

Drugs on the web; the Psychonaut 2002 EU project

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Abstract

Purpose: Only a few formal assessments of websites with drug-related contents have been carried out. We aimed here at fostering collection and analysis of data from web pages related to information on consumption, manufacture and sales of psychoactive substances.

General methods: An 8-language, two-engine, assessment of the information available in a purposeful sample of 1633 unique websites was carried out.

Findings: A pro-drug and a harm reduction approach were evident, respectively, in 18% and 10% of websites accessed. About 1 in 10 websites offered either psychoactive compounds for sale or detailed data on drugs' synthesis/extraction procedures. Information on a number of psychoactive substances and on unusual drugs' combinations not found in the Medline was elicited.

Abbreviations: 2C-E, 2,5-dimethoxy-4-ethylphenethylamine; 2C-I, 2,5-dimethoxy-4-iodophenethylamine; 2C-P, 4-(n)-propyl-2,5-DMPPEA; 2C-T-2, 2,5-dimethoxy-4-ethylthiophenethylamine; 2C-T-7, 2,5-dimethoxy-4-(n)-propylthiophenethylamine; 4 OH-DET ("CZ-74"), N,N-diethyl-4-hydroxytryptamine; 4 OH-DIPT, 4-hydroxy-N,N-diisopropyltryptamine; 4-acetoxy-DET, 4-acetoxy-hydroxytryptamine; 4-acetoxy-DIPT, 4-acetoxydiisopropyltryptamine; 5-MeO-AMT, 5-methoxyalpha-methyltryptamine; 5-MeO-DALT, 5-methoxy-diallyltryptamine; 5-MeO-DMT, 5-methoxydimethyltryptamine; ANOVA, analysis of variance; BZP, 1-benzylpiperazine; DMT, dimethyltryptamine; DPT, N,N-dipropyltryptamine; GHB, gamma-hydroxy-butyrate; HSD, Honestly Significant Difference; mCPP, m-chlorophenylpiperazine; MDMA, 3,4-methylenedioxymethamphetamine; TFMPP, 3-trifluoromethylphenylpiperazine monohydrochloride; TM, trade mark; URL, Uniform Resource Locator.

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Conclusions: This represents the first review which is both comprehensive and multilingual of the online available information on psychoactive compounds. Health professionals may need to be aware of the web being a new drug resource for information and possibly purchase.

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Keywords: Drug prevention; Ecstasy; Internet; MDMA; Psychoactive drugs; Psychonaut 2002 project

1. Introduction

A few hundred websites are already dedicated to both prescription (Littlejohn et al., 2005) and recreational/illicit (Schifano et al., 2003; Rawaf and Schifano, 2000) drugs on the web, but only a few formal assessments of representative samples of drug-related websites have been carried out. To the best of our knowledge, no mapping of the web which is multilingual, comprehensive and focussing on drug-related issues is yet available. With the aim of getting a preliminary general overview of the problem and to address this gap in knowledge the 2-year, European Commission-funded, Psychonaut 2002 project was given the following general tasks: (a) carrying out a comprehensive search of online available information on psychoactive compounds; (b) fostering collection and analysis of data from web pages related to information on consumption, manufacture and sales of psychoactive substances; and (c) identifying possible emerging recreational drug consumption trends. More specific aims included evaluating the level of accessibility of recreational drugs' information to the average user.

2. Methods

2.1. Study design and assessment instruments

To address the above issues, the Google™ and AltaVista™ search engines were chosen between those available because of their importance, reliability and popularity. The rationale for using two different search engines was to have a broader spectrum of findings as each engine refers to different techniques for website indexing and ranking. Google™ is a popular choice for web surfers, since it provides both a

comprehensive coverage of the web and a satisfactory level of relevance of its results. AltaVista™ is the first searchable full-text database of the World Wide Web (Search Engine Watch, 2004).

