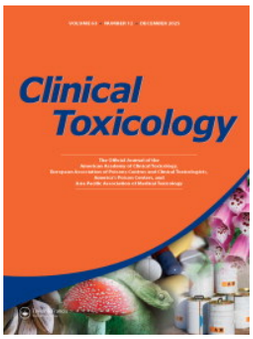

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Psychoactive mushroom edibles: trends and toxicities reported to the United States National Poison Data System®, 2023–2024

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POISON CENTRE RESEARCH

Psychoactive mushroom edibles: trends and toxicities reported to the United States National Poison Data System®, 2023–2024

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ABSTRACT

Introduction: Psychoactive mushroom edibles are gaining popularity, yet little is known of their clinical effects. These unregulated products are widely available, often with unlisted ingredients and inconsistent formulations, underscoring the need for more research to address public health concerns. We aimed to investigate recent trends in demographics and clinical effects associated with these products.

Methods: We conducted a retrospective observational analysis of psychoactive mushroom edible exposures reported to the United States National Poison Data System® between 2023 and 2024. We included both single and polysubstance cases from all ages, using the generic codes identifying edible preparations containing *Amanita muscaria*, psilocybin, or unspecified. We described demographic and clinical characteristics (e.g., management site, related clinical effects) stratified by mushroom type. Our primary outcome was medical admission, and secondary outcomes were the severity of reported toxicity (moderate or worse compared to minimal or non-toxic exposures). Multivariable logistic regression, odds ratios, and 95% confidence intervals were used to measure the association between demographic and clinical factors with each outcome.

Results: Of the 362 total psychoactive mushroom edible exposures identified, the majority were single-substance (78%) and intentional (58%). Factors associated with admission were polysubstance exposures (aOR: 2.58; 95% CI: 1.23–5.40), confusion (aOR: 3.06; 95% CI: 1.36–6.86), and central nervous system depression (aOR: 2.55; 95% CI: 1.29–5.06). These factors were also associated with moderate or worse toxicity (poly-substance exposure [aOR: 2.88; 95% CI: 1.35–6.13], confusion [aOR: 3.05; 95% CI: 1.14–8.13], and central nervous system depression [aOR: 4.92; 95% CI: 2.45–9.88]). No deaths were reported from exposure.

Discussion: The effects of mushroom edible ingestion are unpredictable, and clinical presentations vary widely. Polysubstance exposures involving mushroom edibles are associated with higher hospital admission rates and more severe toxicity.

Conclusion: Psychoactive mushroom edibles are an emerging public health concern that necessitates continued epidemiological and clinical monitoring as the trend evolves.

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Amanita muscaria; mushroom edibles; National Poison Data System®; psilocybin; psychoactive mushrooms; public health; toxicity

Introduction

Psychoactive mushroom edibles are rapidly gaining popularity, marketed as nootropics (to enhance memory and cognitive performance) or "legal" psychedelics, yet little is known about their health effects and toxicity. The widespread availability of unregulated edible products containing hallucinogenic mushrooms and other psychoactive substances, often without clear labeling or consistent formulation, poses considerable health and safety risks to consumers. Further research is needed to address this growing public health concern [1–3].

Much of the clinical information we currently have available is extrapolated from mushroom exposures, rather than the edibles containing these psychoactive compounds. Psilocybin and psilocin-containing mushrooms have gained popularity in both recreational and research settings. These compounds are primarily sought after for their hallucinogenic and

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serotonergic effects, and are shown to enhance neuronal plasticity and survival [4–9]. Use of muscimol and ibotenic acid-containing mushrooms (and edibles), such as *Amanita muscaria*, is also growing, despite numerous health concerns associated with ibotenic acid and muscimol, including seizures and central nervous system depression, respectively [10–22]. Data from the National Poison Data System® (NPDS®) Annual Reports from 2019 to 2022 show a rise in psilocybin mushroom exposures, from 387 cases in 2019 to 996 cases in 2022. Over 76% of these cases were reported as intentional exposures, with adults aged 20 years and older being the most affected. Three potentially related deaths occurred in 2020 [23–26]. While overall exposures to products containing *Amanita muscaria* are reported less frequently than those containing psilocybin and psilocin, similar trends of increased exposure and toxicity are observed in the NPDS® data. Muscimol-containing mushroom exposures rose from 30 in 2019 to 44 in 2022, with the majority occurring in adults aged 20 and older. Despite the risks associated with ibotenic acid and muscimol, no fatalities were reported [23–26].

