

THE RELATION OF INTERNET SEARCHING TO CLUB DRUG KNOWLEDGE AND ATTITUDES

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The effects of the recent explosion of Internet-based health information are little understood. Past research suggests that Internet information on drugs such as ecstasy and speed could increase knowledge of the drugs' potential danger while at the same time making attitudes towards them more accepting. To examine this question, a laboratory experiment was conducted in which participants were randomly assigned to search the Internet for information on "club drugs" or on an unrelated topic. Among those with no history of drug use, Internet searchers came to know more than nonsearchers about ecstasy and speed, and rated more highly the benefit of club drugs and their social disinhibiting effects. Among participants with a history of drug use, Internet searchers and nonsearchers showed fewer differences. The three main findings of this study were that searching increased knowledge, while normalizing risky behavior, but primarily for novices. This leads to the conclusion that people new to a health behavior may be most porous to new ideas presented on the Internet as they stabilize their mental model of the behavior.

Keywords: Club drug; Internet; Accuracy; Health communication

Obtaining health-related information over the Internet has become a commonplace, and even daily activity for many people. The number of Americans who have used the Internet to search for health information swelled from 53 to 73 million in the last two years (Fox and Ranie, 2002). The regular accessing of health information may amount to a massive public health intervention, the effects of which are largely unknown.

While some popular media have been quick to praise the usefulness of health information on the Internet, many researchers and government officials warn that the Internet contains substantial inaccurate information (Silberg *et al.*, 1997; Lindberg and Humphreys, 1998). For example, the Federal Trade Commission (FTC) has warned that the Web has substantial inaccurate information about treatments for diseases such as AIDS and cancer (FTC, 2000).

One response to the concern about inaccurate information on the Internet has been to formulate an agenda for assessing and increasing the quality of interactive health

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communication tools, including Internet-based health communication. The Science Panel on Interactive Communication has recommended several outcome measures to assess the effectiveness of Internet-based health communication, including increases in knowledge and changes in attitudes (such as perceived importance and intentions) (Robinson *et al.*, 1998). Although numerous studies have assessed whether Internet-based health information is accurate, few studies have assessed the impact of Internet searching on Robinson *et al.*'s outcome measures. The present study was conducted to offer an empirical examination of the effects of Internet searching on people's knowledge and attitudes.

ACCURACY OF HEALTH INFORMATION ON THE INTERNET

Most studies of the content of health-related web sites have found that the sites contain helpful if somewhat incomplete information. An authoritative study of the quality of Internet health information by Berland *et al.* (2001) examined the content of several hundred frequently visited web sites on breast cancer, childhood asthma, depression and obesity. They reported that English language web pages tended to be accurate but only moderately comprehensive. Other research supports the conclusion that the Internet contains mostly accurate, if incomplete, health information. Sandvik (1999) found that Internet information on female urinary incontinence was largely accurate and would be helpful to patients. Latthe *et al.* (2000) reported that web sites on menorrhagia (i.e., abnormally heavy menstrual flow) frequently failed to include critical information about the disease.

A smaller group of studies have found substantial inaccurate health-related information on the Internet. Davison (1997) reported that just under half of 76 sites provided dietary information inconsistent with Canadian governmental standards for good nutrition. Whereas health organizations' sites generally provided little misinformation (1.3%), many private vendors' sites provided a great deal of inaccurate information (57.1%). Pandolfini *et al.* (2000) reported that websites with information on managing cough in children were typically incomplete and that just under half of 19 sites contained more incorrect than correct information.

In general, there is helpful health information available on the Internet. Many web sites have incomplete information, a problem that may be remedied by people reading multiple sites. A smaller number of web sites may have incorrect information, but there is little similarity among sites when inaccuracy is found. It may be that inaccurate knowledge may accumulate in Internet users, but a more likely scenario is that readers will learn accurate information that is confirmed on multiple sites.

