Wild Mushroom Exposures in Florida, 2003–2007

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ABSTRACT

Objective. Exposure to wild mushrooms can lead to serious illness and death. However, there is little information on the epidemiology of mushroom exposures nationwide, as there is no specific surveillance for this outcome. We described mushroom exposures in Florida using available data sources.

Methods. We performed a population-based study of mushroom exposure calls to the Florida Poison Information Center Network (FPICN) and cases of mushroom poisoning reported in hospital inpatient and emergency department (ED) data from 2003 through 2007.

Results. There were 1,538 unduplicated mushroom exposures reported during this period, including 1,355 exposure calls and 428 poisoning cases. Most exposures reported to FPICN occurred in children ≤ 6 years of age (45%) and males (64%), and most were unintentional ingestions (60%). Many exposures resulted in no effect (35%), although 21% reported mild symptoms that resolved rapidly, 23% reported prolonged/systemic (moderate) symptoms, and 1% reported life-threatening effects. Most calls occurred when in or en route to a health-care facility (43%). More than 71% of poisonings identified in hospital records were managed in an ED, and most occurred in young adults 16–25 years of age (49%), children ≤ 6 years of age (21%), adults > 25 years of age (21%), and males (70%). No deaths were reported.

Conclusions. Combined, these data were useful for describing mushroom exposures. Most exposures occurred in males and in young children (≤ 6 years of age) and young adults (16–25 years of age), with 78% resulting in contact with a health-care facility. Education should target parents of young children—especially during summer, when mushrooms are more abundant—and young adults who are likely experimenting with mushrooms for their potential hallucinogenic properties.

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Wild mushroom exposures are becoming increasingly common worldwide, particularly in Europe, but also in the United States, as mushroom hunting gains popularity.¹⁻³ Mushroom poisoning (mycetismus) describes the effects of ingesting many different toxic substances found in mushrooms. Of the 5,000 species of mushrooms, about 100 are known to be poisonous to humans, and fewer than 10 are considered deadly.^{4,5}

A common exposure involves accidental mushroom ingestion by children during outdoor play. Such exposures are usually not serious, as most backyard mushrooms are harmless or result in mild gastrointestinal (GI) illness. Typically, very little of the mushroom is swallowed, and the caregiver usually seeks prompt medical attention. Mushroom exposures in adults can be serious and may be fatal. Adults are more likely to forage for and consume large quantities of wild mushrooms, typically more than one type, and are more likely to wait before seeking medical attention.⁶ Adults might be unaware of the risk of eating wild mushrooms, lack experience to properly identify mushrooms, or be immigrants from areas where edible mushrooms look similar to local poisonous varieties.^{2,7}

The American Association of Poison Control Centers (AAPCC) has recorded 7,000–9,000 cases of mushroom exposures nationwide annually since 2004.⁸⁻¹¹ Nationally, exposures are more common from June to October. Florida has optimal conditions for wild mushroom growth, such as high humidity and rainfall, as well as an abundance of species, including many poisonous varieties.¹² In fact, more types of *Amanita* mushrooms, the genus containing the most poisonous varieties, are found in the southeastern U.S. than anywhere else in the country.¹³

Most literature related to mushroom exposures and poisonings are clinical case reports, with few studies characterizing the epidemiology of exposures.¹⁴⁻¹⁷ None are specific to Florida. The main objective of this analysis was to describe the epidemiology of mushroom exposures and poisonings in Florida during a recent five-year period.

METHODS

We performed a population-based study of reported mushroom exposures/poisonings in Florida from January 1, 2003, through December 31, 2007. There are no surveillance systems specific to mushroom poisoning in Florida; therefore, we acquired data from two separate sources for analysis. The Florida Poison Information Center Network (FPICN) provided mushroom exposure data, including demographic, exposure, treatment, and outcome information on calls placed to the

poison control hotline. The Florida Agency for Health Care Administration (AHCA) provided poisoning data related to mushroom ingestions from hospital inpatient and emergency department (ED) visits.