In 2024, an outbreak involving the mushroom edible brand "Diamond Shruumz" was reported, underscoring the need for further investigation of these products. Patients were hospitalized throughout the United States (US), with life-threatening symptoms reported, including seizures, respiratory depression, and potentially three deaths. Testing by the US Food and Drug Administration revealed the presence of several unlisted ingredients (e.g., illegal psychoactive compounds) and contaminants in these edibles, even within the same product type [1–3]. Correia and colleagues [27] analyzed similar nootropic products obtained from local vape shops and found that they mostly contained psilocin and tryptamine congeners, regardless of the "active ingredients" on each label. The clinical effects of these substances are only partly understood, which limits our interpretation of the broader health risks.

We sought to fill this gap in our understanding of the clinical effects and epidemiological trends of mushroom edible exposures reported to poison centers in the US. Our primary objective was to characterize these exposures demographically, by intentionality, and outline the most common clinical effects reported from these exposures. Our secondary objective was to describe demographic, exposure-specific, and clinical factors associated with increased clinical management of these substances.

Methods

Study design, setting, sample

We conducted a retrospective observational study of psychoactive mushroom edible ingestions (i.e., psychedelic mushroom edibles containing psilocybin/psilocin and/or muscimol/ibotenic acid) reported to NPDS® between 2023 and 2024. We included reported psychoactive mushroom edible ingestions using generic codes identifying: "Mushroom chocolate bar NOS," "Mushrooms, Processed Preparations: Amanita containing," "Mushrooms, Processed Preparations: NOS," and "Mushrooms, Processed Preparations: Psilocybin containing." These codes were introduced to poison control centers in 2023. Cases of all ages were included, and reported exposures could have also been polysubstance (the mushroom-containing product and at least one additional substance). This study was considered exempt by our local Institutional Review Board and is reported in accordance with the STROBE guidelines [28].

Covariates

We characterized the demographics by including age in years (≤5, 6–12, 13–19, 20–29, 30–49, 50+, unknown adult (≥20 yrs)) and gender (male, female, and unknown). The NPDS® data also provide exposure characteristics from which we included the following: management site (not managed at a health care facility reported as "home", referred/enroute/treated at a health care facility reported as "HCF", and other), exposure reason (intentional, unintentional), multiplicity of exposures (reported as single substance if psychoactive mushroom edibles were the only substance and as polysubstance if there were additional ingested substances), and clinical effects that were clinically deemed to be related to the exposure (e.g., tachycardia, hallucinations, agitation, etc.). We also classified the psychoactive mushroom type (*Amanita* spp. and *Psilocybin* spp.).

Outcomes

Our primary outcome was a composite measure capturing healthcare utilization as medical admission (to either a critical care unit or non-critical care unit) versus not (admitted to a psychiatric facility, treated or evaluated by the emergency department and released home, refusing referral for medical evaluation, or opting to leave the healthcare facility against medical advice). Our secondary outcome was clinical toxicity,

which we operationalized by categorizing clinical effects from the NPDS Coding Users' Manual, Version 4.4.3. We identified those with more serious effects (i.e., "Moderate effect," "Major effect," "Death") compared to less serious effects (i.e., "No effect," "Minimal effect," "Not followed- minimal or no clinical effect suspected/nontoxic," and "Unable to be followed- judged as potentially toxic exposure").

Statistical analysis

We describe the geographic distribution of reported cases by state and provide descriptive statistics (e.g., frequencies and percentages) to describe our analytical cohort, including demographics, exposure characteristics, and clinical factors, by mushroom type. We also descriptively assessed intentionality stratified by age and sex. To measure the association between these factors with each outcome (i.e., medical admission, clinical effects severity), we used multivariable logistic regression, odds ratios (OR), and 95% confidence intervals (CI). The presence of collinearity among covariates was assessed with the variance inflation factor. Final multivariable models were adjusted for age, gender, exposure type, mushroom type, substance multiplicity, and selected clinical effects that were deemed relevant to the exposure. We used a complete case analysis due to the presence of dispersed missing values for variables. All statistical analysis was performed using R, version 4.2.1 (R Foundation, Vienna, Austria).

