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Smartphone and Mobile Application Utilization Prior to and Following Treatment Among Individuals Enrolled in Residential Substance Use Treatment

Jennifer Dahne and **C. W. Lejuez**

Center for Addictions, Personality, and Emotion Research, University of Maryland, College Park, 2103 Cole Student Activities Building, College Park, MD 20742, United States

Abstract

Background—Following completion of substance use treatment, it is crucial for patients to continue to utilize skills learned in treatment for optimal treatment outcomes. Mobile applications (apps) on smartphones offer a unique platform to promote utilization of evidence-based skills following completion of substance use treatment. Despite the promise of mobile apps and smartphones for treatment delivery, it remains unknown whether patients in substance use treatment in the United States have access to smartphones and utilize mobile apps on smartphones. The present study sought to determine smartphone utilization among individuals enrolled in one residential substance use treatment center in the U.S catering specifically to low-income adults.

Methods—Participants included 251 individuals at a residential substance use treatment center in Washington DC admitted to the center between March, 2014 and January, 2015. During the intake process, participants completed interviewer-administered demographics and psychiatric questionnaires as well as a self-report of technology utilization.

Results—Results indicated that the majority of patients in this residential substance use treatment center owned mobile phones prior to treatment entry (86.9%) and expected to own mobile phones after leaving treatment (92.6%). Moreover, the majority of these phones were (68.5%) or will be smartphones (72.4%) on which patients reported utilizing mobile applications (Prior to treatment: 61.3%; Post treatment: 64.3%) and accessing the internet (Prior to treatment: 61.3%; Post treatment: 65.9%).

Conclusions—Mobile phone and smartphone ownership among this sample were comparable to ownership among U.S. adults broadly. Findings suggest that smartphones and mobile apps may hold clinical utility for fostering continued use of treatment skills following substance use treatment completion.

Correspondence concerning this article should be addressed to Jennifer Dahne, Center for Addictions, Personality, and Emotion Research, University of Maryland, College Park, 2103 Cole Student Activities Building, College Park, MD 20742, United States. jdahne@umd.edu. Phone number: (443) 625-8435.

Keywords

mobile applications; smartphones; technology; substance use treatment

1. Introduction

In 2012, at any given time, more than 1.25 million individuals were enrolled in the 14,500 dedicated substance use treatment centers in the United States (National Institute on Drug Abuse, 2012; Substance Abuse and Mental Health Services Administration, 2013). While treatment itself is crucial to recovery, it is also necessary for patients to continue to utilize skills learned during the course of substance use treatment following completion of treatment as patients who more frequently utilize treatment skills tend to have better treatment outcomes following treatment completion (Hundt et al., 2013). In recent years, a number of mobile applications (apps) have been developed that adhere to evidence-based substance use treatment principles. These apps may be ideal for helping patients to continue to use treatment skills after completing substance use treatment.

Utilization of mobile app therapies for promoting evidence-based skill use following the completion of substance use treatment is predicated on patients having access to smartphones capable of downloading mobile applications. Despite the potential promise of smartphones and mobile apps for addressing gaps in substance use treatment research, few studies to date have examined smartphone ownership and mobile app utilization among individuals in substance use treatment. One study by Milward and colleagues (2015) with patients enrolled in four United Kingdom (U.K.) community drug treatment programs found that 83% of patients reported owning a mobile phone, 57% of which were smartphones. Moreover, 72% of patients in this study had pay-as-you-go contracts, which may be related to more frequently changing phone numbers and lower treatment retention (McClure et al., 2013). An additional study by McClure and colleagues (2013) solely examined technology utilization among individuals in substance use treatment in the U.S., but did not gauge smartphone or mobile application utilization. Results of this study suggest that 91% of patients had access to a mobile phone and 79% utilized text messaging. Moving forward from these two studies to understand the potential use of evidence-based smart phone apps for substance use treatment in the United States, it is important to consider access to smartphones, particularly among low-income patients in the most intensive levels of care (i.e., residential treatment) as these patients may have the greatest treatment needs.

The present study sought to determine smartphone utilization among individuals enrolled in a residential substance use treatment center in the U.S catering specifically to low-income adults. To extend previous research by Milward et al. (2015) and by McClure et al. (2013), within smartphone utilization, we were specifically interested in: 1) mobile phone ownership, 2) SMS text messaging capability and utilization, 3) smartphone ownership, 4) utilization of mobile apps, 5) utilization of a smartphone to access the internet, and 6) contract type. An additional exploratory aim of the present study was to examine associations between demographic variables and mobile phone utilization.