Mushroom exposure calls to FPICN were extracted from the statewide database. Patient exposures are assessed, managed, and coded by specialists in poison information (SPIs) including pharmacists, nurses, physicians, or physician assistants trained and certified to operate the hotline. We excluded the following from analysis: calls coded as “nontoxic exposure,” exhibiting an “unrelated effect,” subsequently “confirmed as a non-exposure,” “miscellaneous, nontoxic mushroom” exposures, and exposures attributed to substances such as flowers, seeds, and plants ($n=164$). These calls were determined not to be true mushroom exposures based on information received during the call and the technical experience of the SPI. Variables included age, gender, ZIP code/county where exposure occurred, ZIP code/county where call originated, date/site of exposure, exposure reason, site where case was managed, admission facilities, ingested substances, symptoms, treatment, and medical outcome. We categorized reported symptoms into GI, neurological, cardiovascular, ocular, and other syndromes, based on the AAPCC categories by organ system.

We obtained hospital data on all cases of mushroom poisoning reported to AHCA. Cases were selected based on the International Classification of Diseases, Ninth Revision (ICD-9) using code 988.1 (mycetismus) in primary or secondary diagnosis fields to capture all possible cases.¹⁸ The dataset included inpatient data (available 2003–2007) and ED data (available 2005–2007). Variables included year and quarter of admission, gender, age, race/ethnicity, ZIP code/county of residence, facility, reason for visit, diagnostic and procedure codes, and hospital charges.

Standard variables used to link data (patient name, date of birth, and social security number) were absent from one or both datasets. Therefore, we manually matched the datasets using date of exposure (FPICN) and year and quarter of admission (AHCA); county of residence (AHCA) and exposure or caller county (FPICN); ZIP code (AHCA) and exposure or caller ZIP code (FPICN); gender; age; and health-care facility. We used FPICN exposure ZIP code and county if available, followed by caller ZIP code and county, as callers were often the physicians. We considered cases matching on all six variables to be exact matches, and cases matching on four or five variables to be probable matches.

We obtained population estimates from the Florida Department of Health Community Health Assessment Resource Tool Set.¹⁹ We calculated average annual

incidence rates as total cases divided by the sum of the population estimates for the study period per 100,000 population. We reported frequencies and percentages on all categorical variables, and we reported medians and ranges on non-normally distributed continuous variables. We performed logistic regression analyses using clinical outcome information from the FPICN database to determine factors associated with clinical effects, providing crude and adjusted odds ratios (ORs) with 95% confidence intervals (CIs). We performed all analyses using SAS® version 9.1.3.²⁰

RESULTS

Combined data

From 2003 to 2007, there were 1,355 calls placed to FPICN related to mushroom exposures, and 428 inpatient or ED visits within AHCA data where mushroom poisoning was listed as a diagnosis. There were 245 cases occurring in both data sources as determined by manual matching, yielding 1,538 unduplicated mushroom exposures (308 per year). The average annual incidence of mushroom exposures was 1.7 cases per 100,000 population.

The majority of reports occurred among males (65%), children ≤6 years of age (41%), and 16- to 25-year-olds (33%). Average annual incidence differed by age, with the highest rates among children ≤6 years of age (8.3 per 100,000 population) and those aged 16–25 years (4.4 per 100,000 population), and the lowest among children 7–15 years of age (1.3 per 100,000 population) and adults ≥26 years of age (0.4 per 100,000 population).

Figure 1 shows the distribution of mushroom exposure/poisoning incidence rates. Counties with higher incidence were on the northeast side of Lake Okeechobee and in the south and north central part of the state and the Panhandle. South Florida had lower incidence rates.

FPICN data

Among calls placed to FPICN, the majority of exposures were coded as unintentional (60%), 36% were coded as intentional (e.g., drug misuse/abuse or suspected suicide), and 4% were coded as other/unknown. Most exposures (79%) occurred at a residence and 7% occurred at a school (data not shown).

