existential reflection, and meaning-making. Although the present data do not permit conclusions regarding broader Italian cultural attitudes, the observed motivational patterns are consistent with emerging evidence from European and Europe/UK contexts [25,30,34,35] suggesting that psychedelic use is not limited to recreation, but may also be embedded within personal growth, self-care, spiritual, therapeutic, or wellness-oriented frameworks.

Participants frequently described psychedelic experiences as intense and phenomenologically distinctive. Most respondents reported at least one highly intense experience characterized by strong feelings of awe, connectedness, and encounter with perceived vastness. Such phenomenology corresponds to findings from studies using the Awe Experience Scale [31], where feelings of connectedness, vastness, and self-transcendence are associated with improvements in emotional well-being and meaning-making following psychedelic experiences. Even when experiences were challenging, many users retrospectively interpreted them as psychologically meaningful or somehow beneficial. Participants frequently reported broader life changes correlated with psychedelic experiences. Reported domains included shifts in personal goals, values, spirituality, social relationships, and lifestyle behaviors.

Nevertheless, psychedelic use has also been correlated with adverse effects. A subset of participants reported post-acute psychological difficulties lasting more than 24 h, including depressive feelings, existential distress, derealization, depersonalization, or social disconnection. These experiences were typically short-lived and mild to moderate in severity, although longer durations occurred in a minority of cases. Many respondents interpreted such experiences as part of a broader integration or personal growth process. Persistent hallucinations beyond the acute phase were rare. Taken together, these findings are broadly aligned with previous research showing that adverse psychological reactions to psychedelics are usually transient, but that a minority of users may experience persistent difficulties, particularly in non-clinical settings or in the absence of adequate preparation, support, and integration [19,21,23,36–39]. Addiction-related findings were also notable. More than one-third of respondents reported a lifetime history of problematic

substance use, particularly involving tobacco, cannabis, alcohol, or stimulants. Among those with such histories, a subset reported reductions or cessation of other substance use temporally associated with psychedelic experiences. Alcohol, nicotine, cannabis, and cocaine were the substances most commonly reported to decrease following psychedelic use. Although causal inference is not possible in a cross-sectional design, these observations are directionally consistent with observational research and early clinical trials investigating psychedelic-assisted treatment for substance use disorders [40–44]. At the same time, psychedelic use in this cohort occurred within complex polysubstance environments that may both confound interpretation and introduce additional risks.

Healthcare integration of psychedelic use appeared limited. Fewer than one-third of respondents with regular healthcare contact had discussed psychedelic use with a clinician, a pattern broadly consistent with previous studies showing that naturalistic psychedelic use often remains disconnected from primary care and psychiatric care [45]. The regression model predicting disclosure to healthcare professionals yielded no significant findings across sex, age, education, and psychedelic experience, indicating that the decision to disclose does not cluster around any particular demographic or experiential profile. The overall disclosure rate of 26.6% was low and homogeneously distributed, suggesting that the barrier to disclosure operates at a structural rather than individual level. Concerns about stigma, perceived clinician unfamiliarity with psychedelics, and privacy preferences were the main barriers to disclosure, in line with prior findings identifying stigma, perceived provider knowledge gaps, legal concerns, and lack of trust as key obstacles to patient–clinician communication about psychedelic use [45,46]. Perceived clinician knowledge was generally low, suggesting a structural gap between widespread informal psychedelic use and healthcare system awareness. These findings support the importance of educational initiatives directed at both healthcare providers and the broader population, aimed at building a shared, evidence-based language around the benefits and risks of psychedelic use, as well as the development of clinical environments in which patients feel safe to report psychoactive substance use without anticipating stigmatizing or uninformed responses [47,48]. At the same time, strong support for regulated medical access indicates openness toward structured therapeutic models. Harm-reduction practices were present but inconsistently implemented. Awareness of drug-checking services exceeded actual use, and most psychedelic consumption occurred outside clinical environments. Financial expenditure on psychedelic substances was generally low, while spending on therapist-assisted psychedelic treatment was rare, reflecting the limited availability and accessibility of regulated services. Social attitudes appeared to be shifting, with many respondents perceiving decreasing stigma and expressing support for legal medical access. However, perceived disapproval from family members and workplaces remained relatively common, indicating that normalization remains socially stratified.

