Published in final edited form as:
*J Subst Abuse Treat*. 2012 December ; 43(4): 397–401. doi:10.1016/j.jsat.2012.09.005.

# Attitudes toward technology-based health information among adult emergency department patients with drug or alcohol misuse☆,☆☆

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## Abstract

Technology-based screening and interventions are emerging solutions to the challenge of addressing substance use in the emergency department (ED). A standardized questionnaire of adult patients at a large-volume, urban, academic ED assessed interest in, and potential barriers to, technology-based substance use information. Questionnaire topics included substance use, access to technology, preferences for health information, and perceived barriers to technology interventions. Among the 430 participants, mean age was 39 years and 55% were female; 37% reported alcohol misuse and 52% drug misuse. Access to technology was high. Technology was preferred by 46% of alcohol misusers (vs. 43% non-misusers, $p$=0.65) but only 41.9% of drug misusers (vs. 56% non-drug misusers, $p$=0.005). In multivariate analyses, drug misuse was associated with decreased interest in receiving technology-based information. Cited barriers included confidentiality, complexity, and time. Our findings suggest that drug misusers in particular may wish to have reassurances about the confidentiality of technology-based interactions.

### Keywords

Substance abuse; Substance use disorders; Alcohol abuse; Drug abuse; Drug use disorders; Emergency medicine; Technology; Computers

## 1. Introduction

Substance use has been described as the most important modifiable health behavior in the emergency department (ED) (Bernstein & D'Onofrio, 2009). Risky alcohol use and illicit drug use are more common among ED patients than in the general population; these patients

☆Presentations: Presented as a poster at the American College of Emergency Physicians Scientific Assembly, San Francisco, CA, October 15, 2011.

☆☆Financial support: None.



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are frequent ED users, typically have not had substance use treatments, and often do not have a primary care provider (Rockett, Putnam, Jia, Chang, & Smith, 2005). Therefore, the ED has come to be seen as an important venue for screening patients for substance use problems, providing appropriate referrals, and potentially providing bedside interventions for reducing dangerous substance use. However, numerous barriers—including clinicians' time constraints, lack of training in providing effective interventions, and lack of knowledge of appropriate follow up resources—prevent effective delivery of behavioral health screening and interventions in the ED (Delgado et al., 2011; Fein et al., 2000; McGrath et al., 1997; Meadows, Valleley, Haack, Thorson, & Evans, 2011; Waalen, Goodwin, Spitz, Petersen, & Saltzman, 2000; Yarnall, Pollak, Østbye, Krause, & Michener, 2003).

Technology may be a potential solution to these barriers (Revere & Dunbar, 2001). Computer- or Internet-based interventions delivered in the ED could provide high-fidelity interventions that would not require the expertise or time of individual practitioners, and could be tailored based on the responses of individual patients (Amstadter, Broman-Fulks, Zinzow, Ruggiero, & Cercone, 2009; Mackenzie et al., 2007; Noar, 2011; Walton et al., 2008; Webb, Joseph, Yardley, & Michie, 2010). Interventions and boosters could also be delivered post-discharge using technology such as automated text messages or e-mails, formats that may be more convenient than following up in person in a clinic or office (Amstadter et al., 2009; Chen, Mishara, & Liu, 2010; Cornelius & St Lawrence, 2009; Heron & Smyth, 2010; Mackenzie et al., 2007; Noar, 2011; Walton et al., 2008; Webb et al., 2010). Computer interfaces also offer privacy, intimacy, and anonymity—qualities that have been shown to make patients more comfortable divulging sensitive topics such as alcohol and drug use or sexual behaviors (Rhodes, Lauderdale, He, Howes, & Levinson, 2002; Rhodes & Pollock, 2006; Turner et al., 1998).

