Original Paper

Survey study of challenging experiences after ingesting psilocybin mushrooms: Acute and enduring positive and negative consequences

Journal of Psychopharmacology
1–11

DOI: 10.1177/0269881116662634
jop.sagepub.com

Theresa M Carbonaro[1], Matthew P Bradstreet[1], Frederick S Barrett[1], Katherine A MacLean[1], Robert Jesse[1,2], Matthew W Johnson[1] and Roland R Griffiths[1,3]

Abstract

Acute and enduring adverse effects of psilocybin have been reported anecdotally, but have not been well characterized. For this study, 1993 individuals (mean age 30 yrs; 78% male) completed an online survey about their single most psychologically difficult or challenging experience (worst "bad trip") after consuming psilocybin mushrooms. Thirty-nine percent rated it among the top five most challenging experiences of his/her lifetime. Eleven percent put self or others at risk of physical harm; factors increasing the likelihood of risk included estimated dose, duration and difficulty of the experience, and absence of physical comfort and social support. Of the respondents, 2.6% behaved in a physically aggressive or violent manner and 2.7% received medical help. Of those whose experience occurred >1 year before, 7.6% sought treatment for enduring psychological symptoms. Three cases appeared associated with onset of enduring psychotic symptoms and three cases with attempted suicide. Multiple regression analysis showed degree of difficulty was positively associated, and duration was negatively associated, with enduring increases in well-being. Difficulty of experience was positively associated with dose. Despite difficulties, 84% endorsed benefiting from the experience. The incidence of risky behavior or enduring psychological distress is extremely low when psilocybin is given in laboratory studies to screened, prepared, and supported participants.

Keywords

Psilocybin, psychedelic, hallucinogen, bad trip, adverse effects, survey, human

Introduction

Psilocybin, the principal psychoactive component of the *Psilocybe* and other genera of mushrooms (Presti and Nichols, 2004), has likely been used for millennia within some cultures for religious or divinatory purposes (Guzmán, 2008; Metzner, 2004; Stamets, 1996; Wasson, 1980). Of the US population aged 12 years or older, 8.7% (22.9 million people) reported lifetime use of psilocybin (NSDUH, 2014). In 2004–2005 (the last year data were available), over half (52%) of those who reported initiating use of a hallucinogen in the past year did so with psilocybin (NSDUH, 2007).

Although psilocybin has very low physiological toxicity and is not associated with compulsive drug seeking, it sometimes produces acute and, more rarely, persisting adverse psychological reactions (Johnson et al., 2008; Tylš et al., 2014). Case reports document adverse effects of psilocybin in non-research settings, including short-term distressing psychological symptoms such as fear (Nordic Council of Ministries, 2009; Riley and Blackman, 2008; van Amsterdam et al., 2011), individuals putting themselves at risk for physical harm (Allen et al., 1991; Schwartz and Smith, 1988; van Amsterdam et al., 2011), seeking medical help (Allen et al., 1991; Nordic Council of Ministries, 2009; Mowry et al., 2014), and enduring negative psychological or psychiatric problems (Allen et al., 1991; Nordic Council of Ministries, 2009; Nielen et al., 2004). However, the perceived risk of psilocybin-related harm was found to be very low when evaluated by drug experts (Nutt et al., 2010; van Amsterdam and van den Brink, 2010) and by experienced drug users (Carhart-Harris and Nutt, 2013), and psilocybin was ranked as moderately beneficial by experienced drug users (Carhart-Harris and Nutt, 2013).

Data-reporting systems from emergency rooms and poison centers also confirm that psilocybin is associated with seeking medical treatment (DAWN, 2013; Mowry et al., 2014). However, the incidence of psilocybin toxicity is extremely low relative to other drugs used non-medically. For instance, in 2011, emergency room mentions of problems with psilocybin alone (83 mentions) were only a very small fraction of mentions for heroin

[1]Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD, USA
[2]Council on Spiritual Practices, Baltimore, MD, USA
[3]Department of Neuroscience, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Corresponding author:
Roland Griffiths, Departments of Psychiatry and Neuroscience, Johns Hopkins University School of Medicine, 5510 Nathan Shock Drive, Baltimore, MD 21224-6823, USA.
Email: rgriff@jhmi.edu

alone (10,309 mentions, 0.81%), cocaine alone (9828, 0.84%), and marijuana alone (9711, 0.85%) (DAWN, 2013).

The present study was undertaken to characterize challenging experiences occasioned by psilocybin and the consequences of such experiences. An internet survey was conducted of a large international sample of individuals who reported having had a difficult or challenging experience with psilocybin. Detailed questions were asked about an individual's single worst "bad trip." Questions addressed demographics, the set and setting conditions in which psilocybin was ingested, as well as any negative and positive acute and enduring psychological and emotional consequences of the challenging psilocybin experience.

Methods

Participant recruitment

Participants were recruited primarily via internet advertisements and email invitation. An internet link to the survey was posted on websites that attract individuals interested in hallucinogens (e.g. Erowid, Bluelight, Reddit, etc). Information about the survey was also shared by email with individuals knowledgeable about psychedelic drugs, and information about the survey spread through online social networks. Individuals were recruited who endorsed having had a difficult or challenging experience after ingesting psilocybin mushrooms (e.g. "Have you had a difficult or challenging experience (i.e., a "bad trip") with psilocybin mushrooms? If so, please take the Johns Hopkins online survey on psilocybin and bad trips"). The link directed participants to a webpage that described the aims of the study and provided basic information about study completion. Participants were informed that study participation was anonymous, they could choose to stop answering questions at any time, and if they did not complete the survey their specific responses would not be used. The Institutional Review Board of the Johns Hopkins University School of Medicine approved all study procedures.

Survey administration

The survey was designed to take approximately 45 minutes to complete (not including an optional open-ended written response), and participants were required to complete the survey in one sitting. The survey was administered using SurveyMonkey (www.surveymonkey.com), an online survey and data-collection software tool with security and privacy features that make it suitable for clinical research.

Inclusion criteria

Participants were required to fulfill six inclusion criteria: (1) At least 18 years old; (2) Read, write, and speak English fluently; (3) Have taken a dose of psilocybin mushrooms that produced moderate to strong psychoactive effects; (4) After taking psilocybin mushrooms, "have you ever had a psychologically difficult or challenging experience (i.e., a bad trip)—that is, have you experienced significant fear, anxiety, or distress or anything else that you found psychologically difficult?"; (5) The experience referred to above (#4) occurred when between 18 and 70 years old and did not occur in the context of a university or hospital study; (6) Have not completed this survey previously.

Participants who met the inclusion criteria were directed to the remaining questions in the survey. In completing the survey, participants were instructed to complete the survey items in reference to their single most psychologically difficult or challenging session or experience (worst "bad trip"). Individuals who did not meet the inclusion criteria were linked to an alternate, shorter version of the survey and their data were not used in the analyses. It was reasoned that this approach would discourage such individuals from attempting to take the survey again and providing different answers because it would appear to them that they had completed the survey. Participants were excluded from analysis if the challenging experience was attributed to the co-consumption of a substance other than psilocybin or if the open-ended written comments raised concern about validity of their other responses.

Measures

Demographics. Participants provided basic demographic information as described in the results section.