Results

Characteristics of the sample

Of the 362 edible mushroom exposures, 56.4% were coded as psilocybin ($n=204$) compared to 43.6% that were coded as Amanita-based exposures ($n=158$). A higher proportion of exposures occurred among males (62.4%, $n=226$) (Table 1) and involved single-substance exposures (77.6%, $n=281$) (Table 2). Among those with polysubstance exposures, the most common co-exposures in decreasing order of occurrence constituting a polysubstance exposure as reported by the centers were: marijuana: dried plant, marijuana: edible preparation, ethanol (beverages), benzodiazepines, and unknown stimulants or street drugs. Overall, 58.3% of exposures were intentional ($n=211$) and 31.5% were unintentional ($n=114$); however, intentional exposures accounted for the majority of the older groups (Supplemental Figure 1). We also found that most intentional exposures were among males, particularly those 13–29 years old (Supplemental Figure 2). Children 12 years and under accounted for 77.2% of unintentional exposures, with 70.5% of those in children less than 5 years of age. States reporting the most cases included Texas ($n=41$), Virginia ($n=31$), and Florida ($n=26$) (Figure 1). The most common clinical effects identified included tachycardia 21.8% ($n=79$), agitation 21.3% ($n=77$), and hallucinations/delusions 20.7% ($n=75$). A total of 23.2% of exposures reported any degree of central nervous system depression (8% moderate ($n=29$) and 2.2% major ($n=8$)). Other potentially life-threatening effects were reported in less than 5% of exposures (e.g., seizure, respiratory depression with one reported respiratory arrest, hyperthermia, hypotension, and bradycardia). As there is no specific antidote for mushroom edible exposures, symptom-based treatment was most common, including intravenous fluids (27.6% of cases, $n=100$), followed by benzodiazepines (14.1%, $n=51$) and antiemetics (9.1%, $n=33$). All other modalities occurred in fewer than 5% of total cases.

Primary outcome: medical admission

Medical admission was most prevalent among 30–49 years old (27.3%; of which 10.6% to intensive care unit, 16.7% to non-intensive care unit), males (60.6%; 22.7% to intensive care unit, 37.9% to non-intensive care unit), intentional exposure (45.5%; 21.2% to intensive care unit, 24.2% to non-intensive care unit), and single substance (62.1%; 25.8% to intensive care unit, 36.4% to non-intensive care unit) (Table 3). Clinical effects most present on medical admissions were confusion (27.3%; 9.1% to intensive care unit, 18.2% to non-intensive care unit), central nervous system depression (40.9%; 21.2% to intensive care unit, 19.7% to non-intensive care unit), hallucinations/delusions (25.8%; 9.1% to intensive care unit, 16.7% to non-intensive care unit), mydriasis (25.8%; 7.6% to intensive care unit, 18.2% to non-intensive

Table 1. Demographic characteristics by reported mushroom edible type.

	Overall ($n=362$) *n* (%)	*Amanita* species ($n=158$) *n* (%)	*Psilocybin* species ($n=204$) *n* (%)
Age (years)			
≤5	62 (17.1)	24 (15.2)	38 (18.6)
6–12	31 (8.6)	11 (7.0)	20 (9.8)
13–19	85 (23.5)	28 (17.7)	57 (27.9)
20–29	80 (22.1)	43 (27.2)	37 (18.1)
30–49	72 (19.9)	34 (21.5)	38 (18.6)
50+	30 (8.3)	16 (10.1)	14 (6.9)
Unknown adult (≥20)	2 (0.6)	2 (1.3)	0
Gender			
Male	226 (62.4)	102 (64.6)	124 (60.8)
Female	135 (37.3)	56 (35.4)	79 (38.7)
Unknown	1	0	1

Table 2. Exposure characteristics by reported mushroom edible type.