CHANGES IN WEB SURFERS' KNOWLEDGE AND ATTITUDES

The studies reviewed above do not directly assess the impact of Internet-based health information on people who "surf" the World Wide Web. What effect, if any, widespread use of the Internet is having on the accuracy of people's health beliefs and on their behavior is as yet unknown. Research on persuasion has shown that some communication modalities such as video can be more persuasive than others such as written communication (Chaiken and Eagly, 1976). Cassell *et al.* (1998) argue that the Internet

provides a unique opportunity for health communication because it combines elements of personal communication (i.e., tailoring of a message) and mass communication capacity. If this line of argument is correct, then Internet use should persuasively alter both knowledge and attitudes (see Brewer, in press, manuscript under review).

Support for the hypothesis that Internet use increases health knowledge is offered by Kalichman *et al.* (2002). In a cross-sectional survey of 147 patients with HIV, they found that Internet use correlated with more accurate knowledge about HIV treatment. Increased knowledge was accompanied by higher risk for transmitting HIV to other people. Based on the study by Kalichman *et al.* and reviews of health information on the Internet, it is reasonable to hypothesize that Internet use should generally be associated with higher levels of health knowledge in the domain searched, but could be accompanied by more permissive attitudes toward their use.

THE PRESENT STUDY

To address the gap in our understanding of the effects of Internet use, the present study explored the effects of searching for club drug information on the Internet. *Club drug* is a loosely defined term referring to drugs that are most frequently used by college students and teens in environments such as dance clubs and raves (Community Epidemiology Work Group, 2000). Club drugs include ecstasy (methylenedioxy-methamphetamine, also called MDMA), speed (methamphetamine), LSD (lysergic acid diethylamide), GHB (gamma-hydroxybutyrate), rohypnol, and ketamine. The adverse effects of the drugs vary, but they include cognitive impairment, depression, addiction, and overdose (Ropero-Miller and Goldberger, 1998).

Club drug information on the Internet may pose a substantial public health problem. Club drug use has risen in popularity to such an extent that the National Institute on Drug Abuse (NIDA, 1999) has sponsored a national initiative to combat their use. Increased knowledge about club drugs' negative effects would not be a cause for concern, but an increase in permissive attitudes toward their use would be. A population of high concern is college students who make extensive use of both the Internet and club drugs. As of December 2000, 75% of college age adults were online, and college educated adults showed the highest prevalence of Internet usage (82%) of any education cohort (Ranie and Packel, 2001). The Community Epidemiology Work Group (2000) identifies college students in New Jersey as having notably high use of the club drug ecstasy.

The first hypothesis was that increased exposure to information on the Internet would cause searchers to have more accurate knowledge about club drugs. The second hypothesis was that the increase in knowledge would be accompanied by an increase in permissive attitudes towards club drug use as a result of having been familiarized with the topic.

METHOD

An experimental design with random assignment was used to explore the two research hypotheses. Participants were randomly assigned to search for club drug information on the Internet or assigned to a control condition.

Participants

In April 2000, 117 undergraduate college students were recruited at a New Jersey university for a study about “how people obtain health information on the Internet.” When participants arrived for the study, they were told that they might obtain information about illegal activities as part of their search but that they were free to not participate or to ask for another search topic. All participants signed a consent form; none opted out of the study or requested another search topic. The Rutgers University institutional review board reviewed and approved the experimental protocol. The students participated in the experiment in exchange for course credit.

Data for one participant who failed to complete the postsession survey were dropped from all analyses. Participants were ethnically diverse (9% African-American, 22% Asian-Pacific Islander, 53% White, and 16% other ethnicity or not stated), had a median age of 20 (range 17–40), and were two-thirds women.

Procedure

All communications to participants were either read from a script or provided on an instruction sheet. Participants were individually seated at a Pentium computer equipped with Netscape Navigator 4.6, an Internet browser. Students participated in groups of 9–27. Participants received a five-minute group tutorial that introduced them to basic Internet search skills using Netscape Navigator. Each participant started with a search engine that was randomly assigned from this list: AltaVista, Ask Jeeves, Excite, Google, GoTo.com, Hotbot, LookSmart, Lycos, and Netscape. Participants were free to switch to another search engine.