Lifetime hallucinogen use. Participants reported the total number of different occasions on which they had ingested any of the following hallucinogens: psilocybin mushrooms, LSD, morning glory seeds, mescaline, peyote cactus, San Pedro cactus, DMT, or ayahuasca. They also provided the total number of occasions they used only psilocybin mushrooms. Both questions were answered on an 8-point categorical scale (1; 2–5; 6–10; 11–20; 21–50; 51–100; 101–300; and more than 300 times). Participants also reported how old they were when they first and last used psilocybin mushrooms.

Questions about the session experience. After participants had chosen their session (i.e. their worst "bad trip"), they were asked questions about the estimated dose of psilocybin consumed, the set and setting conditions in which the session occurred, the duration of the difficult experience, strategies attempted and that helped to stop the experience, and acute negative consequences of the experience. As with laboratory studies of psilocybin (Griffiths et al., 2006, 2011), the phenomenology of the psilocybin experience was assessed using three questionnaires: Hallucinogen Rating Scale (HRS) (Strassman et al., 1994); Mystical Experience Questionnaire – 30 item version (MEQ30) which is part of the States of Consciousness Questionnaire (Barrett et al., 2015; Griffiths et al., 2006; MacLean et al., 2011); and selected subscales from the 5D-ASC (Studerus et al., 2010). Data analyzed for this report were the six subscales of the HRS (expressed as raw scores) and the total and four subscales of the MEQ30 (expressed as percentages of maximum possible scores). A participant was designated as having had a "complete" mystical experience if scores on each of the four subscales of the MEQ30 were 60% or higher. The results from other questions and subscales will be reported elsewhere.

Qualitative ratings of the psilocybin experience. Participants were instructed to answer four questions according to "how you feel *now* about your chosen psilocybin session" and to "retrospectively evaluate your experiences during your psilocybin session in the context of your full life experience." The questions were as follows: (1) How psychologically difficult or challenging was the

experience? (2) How personally meaningful was the experience? (3) Indicate the degree to which the experience was spiritually significant to you; and (4) Do you believe that the experience and your contemplation of that experience have led to a change in your current sense of personal well-being or life satisfaction? The response options for all four questions are shown in Figure 1.

Negative psychological or emotional experiences before and after the experience. Participants answered questions about the occurrence, duration, and severity of the negative psychological or emotional experiences of fear, paranoia, anxiety, depression, and "other" that they may have experienced at any time before the challenging experience occurred. Participants also answered a similar set of questions about these same types of negative psychological experiences if they occurred after the challenging experience and were attributed to the challenging psilocybin experience.

Open-ended written comments. Participants were offered an optional opportunity to provide a written description of their psilocybin experience.

Statistical analysis

Descriptive statistics (percentages, mean, median, range, and standard error of the mean) were used to characterize the responses to questions and the subscale scores of the questionnaires. Pearson correlations were used to analyze the associations among participant ratings of the degree of difficulty of the challenging experience, the duration of the challenging experience, personal meaning, spiritual significance, and enduring change in well-being. Multiple regression analysis was used to further explore the relative roles of duration of difficult experience and the degree of difficulty of the experience on the ratings of personal meaning, spiritual significance, and enduring change in well-being. Pearson correlations were also used to analyze the association of difficulty and duration of difficulty of the psilocybin experience to dose (weight of dried mushrooms consumed and HRS item referring to approximate dose), setting conditions, age at time of the psilocybin experience, past hallucinogen experience, use of cannabis and use of another mood-altering drug (including cannabis, but excluding nicotine) immediately before or during the session, and endorsement of putting self or others at risk for physical harm. Binary logistic regression (odds ratios) were used to analyze the associations of setting conditions, use of cannabis and the use of another mood-altering drug (including cannabis, but excluding nicotine) immediately before or during the session to endorsement of putting self or others at risk for physical harm. The percentage of participants reporting negative psychological and emotional symptoms as well as the percentage seeking treatment for such symptoms before and after the chosen psilocybin session was assessed. Rates of endorsing these experiences were analyzed by z-tests to compare independent proportions.

Results

Survey completion

During recruitment (January–July, 2013), 5850 individuals began the survey. Of these, 1074 were excluded because they did not meet the inclusion criteria; 92 were excluded because participants reported that the experience was attributed to the co-consumption of a substance other than psilocybin or because the open-ended written comments raised concern about validity of their other responses. Some 2691 were excluded because they did not complete the survey, with 91% of these failing to complete half of the survey questions. Thus 1993 individuals provided useable data. Of these, 70% found the survey link on a website, 7% received the survey link as a part of an email distribution list, and 13% heard of the survey by word of mouth. The median time to complete the survey was 59 minutes. A written response in the open-ended comment section was provided by 83% of participants.

Participant characteristics

Table 1 presents participants' reported characteristics. Participants were, on average 29.8 years of age. The majority were male (78%), White (89%), had a college or graduate degree (51%). Most participants (93%) had used psilocybin more than two times in their life (median = 6–10 times) and had used hallucinogens more than 10 times in their life (59%) (median = 11–20 times). At the time of the survey, daily use of cannabis, tobacco, and alcohol were reported by 38%, 27%, and 11% of the group, respectively.

Participants were, on average 23.3 years of age at the time of their chosen session (Table 1), which occurred on average 6.5 years before completing the survey. Median number of uses of psilocybin before their chosen session was 2–5 times. Of the respondents, 16% had not used psilocybin at all before their chosen session and for 10% of the total sample, the chosen session was the first time they had used any hallucinogen.

The challenging psilocybin session

Some 84% and 16% of participants, respectively, reported taking dried and fresh mushrooms. Of those who reported knowing the weight of the mushrooms consumed, the median reported weight of dried psilocybin mushrooms was 4 g (n = 1203 respondents), and the median weight of fresh mushrooms was 21–30 g (n = 148). Of the participants, 68% endorsed having taken a moderately high or high dose of psilocybin; 36% reported that they were attempting to take a larger than usual dose of psilocybin for the session.

During the session, participants reported being alone (25%) or in the company of one person (24%), with a few people (39%), in a small to medium size group (9%), or a large gathering (4%). The majority of participants indicated that their emotional state before taking psilocybin (76%), the physical comfort and safety of the surroundings (76%), and the social support and trust for others during the session (65%) were conducive to having a positive experience. Only 25% had a "guide" or "sitter" present during the session and only 2.7% had a trusted and sober guide present who was experienced in supporting psychedelic sessions. Some 53% and 19%, respectively, reported using cannabis or alcohol immediately before or during their chosen challenging psilocybin session. Fifty-nine percent reported having had a serious intention (psychological or spiritual exploration) for their session; 73% covered or closed their eyes for some length of time during the session (median = 10–30 minutes).