	Overall ($n=362$) *n* (%)	*Amanita* species ($n=158$) *n* (%)	*Psilocybin* species ($n=204$) *n* (%)
Management Site			
Home	44 (12.2)	19 (12.0)	25 (12.3)
Health care facility	317 (87.6)	139 (88.0)	178 (87.3)
Other	1 (0.3)	0	1 (0.5)
Intentionality			
Intentional	211 (58.3)	105 (66.5)	106 (52.0)
Suspected suicide	21 (5.8)	4 (2.5)	17 (8.3)
Unintentional	114 (31.5)	45 (28.5)	69 (33.8)
Other	16 (4.4)	4 (2.5)	12 (5.9)
Substance multiplicity			
Single	281 (77.6)	121 (76.6)	160 (78.4)
Polysubstance	81 (22.4)	37 (23.4)	44 (21.6)
Clinical effects			
Acidosis	11 (3.0)	7 (4.4)	4 (2.0)
Agitation	77 (21.3)	38 (24.1)	39 (19.1)
Ataxia	8 (2.2)	4 (2.5)	4 (2.0)
Bradycardia	6 (1.7)	4 (2.5)	2 (1.0)
Confusion	44 (12.2)	15 (9.5)	29 (14.2)
Central nervous system depression	84 (23.2)	45 (28.5)	39 (19.1)
Dizziness/vertigo	20 (5.5)	9 (5.7)	11 (5.4)
Fever/hyperthermia	6 (1.7)	2 (1.3)	4 (2.0)
Hallucinations/delusions	75 (20.7)	24 (15.2)	51 (25.0)
Hypertension	24 (6.6)	5 (3.2)	19 (9.3)
Hypotension	6 (1.7)	5 (3.2)	1 (0.5)
Mydriasis	58 (16.0)	20 (12.7)	38 (18.6)
Nausea	50 (13.8)	24 (15.2)	26 (12.7)
Respiratory depression	9 (2.5)	7 (4.4)	2 (1.0)
Seizure[a]	12 (3.3)	8 (5.1)	4 (2.0)
Tachycardia	79 (21.8)	39 (24.7)	40 (19.6)
Urinary retention	5 (1.4)	4 (2.5)	1 (0.5)
Vomiting	53 (14.6)	31 (19.6)	22 (10.8)
Medical outcome[b]			
Major effect	17 (4.7)	7 (4.4)	10 (4.9)
Moderate effect	155 (42.8)	70 (44.3)	85 (41.7)
Minor effect	96 (26.5)	44 (27.8)	52 (25.5)
No effect	27 (7.5)	10 (6.3)	17 (8.3)
Not followed[c]	23 (6.4)	13 (8.2)	10 (4.9)
Unable to follow (judged potentially toxic)	39 (10.8)	13 (8.2)	26 (12.7)
Disposition			
Admitted to a critical care unit	27 (7.5)	12 (7.6)	15 (7.4)
Admitted to a noncritical care unit	39 (10.8)	16 (10.1)	23 (11.3)
Admitted to a psychiatric facility	8 (2.2)	3 (1.9)	5 (2.5)
Treated/evaluated and released	194 (53.6)	90 (57.0)	104 (51.0)
Other[d]	94 (26)	37 (23.4)	57 (27.9)

[a]Seizure is comprised of either seizure (single) or seizure (multi/discrete).
[b]No deaths were reported from exposure, and five (1.4%) had outcomes considered to be unrelated effects.
[c]Not followed comprises exposures not followed due to suspected nontoxic or minimal effect.
[d]Other comprises patients who were lost to follow-up/left against medical advice, refused referral, or the exposure disposition is missing.

care unit), and tachycardia (33.3%; 12.1% to intensive care unit, 21.2% to non-intensive care unit). Factors associated with medical admission, however, included poly-substance use (aOR: 2.58; 95% CI: 1.23–5.40), confusion (aOR: 3.06; 95% CI: 1.36–6.86), and central nervous system depression (aOR: 2.55; 95% CI: 1.29–5.06). Intentional exposures were less likely to be admitted compared to unintentional exposures (aOR: 0.24; 95% CI: 0.08–0.73). We did not find any significant association between other demographic or clinical factors and medical admission.