Internet Search Conditions

After the tutorial, participants were handed printed search instructions that asked them to spend 40 min searching the Internet for information on a randomly assigned topic. The lab was set up such that people in different experimental conditions sat separately and could not see one another’s computer screen. Furthermore, participants were asked not to talk to one another during the experiment. Experimental condition participants received the following written instructions in which the order of the terms ecstasy and speed were counterbalanced:

“Imagine that a very close friend has started using club drugs. They just tried speed and ecstasy and have suggested that you should also try these drugs. They have asked you to look online to find out more information about club drugs because you have access to a computer. Be sure you learn something new about each of these things: speed (or methamphetamine), ecstasy (or MDMA) and club drug.”

Participants in the control condition received similar instructions telling them that a friend had recently purchased genetically modified foods at a local supermarket and that the friend had asked them to search the Internet for information on genetically modified foods.

Postsearch Survey

After participants had finished browsing the Internet, they were asked to complete a survey. The survey contained sections that asked about participants’ knowledge of

ecstasy and speed, attitudes towards club drugs, intentions to use drugs in the future, Internet use prior to the study, history of drug use, and basic demographic information. A posttest only design was used because random assignment should equalize the experimental groups on nontreatment variables and the potential effects of pretest sensitization are much more problematic. Experimental participants who first completed a pretest would surely have searched for information on the Internet selectively, making any changes in knowledge or attitudes suspect.

Prior Internet Search

A dichotomous variable was created to reflect whether participants had or had not searched for club drug information on the Internet prior to being in the experiment. Prior experience with Internet searching was nearly universal (97%), with a median of four years since first using the Internet, and a median weekly use of three hours. Surprisingly, most participants had previously searched the Internet for information on club drugs (76%).

Prior Drug Use

A dichotomous variable was created to reflect whether participants had or had not used drugs of any sort. (Analyses for participants with any history of drug use, whether club drugs or other drugs, are presented together, as separating by type of drug use did not significantly alter the pattern of results.) Participants were coded as having previously used drugs if they had ever used cocaine, ecstasy, GHB, ketamine, LSD, marijuana, methamphetamine, hallucinogenic mushrooms, or rohypnol. The majority of participants had used marijuana (53%), and many had used ecstasy (26%), hallucinogenic mushrooms (16%), and LSD (11%) (see Table I). Fewer than 10% had used cocaine, GHB, ketamine, rohypnol, or methamphetamine.

Knowledge About Ecstasy and Speed

Participants evaluated two sets of 24 statements about ecstasy and speed. Participants used a four-point Likert scale to record whether they strongly disagreed, disagreed, agreed, or strongly agreed with each statement. Correct responses, whether agreement or strong agreement, were coded as 1 and incorrect responses coded as 0. A single,

TABLE I Drug use reported by study participants

<i>Drug</i>	<i>Percent ever having used (%)</i>
Cocaine	7
Ecstasy (MDMA)	26
GHB	3
Ketamine	9
LSD	11
Marijuana	53
Mushrooms	16
Rohypnol	3
Speed (Methamphetamine)	4

TABLE II Questions assessing accuracy of knowledge about ecstasy and speed

Symptoms

1. You get really hungry when you're on [ecstasy/speed].
2. You get really thirsty when you're on [ecstasy/speed].*
3. Sometimes your jaws feel really tight when you're on [ecstasy/speed].*†
4. You can feel anxious when you're on [ecstasy/speed].†

Cause

5. [Ecstasy/speed] acts primarily on the peripheral nervous system.
6. [Ecstasy/speed] stimulates the release of serotonin.*
7. [Ecstasy/speed] stimulates the release of dopamine.†
8. [Ecstasy/speed] is neurotoxin.*†

Timeline

9. [Ecstasy/speed] can take up to 60 min to begin working.*
10. The effects of [ecstasy/speed] can last up to 24 h.†
11. [Ecstasy/speed] causes "flashbacks" of feeling high for up to a year.
12. The feeling of being high can come and go when you're on [ecstasy/speed].*

Consequences

13. Paranoia is a side effect of [ecstasy/speed] use.*†
14. [Ecstasy/speed] use can cause kidney failure.*†
15. [Ecstasy/speed] use is not related to heart disease.
16. [Ecstasy/speed] use is related to higher rates of transmission of HIV and AIDS.*†