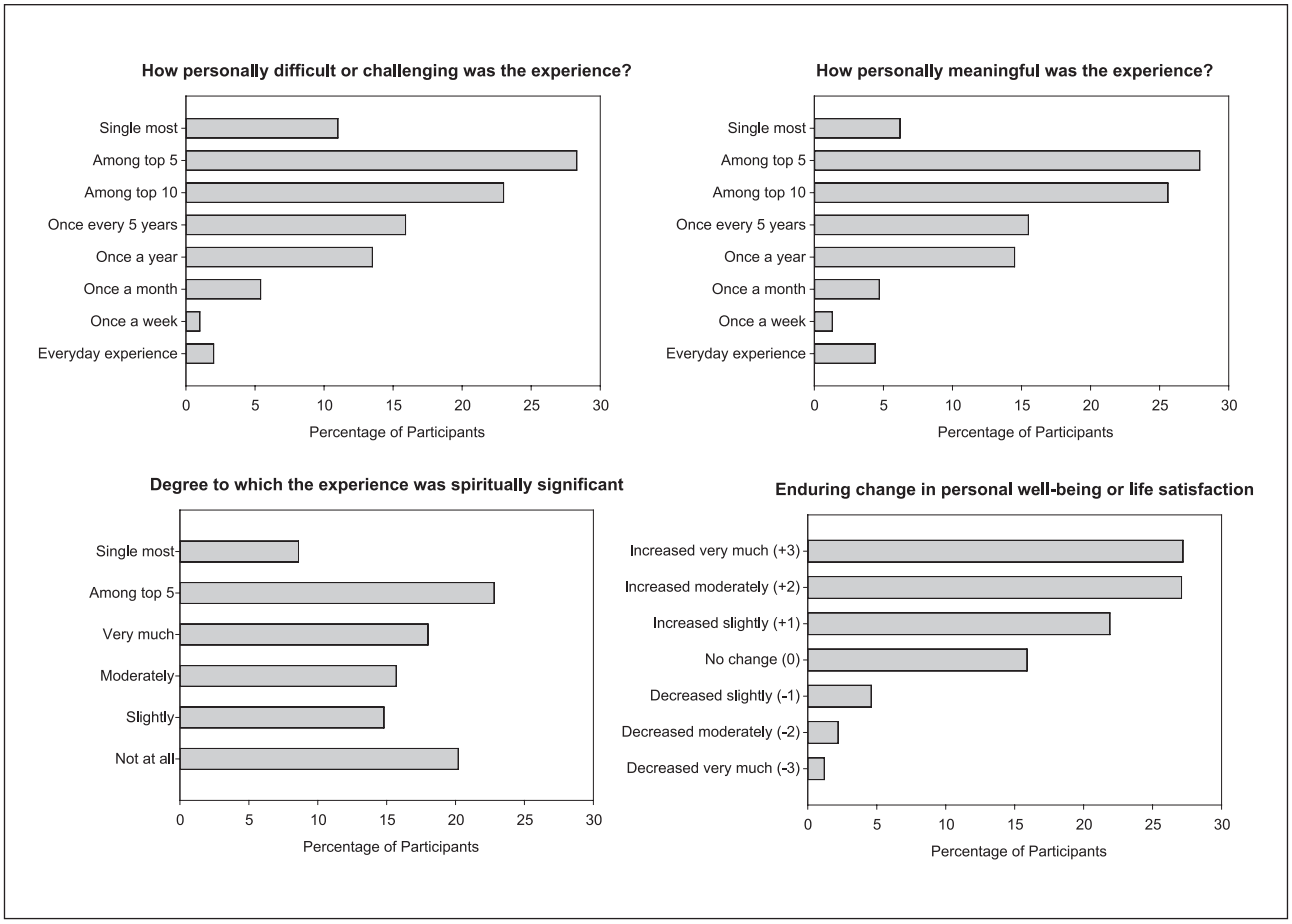

Figure 1. Distributions of ratings in response to four questions about how the participant felt in retrospect about their experiences in the context of their full life experience (N = 1993). Bars show percentage of total participants that endorsed each category.

Figure 2 shows the distribution of durations of the psychologically difficult portion of the experience; 31% percent reported the duration to be 1 hour or less, with 25% and 40% reporting the duration to be 1 to 2 hours and 2 hours or longer, respectively.

Qualitative ratings of the psilocybin experience

As shown in Figure 1, the majority of participants (62%) considered the experience to be among the top 10 most psychologically difficult or challenging experiences of their lives (Figure 1, sum of among top 10, among top five and single most), with 39% rating it as among the top five including single most and 11% rating to be the single most. Despite this psychological challenge, 34% and 31% rated this same session to be among the top five including single most personally meaningful and spiritually significant, respectively (Figure 1), experiences of their lives, with 6.2% and 8.6%, respectively, rating it to be the single most personally meaningful and spiritually significant of their lives. Although most of the participants (76%) reported that experiences during the psilocybin session led to increases in current well-being and life satisfaction, 8% reported that the chosen challenging experience resulted in a decrease in their sense of well-being or life satisfaction (slightly or greater) (Figure 1). A substantial majority of participants (84%) rated that they benefited from the challenging portions of their sessions. Almost half (46%) endorsed that they would want to repeat their chosen session and all that had happened in it, including the difficult or challenging portions of the session.

Table 2 shows correlations among the four measures of qualitative effects described above and the duration of difficult experience. The duration correlated positively (r = 0.30) with the overall degree of difficulty of the experience, but negatively or less robustly with the meaningfulness, spiritual significance, or enduring changes in well-being. Interestingly, the degree of difficulty of the experience correlated positively with the degree of personal meaning (r = 0.41), with less robust but significant correlations with spiritual significance and enduring well-being. Finally, spiritual significance correlated robustly with personal meaning, and enduring change in well-being correlated robustly with both personal meaning and spiritual significance. Table 3 shows the results of multiple regression analysis regressing participant ratings of personal meaning, spiritual significance, and enduring change in well-being on degree of difficulty and the duration of the psychologically

Table 1. Participant characteristics (N = 1993).[a]

Numerical variable	
Age at time of survey (years)	M = 29.8 (18–79)
Age of first psilocybin use (years)	M = 19.9 (12–65)
Age of last psilocybin use (years)	M = 26.1 (18–66)
Age of chosen psilocybin session (years)	M = 23.3 (18–66)
Lifetime hallucinogen use (times)	Med = 11–20 (1–300 or more)
Lifetime psilocybin use (times)	Med = 6–10 (1–300 or more)
Categorical variable	
Gender	78% male, 22% female
Education	17% graduate degree, 8% some graduate school, 26% college degree, 36% some college, 11% high school diploma, 2% some high school
Race	89% White, 1.3% American Indian, 1.2% Asian, 0.3% Black or African American, 1.7% some other race
Hispanic or Latino	93% No, 6% Yes
Current marital status	50% single, 30% in a committed relationship (not married), 15% married, 4%, divorced, 1% widowed
Current household income (USD)	18% <10K, 26% 10–30K, 25% 30–60K, 14% 60–90K, 14% 90–200K, 3% > 200K
Current country of residence[b]	66% US, 8% Canada, 7% UK, 3.4% Australia, 1.9% Sweden, 1.8% Germany, 1.6% Netherlands, 1% Norway
Current daily drug use	38% cannabis, 27% tobacco, 11% alcohol, 2.8% prescription stimulants, 2.1% benzodiazepines, 1.7% opioids, 0.4% synthetic cannabinoids, 0.2% methamphetamine, 0.1% cocaine

[a]The table presents descriptive statistics for demographic variables (N = 1993). Numerical variables are reported as mean (M) or median (Med) values with range in parentheses. Categorical variables are reported as percentage of respondents that endorsed each category. Percentages do not sum to 100 because some questions include a "prefer not to answer" option.
[b]Approximately 48 additional countries of residence (not listed) were represented by 15 or fewer participants each.