However, little is known about the acceptability of technology-based behavioral health interventions among patients with substance use problems. While prior ED studies have reported acceptability of individual computer-based interventions for substance use among subjects meeting specific study criteria (Boudreaux et al., 2009; Karlsson & Bendtsen, 2005; Vaca, Winn, Anderson, Kim, & Arcila, 2010), we lack information about general attitudes toward technologies that might be employed to engage individuals with substance use problems presenting to the ED. Gaining more knowledge about substance-using patient perceptions regarding the use of current technologies—and, more importantly, identifying which patient populations are most amenable to technology-based interventions—will provide critical information for physicians and researchers seeking to minimize the barriers to uptake of these technologies for screening, intervention and follow up in the ED (Rhodes et al., 2002; Rhodes & Pollock, 2006; Samal et al., 2010; Turner et al., 1998).

This study had two objectives. First, we wished to assess accessibility of technology and interest in technology-based health information regarding substance use among patients who report drugs or alcohol misuse, compared to other patients. Second, we wished to identify specific potential barriers to the use of technology-based interventions among patients with drug or alcohol misuse.

## 2. Materials and methods

### 2.1. Study design and setting

This study is a secondary analysis of data collected for a cross-sectional questionnaire of overall technology preferences; thus, it represents an examination of the technology preferences in the subset of subjects with substance use problems. The study enrolled eligible adult patients presenting to an urban, academic ED with an annual census of 110,000 patients per year. The hospital serves a population approximately 60% white, 20% African-American, and 20% Hispanic, with 30% on public assistance.

### 2.2. Selection of participants

Research assistants (RAs) enrolled a random sample of patients 18 years or older presenting to the ED during a purposive sample of shifts between 7 am to 11 pm, 7 days a week, over a 9-month period in 2010. A computerized random number generator directed the RAs to a random ED room number; the patient in that room was then screened for eligibility.

Patients were eligible for participation if they were clinically stable and literate in English. Patients were excluded if they presented with a psychiatric chief complaint; were unable to provide consent (e.g. medically unstable, intoxicated, or altered mental status); were a prisoner or detainee; were a victim of sexual assault; or reported previous completion of the study. If eligible, verbal consent was obtained prior to questionnaire administration. Approached patients were offered a packet of printed information containing treatment resources for the health behaviors measured in the questionnaire. Participants were offered a $2 gift card on completion of the questionnaire.

All study procedures were approved by the institutional review board of the participating hospital.

### 2.3. Methods of measurement, data collection, and processing

The questionnaire was designed using standard principles of survey development, expert consultation, and, when available, existing validated questions (Choi & Pak, 2005; Beatty, 2004). Questionnaire topics included: (1) current access to and use of technology; (2) interest in a variety of technologies (including computer, Internet, mobile phone calls, mobile phone text messaging) for information about reducing alcohol or drug use; (3) health behaviors; and (4) basic demographics. Further, patients who did not state a preference for technology options received follow-up questions about specific potential concerns regarding technology use. Questions regarding participants' current technology use and health information preferences were adapted from previous surveys administered to patient populations (Chen et al., 2010; Cornelius & St Lawrence, 2009; Denizard-Thompson, Feiereisel, Stevens, Miller, & Wofford, 2011; Holmes, Ohr, & Shea, 2005; Delgado, Ginde, Pallin, & Camargo, 2010; Pena, Watson, Kvedar, & Grant, 2009; Salo et al., 2004) and included access to and use of computers, the Internet, social networking, cell phones and text messaging. "Technology" intervention preferences were defined as preferring an intervention via Internet (Web site), text message, e-mail, social networking site (e.g.

Facebook, MySpace), or DVD. “Non-technology” intervention preferences were defined as preferring an in-person intervention, written brochures, or conventional phone calls.

Alcohol use was assessed using a short version of the Alcohol Use Disorders Identification Test (AUDIT). The full, 10-item AUDIT contains questions on the amount and frequency of drinking, alcohol dependence, and problems caused by alcohol. It has been shown to reliably distinguish participants with harmful or hazardous alcohol use from non-hazardous drinkers (Bohn, Babor, & Kranzler, 1995; Bradley et al., 2007). The AUDIT-C consists of the first three questions of the AUDIT, which ask about consumption: frequency of drinking, quantity consumed at a typical occasion, and frequency of heavy episodic drinking. The AUDIT-C is scored on a scale of 0–12. In men, a score of four or more is considered positive for hazardous drinking; in women, a score of three or more is positive. The AUDIT-C has performed favorably compared to the full AUDIT in screening for risky drinking (Aalto, Alho, Halme, & Seppä, 2009; Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998).