Secondary outcome: severity of clinical effects

The most prevalent characteristics among those with moderate or worse medical outcome were 30–49 years old (22.1%; of which 3.5% with major, 18.6% with moderate), males (64.0%; 6.4% with major, 57.6% with moderate), intentional exposures (60.5%; 5.2% with major, 55.2% with moderate) and single substance (70.3%; 5.8% with major, 64.5% with moderate) (Table 4). Factors associated with moderate or worse medical outcome included poly-substance exposure (aOR: 2.88; 95% CI: 1.35–6.13), confusion (aOR: 3.05; 95% CI: 1.14–8.13), CNS depression (aOR: 4.92; 95% CI: 2.45–9.88), hallucinations/delusions (aOR: 21.21; 95% CI: 7.87–57.13), hypertension (aOR: 10.16; 95% CI: 2.39–43.21), and mydriasis (aOR: 3.92; 95% CI: 1.57–9.80). We did not find any statistically significant association between other demographic or clinical factors and medical outcome.

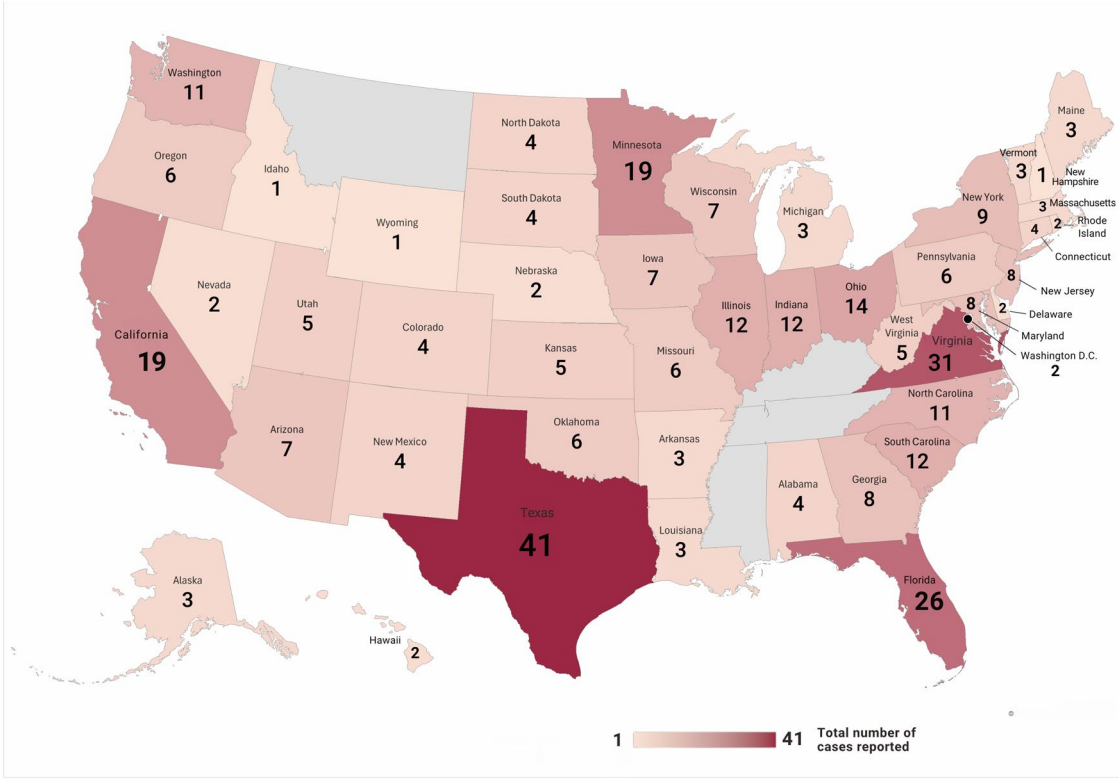

Figure 1. Mushroom edible cases reported by state (2023–2024). This map demonstrates the geographic distribution of psychoactive mushroom edible exposures reported to the United States National Poison Data System® by state in 2023 and 2024. There were no reported exposures for Montana, Mississippi, Kentucky, or Tennessee during that time. The corresponding data table is available to review as Supplementary Table 1.