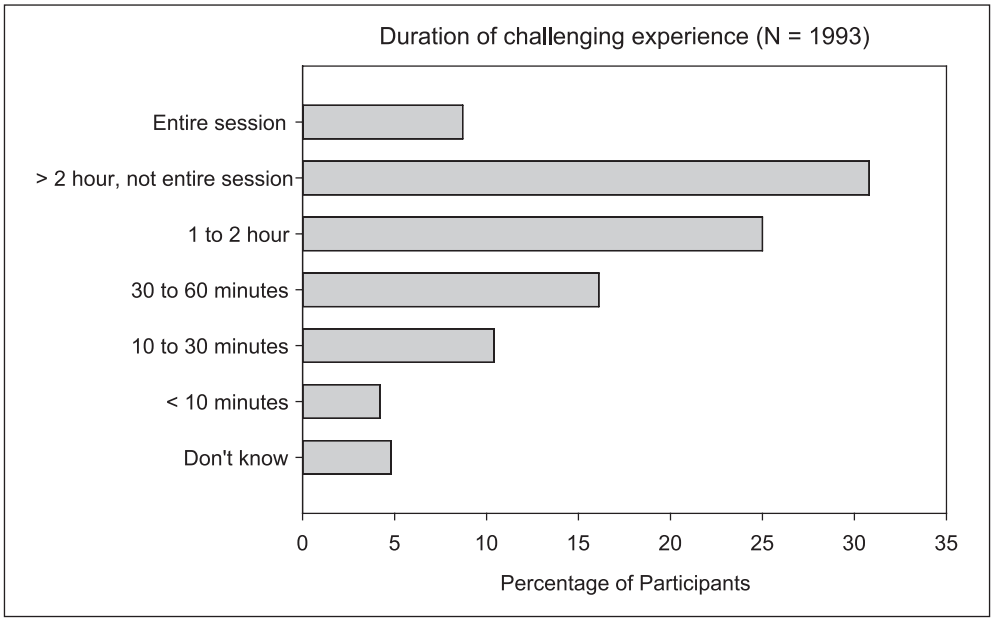

Figure 2. Distribution of participant-rated durations of challenging experiences (N = 1993). Bars show percentage of total participants that endorsed each category.

challenging experience after taking psilocybin. These data show a consistent pattern of effects, with personal meaning, spiritual significance, and increases in well-being all positively and significantly related to difficulty of experience. In contrast, all three of these outcome measures are significantly negatively related to the duration of the difficulty of the experience.

Difficulty and duration of difficulty of the psilocybin experience: Relationship of dose, setting conditions, use of another mood-altering drug, age, and past hallucinogen experience

As shown in Table 4, dose assessed by weight of dried mushrooms consumed, and estimated dose (from a question on the

Table 2. Pearson correlations (*r*) examining relationships among participant ratings of duration of difficult experience, difficulty of experience, personal meaning, spiritual significance, and enduring increased well-being.[1]

	Duration of difficult of experience	Difficulty of experience	Personally meaningful	Spiritually significant	Enduring change in well-being
Duration of difficulty of experience	X				
Difficulty of experience	0.30****	X			
Personally meaningful	*ns*	0.41****	X		
Spiritually significance	–0.14****	0.20****	0.58****	X	
Enduring change in well-being[3]	0.18****	0.11****	0.39****	0.46****	X

[1]Data analyzed are from those respondents who endorsed knowing the length of their difficult or challenging experience (n = 1897).
[2]Asterisks indicate significance level (*p < 0.05, **p < 0.01, ***p < 0.001; ****p < 0.0001); *ns* = not significant;
[3]Positive scores indicate increased well-being.

Table 3. Multiple regression analysis regressing participant ratings of personal meaning, spiritual significance, and enduring increased well-being on degree of difficulty and the duration of the psychologically challenging experience after taking psilocybin.[1]

Dependent variable	Adjusted R^2	Predictors	Estimate	SE	t	p
Personal meaningful (Scored from 1 to 8)	0.2	(Intercept)	5.53	0.03	162.86	<0.0001
		difficulty	0.49	0.02	21.72	<0.0001
		duration	–0.23	0.03	–8.36	<0.0001
Spiritual significance (Scored from 1 to 6)	0.084	(Intercept)	3.33	0.04	92.69	<0.0001
		difficulty	0.28	0.02	11.69	<0.0001
		duration	–0.27	0.03	–9.49	<0.0001
Enduring change in well-being (Scored –3 to +3)	0.061	(Intercept)	1.44	0.03	51.97	<0.0001
		difficulty	0.16	0.02	7.82	<0.0001
		duration	–0.25	0.02	–10.00	<0.0001

[1]Data analyzed are from those respondents who endorsed knowing the length of their difficult or challenging experience (n = 1897).

Table 4. Pearson correlations (*r*) examining the relationship of dose, setting conditions, use of another mood-altering drug, age, and past hallucinogen experience to difficulty and duration of difficulty of the psilocybin session.[1,2,3]

	Difficulty of experience	Duration of difficult experience
Weight of dried mushrooms (g)	.110***	.107***
Estimated dose[4]	.181***	.069**
Emotional state before ingestion	–.052*	–.087***
Physical comfort of setting	–.068**	–.074***
Social support during the session	–.085***	–.146***
Guide present	*ns*	–.092***
Cannabis use before or during session	–.057*	*ns*
Any drug use before or during session[5]	–.072**	*ns*
Age	–.062**	*ns*
Past hallucinogen experience[6]	–.054*	*ns*

[1]Data are analyzed are from those participants who endorsed knowing the length of their difficult or challenging experience (n = 1897). n = 1151 for data with weight of dried mushrooms because not everyone used dried mushrooms and not everyone knew the weight of the consumed mushrooms.
[2]Point by serial correlations were used for emotional support, physical comfort, social support, guide present, cannabis use before or during session, and any drug use before or during session because these data are dichotomous.
[3]Asterisks indicate significance level (*p < 0.05, **p < 0.01, ***p < 0.001); *ns* = not significant.
[4]Estimated dose was rated on a scale from 1 (low) to 4 (high) in the Hallucinogen Rating Scale (HRS).
[5]Use of another mood-altering drug (excluding nicotine) immediately before or during the session.
[6]Number of occasions of past use of psilocybin-like classic hallucinogens.

HRS), both significantly positively correlated with degree of difficulty and duration of difficult experience. Emotional state before ingesting psilocybin mushrooms, physical comfort of setting, and social support present during the session were significantly negatively correlated with degree of difficulty and duration of difficult experience. Having a guide present was significantly negatively correlated with duration of difficult experience, but not with degree of difficulty. The use of

cannabis and/or another mood-altering drug (excluding nicotine) immediately before or during the session, age at the time of the experience, and past hallucinogen experience were significantly negatively correlated with difficulty of experience, but not with duration of difficult experience.