Drug use was assessed using the National Institute of Drug Abuse–modified Alcohol, Smoking and Substance Involvement Screening Test (NM-ASSIST) (NIDA, 2009). The original ASSIST is an eight item questionnaire that assesses lifetime and past 3-month substance use, problems related to substance use, risk of drug-related harms, drug dependence and injection drug use. ASSIST has demonstrated validity and reliability for identifying substance use and distinguishing varying levels of use (Ali et al., 2002; Humeniuk et al., 2008). The NIDA-modified version of ASSIST separates drug use questions from those addressing alcohol and tobacco use, distinguishes between prescription and illicit drug misuse, and is available as a Web tool. Drug misuse is defined by this scale as past 3-month illicit drug use or non-medical use of prescription drugs.

Other health behaviors queried included involvement in violence, sexually transmitted infection (STI) risk factors, and mental health. Demographic questions (age, race, gender, ethnicity, education level, income) were drawn from the Behavioral Risk Factor Surveillance System (Centers for Disease Control and Prevention, 2008). For the purpose of analysis, race was collapsed into categories of white, black and Other. Income was collapsed into below the poverty line (income <$25,000, or reporting receiving public assistance) versus above the poverty line.

After initial design, the questionnaire was reviewed by experts in survey development and behavioral interventions and tested with 10 participants to assess cognitive understanding and readability. It was then formally piloted with 10 adult ED patients. The final, self-administered questionnaire consisted of 71 questions, including a mixture of yes/no, multiple-choice and ordered-ranking formats.

Consenting participants completed the questionnaire on an iPad using DatStat Illume (Seattle, WA), a HIPAA-compliant Web-based survey program. If patients expressed discomfort using the iPad, they were permitted to complete the questionnaire on paper; paper data were entered immediately into DatStat by an RA.

### 2.4. Primary data analysis

We estimated descriptive statistics (means, proportions) for demographic characteristics, technology use, preferences for receiving information about substance use, and concerns about technology. We used *t*-tests and chi square tests to make univariate comparisons between patients endorsing substance misuse and those denying substance misuse. After examining for collinearity between dependent variables, we performed multivariable logistic regression to assess associations between preferences for technology-based information and drug or alcohol misuse, adjusting for demographic factors that might influence attitudes toward technology (including age, gender, race and income level). Goodness-of-fit of the models was assessed using the Hosmer–Lemeshow test. Statistical analyses were conducted using Stata 10 SE (Stata Corp LP, College Station, TX).

## 3. Results

Of 964 adult patients screened, 656 (68%) met eligibility criteria; 430 (66%) of these consented and completed the questionnaire. There were no differences in mean age or gender between patients who consented and those who declined. One hundred sixty (37%) subjects reported risky alcohol use and 222 (52%) reported drug misuse; in total, 273 (63%) subjects were positive for substance use, with some subjects reporting both alcohol and drug misuse. Those reporting either alcohol or drug misuse were younger than non-substance-using patients; among alcohol misusers, there were more white and fewer black patients than among non-alcohol misusers. No other differences were detected in gender, race, or income level between the groups (see Table 1).

Overall, access to technology was high among substance-misusing patients: 89% reported computer use, 75% Internet use, 55% social networking, 97% cell phone use, and 72% text-messaging. More patients with alcohol misuse reported cell phone use (98.7 vs. 92.9%, $p$=0.007) and texting (75.6 vs. 65.2%, $p$=0.03) than those without alcohol misuse; more patients with drug misuse reported using a computer (90.9 vs. 83.0%, $p$=0.015), Web sites (79.5 vs. 63.5%, $p$= 0.001) and texting (77.2 vs. 60.1%, $p$<0.001) than those without drug misuse. Many patients with alcohol (47.7%) and drug (41.9%) misuse expressed a preference for technology-based means of receiving information about substance use. In the logistic regression analysis (Table 2), after adjusting for demographic factors, drug misuse was associated with *decreased* odds of preferring technology-based information about substance use (OR 0.40, 95% CI 0.24, 0.73). In contrast, there was no association between alcohol misuse and odds of technology preference.