Discussion

In this national study of psychoactive-mushroom-based product exposures reported to US poison centers, we found that these substances led to increased likelihood of admission when combined with another substance, and most often included cognitive disturbances or circulatory issues. We additionally found that intentional use was mostly among males between 13 and 19 years of age. In aggregate, these findings suggest that there may be some opportunities to target harm reduction efforts within higher-risk groups. The findings allow us to assess the overall impact of these exposures from both clinical and healthcare utilization perspectives while identifying target populations for potential interventions.

As we identified, polysubstance exposures were associated with increased admission rates and the development of more severe clinical outcomes. One potential explanation for this could be that if any synergistic effect exists, the overlapping clinical effects from co-exposure to various stimulants, serotonergics, and/or sedative-hypnotics create a longer duration or more concerning toxicity at the bedside, warranting admission. Another possible reason for this could be if poison center specialists recommend longer monitoring times due to the co-ingestants reported. Uncertainty about the expected outcomes from mushroom edible exposure could drive clinicians to act with an abundance of caution, explaining why 7.9% of admissions remained asymptomatic.

The clinical effects reported by our study reveal several key findings applicable to future practice. We observed no deaths, and life-threatening effects, such as respiratory depression, seizures, major central nervous system depression, and hypotension, were infrequent (<5%). Common effects reported from both types of edibles include elevated heart rate and blood pressure, confusion, hallucinations, and mydriasis, which are symptoms seen also in sympathomimetic, serotonergic, or even antimuscarinic toxicities. This could be partly explained by a serotonergic compound such as psilocin, which Correia and colleagues [27] demonstrated was a frequently detected ingredient in mushroom gummies. Similar effects can be elicited from exposure to considerable amounts of various tryptamines, including those found during investigation of the Diamond Shruumz outbreak [1–3] and the analysis by Correia and colleagues [27]. Contaminants such as these could also explain some of the rare

Table 3. Unadjusted and adjusted odds ratio with medical admission.

	Medical admission ($n=66$) *n* (%)	No medical admission ($n=251$) *n* (%)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Age (years)				
≤5	12 (18.2)	40 (15.9)	0.80 (0.34–1.86)	0.39 (0.09–1.61)
6–12	6 (9.1)	23 (9.2)	0.70 (0.24–1.99)	0.44 (0.10–1.89)
13–19	17 (25.8)	65 (25.9)	0.70 (0.33–1.49)	0.60 (0.25–1.46)
20–29	8 (12.1)	60 (23.9)	0.36 (0.14–0.89)	0.58 (0.21–1.57)
30–49 (reference)	18 (27.3)	48 (19.1)	–	–
50+	5 (7.6)	14 (5.6)	0.95 (0.30–3.03)	1.01 (0.27–3.78)
Gender				
Male	40 (60.6)	156 (62.2)	0.93 (0.53–1.62)	1.34 (0.69–2.60)
Female (reference)	26 (39.4)	94 (37.5)	–	–
Intentionality				
Intentional	30 (45.5)	157 (62.5)	0.57 (0.31–1.04)	0.24 (0.08–0.73)
Suspected suicide	8 (12.1)	13 (5.2)	1.82 (0.67–4.92)	0.53 (0.12–2.38)
Unintentional (reference)	24 (36.4)	71 (28.3)	–	–
Other	4 (6.1)	10 (4.0)	1.18 (0.34–4.12)	0.62 (0.12–3.24)
Reported mushroom type				
Amanita species	28 (42.4)	111 (44.2)	0.93 (0.54–1.61)	0.88 (0.45–1.70)
Psilocybin species (reference)	38 (57.6)	140 (55.8)	–	–
Substance multiplicity				
Single (reference)	41 (62.1)	197 (78.5)	–	–
Polysubstance	25 (37.9)	54 (21.5)	2.22 (1.24–3.98)	2.58 (1.23–5.40)
Select clinical effects				
Acidosis[a]	8 (12.1)	3 (1.2)	***	***
Agitation	17 (25.8)	55 (21.9)	1.24 (0.66–2.32)	1.02 (0.47–2.19)
Bradycardia[a]	6 (9.1)	0	***	***
Confusion	18 (27.3)	24 (9.6)	3.55 (1.79–7.04)	3.06 (1.36–6.86)
Central nervous system depression[b]	27 (40.9)	50 (19.9)	2.78 (1.56–4.97)	2.55 (1.29–5.06)
Dizziness/vertigo	3 (4.5)	15 (6.0)	0.75 (0.21–2.67)	0.71 (0.14–3.48)
Fever/hyperthermia[a]	4 (6.1)	2 (0.8)	***	***
Hallucinations	17 (25.8)	48 (19.1)	1.47 (0.78–2.77)	1.29 (0.59–2.83)
Hypertension	6 (9.1)	18 (7.2)	1.29 (0.49–3.40)	1.03 (0.33–3.28)
Hypotension[a]	5 (7.6)	1 (0.4)	***	***
Mydriasis	17 (25.8)	39 (15.5)	1.89 (0.99–3.61)	1.52 (0.66–3.51)
Nausea	11 (16.7)	32 (12.7)	1.37 (0.65–2.89)	1.75 (0.68–4.50)
Respiratory depression[a]	6 (9.1)	3 (1.2)	***	***
Seizure[a,c]	7 (10.6)	4 (1.6)	***	***
Tachycardia	22 (33.3)	57 (22.7)	1.70 (0.94–3.07)	1.66 (0.81–3.40)
Vomiting	13 (19.7)	36 (14.3)	1.46 (0.73–2.96)	1.71 (0.72–4.10)