On the week starting on June 23rd, 2003, each of the 11 research partners carried out a “snapshot” of the available websites with contents related to the chosen drug-related categories. This was carried out to overcome the problem of the ever changing and expanding nature of the Internet. Search engine queries were carried out using specific generic keywords (e.g. MDMA, ecstasy, cocaine, heroin). Data collected was automatically stored in a database located within the coordinating centre (St George's, University of London) protected website. In each research centre, the first 20 links were assessed both by the senior researcher(s) and the research assistant to reach a satisfactory level of coding reliability. To control for possible biases in interpretation of data between the geographically dispersed researchers and to ensure standardization in coding, in the time-frame September 2003 to August 2004 information collected was double-checked by the first two authors of the present paper. If a doubt was arising with respect to coding, an agreement was sought between them and the researcher. Each of the participating centres were given two tasks: (a) assessing the information available in English related to an assigned drug-related category (Table 1) and (b) assessing the information available in their own language related to the remaining drug categories. As a result, the information available online was searched in 8 languages: English, French, Italian, Finnish, Danish, German, Spanish and Portuguese.

Although in most instances over 100,000 web pages Uniform Resource Locators (URLs; web addresses) may be reported as a result of a query, in common with other engines

Table 1

Number of websites found by Google™ and AltaVista™ running a search for the different groups of psychoactive compounds

Substances/groups of substances	Keyword(s)	Google™ results	AltaVista™ results	Total records (i.e.: number of websites reviewed)
Ecstasy	<i>MDMA</i>	71,400 (810*)	48,747	280
Herbs, plants	<i>Psychoactive plants</i>	20,200 (497*)	21,397	265
Precursors to illicit drugs	<i>Manufacturing drugs</i>	661,000	269,660	290
Heroin and other opiates	<i>Opiates</i>	83,400	61,208	290
Other stimulants, inhalants, solvents	<i>Inhalants</i>	88,700 (612*)	32,273 (990*)	270
Prescription drugs	<i>Prescription drugs</i>	985,000	468,354	290
Tobacco	<i>Tobacco</i>	2,710,000	1,997,028	290
Cannabis	<i>Cannabis</i>	359,000	229,873	290
Amphetamines	<i>Amphetamines</i>	68,700 (577*)	87,575	269
Recreational drugs	<i>Ketamine, LSD, GHB</i>	9580	3983	290
Cocaine, crack cocaine	<i>Cocaine</i>	626,000 (808*)	517,503	280
				3104

The results shown here were obtained through a search run on the week starting 23rd June, 2003 with English keywords. In most cases, only 1000 results were actually accessible. In those cases identified with an * the actual number of available websites was smaller, as reported here.

both Google™ and AltaVista™ are designed for displaying only up to the first 1000 pages searched (Schifano et al., 2003). To carry out the present exercise, a purposeful website sampling technique was designed. The first 100 websites identified by Google™ and AltaVista™ with the chosen keywords were fully assessed, together with a further random (Randomizer, 2004) sample of 5% of the remaining sites which were chosen among those actually available. The first 10 websites (i.e.: the number of links which appeared in the first results' page) identified by Google™ and AltaVista™ with queries formulated in each of the participating country own language were assessed as well. In this way, the snapshot produced a total of 4644 websites; 3104 were in English and 1540 in another language. Of these, 4523 (97.4%) were actually online (i.e.: not cached) but only 3031 (65.3% of the initial sample) were considered to be relevant to the study aims. More specifically, those websites where no mention whatsoever was made to drugs and which were referring to other issues (e.g. music, movies, etc.) were discarded. A number of websites were being repeatedly identified through different sources: by the same search engine, by both search engines, and/or also through the use of different keywords. Due to these redundancy issues, the sample was reduced by a further 46% to 1633 unique websites; 1103 were in English and 530 in another language.

The keywords used to run the queries were chosen to achieve both a general overview of online information on drug issues and a comprehensive listing of links. Results of the English "snapshot" search are given in Table 1. Keywords used to run the queries in the remaining 7 languages were the exact translation of the English keywords.

Survey data of sampled websites included: website relevance; ranking; country of origin; website position towards drug use; possibility of purchasing drugs. Relevance referred to the content of the information offered by the website, which was not always pertinent to the aims of the search; ranking referred to the link's numerical order of presentation in the engine results' page. The links in the Google™ directory are ordered in a way that highly cited sites on any topic are listed first; the placement position within the results themselves is not for sale (Google, 2004). AltaVista™ ranking relies on both static (a computation of page value independent from any particular query) and query-dependent factors (AltaVista, 2004). The country of origin of a website was not routinely identified through the URL domain extension (i.e.: .uk; .com; .it, etc.) but with the help of both WHOIS (Arin, 2005) and other information available (i.e.: postal address; telephone numbers etc). The categorization of the index website position towards drug use included four main groups: anti-drug; pro-drug; harm reduction approach; not stated. Anti-drug websites typically advocated against the misuse of any drug; most usually, they offered either prevention and/or treatment information. Conversely, pro-drug websites were actively promoting or facilitating the use of psychoactive drugs. Typically, they provided information on how to synthesize, purchase or consume a variety of substances. Harm reduction websites neither condemned nor promoted the use of drugs;

they aimed instead at presenting evidence and facts, giving the surfer/reader the possibility to draw their own conclusions. In those cases in which no statement was found and/or when the website aims were unclear, the website was given a not stated position.