Endorsement of putting self or others at risk of physical harm: Relationship of dose, setting conditions, difficulty and duration of difficulty of experience, use of another mood-altering drug, age, and past hallucinogen experience

Endorsement of putting self or others at risk for physical harm was positively correlated with estimated dose (from a question on the HRS) ($r = 0.071$, $p < 0.01$), degree of difficulty of experience ($r = 0.154$, $p < 0.001$), and duration of difficult experience ($r = 0.157$, $p < 0.001$). Furthermore, endorsement of putting self or others at risk for physical harm was less likely in those who also endorsed that the physical comfort of the setting (odds ratio = 0.562, $p < 0.001$, 95% CI [0.416, 0.760]) and the social support during the session (odds ratio = 0.657, $p = 0.004$, 95% CI [0.493–0.875]). Endorsement of risk of physical harm was not significantly associated with the weight of dried mushrooms, age, past hallucinogen experience, emotional state before ingestion, use of cannabis, or use of a mood-altering drug (excluding nicotine).

Hallucinogen Rating Scale and Mystical Experience Questionnaire 30

The mean (SEM) for all 1993 participants for the six subscales of the HRS were: Intensity, 2.62 (0.01); Somaesthesia, 1.64 (0.02), Affect, 1.89 (0.01), Perception, 2.54 (0.02), Cognition, 2.30 (0.02), Volition, 2.02 (0.02). The means (SEM) for the subscales and total scores on the MEQ30 were: Mystical 45.35 (0.65), Positive Mood 50.74 (0.61), Transcendence of Time and Space 52.56 (0.53), Ineffability 69.24 (0.58), and Total Score 50.26 (0.54). The percentage of participants who fulfilled criteria for having had a "complete" mystical experience on the MEQ30 was 20.5%.

Strategies for alleviating the challenging experience

The majority of participants reported that the social support and trust for others physically present (65%), physical comfort and safety of surroundings (75%), and emotional state (76%) before taking psilocybin was conducive to having a positive experience. Most participants (91%) reported trying to stop the challenging experience. As shown with the gray bars in Figure 3, participants tried a wide range of different strategies to attempt to stop the experience. Most participants reported trying to calm their mind (69%) or change location (63%). Some 33–40% tried to stop the experience by shifting their body, changing the music or social environment, or asking for help from a friend. About 25% smoked cannabis or changed their environment in other ways, with a minority reporting drinking alcohol (5%) or taking another drug (3%). The striped bars in Figure 3 show the percentage of participants who indicated that the specific strategy helped to substantially stop the challenging experience. Comparison of the gray and striped bars indicates that all strategies were only modestly effective (i.e. on average, striped bars are 57% as long as gray bars).

Risks and problems during the experience

Of the 1993 respondents, 10.7% reported putting themselves or others at risk of physical harm, 2.6% reported behaving in a physically aggressive or violent manner towards themselves or others, and 2.7% reported getting help at a hospital or emergency department during the chosen occasion.

Suicidality

Two research staff members independently reviewed all open-ended textual responses to identify instances in which changes in suicidal thoughts or behavior were attributed to acute or enduring effects of the challenging experience. This review provided evidence of both increased suicidality (five cases) and decreased suicidality (six cases). More specifically, one individual, who had pre-existing anxiety, depression and suicidal planning, reported purposely attempting suicide by overdosing with benzodiazepines and, subsequently, awakening in an intensive care medical unit. Another respondent reported unsuccessfully trying to shoot himself in the head. A third respondent reported that pre-existing serious depression was exacerbated by the psilocybin experience and later resulted in a suicide attempt. Two other individuals reported salient suicidal thoughts during their psilocybin experience. In contrast, six respondents reported that pre-existing suicidal thoughts (including depression in five cases) fully remitted after their psilocybin experience.

Enduring negative psychological and emotional experiences

To meaningfully assess enduring effects, data from participants whose session occurred at least 1 year before completing the survey were analyzed ($n = 1339$). Of the participants, 19.3% endorsed that they had sought treatment for at least one of five negative psychological symptoms: fear (F), anxiety (A), depression (D), paranoia (P), and "other" (O) before their chosen session and which they did not attribute to having taken psilocybin or some other hallucinogen. After the challenging session, 24% of these 1339 participants reported experiencing one or more of these symptoms that lasted 1 week or longer and that the participant attributed to the chosen psilocybin session (F = 13%, A = 16%, D = 12%, P = 9%, O = 12%). The majority of those reporting symptoms (65%) reported more than one symptom. Some 10% of the 1339 participants reported psychological symptom(s) lasting $\geqslant$12 months after the challenging session, and 7.6% sought professional treatment for the symptom(s) after the chosen session (F = 3.4%, A = 4.6%, D = 4.8%, P = 1.8%, O = 3%). Of those who sought professional treatment after the session, 28 (2.1% of the 1339) reported no previous symptoms or treatment. Those that sought treatment before the challenging experience were significantly more likely to seek treatment afterwards (14.3% with vs. 6% without prior treatment histories; $p < 0.001$; $z = 4.37$). All of these findings based on the subset of 1339

