

Regular article

## Internet access to *Salvia divinorum*: Implications for policy, prevention, and treatment

Valerie Hoover, (B.A.)<sup>a,\*</sup>, Douglas B. Marlowe, (J.D., Ph.D.)<sup>a,b</sup>,  
Nicholas S. Patapis, (Psy.D., M.A.C.J.)<sup>a</sup>, David S. Festinger, (Ph.D.)<sup>a</sup>, Robert F. Forman, (Ph.D.)<sup>c</sup>

<sup>a</sup>Treatment Research Institute at the University of Pennsylvania, 150 South Independence Mall West, Philadelphia, PA 19106, USA

<sup>b</sup>School of Medicine, University of Pennsylvania, Philadelphia, PA 19104, USA

<sup>c</sup>Alkermes, Inc., Cambridge, MA 02139, USA

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### Abstract

This study determined the degree to which *Salvia divinorum*, a potent hallucinogenic drug that is legal in most U.S. jurisdictions, is being proffered for sale over the Internet and how it is being characterized on popular Web sites. Search results revealed that between one half and two thirds (58%) of the Web sites either offered to sell *S. divinorum* or linked to other Web sites offering to sell the drug and that more than three quarters (78%) of the Web sites advocated for its use. Many of the statements issued on the Web sites were erroneous or falsely interpreted the absence of scientific data on the possible side effects of *S. divinorum* as evidence that no side effect exists. The portrayal and availability of *S. divinorum* on the Internet are similar to those of other illicit and prescription drugs of abuse. However, much less is known about the short- and long-term effects of this novel drug. Consequently, there is little basis to contradict the many Web sites that encourage its use. Implications for drug policy, prevention, and treatment are discussed. © 2008 Published by Elsevier Inc.

**Keywords:** Internet; *Salvia divinorum*; Web sites; *S. divinorum*

### 1. Introduction

#### 1.1. *Salvia divinorum*

*Salvia divinorum* is a naturally occurring psychoactive member of the Labiatae, or mint, family. Its pharmacological mechanism of action has yet to be fully understood, and the long-term effects of using this drug have not been well studied or described. The main psychoactive component of *S. divinorum* has been identified as the neoclerodane diterpene salvinorin A (Bigam, Munro, Rizzacasa, & Robins-Browne, 2003; Giroud et al., 2004; Valdes, 1994). This novel compound is a potent and highly selective agonist of the  $\kappa$ -opioid receptor, making it the first naturally occurring nonnitrogenous opioid receptor subtype-selective

agonist to be identified (Butelman, Harris, & Kreek, 2004; Lee et al., 2005; Munro, Rizzacasa, Roth, Toth, & Yan, 2005; Roth et al., 2002) and the only nonalkaloidal hallucinogen (Bucheler, Gleiter, Schwoerer, & Gaertner, 2005). It is structurally unique and has no known analog among other drugs of abuse (Chavkin et al., 2004; Roth et al., 2002; Valdes, 1994).

Similar to cannabis, *S. divinorum* can be readily cultivated indoors or in any humid and semitropical environment (Halpern, 2004). It can be chewed or smoked to extract its active ingredient, salvinorin A (Gonzalez, Riba, Bouso, Gomez-Jarabo, & Barbanoj, 2006); highly concentrated liquid extracts are now also being offered for sale on the Internet. When the leaves are dried and smoked, psychoactive effects typically appear rapidly and intensely, with potent effects lasting for 5–6 minutes, after which the effects subside over an additional 20–30 minutes (Gonzalez et al., 2006; Siebert, 2005). When the leaves are chewed, psychoactive effects are typically felt in roughly 15 minutes

\* Corresponding author. Tel.: +1 202 686 2210x378; fax: +1 202 686 0094.

E-mail address: [vhoover@washingtongcr.org](mailto:vhoover@washingtongcr.org) (V. Hoover).

and increase to a climax at approximately 30 minutes. This peak level can then be maintained for an additional 30–60 minutes, after which it typically declines over another 30–60 minutes (Siebert, 2005). When absorbed as a tincture held in the mouth, the effects generally emerge in 10–15 minutes and rapidly escalate to a peak intensity that can be maintained for 20–40 minutes (Gonzalez et al., 2006; Imanshahidi & Hosseinzadeh, 2006).

The behavioral effects of salvinorin A have been reported to vary considerably from person to person, with some users reporting lack of control over their reactions and hallucinogenic effects that are perceived as excessive or unpredictable. Furthermore, many users report that they experienced serious symptoms of fatigue, dizziness, exhaustion, and mental slowness after ingesting *S. divinorum* (Gonzalez et al., 2006). These behavioral effects could be disorienting to new users of *S. divinorum*, especially if they were anticipating effects similar to those of cannabis, mescaline, or the more commonly known classes of opiates.