2.2. Data analysis

To check for websites' ranking number as a possible function of their position towards drug use, the one-way ANOVA and the Tukey's HSD post-hoc test were both applied. The St. George's Local Research Ethics Committee granted the ethical approval of the project.

3. Results

Out of the 1633 unique websites, the "private interest" (i.e.: private company; individual) pages represented 41.4% (676 websites) of the sample. They typically reported either personal or others' accounts of drug intake experiences and/or offered different items for sale. Conversely, the governmental and educational websites were less frequently represented (310 websites; 19% of the sample). Overall, only 317 (19.4%) websites contained a disclaimer/warning regarding the information provided. Although for 145 websites (8.9%), it was impossible to identify their country of origin, 53.6% of websites resulted to be hosted by English-speaking countries. Countries mostly represented were: USA 660 (40.4%); UK 111 (6.8%); Italy 93 (5.7%); Germany (4.9%); France (4.2%).

With respect to the websites' overall position towards drug use, it appeared that 685 (42.0%) of them showed a clear anti-drug position, 493 (30.1%) did not clearly state their view, 292 (17.9%) websites showed a pro-drug approach and 163 (10.0%) a harm reduction approach. If the whole sample was taken into account, the websites' ranking levels did not differ significantly as a function of the website position towards drug use ($F(3; 1250)=1.094$; $p=0.35$; ns). A different picture emerged if separate analysis of specific websites' sub-samples (i.e.: hard drugs; recreational drugs) were carried out. For heroin, only 6 websites showed a clear pro-drug approach and their average ranking number (35.33 ± 34.9) was not significantly different from that one of the anti-drug websites (51.97 ± 28.1 ; $F(3; 153)=0.885$; $p=0.45$; ns). On the other hand, the MDMA pro-drug websites showed a lower ranking (average value: 40.34 ± 32.5), hence appearing significantly earlier in the results' list, than both the anti-drug (55.0 ± 26.6) and the harm reduction (54.25 ± 22.9) websites ($F(3; 159)=3.288$; $p<0.022$). The Tukey's HSD post-hoc test confirmed that the MDMA pro-drug websites had a lower ($p<0.05$) ranking than the MDMA anti-drug websites. Pro-drug websites were more frequently represented in English-written links than in those written in another language (respectively: $n=227$; 20.6% vs. $n=65$; 12.3%). Conversely, anti-drug websites were less frequently represented in English-written links than in those written in another language (respectively: $n=444$; 40.3% vs. $n=241$; 45.5%; chi-square=18.100; $df=3$; $p<0.000$).

Table 2

Examples of psychoactive compounds allegedly offered for sale on the web

Group of psychoactive compounds	Web URL
Opioid analgesics: buprenorphine; butorphanol; codeine; dextropropoxyphene; hydromorphone; levorphanol; meperidine; methadone; morphine; nalbuphine; opium injection; oxycodone; oxymorphone; pentazocine; propoxyphene; codeine	http://www.online-drug-source.com/private/resources/index.ws ^a http://www.pharmabymail.com/cgi-bin/store.cgi?lang=en&header=home&show=DOLOFRIX ^b
Psychiatric medications: antidepressants; sedative-hypnotics	http://www.eprescriptionsnow.com/ http://www.md-pillstore.com/ http://www.jmarchemical.com ^c
Hallucinogenic tryptamines and phenethylamines: DMT (dimethyltryptamine); 4 OH-DET (“CZ-74”) (<i>N,N</i> -diethyl-4-hydroxytryptamine); 4 OH-DIPT (4-hydroxy- <i>N,N</i> -diisopropyltryptamine); 5-MeO-AMT (5-methoxyalpha-methyltryptamine); 5-MeO-DMT (5-methoxydimethyltryptamine); DPT (<i>N,N</i> -dipropyltryptamine); 4-acetoxy-DIPT (4-acetoxydiisopropyltryptamine); 2C-I (2,5-dimethoxy-4-iodophenethylamine); 2C-T-2 (2,5-dimethoxy-4-ethylthiophenethylamine); 2C-T-7 (2, 5-dimethoxy-4-(<i>n</i>)-propylthiophenethylamine)	
Plants, herbs, mixtures: <i>Salvia divinorum</i> ; <i>Lophophora williamsii</i> (“Peyote”); <i>Trichocereus pachanoi</i> (“San Pedro”); <i>Banisteriopsis caapi</i> and <i>Psychotria viridis</i> (“Ayahuasca”)	http://www.amazing-nature.com/how_order.htm
Others: Anabolic steroids; phentermine; phendimetrazine, barbiturates; sildenafil; dextromethorphan	http://www.medprescribe.com/catwellness.aspx http://www.eprescriptionsnow.com/ https://www.rxcllc.com/website_signup ^a