Control/Cure

17. Addiction is a common problem among people who use [ecstasy/speed].†
18. There are medications that treat an overdose of [ecstasy/speed].
19. You can control the intoxicating effects of [ecstasy/speed] by taking Prozac.*
20. It's difficult to control the intoxicating effects of [ecstasy/speed].*†

Use

21. [Ecstasy/speed] is often injected intravenously.†
22. [Ecstasy/speed] can be snorted.*†
23. The latest studies show that [ecstasy/speed] use in on the increase.*
24. [Ecstasy/speed] is most commonly sold in pill form.*

* Correct for ecstasy; †Correct for speed.

summary accuracy score for ecstasy and another for speed were calculated that had a range of 0% (completely inaccurate) to 100% (completely accurate). Table II shows the items and the correct answers. The standard for accuracy was information provided by NIDA on their web sites.

Each set of 24 statements was structured using the mental models portion of Leventhal's self-regulation model (Leventhal *et al.*, 1984). The model posits that health and illness beliefs are composed of five factors: symptoms (the somatic experience of the health state), cause (the origin or etiology of the health state), timeline (the likely time course), consequences (the expected outcome or prognosis), and cure (available treatments). An additional sixth factor assessed topics specific to drug use. Four items assessed each of the six factors.

Attitudes About Ecstasy and Speed

Ten questions assessing participants' attitudes towards club drugs were separated into four factors based on the results of a principal components analysis with an Oblimin rotation (see Table III). The four factor solution (eigenvalues 4.19, 1.39, 1.03, and

TABLE III Loading of club drugs attitude items onto factors

	<i>Benefit</i>	<i>Fitting in</i>	<i>Fatality</i>	<i>Future use</i>
1. Using club drugs can be safe if proper precautions are taken.	0.87	-0.15	0.08	-0.06
2. The side effects of club drugs are only a minor nuisance.	0.75	-0.17	0.20	0.14
3. Using club drugs would enhance a party or a concert.	0.68	0.34	-0.20	0.04
4. Using club drugs can be fun.	0.66	0.27	-0.07	0.20
5. If I am high, I am more likely to talk to people who I do not know.	0.01	0.82	-0.05	-0.14
6. The use of club drugs would help me fit in at a party or concert.	-0.08	0.76	0.20	0.18
7. When using club drugs, there is a real risk of fatality.*	0.10	0.13	-0.95	-0.02
8. One should never experiment with club drugs.*	-0.10	-0.14	-0.12	0.92
9. I expect that I'll use a club drug in the future.	0.14	0.09	-0.18	0.80
10. Using club drugs would be a good experience.	0.31	0.23	-0.02	0.66

Note: Figures are standardized regression coefficients.;* Responses were reverse coded.

0.98) was established by examining the scree plot. The squared factor loading of any item on its principle factor was more than twice its squared loading onto any other factor.

The first factor, *benefit*, assessed participants' beliefs that using club drugs can be fun and safe, that side effects are only a minor nuisance, and that using them would enhance a social event. The second factor, *fitting in*, assessed whether using drugs helps people "fit in", and helps them talk to people they do not know. The third factor, *fatality*, assessed whether they believed that using club drugs can be fatal. The fourth factor, *future use*, assessed their belief that they will use a club drug in the future and that people should never use club drugs. Participants answered the questions using the same response scale described above. Their responses were coded to create a continuous variable (strongly disagree = 1 ... strongly agree = 4); two questions were reverse coded as noted in Table III. Scores for questions comprising each factor were averaged to form indices of benefit, fitting in, fatality, and future use. The internal consistency reliability was checked for indexes that comprised three or more items and was found to be very good (benefit $\alpha = 0.80$; future use $\alpha = 0.82$).

Data Analysis

The general approach was to examine how Internet searching and covariates predicted club drug knowledge and attitudes. A preliminary analysis identified the covariates by examining the correlations between predictor variables (i.e., Drug Use, Prior Internet Search, and Experimental Internet Search), demographic variables (i.e., white ethnicity, male gender, age, and education) and the dependent variables (i.e., knowledge and attitudes). The three variables that showed significant bivariate relations with one or more of the six dependent variables were: prior drug use, ethnicity, and gender.