### 1.2. Legal status of *S. divinorum*

Although *S. divinorum* has been identified as a “drug of concern” by the U.S. Drug Enforcement Administration (DEA, 2005), under U.S. federal law, it is not illegal to possess or distribute this drug and it is not scheduled as a controlled dangerous substance under the Controlled Substances Act of 2005. It is also legal to possess it in most U.S. states and territories, although a few jurisdictions are now taking measures to outlaw its use. Presently, Louisiana prohibits possession of *S. divinorum*, and very recently, Missouri (Comprehensive Drug Control Act of 1989, Revised) and Delaware (Delaware Uniform Controlled Substance Act, 2006) passed laws making both *S. divinorum* and salvinorin A Schedule I substances. In addition, *S. divinorum* is a controlled substance in many other countries, including Australia, Denmark, Belgium, Italy, Finland, and South Korea.

### 1.3. Presence on the Internet

The National Institute on Drug Abuse (2000), DEA (2006), and U.S. Government Accountability Office (GAO, 2005) have reported that the Internet is the most widely used venue for obtaining various prescription drugs without a prescription. A recent study conducted by the GAO (2005) found that 90% of the orders it placed for opioid narcotics (i.e., hydrocodone) with online pharmacies were received despite the absence of a valid prescription and that all of those shipments were from foreign countries.

Illicit drugs of abuse are similarly readily available through the Internet. Spores of fungi that produce psilocybin, marijuana, and opium poppy seeds can be found for sale via numerous Web sites. *S. divinorum* is the only known psychoactive plant that is proffered in its adult and fully psychoactive form. Several investigators have reported an

apparently increasing availability of *S. divinorum* over the Internet (Butelman et al., 2004; Halpern & Pope, 2001; Pichini et al., 2005), although they were not able to identify epidemiological data addressing the prevalence of *S. divinorum* use or whether its use has been increasing or decreasing. Internet Web sites offering to sell *S. divinorum* in a variety of forms, including whole plants, seeds, dried and fresh leaves, and extracts, have appeared (DEA, 2005). Other Web sites offer firsthand experiential reports, information on plant cultivation, dosage instructions, and suggestions for “safe” use and maximum enjoyment of the plant (Bucheler et al., 2005). The DEA recently concluded that the Internet is an important venue for the distribution of this substance in the United States (Halpern, 2004).

The following features of *S. divinorum* make it an ideal candidate to be exploited and proffered over the Internet:

1. it is legal to use and sell in most jurisdictions;
2. it can be easily cultivated, requiring little pharmacological expertise and posing little risk from dangerous or combustible precursor chemicals;
3. it is psychoactive and potentially potently so; and
4. it has been seriously understudied, thus providing no information regarding potential toxicity or dangerous side effects in humans.

The purposes of the present study were to quantify the degree to which *S. divinorum* is being proffered for sale over the Internet and to assess how the drug is generally being characterized on popular Web sites. Research methods that were intended to assess what a person with a moderate understanding of the Internet would be likely to encounter if he or she conducted a search on the most popular search engines using the search term “salvia divinorum” were used.

## 2. Materials and methods

Five Google (<http://www.google.com>) Internet searches were conducted using the term “salvia divinorum” in June 2005, October 2005, November 2005, February 2006, and May 2006. The searches for *S. divinorum* were conducted in the context of a larger study, and the time frames selected for conducting the searches were interspersed among those for other drug search terms. For all five searches, the first 20 links that were retrieved were coded by independent raters using a standardized rating protocol subsequently described. The investigators chose to evaluate the first 20 links because of the time intensiveness of the searches and the authors’ belief that examination of the first 20 links allows for thorough characterization of both the frequency of Web sites that offer to sell the drug appearing and the portrayal of the substance. This method has been used by other investigators to evaluate the availability and presence of drugs such as opioids (e.g., codeine) without a

prescription over the Internet (Forman, Woody, & McLellan, 2006) and has demonstrated the widespread availability of almost all drugs of abuse via the Internet (Gordon, Forman, & Siatkowski, 2006).