[a][***] This clinical effect is deemed clinically important and reported descriptively, but no analytical models were developed due to small sample sizes.
[b]Central nervous system depression is comprised of having any degree of central nervous system depression (ie, mild, moderate, major).
[c]Seizure is comprised of presenting either Seizure (single) or Seizure (multi/discrete).

life-threatening symptoms, such as seizures and hyperthermia, that are not typically reported with psilocybin exposure alone [4–8].

Previous research further suggests that negligible amounts of *Amanita muscaria* extract are present in these edibles, including those labeled as Amanita-containing products (or advertised as using ibotenic acid and/or muscimol as active ingredients) [1–3,27]. Ibotenic acid is known to cause seizures, particularly in pediatric populations, which could further explain the rare life-threatening effects [10–12,18]. Interestingly, we found that central nervous system depression was one of the most reported effects following overall exposure and was associated with increased frequency of medical admissions and moderate-severe outcomes. Muscimol, one of the primary active constituents of *Amanita muscaria*, is a gamma aminobutyric acid type A (GABA-A) receptor agonist; ingestion is expected to cause anxiolysis and sedation like that of other GABAergic xenobiotics, such as benzodiazepines and barbiturates [16,20,21]. Some product types or specific batches may contain a clinically significant concentration of this sedative, despite previous studies reporting negligible amounts of *Amanita muscaria* extract [1–3,27]. However, it is equally possible that this is the result of other central nervous system-depressing contaminants, such as the detection of pregabalin in Diamond Shruumz [2,3].

Limitations

Our study has several limitations. As this was a retrospective observational study using poison center data of self-reported data, we could not validate the specific compounds contained in each product, which may likely include contaminants. Second, NPDS® is a passive surveillance system, so there may be an over-representation of more serious cases and an under-representation of exposures with lower acuity. Third, while variability across poison centers may

Table 4. Unadjusted and adjusted odds ratio with moderate or worse medical outcome.