^a Access restricted to members, who needed to have their card validated first.^b Free prescription with every order; free online consultation.^c Although active during study period, only available as cached when re-accessed on 18th November 2004.

One hundred and sixty-five (10.1%) websites were offering the possibility to purchase drug-related items (including paraphernalia and/or psychoactive drugs). This happened either through the use of online forms or via a system that involved the use of emails. A few examples of psychoactive compounds allegedly offered for sale on the web are given in Table 2.

One-hundred and forty eight (9.1%) websites offered detailed information about the technical procedures to be put in place to synthesize and/or to extract a range of different recreational psychoactive compounds. Furthermore, we found detailed information on dosage, best ways of experimenting with drugs or coping with possible adverse effects, related to a number of “new” psychoactive compounds, not mentioned in the Medline (Table 3). Information on these compounds was available from 59 (5.5%) English-written websites and from 33 (6.2%) websites written in another language.

Finally, during our Internet search we met with a number of combinations of psychoactive compounds not reported in the

Medline. A few examples of these combinations are provided in Table 4. It seemed from here that the polydrug intake might be carried out to achieve either a specific type of mind alteration (i.e.: combination of tryptamines with ketamine) or to come off from previously self-administered psychoactive compounds (i.e.: taking some GHB following a piperazine intake).

4. Discussion

4.1. Summary of main findings

To the best of our knowledge, the present report constitutes the only comprehensive and multilingual overview of the online available information on psychoactive drugs.

We have been able to identify here a number of websites offering both prescription and controlled drugs for sale, and it seems that monitoring the web with respect to drug-related issues may provide the practising clinician with some valuable

Table 3

Examples of “new” psychoactive compounds (i.e.: no reports of misuse available in the Medline) identified during the Psychonaut 2002 project Internet search

Compound	Web address	Comments offered
DMT-related herbs/plants <i>Mimosa hostilis</i>	http://www.erowid.org/experiences/subs/exp_Mimosa_hostilis.shtml	“...M Hostilis classically comprises a source of DMT made orally active by the addition of a plant containing harmful alkaloids for monoamine oxidase inhibition...”
Hallucinogenic phenethylamines 2,5-dimethoxy-4-ethylphenethylamine (2C-E); 4-(<i>n</i>)-Propyl-2,5-DMPEA (2C-P)	http://hipforums.com/forums/showthread.php?postid=65532#poststop http://66.102.9.104/search?q=cache:ZOBZWLTAbJsJ:hipforums.com/forums/search.php%3Fdo%3Dfinduser%26u%3D1145+the+hip+forum+and+2C-P&hl=en http://www.erowid.org/chemicals/4-acetoxy_det/4-acetoxy_det_primer.shtml	“...I plan on getting some 2c-e...also, what amount did you take?...” “...2C-P is the biz I hear...”
Tryptamine hallucinogens 4-acetoxy-DET (4-acetoxy- hydroxytryptamine); 4-acetoxy-DIPT; 4-OH-DIPT, 5-MeO-DALT (5-methoxy- diallyltryptamine)	http://www.catbull.com/alamut/Lexikon/Mittel/CZ-74.htm http://www.erowid.org/chemicals/4-acetoxy_dipt/4-acetoxy_dipt_primer.shtml	“...Recently, I had the opportunity to experiment with 4-acetoxy-DET and provide it to a few friends...”; “...The free-base form of 4-acetoxy-DET: smoking anywhere from 5–20 mg can provide an immersive full-flavored tryptamine experience...”