The main analyses first employed a five-way MANOVA predicting the six knowledge and attitude variables. The independent variables were Experimental Internet Search, Prior Internet Search, Drug Use, White Ethnicity, and Male Gender. Only two variables interacted, Experimental Internet Search and Drug Use. The analysis reported below eliminates the nonsignificant interactions, and is thus a 2 (Experimental Internet Search) \times 2 (Drug Use) MANCOVA covarying Prior Internet Search, ethnicity, and gender.

RESULTS

Manipulation Check

It is possible that the random assignment to search for club drug information or on a control topic did not create equivalent groups. To address this question, a manipulation check was conducted. A multiple logistic regression showed the experiment and control groups did not differ in drug use, gender, age, education, weekly computer usage, years since first computer use, or having previously searched the Internet for club drug information (ORs = 1.00 to 1.93, n.s.).

Multivariate Analysis

A multivariate analysis examined whether Internet searching differently affected drug knowledge and attitudes. Knowledge and permissive attitudes towards drugs were higher among those who searched for drug information prior to the experiment, those who searched during the experiment, previous drug users, men and Whites. A 2 (Experimental Internet Search) \times 2 (Drug Use) MANCOVA covarying out the effects of Prior Internet Search, ethnicity, and gender and predicting the six Dependent Variables indicated significance for all univariate terms in the model, $F_s(1, 109) = 4.49$ to 17.28 , $ps < 0.0001$ to 0.05 .

The main effects were qualified by several multivariate interactions. The composite Dependent Variable from the MANOVA interacted with all terms involving Internet search (i.e., Prior Internet Search, Experimental Internet Search, and Exp. Search \times Drug Use), $F_s(7, 763) = 2.20$ to 3.11 , $ps < 0.005$ to 0.05 , but not the other covariates. The implication of the significant interactions was that additional univariate analyses were required to fully understand how Internet use affected drug knowledge and behaviors.

Univariate Analyses

The univariate analyses for each of the dependent measures are presented below and summarized in Table IV. To simplify presenting the results, effect sizes are reported in the text as semipartial correlation coefficients (i.e., r_s). All effects reported in the text are statistically significant (at $p < 0.05$) except as noted. The reader may question the meaning of an r reported for the interaction between Experimental Search and Drug Use (see Pedhazur, 1997). It is helpful to visualize the 2×2 table that describes their interaction. Specifically, the upper left cell (no search, no drug use) and bottom right cell (search and drug use) are pooled in the ANOVA and compared to the remaining two. The magnitude of the difference represents the effect size for the interaction. The interactions are also graphed in Figs. 1 and 2.

Ecstasy Knowledge

Knowledge about ecstasy was higher for people who searched the Internet during the experiment for club drug information ($r = 0.30$) or who had previously used drugs ($r = 0.23$). Search during the experiment and drug use interacted, as shown in Fig. 1. A post-hoc analysis revealed that nondrug users showed greater ecstasy knowledge as a result of searching (48 to 62% accurate, $r = 0.39$) while drug users showed no

TABLE IV Predictors of drug knowledge and attitudes

	<i>Prior Internet search</i>	<i>Experimental Internet search</i>	<i>Drug Use</i>	<i>Prior Internet search * drug use</i>	<i>White ethnicity</i>	<i>Male gender</i>
Knowledge						
Ecstasy	-0.02	0.30***	0.23**	0.29**	0.16 [†]	0.02
Speed	-0.01	0.40****	0.17*	-0.01	0.05	0.05
Attitudes						
Benefit	0.16*	0.14 [†]	0.27***	0.22**	0.18*	0.24**
Fit In	-0.03	0.18*	0.16 [†]	0.13	0.03	0.21*
Fatal	0.13	-0.04	-0.15	-0.05	0.23*	0.13
Future Use	0.25***	0.00	0.26***	0.08	0.16*	0.20**

[†] $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, **** $p < 0.0001$; *Note:* Numbers in the table represent semipartial correlations. (Semipartial correlations can be calculated by taking the unique sums of squares for a factor, dividing it by the corrected total sums of squares, and then taking the square root of the result).