For all types of technology-based interventions, the most common concern was confidentiality, with 48% of risky drinkers and 54% of drug misusers selecting this as a reason for *not* selecting a technology as their favorite means of receiving substance use information. Time (alcohol, 36.3%; drugs, 36.5%) and complexity (alcohol, 20%; drugs, 25.7%) were other commonly selected barriers identified by study subjects.

## 4. Discussion

Incorporating patient values and preferences is a key step in developing interventions and treatment guidelines (Krahn & Naglie, 2008). Exploring attitudes of patients with substance misuse toward a variety of potential intervention delivery mechanisms could allow the ED to focus efforts on developing interventions most likely to gain traction in this patient population and to address specific patient concerns during intervention design. Computerized alcohol interventions providing screening, brief interventions, and/or tailored feedback or referrals have been developed, although thus far used only in a research context. Results have been mixed, with some studies demonstrating effects on alcohol-related consequences but no main effects (Walton, 2010), and others demonstrating early promise for reducing alcohol use (Vaca, 2011). As technologies for substance use in the ED continue to emerge—and begin to address the needs of those with risky drug as well as alcohol use—we hoped this study might contribute information that will allow researchers to anticipate and address potential technology-specific barriers. This is particularly crucial if technology-based ED interventions are to improve not only upon the feasibility and disseminability of in-person brief interventions, but also upon the often modest effects of these brief interventions on alcohol use (Bernstein & Bernstein, 2008; Field, Baird, Saitz, Caetano, & Monti, 2010; Havard, Shakeshaft, & Sanson-Fisher, 2008; Nilsen et al., 2008).

In this study, most patients with drug and alcohol misuse reported using technology, often in higher proportions than the general ED population. Substance-misusing patients have been difficult to engage in interventions and contact for follow-up assessments; thus, this high level of access to technology is intriguing, and supports the notion that computers and mobile technologies may increase researchers' ability to improve recruitment and minimize attrition bias in this population. Of note, our study population had a higher proportion of drug misuse compared to earlier estimates of ED populations (Rockett, Putnam, Jia, & Smith, 2006). Use of self-administered computerized questionnaires has been noted to strikingly increase the reporting of illicit drug use (Tourangeau & Smith, 1996; Turner et al., 1998); this effect seems to be less sizable for alcohol (Turner et al., 1998), perhaps because alcohol is a legal substance. Another possible reason that subjects were more likely to report drug misuse in our study was because these questions were embedded in an extensive questionnaire that contained many other topics; this lengthy questionnaire may have destigmatized the substance-related questions. Finally, although we did not detect demographic differences between eligible patients who chose to participate and those who declined, it may be that those who were comfortable with technology (ie, felt interested in taking a questionnaire administered on an iPad) were also more likely to misuse drugs or confide drug misuse through a computer.

In the adjusted analysis, those reporting drug misuse had decreased odds of selecting a technology option for substance use information than non-drug using subjects. Questions regarding barriers to engaging in technology-based behavioral interventions suggest a reason for this finding. Confidentiality was drug misusers' most commonly selected concern about technology-based interventions, with over half of drug-misusing patients indicating this as a concern.

We note that these concerns regarding confidentiality are at odds with the literature demonstrating comfort with computer-delivered questions about sensitive topics (Tourangeau & Smith, 1996; Turner et al., 1998) and also with our subjects' apparent willingness to divulge drug use, as demonstrated by the high prevalence of drug use reported in this study. It may be that subjects distinguish between admitting drug use in the context of an anonymous questionnaire and receiving information tailored to them in a personal way that implies that others—including potentially their healthcare providers in the ED—will know about their drug use. Further research, including qualitative interviews with drug users in the ED, may help identify more specific reasons for this contradiction. Although high standards of confidentiality and privacy are required within our health care systems and research review boards, clarifying these standards to patients may facilitate participation in technology-based interventions regarding substance use.