Table 4
Examples of unreported polydrug combinations patterns identified during the Psychonaut 2002 project Internet search

Tryptamines' combination with ketamine ("K")	http://www.erowid.org/chemicals/4_acetoxy_det/4_acetoxy_det_primer.shtml	"... Similar to our results with combining DMT/DPT/5-MeO-DMT with ketamine, combining 4-acetoxy-DET with ketamine also provides an incredible synergy. Highly recommended for the cosmic-mystical near-death inclined... Of the many things I have tried the DMT/K combination is my favorite medicine... Xenon gas while on mushrooms or LSD comes in at a close second..."
Combination of three piperazine compounds (BZP; 1-benzylpiperazine; TFMPP; 3-trifluoromethylphenylpiperazine monohydrochloride; mCPP; <i>m</i> -chlorophenylpiperazine) with cannabis and gamma-hydroxy-butyrate (GHB)	http://www.erowid.org/experiences/exp.php?ID=2394	"... 9:05 PM: Just swallowed a gelcap containing 110 mg of BZP, 60 mg of TFMPP, and 25 mg of mCPP. I significantly dropped the dosages of BZP and TFMPP from what I used the last time, since I am adding in a new compound, mCPP. The problem with piperazines is that there seems to be a wide range of opinions regarding dosage and effects... To some people, piperazines are the next best thing to MDMA... 9:35 PM: ... Kind of like a phenethylamine come-on but with a little more anxiety, which I think is largely psychosomatic. I opt to take 2.5 g of GHB and smoke a little cannabis..."

information on "new" recreational drugs and on unreported drug combinations, which may well represent emerging drug consumption trends.

Analysis of data from web pages showed that those who owned the domains were mostly either an individual or a group, whilst the governmental, educational and research websites were represented in only 19% of instances. In 9% of the sampled websites, information related to the technical procedures to be put in place to synthesize and/or to extract a number of different intoxicating drugs was given. This kind of information sharing was generally seen by the online community as a positive harm reduction approach; i.e.: extracting unwanted compounds made the drug allegedly more acceptable and less toxic. Online data of more concern (including description of ecstasy-type hallucinogenic drugs' purchase modalities) were found here to be the most readily and promptly accessible online. This is an intriguing issue, since it has been suggested that most consumers of recreational drugs (i.e.: MDMA; "ecstasy") access the Internet to obtain information (Falck et al., 2004). One could conclude that governments should invest more in websites as a preventative measure (Bogenschutz, 2001; Falck et al., 2004; Littlejohn et al., 2005).

In about 10% of websites we sampled, either drug-related items or psychoactive drugs were offered for sale. Since we did not fully complete the purchase procedure, no proof is given here that the vending websites could really provide those substances advertised. However, the recent US drug enforcement "Operation Web Tryp", which is likely to have inactivated some of the websites here mentioned (Table 2), identified indeed the presence of a real market of hallucinogens online, with sales from some of the vendors' websites amounting to \$20,000 per week (Drug Enforcement Administration, 2004). It is interesting to note that some of the compounds here described in Table 2 as being available for sale, like dextromethorphan, are involved in drug misuse circuits (Schifano, 2001) but have been studied as well for the treatment of specific addictions (e.g. cocaine; Steinmiller et al., 2003). This might be seen as a sort of a competition between

illicit drugs' production and research of new treatment opportunities.

4.2. Strengths of this study

The present Internet search allowed to elicit information on a few compounds and on a number of idiosyncratic combinations not reported in the Medline. As a consequence, these data are not routinely accessible by health professionals through learned material. The technical knowledge on new recreational compounds is hardly obtained through reference books and scientific journals. In fact, it takes some time for a paper to be published and this does not always match with rapid modification of drug using patterns (Schifano et al., 2005). One of the most interesting trends in the "drug-and-Internet" scenario (Schifano et al., 2003) is given by the dissemination of information on combination of psychoactive agents used. The pharmacological "know how" is often held within groups of users, who exchange information with each other without any contact with the scientific world (Riva, 2004). These combinatory self-experiments have probably occurred for decades but the potential of this information sharing should not be overlooked, because of the immediate and universal accessibility of online data. The psychoactive agents' combinations suggested here (Table 4) are worrying. In fact, from the Emergency Services' perspective, even the ketamine intake on its own shows a definite potential of psychotic episodes' induction (Krystal et al., 2005). As a consequence, one could think that the combination of ketamine with tryptamine psychedelics might bear some further, but unpredictable, level of neurotransmitters' imbalance. This seems to further highlight the gap in terms of our basic and clinical knowledge of polydrug misuse consequences (Schifano, 2004) and confirms the interest of web searches for the building up of an "early warning system".