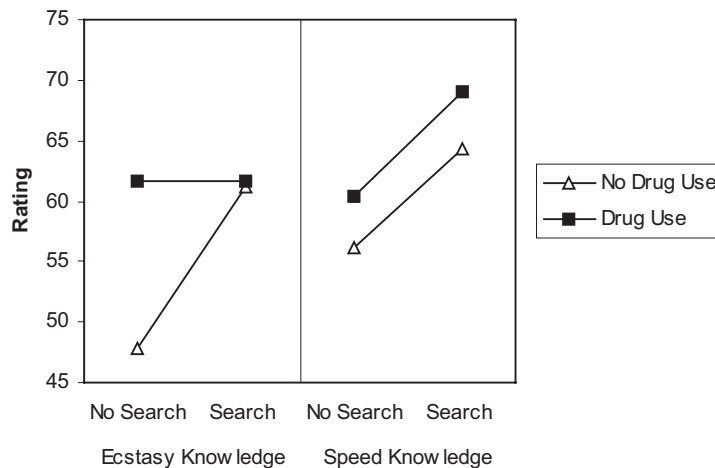


FIGURE 1 Relation of club drug knowledge to internet search (during experiment) and prior drug use.

difference as a result of searching (61 to 62% accurate, $r = 0.02$, n.s.). The adjusted R^2 for the model predicting ecstasy knowledge was 16%. An item level analysis of the ecstasy knowledge items showed significantly more accurate knowledge among experimental searchers (on items numbered 6, 19, 21, and 22) but never significantly less accurate knowledge.

Speed Knowledge

Knowledge about speed was higher for people who searched the Internet for club drug information during the experiment than for people who did not search (67 vs. 59% accurate, $r = 0.40$). Those who had previously used drugs knew more about speed than those who had never used drugs (66 vs. 62% accurate, $r = 0.17$). The two factors did not significantly interact, nor was there any significant effects of prior searching. The adjusted R^2 for the model predicting speed knowledge was 16%. An item level analysis of the speed knowledge items again showed only

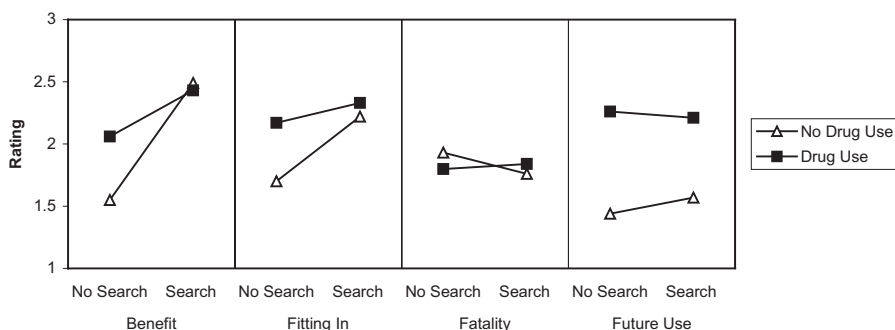


FIGURE 2 Relation of club drug attitudes to internet search (during experiment) and prior drug use.

significantly higher, but never lower, knowledge among experimental searchers (on items numbered 4, 5, 15, 17, 18, and 23).

Perceived Benefit

Although there was no main effect of Experimental Search on perceived benefit of club drugs, there was a main effect of prior drug use ($r = 0.27$) and an interaction of the two, as shown in Fig. 2. A post hoc analysis revealed that nondrug users showed higher perceived benefit as a result of searching ($r = 0.23$) while drug users showed no difference related to searching ($r = 0.06$, n.s.). Perceived benefit was higher among those who previously searched for club drug information than those who had not previously searched ($r = 0.16$). The adjusted R^2 for the model predicting perceived benefits was 29%.

Fitting In

People who searched the Internet for club drug information during the experiment were more likely than people who did not search to believe that club drug use may help them fit in when in a social situation ($r = 0.18$). No other variables were related to attitudes about fitting in. The total R^2 for the model predicting fitting in beliefs was 7%.