Taken together, these findings suggest that psychedelic use in Italy represents an established social phenomenon that has developed largely outside institutional or healthcare frameworks. Experiences are often evaluated positively and integrated into broader ordinary life narratives; however, a substantial proportion of individuals report challenging or distressing experiences. Potential psychological risks remain, particularly in unsupervised settings and in complex polysubstance use contexts. As scientific interest and regulatory discussions surrounding psychedelic therapies continue to evolve, longitudinal and representative research will be essential to clarify causal mechanisms, identify vulnerable subgroups, and inform proportionate clinical, public health, and harm-reduction strategies.

5. Limitations and Future Research

The study's limitations are substantial and should temper interpretation. Participants were recruited through digital media channels, which may have preferentially reached individuals with a pre-existing interest in or exposure to psychedelic substances. In addition, because dissemination occurred partly through psychedelic organizations and related networks, the survey may have been more likely to capture individuals already engaged with the psychedelic community and holding relatively favorable attitudes toward, or positive experiences with, psychedelic use. All data were self-reported, introducing recall and desirability biases. The cross-sectional design precludes causal inference regarding therapeutic effects or substance-use changes. Dose was self-defined, particularly in microdosing contexts, limiting pharmacological precision. Some subgroup analyses involved small denominators, restricting generalizability. Future research should prioritize longitudinal cohort designs, representative population sampling within Italy, pharmacologically verified exposure where feasible, and structured psychiatric assessments to clarify risk–benefit profiles across vulnerable subgroups, and a broader characterization of the evolving psychedelic landscape**,** including emerging psychoactive substances such as Amanita muscaria and related non-serotonergic psychoactive fungi, which may represent a distinct form of psychoactive substance use that is increasingly encountered within psychedelic-engaged communities and remains insufficiently characterized by current research [49,50].

6. Conclusions

This study provides the first large-scale description of psychedelic use patterns among Italian-speaking participants in the Global Psychedelic Survey and contributes new data regarding types of psychedelic experiences, motivations, participants' willingness to discuss psychedelic use with mental health professionals, perceptions of professional competence in the field of psychedelics, and patterns of polysubstance use within a psychedelic-engaged community. At the same time, the findings highlight the complexity of psychedelic use within polysubstance environments and the need for cautious interpretation of self-reported benefits.

Three main considerations appear particularly noteworthy.

First, psychedelics seem to be intended primarily as episodic experiential agents rather than substances driven by continuous reinforcement. Their pattern of use is typically intermittent and apparently context-dependent, which challenges traditional addiction models centered on compulsive, reward-driven consumption. However, this distinction does not eliminate potential risk as psychological destabilization or problematic use may still occur, particularly among individuals with pre-existing psychiatric vulnerability [23,51,52], high cumulative exposure to psychoactive substances [53], or adverse environmental contexts [54,55].

Second, psychedelic use often occurs in association with other substances rather than in isolation. Extensive lifetime exposure to other psychoactive compounds, including stimulants, depressants, cannabis, psychotropics, may shape both acute neurobiological responses and longer-term clinical trajectories. This broader pharmacological complexity represents a critical, and often underappreciated, determinant of individual variability in both therapeutic outcomes and adverse events [53,56,57].

Third, real-world patterns of psychedelic use have evolved more rapidly than the regulatory and healthcare systems designed to manage them. Informal and unsupervised consumption remains common in the Italian landscape, while healthcare systems often lack standardized approaches for screening, disclosure, monitoring, and harm reduction. This structural gap may limit opportunities for early identification of adverse outcomes, reduce transparency in patient-provider communication, and constrain the development of pragmatic public health responses in Italy.

