

Short communication

## College student use of *Salvia divinorum*

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### Abstract

**Objective:** *Salvia divinorum* (salvia) is a plant that appears to be enjoying increased popularity as a legal hallucinogen in many U.S. jurisdictions. While the popular press has claimed that its use has become widespread, there have been no epidemiological studies published documenting this within the U.S.

**Method:** A sample of college students was randomly drawn from a large public university in the southwestern U.S. and invited to participate in an online survey that included salvia use among a set of other drug use items.

**Results:** From the sample of 1516 college student respondents, a pattern of use emerged that indicates that salvia is indeed becoming a significant member of the list of drugs used, with 4.4% of students reporting using salvia at least once within the past 12 months. Subpopulations that are typically most at risk for drug use within college students (Whites, males, fraternity members, heavy episodic drinkers) also were most likely to use salvia.

**Conclusions:** The results indicate that more research is needed to determine the generalizability of these findings, and identify whether there are any negative consequences experienced either by the user or the community associated with this drug.

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**Keywords:** College-student drug use; *Salvia divinorum*; Hallucinogenic drugs

### 1. Introduction

*Salvia divinorum* is a species of the mint family (Labiatae) traditionally cultivated in Oaxaca, Mexico by the Mazatec Indians. The Mazatec shamans have used it for spiritual and medicinal purposes, and it has been suggested that its use may date to the Aztecs (Schultes et al., 2001). Recently, the plant has been propagated in the U.S., and according to popular press accounts, it has been gaining increasing popularity as a hallucinogen. The leaves of this plant can be chewed or smoked to release a psychoactive compound, salvinin A (Siebert, 1994; Valdes, 1994). An extraction of salvinin A can also be produced and is available on sale through Internet sources as either an enhanced dried leaf product or as a tincture to be taken orally. *S. divinorum*'s (salvia) effects are said to be highly dose-dependent, with larger doses causing extreme hallucinatory experiences. A number of U.S. states have considered controls on salvia, but to date only a handful have passed (Griffin et al., in press). The U.S. DEA has placed the drug on a watch list, describing a number of

instances where dried leaves have been confiscated for testing. However, there are no national controls on *S. divinorum* at this time. The scientific literature documenting medical or psychological negative consequences associated with its use is thin (for exception, see Singh, 2007), however, this may be a function of the relatively sparse research that has been conducted to date. Some news accounts do mention negative events that have been associated with its use based on reports from users or parents of users (e.g., CBS News, 2007). Street names for salvia include *Magic Mint*, *Sally D*, and *Diviners Sage* or by a popular brand name *Purple Sticky*<sup>TM</sup> sold in smoke shops. Salvia is also widely available on the Internet both from dedicated sites as well as general consumer sites such as eBay.com (Halpern and Pope, 2001). Further, the short duration of this drug's effects, which operates as a kappa-opioid receptor agonist (Prisinzano, 2005), perhaps make it more attractive than some other hallucinogens such as LSD.

There have been no large-scale epidemiological studies of salvia's use within the U.S. Nor are there published studies on the use of salvia among U.S. college students, a population that would seem to be most likely to adopt this drug early given the prevalence of drug use in this population and their access and use of Internet communities that have fostered information and

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access to the drug. A few studies have demonstrated its use in other countries (i.e., Gonzalez et al., 2006; Pavarin, 2006). This brief report presents the results of a series of surveys at a large public university in the southwestern U.S. located within a state with no specific controls on salvia.

## 2. Methods

### 2.1. Study procedure

Data collected from two semesters (Fall 2006, and Spring 2007) of an internet-based survey were used to examine the use of salvia in the past year among a sample of undergraduate students attending a large public university in the southwestern United States located within a state where salvia is legal. For each survey, a random sample of undergraduate students received an email invitation to participate in a web-based questionnaire concerning college student achievement, lifestyles, alcohol, and other drug behavior. In the Fall 2006 survey administration, participants completing the survey were entered into a sweepstakes drawing with the possibility of winning one of 20 prizes ranging in value from US\$25 to US\$250. Respondents in the Spring 2007 survey were given a US\$5 gift certificate for an online Internet retailer for their participation, a change made to try to increase participation rates.

Participants accessed the survey using their student ID number ensuring a respondent could only complete the questionnaire once. For each survey, three email reminders were sent to non-responders and to individuals who only partially completed the survey. The reminder emails were sent at approximately 1-week intervals. Each survey was comprised of a set of demographic items, alcohol consumption questions, and questions concerning the use of drugs.

### 2.2. Study measures

The demographic questions used for this survey included respondent gender, race/ethnicity (Caucasian, Hispanic/Latino, African American, Asian-Pacific Islander, and other/multi-race), place of residence (on-campus dormitory, off-campus, fraternity/sorority), and membership in a Greek-letter member organization (i.e., fraternity/sorority). Heavy episodic drinking was measured by a question asking participants to indicate the maximum number of drinks they consumed on any one occasion during the past 2 weeks. Consuming five or more drinks on any one occasion was defined as engaging in a heavy episodic drinking event for men while four or more on any one occasion was defined as heavy episodic drinking for women (Wechsler et al., 1995). In each survey, participants were also asked about the number of occasions they used drugs such as marijuana, cocaine, ecstasy, heroin, methamphetamine, and salvia.