Fatality

Searching and prior drug use were unrelated to fatality beliefs. The adjusted R^2 for the model predicting fatality beliefs was 6%.

Future Use

Experimentally prompted Internet use showed no relation to attitudes toward future drug use. The finding stands in contrast to that for prior searchers who reported more affinity for future club drug use than those who had not previously searched ($r = 0.25$). Of course, the study's design does not permit an inference as to whether raised intentions led to more searching, or vice versa, or whether elevations in the two were related to an unmeasured third variable. Previous drug use ($r = 0.26$) also

positively predicted positive attitudes toward future drug use. The adjusted R^2 for the model predicting intentions was 33%.

Additional analyses showed that positive attitudes do not mediate the relation of future use intentions to prior internet searching. The author repeated the ANCOVA adding the other attitude variables (i.e., benefit, fatality and fitting in) as covariates with the expectation that the effect of Prior Searching on attitudes toward future use would drop to nonsignificance. The relation remained significant and positive. Of the three covariates added, only believing that the drugs are beneficial predicted intentions ($r=0.32$). The adjusted R^2 for the revised model was 45%.

A final set of analyses examined whether experimental searching moderated the relation of covariates to future drug use intentions. The analyses showed a trend toward attitudes replacing knowledge as a predictor of future use intentions. An ANCOVA was conducted, using as predictors knowledge (of ecstasy and speed), attitudes (benefit, fitting in, and fatality), and demographics (white ethnicity and male gender) as well as the interaction of each term with experimental Internet searching. The outcome measure was attitude toward future drug use. For the sake of brevity, only significant interactions and related follow-up analyses are reported. Ecstasy knowledge was marginally more strongly related to intended drug use for nonsearchers than for searchers ($p < 0.06$). Separate follow-up regressions showed a relation between ecstasy knowledge and intentions for nonsearchers ($r=0.29$) but not for searchers ($r=0.01$, n.s.). Searching caused attitudes toward fitting in to become marginally more positively related to intentions ($p < 0.06$). Fitting in was positively related to intentions for searchers ($r=0.17$) but not for nonsearchers ($r=-0.11$, n.s.).

DISCUSSION

There were three notable findings in the present study. First, the research hypotheses that Internet use would lead to more accurate knowledge and accepting attitudes towards club drugs were generally supported. Second, the effects of Internet searching were often strongest among those who had never used drugs. Finally, the findings for the experimental manipulation of Internet use differed from the cross-sectional measure. The two showed complexly different relations to different measures of knowledge and attitudes (see Table IV). Before discussing these findings, the author briefly discusses several limitations of the present study.

Limitations

First, the Internet is a rapidly changing medium. The findings of the present study may not generalize over time as the content of club drug websites change, as NIDA increases their efforts to combat club drug usage (1999), and as the legal status of club drug use evolves. Second, the present research used a posttest only experimental design. While the design has its strengths, it allows analysis only at the level of the group but not the individual. There may be individual differences that are obscured by the between-groups design. Also, the design does not allow inferences about the causal direction of within-groups effects, such as the effect of Internet use prior to the study. Third, the response scale that accompanied the club drug attitude questions offered only degrees of agreement or disagreement. It may be that participants who held no par-

ticular opinion were forced to offer one. Finally, participants were well educated and computer-savvy. While our findings are likely to generalize well to other college students, they may not generalize to youth who are less well educated or less computer literate.

Club Drug Knowledge

The present study found that searching for club drug information on the Internet increased mean levels of knowledge about the drugs. Internet searchers showed greater knowledge about speed, and searchers with no history of drug use showed higher levels of knowledge about ecstasy. The positive effect of searching on knowledge is especially surprising given the widespread alarm about inaccurate health information on the Internet (Silberg *et al.*, 1997; FTC, 2000). The finding of increased accuracy among searchers is an extension of previous research showing that the Internet contains much helpful health-related information (Galimberti and Jain, 1999; Sandvik, 1999; Berland *et al.*, 2001).