As clinical research advances and psychedelic-assisted therapies progressively enter clinical practice, broader societal exposure to these substances is likely to increase. In this context, integrating epidemiological research on real-world patterns of use with clinical and mechanistic studies will be essential to better understand and manage the expansion of psychedelic consumption accompanying scientific and therapeutic developments. Such integration is particularly important to counterbalance excessive enthusiasm that may lead to underestimation of risks associated with psychedelic use in uncontrolled settings. The growing phenomenon of psychedelic use has implications that extend beyond strictly clinical outcomes. It also affects the cultural and meaning-making dimensions of individuals who engage with these substances. In many cases, psychedelics—and the communities that form around their use—are sought not only for their pharmacological effects but also as sources of personal growth, social support, existential orientation, and perceived therapeutic benefit [58–60].

Given these considerations—particularly in light of the patterns observed within the Italian context—there is a growing need to enhance both the quality and accessibility of scientific information on psychedelic substances for the general public, alongside strengthening professional training and continuing education for healthcare and educational practitioners. In parallel, the development of targeted support services, risk-mitigation strategies, and harm-reduction approaches tailored to psychedelic use emerges as an increasingly relevant public health priority.

Supplementary Materials

The additional data and information can be downloaded at: https://media.sciltp.com/articles/others/2608251527269211/CNA-26030202-SI.pdf. Figure S1. Substance-specific social contexts of lifetime regular-dose psychedelic use; Figure S2. Substance-specific physical settings of lifetime regular-dose psychedelic use; Figure S3. Microdosing-related activities and contexts; Figure S4. Behavioral addictions and self-reported outcomes following psychedelic treatment; Table S1. Self-reported changes in substance use following psychedelic experiences. Percentages represent the proportion of respondents reporting cessation, reduction, no change, increased use, initiation, or non-use for each substance; Table S2. Preferred access or purchase modalities for psychedelic substances among respondents (N = 730); Table S3. Logistic regression model: predictors of disclosure of psychedelic use to a primary healthcare provider (N = 234).

Author Contributions

M.B.: Writing—review & editing, Writing—original draft, Conceptualization, Coordinator of the Italian section of the Global Psychedelic Survey 2025; D.B.B.: Writing—review & editing, Writing—original draft,

Conceptualization; L.J.A.: Writing—review & editing, Writing—original draft, Conceptualization, Data Analysis; F.F.: Writing—review & editing, Writing—original draft, Conceptualization; J.A.: Writing—review & editing, Writing—original draft, Conceptualization; C.L.: Writing—review & editing, Writing—original draft, Conceptualization; A.A.: Writing—review & editing, Writing—original draft, Conceptualization; R.E.: Translation, Data collection; D.M.: Translation, Data Collection; B.C.: Translation, Data Collection; G.A.: Translation, Data Collection; S.O.A.: review & editing; N.C.: review & editing; L.D.: review & editing; G.K.: review & editing; G.S.: review & editing; D.L.S.S.: review & editing; B.K.: review & editing; F.A.: review & editing; L.A.: review & editing; A.S.J.: review & editing; L.S.: review & editing; K.D.: review & editing. L.P.: Study conceptualization, Design and Coordination. Review & editing. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted according to the guidelines of the Declaration of Helsinki. It was developed by a consortium of academic researchers and non-governmental organizations (NGOs) and deployed between 1 May and 21 May 2025. The study was reviewed by the Health Sciences and Behavioral Sciences Institutional Review Board at the University of Michigan (IRB-HSBS; protocol code HUM00268282; exemption determination date: 3 February 2025) and was deemed exempt from ongoing IRB review under Exemption 2(i) and/or 2(ii) at 45 CFR 46.104(d).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The dataset was collected through the University of Michigan (USA) Global Psychedelic Survey. To obtain access to the data, contact the survey administrators directly. The code used in the analysis will be provided upon request by email to Alessandro Lo Jacono (ALoJacono@santpau.cat).

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Conflicts of Interest

N.C. serves as a paid consultant to Usona Institute, Resilient Pharmaceuticals, Otsuka Pharmaceuticals, and Vail Health, and holds equity in Negev Labs and in Psilera as a scientific advisor. The authors declare no conflict of interest.

Use of AI and AI-Assisted Technologies

During the preparation of this work, the authors used large language models or AI-assisted writing software (ChatGPT, Claude) to help translation. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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