One of the major values of this study is that online available information was assessed in 8 languages. Taken together, 5 of these languages (English, Spanish, Italian, German and French) are used by about 80% of those who access Google™

(Zeitgeist, 2004). The English-speaking countries were here well represented (about 54% of cases), but this may be explained by the sampling technique chosen, by language facilitation issues and by larger availability of the IT technology in their population. It seems that pro-drug websites were more represented in websites written in English with respect to others. Conversely, anti-drug websites were more frequently represented in websites written in another language. It may be that the customers' native language was used to make prevention and treatment information, which was likely to be addressed locally, more easily accessible. On the other hand, advertisement of sales of prescribing drugs and hallucinogens, which may constitute a legal issue in a number of countries, was possibly written in English to get both a wider audience and give the links' owners an increased level of anonymity. It is of interest, however, that some 6% of websites written in a language different from English offered information on new drugs.

4.3. Limitations of this study

One of the major limitations of the present study is given by the use of a fixed set of keywords during the "snapshot". In this sense, statistical data given here about the underlying nature of each website (i.e.: pro-drug; anti-drug, etc.) may be merely a reflection of the bias of the keywords used in the search. For example, one could think that instead of searching for "cannabis" websites, a search for "marijuana" would have led to many others. In this study, the keywords' limited selection was made to reduce the otherwise impractical number of pages to be visited. Similarly, the exclusive use of European and American languages, with a search being carried out with the help of two search engines more likely to be used in the western world countries, might have implications for the present findings. Illicit drugs routes might involve Arabic, Balkans, Asian and Russian Federation countries. The contacts between these countries and their European immigrants could be maintained through specific websites in the respective languages. Other Psychonaut 2002 exercises have been separately carried out, with both larger sets of keywords and with a more extended language coverage, to get an in-depth knowledge of data related to specific compounds (Schifano et al., 2005). In line with other reports (Lumb and Ruttu, 2001), the websites' search redundancy level found here was of about 50%. If the capture/recapture paradigm (Gemmell et al., 2004) is applied, one can think that the higher the level of redundancy of a search the higher the coverage/efficacy of the sampling technique used. It must be acknowledged that use of search engines may reach no more than 10–35% of all the online available information (Search Engine Watch, 2004) and use of trained software (e.g. metacrawlers) could possibly have improved the coverage of this study. It is also possible that more information is exchanged not through the web pages but through more private ways of communication (i.e.: newsgroups, chatrooms, mailing lists, newsletters, bulletin boards, etc.). Indeed, however, we aimed at carrying out here

an analysis of that information which was immediately available to the average user. The choice of searching the Internet using highly disparate terms such as "cocaine" and "tobacco" (which are specific substances) and "prescription drugs" or "manufacturing drugs" (which are general terms, with hundreds of examples) might be questioned as well. On the other hand, we aimed at achieving a general overview of the whole set of information on drug-related issues. One might wonder if it is possible to take a statistically representative sample of the Internet and if drawing inferences about the Internet based on the proportions derived is appropriate. From this point of view, an unlimited number of different sets of keywords could theoretically have been used and percentages here reported were wholly dependent on what was searched. Finally, due to the rapidly changing nature of the web any report on Internet issues, including the present one, might be considered somewhat out of date. Further studies should be carried out to shed more light on these issues.

5. Conclusions

Internet drugs' vendors transcend different countries' laws, making it difficult to take action against those engaging in illegal practices. Nations clearly cannot solve this problem without international help. Because of both the ease and rapidity of access, the Internet offers a flood of drug-related data that runs constantly ahead of that available to clinicians and regulatory authorities (Boyer et al., 2001; Halpern and Pope, 2001). Those who meet the prerequisites of literacy, Internet access and credit card ownership and who are most likely to come from the socio-economically privileged sections of society may possibly comprise the group of "expert drug users" (Littlejohn et al., 2005). The emergence of the Internet as an unregulated source of controlled substances is an important development that may have significant public health implications. Descriptions of this phenomenon are valuable to clinicians and public health professionals since patients and the general public are now using the Internet to obtain drugs, both licit and illicit (Boyer et al., 2001; Halpern and Pope, 2001; St. George et al., 2004).