A sensible explanation for increased accuracy is that the web sites participants searched contained highly accurate information. To address this explanation, a single judge looked for the information assessed in the club drug knowledge questions on 16 of the web sites participants most frequently reported having used. It was common for sites not to have information relevant to topics assessed in the survey. On average, sites lacked information on 73% of the ecstasy items assessed and 66% of the speed items. What information the sites had tended to be accurate, with a few exceptions. On average, the information presented on ecstasy was 87% accurate and the information on speed was 88% accurate.

An alternative explanation for the observed increase in accuracy can be termed an "Anna Karenina effect." The novel's famous first line states that all happy families are alike but that unhappy families are all unhappy in their own way. It may be that accurate information gleaned by searchers is largely the same but that inaccuracies caused by web searching are unique to each searcher. The standardized, closed-ended surveys used in the present study may have undercounted inaccuracies that are infrequent for any one searcher but are present in some form for all searchers.

Club Drug Attitudes

Higher club drug knowledge was accompanied by more permissive attitudes towards the drugs. Searching for club drug information during the study led to stronger beliefs that the drugs would help the user be more at ease socially. Searching also caused those who had never used drugs to be more likely to believe the drugs would be beneficial. Participants' attitudes toward future club drug use were unaffected by their search during the experiment, a finding that is consistent with the fact that searching did not actually engender positive attitudes towards the drugs. (Strictly speaking, searching made attitudes less negative). Nonetheless, the decreases in negative regard for the drugs could have a delayed effect such that searching may influence behavior toward increased use when in high-stakes situations such as being offered drugs by friends. The findings suggest that concern should shift from the presence of inaccurate information to how Internet use changes attitudes. This conclusion is bolstered by the finding of

the moderational analysis showing that Internet searching tends to weaken the role of knowledge but bolster the role of attitudes.

Experimental *versus* Cross-sectional Finding

One of the unexpected findings of the present study is that the experimental manipulation of Internet searching lead to findings that were quite dissimilar to the cross-sectionally measured correlate of prior Internet searching. A glance at the Internet Search columns of Table IV shows that experimental effects were, in most cases, larger. A notable exception is that future use attitudes were more positive among students who had searched prior to the experiment for drug information than those who had not. The relation of past searching to future use attitudes held even when other attitudes were covaried out. The finding stands in contrast to the independence of intentions from the experimental searching.

Several other studies have shown similar effects (Brewer, in press, manuscript under review). Experimentally induced Internet searching on HIV infection and multiple sclerosis (MS) led to substantial increases in knowledge among college students. Cross-sectionally assessed Internet searching on the same topics showed little effect on MS and HIV-positive patients' knowledge. Similarly, experimental searches by students lead to increases in perceived knowledge (and overconfidence) that were far larger than similar increases among patients.

While it is possible to speculate about the reasons for the difference between experimental and cross-sectional findings (see Brewer, in press), competing explanations cannot be ruled out given the design of the present study. An explanation that fits the data is that changes in knowledge decay quickly over time, perhaps because the information learned was only shallowly encoded during the reading of multiple websites. The related changes in attitudes are more durable but the attitudes caused by searching take time to alter intentions. Whatever be the reason for the differences in the results of the two methodologies, the findings suggest that it may be difficult to compare the findings of studies of Internet use that employ experimental and nonexperimental methodology.

Novice Drug Users

Another unexpected finding was that the people most affected by Internet searching were those with no history of prior drug use. They showed higher knowledge about both speed and ecstasy and thought that club drug use would be less harmful when they searched. However, participants with a previous history of drug use only showed higher knowledge about speed as a result of their searching but did not otherwise change. It may be that people update their health beliefs differently as a result of searching the Internet, depending on their past experience with the particular health behavior. This conclusion has the interesting implication that we should be most concerned about the influence of the Internet among people who have not yet used club drugs. People new to a health behavior are likely to be still fleshing out their mental model of the behavior and may be most porous to new ideas presented on the Internet.

In summary, the present study demonstrates the necessity of empirical research to answer the question of how exactly Internet-based health information is affecting

users. The three main findings of this study—that searching increases knowledge, while normalizing risky behavior, but only for novices—are unexpected or altogether contradict common wisdom about Internet use. Additional empirical work is needed to assess what impact Internet searching may have on health behavior.

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