2. Methods

2.1 Participants

Participants included 251 individuals admitted to a residential substance use treatment center in Washington DC between March, 2014 and January, 2015. Demographic information for participants is shown in Table 1.

2.2 Procedure

Permission to conduct research was obtained from the University of Maryland Institutional Review Board. Data for the present study was collected as part of an intake to treatment interview at the residential substance use treatment center during which doctoral-level trained interviewers asked patients questions about their substance use history, psychopathology, and smartphone utilization. At the end of the interview, participants were given the option to provide informed consent for the data they shared to be used for research purposes. More than 95% of individuals did consent to be included in research and are included here.

2.3 Measures

Demographic Information—Demographic information (sex, age, race, education) was collected using the demographic portion of the Psychiatric Research Interview for Substance and Mental Disorders (PRISM; Hasin et al., 1996).

Substance Use and Psychopathology—As part of the standard intake battery at the treatment facility, psychiatric history and current psychopathology were diagnosed by trained doctoral-level interviewers using the Structured Clinical Interview for the DSM-IV-TR (First, Spitzer, Gibbon, & Williams, 2002).

Mobile Phone Utilization—Mobile phone utilization was assessed using an adapted version of the communication technology questionnaire developed by McClure and colleagues (2013). Questions gauged mobile phone and smartphone utilization both prior to and following treatment. Questions assessed: 1) mobile phone ownership (Y/N), 2) contract type (pay-as-you-go, annual contract, government issued/Safelink, other), 3) phone SMS text messaging capability (Y/N), 4) SMS text messaging utilization (Y/N), 5) smartphone ownership (Y/N), 6) mobile app downloads (Y/N), and 7) using the phone to access the internet (Y/N). We refer to questions regarding technology utilization prior to treatment as “prior to treatment” and questions regarding anticipated technology utilization following treatment discharge as “post treatment.”

2.4 Data Analytic Strategy

All data were analyzed using SPSS version 22. Descriptive statistics were used to examine demographic characteristics, mobile phone utilization, and DSM-IV-TR substance use disorder (SUD) diagnoses of the sample. In order to predict technology use outcomes, exploratory binary logistic regression analyses were used in order to control for inter-related predictors. Because having a non-annual phone plan has been related to more frequently changing phone numbers (McClure et al., 2013), we dichotomized mobile phone plan as

annual contract vs. not annual contract. Thus, all technology variables were binary. All demographic variables were binary with the exception of age, which was continuous. In order to remain consistent with the previous study by McClure et al. (2013), we dichotomized education as less than a GED vs. GED or greater and annual income as < $15,000 or >$15,000.

3. Results

3.1 Technology Use Characteristics

The vast majority of participants reported owning a mobile phone prior to treatment (86.9%) and expecting to own a mobile phone after leaving treatment (92.6%). Of individuals who reported owning a mobile phone prior to treatment, these phones largely were capable of sending and receiving SMS text messages (95.9%) and participants reported utilizing the SMS text messaging capability on their phones (83.0%). Similarly, among individuals who reported planning to own a mobile phone after leaving treatment, 96.4% reported that their phones would have SMS text messaging capability and 84.7% planned to use text messaging on their phones. Among individuals who reported owning a mobile phone prior to treatment, the majority of these phones were smartphones (68.5%), defined as a mobile phone that includes web browsing, is Wi-Fi enabled, and is capable of downloading 3rd party applications. Moreover, these smartphones were used to download mobile apps (61.3%) and access the internet (61.3%). Among individuals who planned to own a mobile phone after leaving treatment, 72.4% planned to own a smartphone, 64.3% planned to download mobile apps on their smartphone, and 65.9% planned to use their smartphone to access the internet. Pay-as-you-go plans were the most popular phone plans both prior to (50.70%) and post (51.60%) treatment (Table 1).