Many exposures resulted in some clinical effect (45%). Minor clinical effects occurred in 21% and moderate clinical effects occurred in 23% of cases. Major clinical effects occurred in only 1% of exposures, and 35% of exposures resulted in no effects. The remaining 21% of cases were not followed by the SPI

for reasons including inability to contact the patient for follow-up, exposure judged to result in minimal effects with follow-up not needed, or patient refused follow-up and exposure was judged likely to result in minimal effects. Common clinical syndromes were GI (36%) and neurological (20%). Specific symptoms reported included vomiting (29%), nausea (15%), diarrhea (12%), abdominal pain (11%), hallucinations/delusions (10%), tachycardia (7%), and agitation/irritability (5%) (data not shown).

Most individuals were already in or en route to a health-care facility when FPICN was called (43%) or were referred to a health-care facility by the SPI (29%). Only 320 (24%) exposures were managed at the call site (primarily residential). Most calls (71%) occurred between June and October (Figure 2).

Characteristics of exposures differed by age (Table 1). More exposures occurred among males in older age groups. Unintentional exposures were most common among children ≤6 years of age, while intentional exposures were more common for those in other age groups. Children ≤15 years of age most often had no clinical effects reported. Young adults (aged 16–25 years) had the highest proportion (81%) of intentional exposures. Moderate effects were com-

Figure 1. Mushroom exposure incidence rates by county: Florida, 2003–2007^a

^aIncludes data on 1,518 cases. Twenty (1%) cases with missing or unknown county of residence were not included.

Figure 2. Mushroom exposures reported to FPICN (month/year) and mushroom poisonings reported to Florida AHCA (quarter/year): Florida, 2003–2007

FPICN = Florida Poison Information Center Network
 AHCA = Agency for Health Care Administration

mon among those ≥ 16 years of age. Most exposures resulting in major clinical effects also occurred among 16- to 25-year-olds. Adults were typically in/en route to a health-care facility when FPICN was called or referred to a health-care facility by the SPI. Exposures in children ≤ 6 years of age were commonly managed at the call site. GI symptoms were the most common symptoms among all age groups. Individuals aged 16–25 years experienced the highest proportion of neurological or cardiovascular symptoms and hallucinogenic mushroom ingestion compared with other age groups.

Symptoms associated with mushroom exposures differed by outcome severity. Common symptoms reported for people with major effects were tachycardia (31%), abdominal pain, diarrhea, vomiting, hallucinations/delusions, hypertension, and diaphoresis (all reported in 23% of exposures). Those with moderate effects experienced similar symptoms: vomiting (48%), hallucinations/delusions (35%), nausea (33%), diar-

rhea (23%), and tachycardia (22%). For individuals with minor effects, GI symptoms were most common, including vomiting (64%), nausea (26%), abdominal pain (24%), and diarrhea (20%) (data not shown).

Mushrooms were the only substances involved in 1,291 (95%) records. Most individuals reported exposure to unknown mushrooms (88%). However, 22% reported a specific mushroom type categorized by their distinctive features, with hallucinogenic species reported in 10% of exposures. About 21% of individuals 16–25 years of age reported exposure to hallucinogenic mushrooms, while 75% of this age group reported unknown mushroom exposure. Among all individuals reporting hallucinogenic mushroom exposure, the most common symptoms were neurologic (67%) and cardiac (28%) (data not shown).