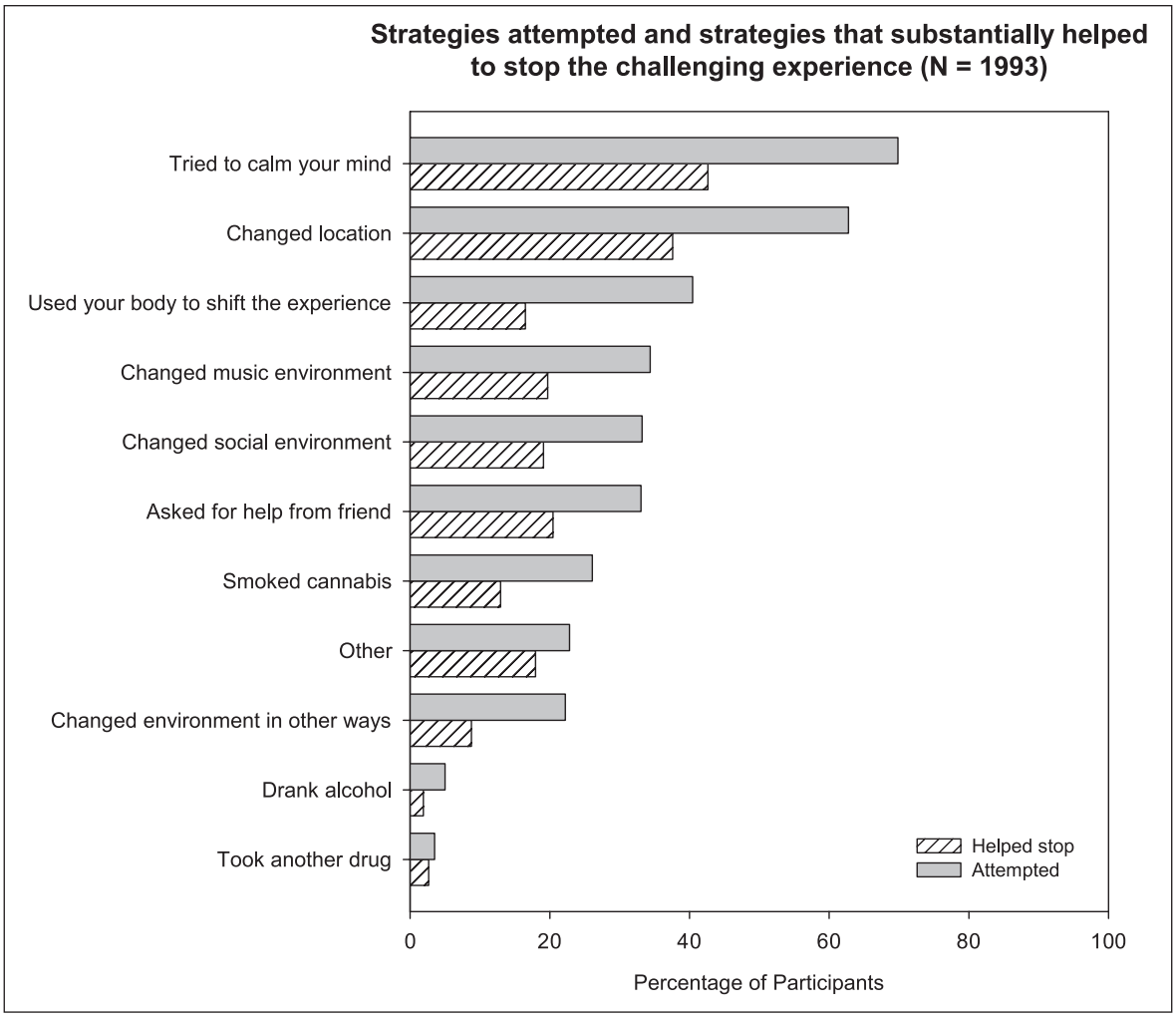

Figure 3. Percentage of participants endorsing specific strategies that they reported using to attempt to stop the challenging experience (gray bars) (*N* = 1993) and that they reported having helped substantially to stop the challenging experience (striped bars) (*N* = 1993). Of the participants 9.1% reported doing nothing to try to stop the experience. The bars sum to more than 100% because most participants (52%) endorsed trying more than one strategy.

participants were similar to those that occurred in the total participant sample.

Inspection of data and review of open-ended comments documented three cases in which the challenging experience with psilocybin was reported to be associated with the onset of enduring and impairing psychotic symptoms. All three were White males who were 18 to 21 years old at the time of the experience, which had occurred 3 to 20 years before the survey. None of the three reported having psychotic symptoms before the experience. In their open-ended written comments about their symptoms the first individual described auditory hallucinations (hearing voices) and paranoia. The second described severe depersonalization, very disturbing visual hallucinations, and extreme confusion. This individual subsequently started taking unspecified antipsychotic drugs and later received a diagnosis of schizophrenia. The third individual reported paranoia, agoraphobia, severe social withdrawal, mental confusion, and also reported that he had received diagnoses of bipolar disorder and post-traumatic stress disorder.

Discussion

This survey documents that psychologically difficult experiences after taking psilocybin mushrooms can be associated with acute adverse effects and enduring psychological problems as well as enduring benefits. Almost 2000 participants, who were on average 30 years old when they took the survey, met inclusion criteria and completed the survey on the basis of their single most psychologically difficult or challenging experience (worst "bad trip") after taking psilocybin mushrooms. Of these respondents, 39% rated the experience as among the top five (including single most) most challenging experiences of their lifetime, 11% reported putting themselves or others at risk of physical harm, 2.6% reported behaving in a physically aggressive or violent manner, and 2.7% reported getting medical help during the occasion. Of those whose session occurred at least 1 year earlier, 7.6% reported that they sought treatment for one or more psychological symptom they attributed to the challenging psilocybin experience. Three cases appeared associated with

onset of enduring and impairing psychotic symptoms and three cases with attempted suicide.

Despite these difficulties, it is notable that 84% of respondents reported having benefited from the experience, with 76% reporting increased well-being or life satisfaction attributed to the experience. Some 60% of respondents considered their experience to be among the top 10 most psychologically personally meaningful experiences of their lives, while 34% and 31% reported the experience in the top five most personally meaningful and spiritually significant, respectively.

The distributions of the degree of difficulty and the degree of personal meaningfulness (Figure 1, top row) were strikingly similar. Furthermore, correlation and multiple regression analyses showed that the degree of difficulty of the experience was positively and significantly related to the attribution of enduring personal meaning, spiritual significance, and increased life satisfaction. These counterintuitive findings are consistent with clinical observations of psychedelic psychotherapists who have reported that, during a psychedelic session, the resolution of psychologically challenging experiences may result in attribution of meaning, spiritual significance, and increased life satisfaction (Richards, 2015), sometimes described as catharsis. Challenging experiences are not necessary for positive therapeutic outcomes. Whether some challenging experiences can have facilitative or detrimental effects on therapeutic outcome has not been scientifically explored.

The duration of the challenging experience was positively related to the degree of difficulty of the experience and negatively related to personal meaning, spiritual significance, and enduring increased well-being. From the perspective of maximizing meaning, spiritual significance, and enduring well-being, this finding suggests that therapeutic interventions during a challenging experience should be preferentially aimed at reducing the duration rather than the peak difficulty of the challenging experience.

Dose assessed by weight of dried mushrooms consumed and estimated dose (from a question on the HRS) positively correlated with degree of difficulty ($r = 0.11$ and 0.18). This finding is consistent with laboratory studies showing that the frequency of challenging experiences increase at higher psilocybin doses (Griffiths et al., 2011; Studerus et al., 2012).

In the present study, respondents who reported having been treated for psychological symptoms before their challenging session were more than twice as likely than those with no treatment history to subsequently seek treatment for psychological symptoms that they attributed to the session (14.3% vs. 6%). This finding suggests alternative interpretations. First, those with treatment histories may be less reluctant to seek out professional treatment or may have better access to treatment services. Second, it is possible that those with treatment histories are more vulnerable to enduring adverse effects of psilocybin.

The present survey documents nontrivial rates of both acute problems (e.g. 11% putting themselves or others at risk for physical harm during the session) and enduring problems (e.g. 7.6% seeking professional help for negative psychological symptoms lasting >1 year). These rates are likely much higher than the expected population rates of problems with a single exposure to psilocybin because survey participants completed the survey based on their worst "bad trip", with participants reporting a median of 6–10 prior psilocybin experiences. More relevant to understanding associations between psilocybin use and treatment-seeking for psychological problems, a population survey has indicated protective effects of lifetime psilocybin exposure and psychological distress and suicidality (Hendricks et al., 2015).