Before conducting the searches reported in this study, raters first familiarized themselves with the standardized rating protocol subsequently described. They were then given several search terms with which they conducted a practice Google search. The practice searches were then compared for coding accuracy against the coding results of two trained independent raters. If the agreement on coding did not reach or exceed 95%, the rater in training again reviewed the standardized coding protocol and then conducted additional practice searches. This process was repeated until the rater in training reached or exceeded 95% agreement on coding. No rater was included in the study until he or she achieved  $\geq 95\%$  reliability with the other trained raters on practice searches. In interrater reliability scoring trials, the consensus on independent ratings virtually always exceeded 95%.

For the searches included in the study, once both independent raters had viewed and coded the Web sites, they then reviewed together any scoring discrepancy; they reached a consensus on 100% of the ratings. The Web sites returned in this examination were largely dichotomous in their portrayal of *S. divinorum*, which resulted in little ambiguity in determining the appropriate coding category.

Duplicate sites (i.e., those with identical content but which might have the same or a different URL address) were categorized as such but were included in the tallies. Including duplicate sites best represented what Internet users would be likely to encounter during a routine search. Although duplicate sites were encountered from time to time, they were not common and did not appear to unduly influence the tallies.

### 2.1. Web sites offering to sell *S. divinorum*

The independent raters coded each Web site according to the following criteria in terms of whether the site purported to offer *S. divinorum* for sale or to facilitate the purchase of *S. divinorum*:

- Retail—A Web site was coded as “retail” if it offered to sell *S. divinorum* directly to the consumer.
- Portal—A Web site was coded as a “portal” if it did not offer to sell *S. divinorum* directly but linked to at least one other Web site that offered to sell the drug.
- Other—A Web site was coded as “other” if it did not offer to sell *S. divinorum* directly or link to at least one other Web site offering to sell the drug (i.e., could not be categorized as either a retail or portal Web site).

The primary aim of this study was to determine the availability of *S. divinorum* over the Internet. For this reason, the “other” category is heterogeneous and includes all Web sites through which the substance

could not be purchased, including Web sites providing strictly scientific information about the drug and unrelated Web sites (e.g., the Web site for a music group named “Salvia”).

### 2.2. Characterization of *S. divinorum* on the Internet

The Web sites were further categorized in terms of their general portrayal of *S. divinorum* according to the following criteria:

- Pro-Use—A Web site was coded as “pro-use” if it met criteria for being a retail or portal site or if it advocated or glamorized use of the drug.
- Anti-Use/Treatment Information—A Web site was coded as “anti-use/treatment information” if it discouraged use of *S. divinorum*, focused on the risks associated with its use, or provided drug treatment resources as well as information and could not be classified as a retail or portal site.
- Other—A Web site was coded as “other” if it could not be categorized as being pro-use or anti-use/treatment information.

The secondary aim of this study was to determine the portrayal of *S. divinorum* over the Internet. For this reason, the “other” category is heterogeneous and includes neutral (i.e., Web sites that presented unbiased information about the drug that did not meet coding criteria as either pro-use or anti-use/treatment information) and unrelated (e.g., the Web site for a music group named “Salvia”) Web sites.

### 2.3. Comparison between Google and Yahoo!

For the May 2006 search, procedures identical to those used in the Google searches were used for a search conducted in Yahoo! (<http://www.yahoo.com>). The Google and Yahoo! comparison searches were conducted on the same day.

## 3. Results

### 3.1. Web sites offering to sell *S. divinorum*

Table 1 reports the percentage of retail, portal, and total commercial (combined retail and portal) *S. divinorum* Web sites for the searches conducted from June 2005 through May 2006. Overall, between one half and two thirds (58%) of the Web sites were in business at least in part to promote the distribution of this drug. Across all five searches, the average percentage of retail Web sites was 18%, ranging from 5% to 30% of the sites returned. The average percentage of portal Web sites was 40%, ranging from 20% to 60%. The average percentage of total commercial Web sites was 58%, ranging from 50% to 75%.

Table 1  
Proportion of Internet Web sites offering to sell *S. divinorum* or advocating for or against its use

Search category	June 2005	October 2005	November 2005	February 2006	May 2006	<i>M</i>
Retail	30	5	30	10	15	18
Portal	20	60	45	40	35	40
Total commercial	50	65	75	50	50	58
Other	50	35	25	50	50	42

Note. Data are presented as percentages.

### 3.2. Characterization of *S. divinorum* on the Internet

Table 2 reports the percentage of Web sites that were classified as being pro-use or anti-use/treatment information regarding the use of *S. divinorum*. On average, more than three quarters (78%) of the Web sites were categorized as pro-use, with a range of 70%–90% across the five searches. The average percentage of anti-use/treatment information Web sites was only 2%, with a range of 0%–5%.