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References

- AltaVista. (accessed October 23, 2003, at: <http://www.altavista.com>); 2004.
- Arin. (accessed March 8, 2005, at: <http://www.arin.net/whois/>); 2005.
- Bogenschutz MP. Drugs on the Internet. *Am J Psychiatry* 2001;158:2094–5.
- Boyer EW, Shannon M, Hibberd PL. Websites with misinformation about illicit drugs. *N Engl J Med* 2001;345:469–71.
- Drug Enforcement Administration. DEA announces arrests of website operators selling illegal designer drugs (accessed August 19, 2004, at: <http://www.dea.gov/pubs/pressrel/pr072204.html>); 2004.
- Falck RS, Carlson RG, Wang J. Sources of information about MDMA (3,4-methylenedioxymethamphetamine): perceived accuracy, importance, and implications for prevention among young adult users. *Drug Alcohol Depend* 2004;74:45–54.
- Gemmell I, Millar T, Hay G. Capture–recapture estimates of problem drug use and the use of simulation based confidence intervals in a stratified analysis. *J Epidemiol Community Health* 2004;58:758–65.
- Google. (accessed August 19, 2004, at: <http://www.google.com/technology/>); 2004.
- Halpern JH, Pope Jr HG. Hallucinogens on the Internet: a vast new source of underground drug information. *Am J Psychiatry* 2001;158:481–3.
- Krystal JH, Perry EB Jr, Gueorguieva R, Belger A, Madonick SH, Abi-Dargham A, et al. Comparative and interactive human psychopharmacologic effects of ketamine and amphetamine: implications for glutamatergic and dopaminergic model psychoses and cognitive function. *Arch Gen Psychiatry* 2005;62:985–94.
- Littlejohn C, Baldacchino A, Schifano F, Deluca P. Internet pharmacies and online prescription drug sales: a cross-sectional study. *Drugs Educ Prev Policy* 2005;12:75–80.
- Lumb PD, Ruddy GN. Forensic web watch. *J Clin Forensic Med* 2001; 8:99–100.
- Randomizer. (accessed May 6, 2004 at: www.randomizer.org); 2004.
- Rawaf S, Schifano F. The Internet, children, young people and substance misuse: co-ordinated approaches are needed to minimise the use of E-commerce to obtain drugs and prevent substance misuse. *Public Health Med* 2000;2:96.
- Riva G. From real to virtual communities: cognition, knowledge and intention in the World Wide Web. In: Wolfe CR, editor. *Learning and teaching on the World Wide Web*. San Diego (CA, USA): Academic Press; 2004.
- Schifano F. New trends in drug addiction: synthetic drugs Epidemiological, clinical and preventive issues. *Epidemiol Psichiatr Soc* 2001;10:63–70.
- Schifano F. A bitter pill? Overview of ecstasy (MDMA; MDA) related fatalities. *Psychopharmacol (Berl)* 2004;173:242–8.
- Schifano F, Leoni M, Martinotti G, Rawaf S, Rovetto F. Importance of cyberspace for the assessment of the drug abuse market: preliminary results from the Psychonaut 2002 Project. *Cyberpsychol Behav* 2003;6:405–10.
- Schifano F, Deluca P, Agosti L, Martinotti G, Corkery J and the Psychonaut 2002 research group. New trends in the cyber and street market of recreational drugs? The case of 2C-T-7 (“Blue Mystic”). *J Psychopharmacol* 2005;19:675–9.
- Search Engine Watch. (accessed August 13, 2004, at: <http://searchenginewatch.com/reports/index.php>); 2004.
- Steinmiller CL, Maisonneuve IM, Glick SD. Effects of dextromethorphan on dopamine release in the nucleus accumbens: interactions with morphine. *Pharmacol Biochem Behav* 2003;74:803–10.
- St. George BN, Emmanuel JR, Middleton KL. Overseas-based online pharmacies: a source of supply for illicit drug users? *Med J Aust* 2004;180:118–9.
- Zeitgeist. (accessed on November 18, 2004, at: <http://www.google.com/press/zeitgeist/zeitgeist-jun04.html>); 2004.