	Moderate or worse ($n=172$) *n* (%)	None/minor ($n=151$) *n* (%)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Age (years)				
≤5	24 (14.0)	29 (19.2)	0.57 (0.27–1.18)	0.38 (0.09–1.60)
6–12	14 (8.1)	13 (8.6)	0.74 (0.30–1.82)	1.00 (0.24–4.17)
13–19	51 (29.7)	29 (19.2)	1.20 (0.61–2.37)	1.36 (0.57–3.28)
20–29	33 (19.2)	41 (27.2)	0.55 (0.28–1.08)	0.62 (0.26–1.48)
30–49 (reference)	38 (22.1)	26 (17.2)	–	–
50+	12 (7.0)	12 (7.9)	0.68 (0.27–1.76)	1.31 (0.41–4.19)
Gender				
Male	110 (64.0)	90 (59.6)	1.20 (0.77–1.89)	1.32 (0.70–2.49)
Female (reference)	62 (36.0)	61 (40.4)	–	–
Intentionality				
Intentional	104 (60.5)	86 (57.0)	1.28 (0.79–2.08)	0.87 (0.29–2.58)
Suspected suicide	12 (7.0)	7 (4.6)	1.82 (0.66–5.00)	0.55 (0.10–3.00)
Unintentional (reference)	49 (28.5)	52 (34.4)	–	–
Other	7 (4.1)	6 (4.0)	1.24 (0.39–3.94)	0.94 (0.16–5.56)
Reported mushroom type				
Amanita species	77 (44.8)	68 (45.0)	0.99 (0.64–1.54)	1.48 (0.81–2.68)
Psilocybin species (reference)	95 (55.2)	83 (55.0)	–	–
Substance multiplicity				
Single (reference)	121 (70.3)	128 (84.8)	–	–
Polysubstance	51 (29.7)	23 (15.2)	2.35 (1.35–4.07)	2.88 (1.35–6.13)
Select clinical effects				
Acidosis[a]	10 (5.8)	1 (0.7)	***	***
Agitation	44 (25.6)	29 (19.2)	1.45 (0.85–2.46)	0.59 (0.28–1.26)
Bradycardia[a]	6 (3.5)	0	***	***
Confusion	34 (19.8)	10 (6.6)	3.47 (1.65–7.30)	3.05 (1.14–8.13)
Central nervous system depression[b]	61 (35.5)	21 (13.9)	3.40 (1.95–5.94)	4.92 (2.45–9.88)
Dizziness/vertigo	10 (5.8)	10 (6.6)	0.87 (0.35–2.15)	0.78 (0.25–2.44)
Fever/hyperthermia[a]	5 (2.9)	1 (0.7)	***	***
Hallucinations	67 (39.0)	6 (4.0)	15.42 (6.45–36.89)	21.21 (7.87–57.13)
Hypertension	20 (11.6)	3 (2.0)	6.49 (1.89–22.31)	10.16 (2.39–43.21)
Hypotension[a]	6 (3.5)	0	***	***
Mydriasis	46 (26.7)	12 (7.9)	4.23 (2.14–8.34)	3.92 (1.57–9.80)
Nausea	24 (14.0)	21 (13.9)	1.00 (0.53–1.89)	1.46 (0.60–3.57)
Respiratory Depression[a]	9 (5.2)	0	***	***
Seizure[a,c]	11 (6.4)	1 (0.7)	***	***
Tachycardia	55 (32.0)	21 (13.9)	2.91 (1.66–5.10)	1.88 (0.89–3.97)
Vomiting	25 (14.5)	24 (15.9)	0.90 (0.49–1.65)	1.12 (0.49–2.53)

[a][***] This clinical effect is deemed clinically important and reported descriptively, but no analytical models were developed due to small sample sizes.
[b]Central nervous system depression is comprised of having any degree of central nervous system depression (ie, mild, moderate, major).
[c]Seizure is comprised of presenting either seizure (single) or seizure (multi/discrete).

impact consistency in documentation and coding, a more significant limitation is that not all relevant substances (e.g., newer or emerging products such as Diamond Shruumz) are captured in the available coding schema. This absence limits the comprehensiveness of our findings regarding the full spectrum of products associated with these exposures.

Conclusion

Due to the unregulated nature and the wide variety of unlisted ingredients, clinical outcomes of psilocybin and Amanita-containing products remain challenging to predict. Our research builds on a limited body of chemical analyses and several reported outbreaks that pose threats to public health. These findings may provide an opportunity to increase education about the use of these substances and to identify those at the most significant risk for ingesting them.

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No potential conflict of interest was reported by the authors.

America's Poison Centers® maintains the National Poison Data System® (NPDS®), which houses de-identified records of self-reported information from callers to the country's Poison Centers. The NPDS® data do not reflect the entire universe of United States exposures and incidences related to any substance(s). Exposures do not necessarily represent a poisoning or overdose and America's Poison Centers® is not able to completely verify the accuracy of every report. The NPDS® data do not necessarily reflect the opinions of America's Poison Centers®.

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Data availability statement

No data will be made available for public sharing.

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