### 2.3. Survey participants

Because the same person could have been invited to participate in either the Fall 2006 or Spring 2007 surveys, we removed any potential respondent from the Spring dataset who was invited to participate in the survey during the previous Fall semester—regardless of survey completion status in the Fall. This resulted in a total of 7350 non-duplicated students who were invited to participate in the survey in Fall and Spring semesters. A total of 632 respondents completed the Fall 2006 survey (response rate 25.3%) and a total of 884 respondents completed the Spring 2007 survey (response rate 18.2%). We combined the data from the Fall and Spring surveys into a single dataset (overall response rate = 20.6%). This is an admittedly low response rate, however, it is not out of step with other web-based surveys (e.g., Link and Mokdad, 2005; Shillington et al., 2006). There were no significant differences between the samples in terms of respondent characteristics, past-month heavy episodic drinking, or drug use. Because female respondents were overrepresented when compared to the university's enrollment by nearly 10% in both survey administrations, we created a weight based upon the actual distribution of male and female undergraduates at the university. Once gender-correcting weights were applied, our sample contained 58% women and 42% reporting being non-White (i.e., Hispanic/Latino, African American, Asian/Pacific Islander, and Native American, multiracial,

other). The mean age of the sample was 22.1 years (S.D. = 5.1). The weighted dataset was used to estimate the descriptive statistics shown in Table 1.

### 2.4. Data analysis

The percentage of respondents reporting past-year salvia use by gender, race/ethnicity (dichotomized into White/non-White), age, type of residence, fraternity/sorority membership, heavy episodic drinking (past-2-week), and past-year use of illegal drugs (marijuana, cocaine, ecstasy, heroin, and methamphetamine) is shown in Table 1. We also conducted bivariate and multivariate logistic regression models with participant demographics, heavy episodic drinking and past-year drug use as predictors and past-year salvia use as the dependent variable (Table 2). For the logistic regression analyses, we combined the past-year use of marijuana, cocaine, ecstasy, heroin and methamphetamine into a single measure of past-year illegal drug use given the low rates of use for most of these drugs except marijuana. Predictor variables with a significant bivariate relationship (Table 1) to past-year salvia use were entered simultaneously into the multiple logistic regression analysis.

## 3. Results

Overall, 4.4% of our combined sample (4.3% in Fall 2006 and 4.5% in Spring 2007) reported the past-year use of salvia. As observed in Table 1, salvia use rates are comparable to other illicit drugs such as ecstasy (5.0%) and cocaine (7.1%) with students reporting less use of heroin (<1%) and methamphetamine (1.2%). Marijuana remains the most widely used illicit drug (34.9%) within the sample.

The left side of Table 2 shows the results of the bivariate logistic regression analyses modeling separately the association between respondent gender, race, fraternity/sorority membership, past-2-week heavy episodic drinking, past-year drug use and the past-year use of salvia. Gender, race, fraternity/sorority membership, past-2-week heavy episodic drinking, and past-year drug use were all significantly related to the past-year use of salvia. Specifically, men, Whites, fraternity/sorority members, past-2-week heavy episodic drinking and past-year drug use were all associated with the increased odds of past-year salvia use.

The adjusted odds (AORs) and corresponding 95% confidence intervals from the multiple logistic regression analysis are displayed in the right side of Table 2. Results of this analysis indicate that only the past-year use of other illicit drugs significantly predicted past-year salvia use after simultaneously controlling for other model covariates. Because of the high proportion of female respondents, we also conducted additional logistic regression analyses stratified by gender. Similar to the results of the non-stratified model, the past-year use of illicit drugs significantly increased the likelihood of reporting the use of salvia during the past 12 months for both men and women (results not shown).

## 4. Discussion

This survey has demonstrated that *S. divinorum* (salvia) is being used on a college campus. It is particularly popular among the subpopulation of students who report using other drugs. Over 10% of the illicit drug-using population reported using salvia at least once in the past year. Prevalence of salvia use

Table 1  
Past-year salvia use by sample demographics, heavy episodic drinking, and other drug use