Major effects were reported by 13 cases: 11 of these cases reported mushrooms as the only substance consumed, and two cases involved both mushrooms and marijuana. Eight cases reported exposure to an

Table 1. Characteristics of mushroom exposures reported to FPICN by age group (n=1,346):^a Florida, 2003–2007

	0–6 years	7–15 years	16–25 years	≥26 years
Characteristic	N (percent)	N (percent)	N (percent)	N (percent)
Gender ^b				
Male	320 (53.4)	70 (60.3)	322 (78.9)	152 (68.5)
Female	279 (46.6)	46 (39.7)	86 (21.1)	70 (31.5)
Exposure reason ^c				
Unintentional	597 (99.5)	51 (44.0)	55 (13.5)	109 (49.1)
Intentional	2 (0.3)	57 (49.1)	330 (80.9)	94 (42.3)
Other	0 (0.0)	4 (3.5)	5 (1.2)	8 (3.6)
Unknown	1 (0.2)	4 (3.5)	18 (4.4)	11 (5.0)
Clinical effect				
Major effect	0 (0.0)	1 (0.9)	10 (2.5)	2 (0.9)
Moderate effect	10 (1.7)	24 (20.7)	199 (48.8)	76 (34.2)
Minor effect	69 (11.5)	31 (26.7)	104 (25.5)	76 (34.2)
No effect	388 (64.7)	39 (33.6)	25 (6.1)	13 (5.9)
Not followed	59 (9.8)	6 (5.2)	3 (0.7)	13 (5.9)
Unable to follow	74 (12.3)	15 (12.9)	67 (16.4)	42 (18.9)
Management site				
On site	263 (43.8)	13 (11.2)	10 (2.5)	31 (14.0)
In/en route to health-care facility	111 (18.5)	61 (52.6)	288 (70.9)	118 (53.2)
Referred to health-care facility	206 (34.3)	41 (35.3)	88 (21.6)	58 (26.1)
Other	12 (2.0)	0 (0.0)	10 (2.5)	12 (5.4)
Unknown	8 (1.3)	1 (0.9)	10 (2.5)	3 (1.4)
Substance				
Mushroom—hallucinogenic	17 (2.8)	13 (11.2)	87 (21.3)	17 (7.7)
Mushroom—other ^d	0 (0.0)	1 (0.9)	14 (3.4)	16 (7.2)
Unknown mushroom	583 (97.2)	102 (87.9)	307 (75.3)	189 (85.1)
Clinical syndrome ^e				
Gastrointestinal	77 (12.8)	39 (33.6)	202 (49.5)	164 (73.9)
Neurological	12 (2.0)	27 (23.3)	187 (45.8)	43 (19.4)
Cardiovascular	3 (0.5)	6 (5.2)	86 (21.1)	18 (8.1)
Ocular	5 (0.8)	9 (7.8)	47 (11.5)	5 (2.3)
Other	19 (3.2)	16 (13.8)	92 (22.6)	34 (15.3)

^aAge is missing for nine cases from FPICN data.^bGender is missing for four cases from FPICN data.^cUnintentional includes environmental, general, misuse, and food poisoning exposures; intentional includes misuse, abuse, and suspected suicides; and other includes other and adverse reactions to food.^dIncludes gastrointestinal, cyclopeptide, orellanine, ibotenic acid, and other potentially toxic mushrooms.^ePercentages do not add up to 100 because individuals can experience more than one category of symptoms.

FPICN = Florida Poison Information Center Network

unknown mushroom, four cases reported exposure to a hallucinogenic mushroom, and one case reported exposure to a mushroom containing ibotenic acid. Nine cases were admitted to a health-care facility. Six cases received a form of GI decontamination therapy, and 12 cases received other forms of therapy, such as intravenous fluids (data not shown).

In univariable analysis, gender, age, exposure reason, management site, and substance were associated with having any clinical effect (major/moderate/minor) vs. no effect (Table 2). Compared with females, males were more likely to have a clinical effect (OR=2.21,

95% CI 1.71, 2.85). As age increased, the odds of a clinical effect also increased ($p<0.0001$). Those with intentional exposures (OR=23.50, 95% CI 15.85, 34.83) and other/unknown exposures (OR=18.54, 95% CI 6.50, 52.87) were more likely to have an effect reported than those whose exposure was judged to be unintentional. Individuals who were in/en route or referred to a health-care facility were more likely to have clinical effects than those managed on site. Exposures to hallucinogenic/other mushrooms were more frequent among people with clinical effects (OR=7.77, 95% CI 4.48, 13.48) than among those with no clinical

effects. In multivariable models, only age and exposure reason were associated with clinical effects (Table 2).