A few studies show that interventions addressing substance use are feasible and potentially efficacious in reducing high-risk health behaviors in the ED (Maio et al., 2005; Vaca et al., 2010). However, the real-life effectiveness of these types of programs for addressing substance use in the ED remains unknown. Our exploratory study suggests that drug misuse may be particularly challenging to address when using technology-based applications to address behavioral health issues in the ED, due to confidentiality and other concerns. Given the modest results to date of alcohol interventions on reducing alcohol use, this information and future studies aimed at further elucidating specific concerns (and means to alleviate the concerns) will be critical to emerging work on interventions inclusive of, or focused on, drug misuse.

## 5. Limitations

As often is the case with secondary data analysis, the information collected on the population of interest is limited. We do not know about patient attitudes toward specific types of substance use information, their experiences with prior substance use treatments, or their motivation or readiness to change. It is also possible that questionnaire non-responders differed from responders, although we did not detect demographic differences between these groups. While we used standardized assessments wherever possible, many questions regarding technology preferences had no precedent and were developed de novo by the study team. Although piloted and refined, our questionnaire did not undergo formal tests of validity and reliability. Further, we acknowledge that stating interest in technology in a questionnaire may not translate into agreeing to participate in a technology-based intervention when actually offered. Finally, this study was conducted at a single institution, which may limit its generalizability to other settings.

## 6. Conclusions

In this study, most ED patients with substance misuse reported use of technology, and many indicated a preference for receiving information about reducing substance use via newer technologies rather than traditional formats. However, the apparent reservations of drug-using patients and concerns about confidentiality underscore the importance of creating an environment that patients perceive as secure when providing screening and interventions in

the ED. A better understanding of patient preferences and concerns, including those specific to subgroups of substance-using patients, may assist researchers and public health advocates in identifying the best means of reaching and intervening effectively in this population.

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*J Subst Abuse Treat*. Author manuscript; available in PMC 2015 February 12.

**Table 1**

Background characteristics of study population.[a]

| Patient characteristics | Total (n=430) | Alcohol misuse (n=160) | Test statistic[b] (t or $\chi^2$), *p* value | Drug misuse (n=222) | Test statistic[c] (t or $\chi^2$), *p* value |
|---|---|---|---|---|---|
| Age, mean (SD) | 39.4 (16.7) | 35.6 (17.3) | $t$=3.58, $p$<0.001 | 36.6 (18.5) | $t$=3.81, $p$<0.001 |
| Female gender, *n* (%) | 229 (54.7) | 76 (47.5) | $\chi^2$=5.37, $p$=0.07 | 119 (53.6) | $\chi^2$=0.22, $p$=0.89 |
| Race, % | | | $\chi^2$=8.84, $p$=0.01 | | $\chi^2$=2.91 $p$=0.23 |
| White | 248 (63.8) | 100 (71.4) | | 144 (66.7) | |
| Black | 49 (12.6) | 9 (6.4) | | 28 (13.0) | |
| Other | 92 (23.7) | 31 (22.1) | | 44 (20.4) | |
| Income category, % | | | $\chi^2$=2.92, $p$=0.09 | | $\chi^2$=0.17, $p$=0.68 |
| ≤poverty level | 196 (53.9) | 68 (48.2) | | 109 (52.9) | |

[a] Percentages reflect complete case analysis.

[b] Comparison is between alcohol misusers and alcohol non-misusers.

[c] Comparison is between drug misusers and drug non-misusers.

## Table 2

Logistic regression model for substance use and interest in tech-based health information.

| Patient characteristics | Alcohol model odds ratio (95% CI) | Drug model odds ratio (95% CI) |
|---|---|---|
| Age | 0.97 (0.95–0.99) | 0.97 (0.95–0.99) |
| Female gender | 0.85 (0.48–1.49) | 0.83 (0.47–1.47) |
| Race | | |
| White | Reference | Reference |
| Black | 1.80 (0.75–4.33) | 1.98 (0.81–4.79) |
| Other | 1.25 (0.64–2.44) | 1.08 (0.54–2.15) |
| Income category | | |
| ≤Poverty level | Reference | Reference |
| >Poverty level | 1.50 (0.83–2.73) | 1.58 (0.86–2.90) |
| Alcohol misuse | 0.84 (0.46–1.53) | N/A |
| Drug misuse | N/A | 0.40 (0.24–0.73) |