The rates and severity of both acute and enduring problems shown in the survey are notably higher than those we and others have observed in laboratory research studies involving administration of high doses of psilocybin to carefully screened, well-prepared, and closely monitored volunteers (e.g. Griffiths et al., 2006, 2008, 2011; Johnson et al., 2014; Studerus et al., 2010). At Johns Hopkins, we adhere to our published guidelines for safe administration of classic hallucinogens (Johnson et al., 2008). Since initiating psilocybin research in 2000, we have administered psilocybin doses of 20 mg/70 kg or higher to about 250 volunteers in more than 380 sessions (as of May 2016). Although no volunteer has been physically harmed during sessions, there were three instances (0.9%) in which a participant's disorientation during a session might have put them or staff members at risk if appropriate supervision had not been provided: (1) a volunteer decided to stand up and engage in expressive movements; (2) a volunteer moved from the couch to the floor while vigorously moving legs and arms in an erratic fashion; and (3) a volunteer became confused and disoriented when in the restroom. In response to these instances, we changed our session management procedures to strongly emphasize to both volunteers and session staff the instruction and intention that volunteers remain on the couch throughout the session when not engaged in a specific task or using the restroom. When volunteers need to go to the restroom, they walk to the restroom with the staff member at their side. When in the restroom, the door remains unlocked and slightly ajar with a staff member of the same gender remaining immediately outside of the door and in intermittent (about 1 minute intervals) verbal contact with the volunteer. With regard to post-session negative symptoms, we have had three cases (0.9%) in which volunteers reported physical or psychological symptoms within several days to a week after a psilocybin session. In the first case, 1 week after a session the volunteer reported feeling anxious after experiencing physical symptoms consistent with a heart attack. An evaluation at an emergency department found no abnormal signs. The volunteer was offered a further medical consultation that the volunteer declined as unnecessary. In the second case, the volunteer reported a range of symptoms that were ultimately diagnosed as hyperthyroidism. In the third case, the volunteer reported that the psilocybin session experience was dominated by negative emotions such as sadness and fear. After the session, the volunteer reported periods of intermittent depressed mood. The volunteer declined our offer to meet with a psychologist, but, instead, sought out a spiritual counselor. At a 5-month follow-up visit, the volunteer reported that the symptoms had resolved. This low rate of enduring psychological symptoms in laboratory studies is also consistent with a summary of such effects from 110 psilocybin research participants from another laboratory (Studerus et al., 2011). In that report, seven participants endorsed negative changes in psychological well-being, but only one participant (0.9%) reported a level of distress sufficient for him to contact the researchers. Those symptoms resolved after a few sessions with an experienced psychotherapist.

Many factors likely contribute to the higher rates of acute and enduring problems reported in the survey compared with the controlled laboratory studies. In addition to the probable absence of

psychological screening and unknown psychological preparation for psilocybin ingestion, only 2.1% of survey respondents reported taking psilocybin under conditions that are usually achieved in laboratory settings (i.e. a conducive emotional state before administration, physical comfort and safety, social support and trust of others, and the presence of a sober, trusted guide who is experienced in supporting psychedelic experiences). Some 36% of survey respondents indicated they took a larger than usual dose of psilocybin and 53% reported using cannabis before or during the session. Cannabis use before or during the session was slightly negatively correlated with difficulty of experience, but had no effect on the duration of the difficult experience or the likelihood of putting themselves or others at risk of physical harm. Twenty-six percent of participants who tried to stop the challenging aspect of the psilocybin session reported using cannabis to try to do so. Of those, 50% reported that it helped substantially. It is noteworthy, however, that in optional open-ended textual responses at the end of the survey several volunteers spontaneously commented that the use of cannabis significantly exacerbated their challenging experience.

Several limitations of the current survey should be noted. As an anonymous internet survey, we cannot know if respondents were truthful in completing the survey. Furthermore, the rate of non-completion was high. However, respondents were not paid for their participation and completing the survey took about an hour on average. Furthermore, 83% of respondents took the time to write open-ended comments about their challenging experience at the end of the survey, and many spontaneously expressed their interest in and gratitude for having had the opportunity to complete the survey. Another limitation is that respondent population was not diverse: 78% were male, 89% were White, and 87% had at least some college education. On the other hand, this lack of diversity may accurately reflect the population of psychedelic users.

Two additional factors limit the generalizability of the findings. First, only people who endorsed having had a challenging experience after psilocybin completed the survey. Therefore it is not possible to estimate the prevalence of such experiences after a single psilocybin exposure or after multiple psilocybin exposures. Second, because recruiting for the survey was primarily conducted via psychedelic-focused internet media, the participant sample was likely biased toward individuals with current favorable interest in psychedelic drugs. As such, the survey may have underestimated the severity of negative effects because individuals who had severe negative effects would be less likely to have heard about the survey.

The current study did not address hallucinogen persisting perception disorder, which is an uncommon DSM-5 psychiatric disorder characterized by clinically significant distress in response to the re-experiencing of hallucinogen-like perceptual symptoms after a period of normalcy following a psychedelic drug experience (Baggott et al., 2011; Halpern and Pope, 2003).

The median reported dose of dried psilocybin mushrooms taken in the survey was 4 g, with most respondents (84%) reporting having taken dried mushrooms rather than fresh. Although there is wide variation in psilocybin and psilocin content both within and across different species of psilocybin-containing mushrooms (Beug and Bigwood, 1982; Bigwood and Beug, 1982), we estimate that 4 g of typically available dried mushrooms (*P. cubensis*) delivers the approximate psychoactive equivalent to 25 mg of psilocybin (Bigwood and Beug, 1982; Michael Beug, personal communication, 10 September 2015; Stamets, 1996). A 25 mg dose of psilocybin is in the moderate to high range of doses we have administered in our previous laboratory studies (Griffiths et al., 2006, 2011). In the survey, the mean score on the HRS Intensity subscale was 2.62 (out of a maximum possible of 4.25), which is quite similar to the mean score of 2.64 at 20 mg/70 kg in a laboratory study (Griffiths et al., 2011). The mean total score from the MEQ30 in the survey was 50.3, with 21% of participants fulfilling criteria for a "complete" mystical experience. Comparable values in a laboratory study of 20 mg/70 kg were considerably higher (mean total score 70.0 and 61% complete mystical experience) (Barrett et al., 2015), which is consistent with the fact that survey participants were reporting on the most challenging psilocybin experience of their life.

In conclusion, this survey of almost 2000 people showed that psychologically difficult experiences after taking psilocybin mushrooms can include acute psychological distress, dangerous behavior, and enduring psychological problems. Factors contributing to the increased likelihood of putting self or others at risk of physical harm included the magnitude of the estimated psilocybin dose, the degree of difficulty of the experience, the duration of the difficult experience, and the absence of physical comfort and social support during the experience. Epidemiological data indicate that rates of adverse effects after psilocybin are very low relative to adverse effects after other psychoactive drugs. However, the findings from this survey affirm concerns about taking psilocybin in uncontrolled environments. With increasing research exploring possible therapeutic uses of psilocybin (Grob et al., 2011, 2013; Johnson et al., 2014), it is important to note that risks of dangerous behavior or enduring psychological problems are extremely low in laboratory studies of psilocybin with carefully screened, well-prepared participants who are supported during and after psilocybin administration.

Acknowledgements

We thank the many anonymous survey respondents who generously gave their time and effort to complete this survey. We also thank Earth and Fire from www.erowid.org for their generous assistance in facilitating survey recruitment.

Contributors

RRG, MPB, MWJ, KAM, and RJ developed the survey. TMC, MPB, and FSB performed data analysis. All authors took part in the interpretation of the data. TMC and RRG drafted the manuscript, and all authors provided comments on the manuscript.