AHCA data

Among inpatient and ED visits ($n=428$) for mushroom poisoning, individuals were more likely to be male (70%), 16–25 years of age (49%), and white (84%). The most common principal payers were commercial insurance (39%) and self-pay (28%). The principal ICD-9 diagnostic code recorded in 80% of visits was 988.1 (mycetismus). Eighty-nine records (20%) had a primary ICD-9 code other than 988.1, with most of these records having a clinical picture suggestive of mushroom poisoning. These records included codes related to gastroenteritis, nausea, vomiting, diarrhea, other poisoning codes, foreign body in mouth/stomach, volume depletion, dehydration, poisoning by psychotropic agents, nondependent drug abuse, and psychiatric disorders. However, 14 cases were not indicative of mushroom poisoning, though a second-

ary diagnosis of 988.1 was reported: two were related to food allergies, and 12 had no other symptom listed related to mushroom poisoning and were not otherwise classified (data not shown).

Inpatient and ED visits were more common in the second and third quarters (April to September) for most years (Figure 2). Characteristics differed by site of visit, with more ED visits ($n=306$, 83%) than inpatient visits ($n=62$, 17%) for 2005–2007. Children ≤ 6 years of age had more ED than inpatient visits (Table 3). Adults ≥ 26 years of age were more likely than those in other age groups to be admitted as inpatients.

ED visits were more common than inpatient visits among all races/ethnicities and all primary payer categories. A greater proportion of patients with ED visits had commercial insurance rather than other payer types. For the 122 hospital admissions, 101 (83%) were discharged to home or self-care, 5% left against medical advice, 3% were discharged to a psychiatric hospital, and 9% were discharged to another type of

Table 2. Predictors of clinical effects (major, moderate, and minor) in mushroom exposures reported to FPICN ($n=1,068$):^a Florida, 2003–2007

Characteristic	Odds ratio 95% CI	Adjusted odds ratio 95% CI
Gender ^b		
Female	Ref.	Ref.
Male	2.21 (1.71, 2.85)	NS
Age group (in years) ^c		
0–6	Ref.	Ref.
7–15	7.05 (4.39, 11.34)	3.46 (1.96, 6.12)
16–25	61.48 (38.28, 98.75)	22.31 (12.15, 40.96)
≥ 26	58.18 (31.43, 107.67)	35.60 (18.81, 67.35)
Exposure reason ^d		
Unintentional	Ref.	Ref.
Intentional	23.50 (15.85, 34.83)	3.73 (2.13, 6.54)
Other/unknown	18.54 (6.50, 52.87)	3.23 (0.99, 10.53)
Management site		
On site	Ref.	Ref.
In/en route to health-care facility	11.20 (7.71, 16.26)	NS
Referred to health-care facility	3.02 (2.04, 4.48)	NS
Other/unknown	5.92 (2.05, 17.09)	NS
Substance		
Unknown mushroom	Ref.	Ref.
Mushroom—hallucinogenic/other ^e	7.77 (4.48, 13.48)	NS

^aOutcome is categorized as major/moderate/minor effect vs. no effect. Excludes those cases not followed and unable to follow ($n=287$).

^bGender is missing for four cases from FPICN data.

^cAge is missing for nine cases from FPICN data.

^dUnintentional includes environmental, general, misuse, and food poisoning exposures; intentional includes misuse, abuse, and suspected suicides; and other includes other and adverse reactions to food.

^eOther includes gastrointestinal, cyclopeptide, orellanine, ibotenic acid, and other potentially toxic mushrooms.