A standardized content analysis was beyond the scope of this research study. However, it is noteworthy that most of the Web sites emphasized the legal status of *S. divinorum* and asserted that it was safe and enjoyable to use. Many sites misinterpreted the absence of scientific data on the possible toxicity or negative side effects of *S. divinorum* as evidence that there are no such effects. Examples of such assertions include the following: “no one has experienced a fatal or injurious over dose [sic] of salvia”; “pure extracts are much less damaging to your health”; “salvia is...not addictive”; and “one needn’t worry about becoming addicted.”

There were numerous attestations about the positive psychoactive effects of the drug. Examples include the following: “this is an extraordinary visionary herb”; “it will put you in touch with another world”; and “it gives a sensual enhancement...and is personally rewarding.” There were also home videos depicting people getting high on *S. divinorum* and having a seemingly pleasurable experience. Finally, one Web site offered free samples of *S. divinorum* and many Web sites also offered to sell marijuana seeds, psilocybin spores, San Pedro cactus spores, and drug paraphernalia.

### 3.3. Comparison between Google and Yahoo!

Table 3 compares the numbers and percentages of commercial and pro-use Web sites obtained from the Google

Table 2  
Proportion of Internet Web sites advocating the use of *S. divinorum*

Search category	June 2005	October 2005	November 2005	February 2006	May 2006	<i>M</i>
Pro-use %	75	85	90	70	70	78
Anti-use/Treatment information	5	0	0	5	0	2
Other	20	15	10	25	30	20

Note. Data are presented as percentages.

Table 3  
Comparison between Google and Yahoo! on the proportion of Web sites offering to sell *S. divinorum* or advocating for or against its use

Search category	Google		Yahoo!	
	<i>n</i>	%	<i>n</i>	%
Web sites offering to sell <i>S. divinorum</i>				
Retail	3	15	7	35
Portal	7	35	7	35
Total commercial	10	50	14	70
Other	10	50	6	30
Portrayal of <i>S. divinorum</i>				
Pro-use	14	70	16	80
Anti-use/Treatment information	0	0	0	0
Other	6	30	4	20

and Yahoo! searches during May 2006. For both of these leading search engines, 35% of the links returned were portal Web sites. However, Yahoo! returned a larger proportion of retail sites (35%) than did Google (15%).

As can also be seen from Table 3, 70% of the Web sites returned in Google and 80% of those in Yahoo! advocated for the use of *S. divinorum*. Neither search engine returned a Web site that was classified as anti-use/treatment information.

## 4. Discussion

This study assessed what a typical Internet user would be likely to encounter if he or she conducted a search on a popular search engine using the term “salvia divinorum.” The results revealed that between one half and two thirds of the Web sites encountered either offered to sell *S. divinorum* or linked to other Web sites offering to do so. In addition, more than three quarters of the Web sites encouraged use of this drug. Few Web sites sought to discourage its use or provided treatment information. These findings are generally consistent with earlier research demonstrating the availability of prescription opioids for sale over the Internet without a valid prescription (Forman, 2003; Forman, Woody, et al., 2006). In addition, one Web site offered free samples of *S. divinorum* and other sites offered to sell marijuana seeds, psilocybin spores, San Pedro cactus spores, and drug paraphernalia.

Of particular concern is the fact that many Internet Web sites are exploiting the relative paucity of data on *S. divinorum* as evidence for its safety. It is frequently promoted, for example, as a safe and legal alternative to scheduled hallucinogenic drugs such as cannabis and mescaline. Moreover, some Web sites wrongly associate the drug with other classes of opioid agonists that typically elicit symptoms of analgesia and euphoria, as opposed to *S. divinorum*’s hallucinogenic effects.

Many of the analogies being posted on the Internet are patently erroneous and potentially dangerous. For instance, cannabis and mescaline exert their effects primarily through the serotonin-2 and cannabinoid receptor systems. Neither

agonism nor antagonism of these systems has been associated with a serious risk of lethality. In contrast, the effects of *S. divinorum* are mediated through  $\kappa$ -opioid receptors (Gonzalez et al., 2006). Unlike  $\mu$ -receptors, which are agonized by commonly abused opiates, agonism of  $\kappa$ -opioid receptors has been associated with a marked decrease in dopamine-2 receptors (Izenwasser, Acri, Kunko, & Shippenberg, 1998).

It is an open question whether *S. divinorum*'s availability and positive portrayal are attributable to its legal status in most U.S. jurisdictions or whether it may be attributable to other factors, such as the relative ease with which it can be cultivated and the lack of clear scientific information about its potential side effect profile. Regardless, the availability and positive portrayal of the substance over the Internet, combined with its current legal status, could potentially lead to increased use and abuse of *S. divinorum* in the coming years.