Characteristics	Sample (n)	Overall	% Users (n)	% Non-users (n)	p-value
<b>Gender</b>					
Female	873	57.9%	2.6% (23)	97.4% (850)	<i>p</i> < 0.001
Male	634	42.1%	6.6% (42)	93.4% (592)	
<b>Race</b>					
Non-White	586	42.0%	2.7% (16)	97.3% (572)	<i>p</i> = 0.010
White	809	58.0%	5.6% (45)	94.4% (764)	
<b>Age</b>					
Mean (S.D.)	1328	22.14 (5.1)	20.9 (2.6)	22.2 (5.2)	<i>p</i> = 0.061
Median		21.0	20.0	21.0	
Range		59.0	14.0	59.0	
<b>Type of residence</b>					
On-campus	268	17.8%	5.2% (14)	94.8% (254)	<i>p</i> = 0.265
Off-campus	1218	80.9%	4.0% (49)	96% (1169)	
Fraternity/sorority house	20	1.3%	15% (3)	85% (17)	
<b>Fraternity/sorority membership</b>					
No	1366	91.1%	3.8% (52)	96.2% (1314)	<i>p</i> = 0.02
Yes	133	8.9%	8.3% (11)	91.7% (122)	
<b>Heavy episodic drinking (past 2 weeks)</b>					
No	813	69.7%	2.7% (22)	97.3% (791)	<i>p</i> = 0.001
Yes	353	30.3%	7.1% (25)	92.9% (328)	
<b>Marijuana (past year)</b>					
No	970	65.1%	0.6% (6)	99.4% (964)	<i>p</i> < 0.001
Yes	519	34.9%	11.1% (58)	88.8% (461)	
<b>Cocaine (past year)</b>					
No	1400	92.9%	3.2% (45)	96.8% (1355)	<i>p</i> < 0.001
Yes	107	7.1%	19.6% (21)	80.4% (86)	
<b>Ecstasy (past year)</b>					
No	1430	95.0%	3.1% (44)	96.9% (1386)	<i>p</i> < 0.001
Yes	76	5.0%	27.6% (21)	72.4% (55)	
<b>Heroin (past year)</b>					
No	1504	99.7%	4.3% (64)	95.7% (1440)	<i>p</i> < 0.001
Yes	5	0.3%	40% (2)	60% (3)	
<b>Methamphetamine (past year)</b>					
No	1489	98.8%	4.0% (60)	96.0% (1429)	<i>p</i> < 0.001
Yes	18	1.2%	33.3% (6)	66.7% (12)	

Table 2  
Results of a bivariate and multivariate logistic regression modeling predictors of past-year salvia use

Characteristics	OR	95%CI	p-value	AOR	95%CI	p-value
<b>Gender</b>						
Female						
Male	2.60	1.55–4.38	<i>p</i> < 0.001	1.93	0.99–3.74	<i>p</i> = 0.052
<b>Race</b>						
Non-White						
White	2.21	1.19–4.10	<i>p</i> = 0.012	1.85	0.87–3.93	<i>p</i> = 0.108
<b>Fraternity/sorority membership</b>						
No						
Yes	2.26	1.11–4.57	<i>p</i> = 0.024	1.33	0.48–3.66	<i>p</i> = 0.585
<b>Heavy episodic drinking (past month)</b>						
No						
Yes	2.74	1.50–5.03	<i>p</i> = 0.001	1.06	0.53–2.12	<i>p</i> = 0.878
<b>Drug use (past year)</b>						
No						
Yes	18.96	8.10–44.40	<i>p</i> < 0.001	11.14	4.48–27.69	<i>p</i> < 0.001

was on par with more established illicit drugs including ecstasy and mushrooms. Though no longitudinal data were available, the fact that so few students (less than 1%) reported use within the free-response “other” category in the previous year’s surveys, may indicate a rapid increase in popularity of this drug. However, it is also likely that at least some students failed to report salvia use in the absence of a specific prompt, resulting in an under-report in those previous surveys. Though salvia has been used within religious contexts by the Mazatec Indians, the likely college-student salvia user has a profile that is familiar to illicit drugs risks: younger, male, on-campus living and fraternity membership. Use of other drugs and heavy episodic drinking also predicted salvia use. Thus, it is likely that salvia is being used as a legal intoxicant for at least a large proportion of these students.

This is the first prevalence study of U.S. college student use of salvia. The results could be read as an alert to others that salvia is becoming popular among this population. However, there are a number of shortcomings that threaten the utility of this study. First, it is a small study reporting the use from only one (albeit large and diverse) campus, using only self-report measures. It is not clear that the studied campus is indicative of all U.S. college campuses. The campus studied was within a state with no legal controls on salvia; use may differ in states that have implemented controls. Further, the survey sample suffered from a low response rate. While we have no reason to believe that salvia use was differentially prevalent between those who participated and those who did not, it is possible that a biased sample was attained. Our weighting of the cases by gender likely corrected for some of this bias, but we cannot be certain that all biases were eliminated.

Finally, though it is clear that salvia use is gaining popularity, this study is silent regarding the associated harm. To date, there are no toxicological studies indicating medical harm, and our survey did not ask students to report social, psychological or legal consequences that may have been experienced. There are no legal or school-based consequences associated strictly with the use of salvia, however, use of this or any hallucinogenic drug within some contexts, such as driving, is illegal and certainly would pose a risk. We have no indication that any student engaged in a particularly risky use of salvia. Campus professionals, and those interested in prevention of drug abuse would benefit from more detailed investigations into salvia use and consequences prior to programmatic or policy development.

### Conflict of interest

All authors declare that they have no conflicts of interest.

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