FPICN = Florida Poison Information Center Network

CI = confidence interval

Ref. = reference group

NS = not significant

Table 3. Characteristics of mushroom poisonings reported to Florida AHCA by age group (n=428): Florida, 2003–2007

Characteristic	0–6 years	7–15 years	16–25 years	≥26 years
	N (percent)	N (percent)	N (percent)	N (percent)
Gender				
Male	39 (43.3)	26 (65.0)	177 (84.3)	57 (64.8)
Female	51 (56.7)	14 (35.0)	33 (15.7)	31 (35.2)
Race/ethnicity				
Black/African American	6 (6.7)	5 (12.8)	6 (2.9)	3 (3.5)
White	74 (82.2)	31 (79.5)	191 (91.0)	63 (73.3)
Hispanic	7 (7.8)	2 (5.1)	11 (5.2)	13 (15.1)
Other ^a	3 (3.3)	1 (2.6)	2 (1.0)	7 (8.1)
Site of visit				
Emergency department	84 (93.3)	27 (67.5)	148 (70.5)	47 (53.4)
Inpatient admission	6 (6.7)	13 (32.5)	62 (29.5)	41 (46.6)
Hospital charges: median (range)	\$754 (\$115–\$7,145)	\$2,042 (\$359–\$10,452)	\$3,241 (\$235–\$23,115)	\$5,230 (\$0–\$107,497)

^aIncludes American Indian/Alaska Native, Asian/Pacific Islander, and other
AHCA = Agency for Health Care Administration

institution. Finally, total hospital charges differed by site of visit. Median total charges for ED visits were \$1,718 compared with \$6,690 for hospital admissions (data not shown).

Characteristics also differed by age (Table 3). Mushroom poisonings were more common among males in all age groups except children ≤6 years of age, and were more common among those of white race/ethnicity. Median total hospital charges increased with age, from \$754 for those ≤6 years of age to \$5,230 for those ≥26 years of age.

DISCUSSION

Few epidemiologic studies have examined mushroom exposures and poisonings in the U.S. Most are case series, related to treatment, or specific to mushroom toxins. A study using 1989 AAPCC data examined mushroom exposures in the U.S.¹⁴ Accidental exposures (95%) and exposures in children (81%) were most common. Most cases had no reported effects (66%) and were managed on site (77%). A study using California AAPCC data found similar results: 88% were unintentional, 67% occurred in children, 50% resulted in no effect, and fewer than 60% were managed on site.¹⁶ One study specifically examined backyard mushroom exposures in children and found most exposures to have no clinical effects (80%).¹⁷ Another California study using hospital data found that children had twice the risk of hospitalization following mushroom consumption as those in other age groups.¹⁵

Finally, a study from Texas reported more than 60% of cases occurred in children and adolescents. Of note, all exposures were reported as intentional based on poison center data.⁷

Most of these studies reported greater proportions of unintentional exposures (>80%), with Florida reporting fewer exposures as unintentional (60%). For Florida, more than 40% of mushroom exposures occurred in children, while other studies reported more than 60% of mushroom exposures occurring in children. Florida had more exposures with clinical effects and fewer cases managed on site compared with these studies, possibly due to the greater proportion of exposures with medical effects in Florida or the greater variety of poisonous *Amanita* mushroom species found in the region.¹³ GI symptoms were common across all studies. Furthermore, few children in Florida were admitted to the hospital, referred to a health-care facility, or managed in/en route to a health-care facility compared with the California hospital discharge study.¹⁵ Finally, others have noted an increased risk of mushroom poisoning among immigrants;⁷ however, we had no information on immigration status.