#### 4.1. Implications for policy, prevention, and treatment

One possible way to reduce the incidence of positive messages about *S. divinorum* on the Internet is to outlaw its use or distribution. Given the positive portrayal of Schedule I hallucinogens such as cannabis and the availability of opioid medications online without a prescription, this would be unlikely to completely eradicate the problem. However, it might serve to curtail the positive portrayal and sale of *S. divinorum* over the Internet.

These data also have implications for primary prevention and educational strategies. Internet search engines are widely used by the youth of various nations. A recent study conducted in the United States by the Partnership for Drug Free America (news release, 2005) found that 40% of teenagers in a mall intercept study reported they knew they could find drugs online. Given that adolescents are generally at risk of experimenting with drugs and are most likely to be frequent users of the Internet, primary prevention efforts should be targeted toward addressing the growth of pro-use drug Web sites and guiding Internet users to more accurate and balanced presentations of the scientific evidence. Publishing data in scientific journals on the pharmacological effects of drugs is unlikely to filter down sufficiently to those people, especially teens, who most need the information. It is important to disseminate accurate scientific knowledge to the public in a manner and medium that are most likely to be read and credited as reliable and valid. The Internet is a dominant medium in our society for information exchange, entertainment, education, and commerce. As such, it could also serve as a medium for prevention efforts, such as correcting erroneous messages, providing brief screenings, and offering treatment referrals, where indicated.

The development of training curricula for parents and educators is another primary prevention effort that could be useful in reducing the negative effects of Internet drug promotion and sales. Such curricula could warn parents and

teachers about the nature of the problem and offer useful strategies for reducing children's and teens' exposure to these sites. For instance, parents and teachers could learn about filtering software that is available, effective strategies for monitoring children's use of the Internet, and methods for "inoculating" children against erroneous and distorted information that they might encounter.

Clinicians in treatment programs also need to be aware of the possible emergence of this drug and other drugs, including prescriptions that are readily available online. Evidence suggests that roughly 10% of drug abusers currently in treatment obtained their drugs over the Internet and that an additional 29% indicated they were aware they could purchase controlled drugs over the Internet without a valid prescription (Gordon et al., 2006). Recent studies by both the Pew and the Kaiser Family Foundations have found that children are aware of the availability of drugs of abuse via the Internet and that they often believe the "safe use" rhetoric that is posted on many pro-use sites. Unsolicited e-mail offers could potentially be a powerful relapse trigger for individuals who are addicted to drugs or early into their recovery. Such e-mails offer variety, convenience, and relative anonymity, thus lowering barriers against addictive drugs while professing legitimacy. Especially if the messages underscore themes of legality, safety, and a low potential for addiction, they may be apt to precipitate a return to high-risk conduct. Health care providers therefore need to develop assessment and treatment approaches that can effectively address the needs of patients related to the Internet. For example, patients might be advised to change their e-mail address, use filtering software programs, or restrict their use of e-mail and the Internet during the early stages of recovery—when their chances for relapse are greatest (e.g., Forman, Marlowe, & McLellan, 2006). The practicality and effectiveness of such approaches are unknown and need to be evaluated in controlled research studies.

#### 4.2. Study limitations

One obvious limitation of this study is that no effort was made to purchase *S. divinorum*. In future research, it will be important to place orders from retail sites to determine whether the sites actually deliver the substance and conduct laboratory tests to verify its authenticity. Notably, research does suggest that many Internet sites offering to sell illicit drugs actually do so. For example, one study by the GAO (2004) placed 90 orders for prescription drugs with multiple online pharmacies, and 50% of the orders were filled without a valid or legal prescription. Comparable research should be conducted on *S. divinorum*.

Another limitation of the study is that it only focused on Web sites. It is quite possible that drug-related discussions and sales occur as frequently, or more frequently, in other Internet fora, such as in chat rooms. Future research should seek to monitor illicit drug sales and erroneous drug information being offered in other Internet venues.

### 4.3. Summary

*S. divinorum* is widely available on the Internet and generally portrayed in a positive light. Although epidemiological data on the prevalence of *S. divinorum* are lacking, the drug's availability and portrayal over the Internet, current legal status in most U.S. jurisdictions, and lack of scientific information regarding potential toxicity and side effects are a cause for concern and require additional research. Efforts are needed to provide regular online monitoring of drug sales as well as scientifically accurate and responsible information to consumers of the Internet.

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