Declaration of Conflicting Interest

The authors declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: RRG is a member of the Board of Directors of the Heffter Research Institute. RJ is convener of the Council on Spiritual Practices.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was supported by NIH grants RO1DA03889 and 5T32 DA007209 and grants from the Council on Spiritual Practices and the Heffter Research Institute.

References

Allen JW, Merlin MD and Jansen KL (1991) An ethnomycological review of psychoactive agarics in Australia and New Zealand. *J Psychoactive Drugs* 23: 39–69.

Baggott MJ, Coyle JR, Erowid E, et al. (2011) Abnormal visual experiences in individuals with histories of hallucinogen use: A Web-based questionnaire. *Drug Alcohol Depend* 114: 61–67.

Barrett FS, Johnson MW and Griffiths RR (2015) Validation of the revised Mystical Experience Questionnaire in experimental sessions with psilocybin. *J Psychopharmacol* 29: 1182–1190.

Beug MW and Bigwood J (1982) Psilocybin and psilocin levels in twenty species from seven genera of wild mushrooms in the pacific northwest, USA. *J Enthopharmacol* 5: 271–285.

Bigwood J and Beug MW (1982) Variation of psilocybin and psilocin levels with repeated flushes (harvests) of mature sporocarps of psilocybe cubensis (Earle) Singer. *J Enthopharmacol* 5: 287–291.

Carhart-Harris RL and Nutt DJ (2013) Experienced drug users assess the relative harms and benefits of drugs: A Web-based survey. *J Psychoactive Drugs* 45: 322–328.

DAWN, Drug Abuse Warning Network (2013) 2011: National Estimates of Drug-Related Emergency Department Visits. HHS Publication No. (SMA) 13–4760, DAWN Series D-39. Rockville, MD: Substance Abuse and Mental Health Services Administration.

Griffiths RR, Richards WA, McCann U, et al. (2006) Psilocybin can occasion mystical-type experiences having substantial and sustained personal meaning and spiritual significance. *Psychopharmacology* 187: 268–283.

Griffiths RR, Richards WA, Johnson MW, et al. (2008) Mystical-type experiences occasioned by psilocybin mediate the attribution of personal meaning and spiritual significance 14 months later. *J Psychopharmacol* 22: 621–632.

Griffiths RR, Johnson MW, Richards WA, et al. (2011) Psilocybin occasioned mystical-type experiences: Immediate and persisting dose-related effects. *Psychopharmacology* 218: 649–665.

Grob CS, Bossis AP and Griffiths RR (2013) Use of the classic hallucinogen psilocybin for treatment of existential distress associated with cancer. In: Carr BJ and Steel J (eds) *Psychological Aspects of Cancer*. New York: Springer Sciences + Business Media, LLC, pp.291–308.

Grob CS, Danforth AL, Chopra GS, et al. (2011) Pilot study of psilocybin treatment for anxiety in patients with advanced-stage cancer. *Arch Gen Psychiatry* 68: 71–78.

Guzmán G (2008) Hallucinogenic mushrooms in Mexico: An overview. *Economic Botany* 62: 404–412.

Hendricks PS, Johnson MW and Griffiths RR (2015) Psilocybin, psychological distress, and suicidality. *J Psychopharmacol* 29: 1041–1043.

Halpern JH and Pope HG, Jr (2003) Hallucinogen persisting perception disorder: What do we know after 50 years? *Drug Alcohol Depend* 69: 109–119.

Johnson MW, Richards WA and Griffiths RR (2008) Human hallucinogen research: Guidelines for safety. *J Psychopharmacol* 22: 603–620.

Johnson MW, Garcia-Romeu A, Cosimano MP, et al. (2014) Pilot study of the 5-HT2AR agonist psilocybin in the treatment of tobacco addiction. *J Psychopharmacol* 28: 983–992.

MacLean KA, Johnson MW and Griffiths RR (2011) Mystical experiences occasioned by the hallucinogen psilocybin lead to increases in the personality domain of openness. *J Psychopharmacol* 25: 1453–1461.

Metzner R (2004) *Teonanacatl: Sacred Mushroom of Visions*. El Verano, CA: Four Trees Press.

Mowry JB, Spyker DA, Cantilena LR, Jr, et al. (2014) 2013 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 31st Annual Report. *Clin Toxicol* 52: 1032–1283.

Nielen RJ, van der Heijden FM, Tuinier S, et al. (2004) Khat and mushrooms associated with psychosis. *World J Biol Psychiatry* 5: 49–53.

Nordic Council of Ministers (2009) Occurrence and use of hallucinogenic mushrooms containing psilocybin alkaloids. Copenhagen: TemaNord.

NSDUH, National Survey on Drug Use and Health (2007) The NSDUH Report: Patterns of Hallucinogen Use and Initiation: 2004 and 2005. Rockville, MD: Substance Abuse and Mental Health Services Administration, Office of Applied Studies.

NSDUH, National Survey on Drug Use and Health (2014) Detailed tables for 2013 National Survey on Drug Use and Health. Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration.

Nutt DJ, King LA and Phillips LD (2010) Drug harms in the UK: A multicriteria decision analysis. *Lancet* 376: 1558–1565.

Presti DE and Nichols DE (2004) Biochemistry and neuropharmacology of psilocybin mushrooms. In: Metzner R and Darling DC (eds.) *Teonanacatl*. El Verano, CA: Four Trees Press, pp.89–108.

Richards WA (2015). *Sacred Knowledge: Psychedelics and Religious Experience*. New York: Columbia University Press.

Riley SC and Blackman G (2008) Between prohibitions: Patterns and meanings of magic mushroom use in the UK. *Subst Use Misuse* 43: 55–71.

Schwartz RH and Smith DE (1988) Hallucinogenic mushrooms. *Clin Pediatr* 27: 70–73.

Stamets P (1996) *Psilocybin Mushrooms of the World: An Identification Guide*. Berkeley, CA: Ten Speed.

Strassman RJ, Qualls CR, Uhlenhuth EH, et al. (1994) Dose-response study of N,N-dimethyltryptamine in humans. II. Subjective effects and preliminary results of a new rating scale. *Arch Gen Psychiatry* 51: 98–108.

Studerus E, Gamma A and Vollenweider FX (2010) Psychometric evaluation of the altered states of consciousness rating scale (OAV). *PLoS One* 5: e12412.

Studerus E, Kometer M, Hasler F, et al. (2011) Acute, subacute and long-term subjective effects of psilocybin in healthy humans: A pooled analysis of experimental studies. *J Psychopharmacol* 25: 1434–1452.

Studerus E, Gamma A, Kometer M, et al. (2012) Prediction of psilocybin response in healthy volunteers. *PLoS One* 7: e30800.

Tylš F, Páleníček T and Horáček J (2014) Psilocybin – summary of knowledge and new perspectives. *Eur Neuropsychopharmacol* 24: 342–356.

van Amsterdam J, Opperhuizen A and van den Brink W (2011) Harm potential of magic mushroom use: A review. *Regul Toxicol Pharmacol* 59: 423–429.

van Amsterdam J and van den Brink W (2010) Ranking of drugs: A more balanced risk-assessment. *Lancet* 376: 1524–1525.

Wasson RG (1980). *The Wondrous Mushroom: Mycolatry in Mesoamerica*. New York: McGraw-Hill.