Mushroom exposures are frequent in parts of Europe and Asia, as documented by studies in Turkey, Iran, Nepal, and other countries. Studies describing hospital admissions or ED visits due to mushroom poisoning in Turkey,^{3,21,22} Nepal,²³ and Iran²⁴ found GI or neurological symptoms were common, with most cases occurring in summer and early fall, similar to the current study. A study from Croatia reported a much

smaller proportion of cases in children compared with Florida data.²⁵ In contrast, Australia has relatively few hospitalizations from wild mushroom exposures, although poisonous varieties do exist there, likely due to limited interest in mushroom hunting.²⁶

Understanding the types of medical care required by different high-risk groups is important for understanding the epidemiology of mushroom exposures/poisonings. Children ≤ 6 years of age with no clinical effects accounted for almost 30% of mushroom exposures reported to FPICN. Most received some form of decontamination therapy (73%), such as ipecac, charcoal, dilution/irrigate/wash, or a snack. Timely use of such therapies may have contributed to the large percentage of cases with no clinical effects. Only 18% of children received no therapy. Approximately one-third of young adults received decontamination therapy, and 19% received no therapy. Prompt decontamination therapy may also be a reason for few clinical effects seen among young adults.

Finally, 5% of reports to FPICN included exposures to multiple substances, such as alcohol, marijuana, and other illegal drugs. Mixing of alcohol, marijuana, and hallucinogenic mushrooms was found to be common among adolescent and young adults attending drug treatment programs.²⁷ Simultaneous use of such drugs has been shown to lead to dependence, depression, and other mood or personality disorders.^{28–30} In a national survey, comorbid alcohol and hallucinogen dependence was common.²⁹

Limitations

This study was subject to several limitations. By including hospital records with only secondary ICD-9 codes for mushroom poisoning, we may have overrepresented the number of poisonings in Florida. However, most of these cases presented with clinical pictures indicative of mushroom poisoning. Using both primary and secondary diagnostic codes was determined to be helpful in identifying true mushroom poisoning cases in hospital data.

Because no surveillance system specific to mushroom poisoning exists, we used available data sources, thereby limiting the questions that could be addressed. We acknowledge the limitations related to verification of exposure and mushroom species; however, these issues could not be addressed without a registry or surveillance system specific to mushroom poisonings or a prospective study design. Also, many unique identifiers were unavailable, and the linkage between datasets was based on matching of other variables. Although most matches were exact or of high prob-

ability, some matches might have been missed due to limited variables available for matching. Finally, no data source is available to provide information on people exposed to wild mushrooms who do not visit a hospital or call FPICN, or who may see a private provider or forgo medical attention. Therefore, our data sources likely did not capture all wild mushroom exposures in Florida during this time period.

Neither data source used was intended for epidemiologic research. However, FPICN data were ideal for describing the circumstances of mushroom exposures, and AHCA data provided a good description of the clinical picture of poisoning cases. Many states do not collect similar ED data. Having these data available strengthened this study, as most cases used ED services. There is also the possibility of underreporting of mushroom exposures/poisonings, especially when associated with illegal experimentation. However, both AHCA and FPICN are rich information sources. This study was a novel application of these data sources and, combined, they were useful for describing the epidemiology of mushroom exposures in Florida.

CONCLUSIONS

Data from FPICN and AHCA demonstrate that exposures and poisonings occurred most often in males, children, and young adults, with almost 80% of reports resulting in contact with a health-care facility. Children are most likely to have unintentional ingestions that result in little or no effect, while young adults are most likely to have intentional ingestions, often with serious side effects. Education related to the effects of wild mushrooms should target parents of young children, especially during the summer months when mushrooms are abundant, and should focus on eliminating mushrooms in child play areas and limiting the time children remain unobserved in areas conducive to mushroom growth. Education for young adults who are likely experimenting with mushrooms for their hallucinogenic properties should focus on legal issues associated with possession and consumption of psilocybin mushrooms, proper identification of native poisonous species, and the potential health consequences associated with wild mushrooms alone and in combination with alcohol, marijuana, and other drugs.

Future studies should focus on the effectiveness of using decontamination therapy in asymptomatic patients to prevent serious clinical effects. Prospectively collected data with emphasis on species identification may also improve the understanding of the epidemiology of mushroom exposures and poisonings. Other

state or local health departments may benefit from using the methodology presented in this article to explore or better understand the epidemiology of mushroom exposures and poisonings in their areas.

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