3.2 Demographic Predictors of Technology Use

Logistic regression analyses predicting technology use both pre- and post-treatment are presented in Table 2. We first explored models that included SUD diagnoses (current alcohol dependence, cannabis dependence, opioid dependence, cocaine dependence, and hallucinogen/PCP dependence) as well as demographic predictors for predicting technology utilization. Across models, SUD diagnosis was not predictive of technology utilization at pre- or post-treatment. As such, we opted for more parsimonious models that only included demographic predictors of technology utilization, which are presented here (the model results presented here were similar to the model results when including SUD diagnosis). Controlling for the interrelatedness of predictors, younger age and greater education emerged as significant predictors of greater likelihood of technology use. Specifically, prior to treatment, younger individuals were more likely to utilize text messages, own a smartphone, download mobile apps, use their phone to access the internet, and have an annual phone contract. Similarly, younger individuals reported a greater likelihood of owning a mobile phone, owning a mobile phone with SMS capability, utilizing text messages, owning a smartphone, downloading mobile apps, using their phone to access the internet, and having an annual contract post treatment. Furthermore, individuals with a GED or greater were more likely to use text messages, download mobile apps, and use their phone to access the internet prior to treatment as compared to individuals with less than a GED.

Post treatment, individuals with a GED or greater were more likely than individuals with less than a GED to anticipate utilizing text messages and using their phone to access the internet. Additionally, prior to treatment, court mandated status was a significant predictor of owning a mobile phone such that individuals who were court mandated to treatment were more likely than individuals who were not court mandated to treatment to report owning a mobile phone.

4. Discussion

The present study investigated smartphone ownership and mobile application utilization among a sample of patients enrolled in residential substance use treatment. Results indicate that patients in a residential substance use treatment center in the Washington DC area owned mobile phones prior to treatment entry and expected to own mobile phones after leaving treatment. Moreover, the majority of these phones are or will be smartphones on which patients utilize mobile applications and access the internet. Rates of mobile phone and smartphone ownership among this sample were comparable to rates of ownership among U.S. adults broadly (90% of U.S. adults own a cell phone and 64% own a smartphone; Pew Research Center, 2015). Additionally, rates of technology ownership and technology utilization were similar pre- and post-treatment. Despite the relatively low income level of patients in this sample (85.7% reported annual income less than $15,000), patients did report substantial technology utilization. Interestingly, while 59.5% of the entire sample reported owning a smartphone prior to treatment entry, recent data from the Pew Research Center (2015) suggests that only 50% of U.S. adults who report less than $30,000 per year in annual income owned a smartphone in 2014. Thus, compared to other low income groups, patients in this sample may be more likely to own smartphones. This in turn raises important questions regarding motivation for obtaining a mobile phone and/or smartphone among low income patients in residential substance use treatment. For example, it has been suggested that as compared to higher income individuals, low income adults in the U.S. general population may not have broadband internet access in their homes and may have few alternative options for accessing the internet other than via their mobile phones (Pew Research Center, 2015). Similar explanations for high rates of smartphone ownership among the current sample of low income adults in an urban residential substance use treatment center may be fitting.

Results extend previous work examining access to technology and technology utilization among this population (e.g., McClure et al., 2013; Milward et al., 2015) to patients in residential substance use treatment in the U.S. and also to smartphone and mobile application use specifically. We found similar demographic predictors of technology ownership and smartphone utilization to that of McClure et al. (2013) such that younger individuals with more education were more likely to utilize technologies assessed in the study. Despite these significant age and education effects, a substantive proportion of older, less educated patients who participated in the study did have access to the technologies assessed. For example, among patients who were one standard deviation above the mean sample age (thus, were age 55 or older), 89.6% reported owning a mobile phone prior to treatment and 44.4% of these individuals reported that their phone was a smartphone. Similarly, among patients who reported having less than a GED, 83.7% reported owning a

mobile phone prior to treatment and 63.2% of these individuals reported that their phone was a smartphone.

These results suggest that smartphones are sufficiently owned and utilized by patients in this sample, making them a viable platform for supporting patients in utilizing treatment skills following treatment completion. Although a number of trials have examined text messaging interventions for problematic substance use (e.g., Gonzales et al., 2013; Keoleian et al., 2013; Suffoletto et al., 2012), comparatively fewer have examined mobile app interventions in this population (see Gustafson et al., 2014 for one example of a smartphone mobile app developed in order to support treatment for problematic alcohol use). Mobile app interventions offer a number of advantages over text messaging-based interventions, with the most important being that a mobile app intervention does not require a patient to retain the same phone number throughout the course of the intervention. Considering that substance users tend to change phone numbers frequently (McClure et al., 2013) and that participants in the current study most frequently had pay-as-you-go contracts, which may in turn be related to changing phone numbers, text-messaging based interventions that requires patients to retain the same phone number throughout the intervention may be inappropriate for this population. In contrast, a mobile app can be downloaded by the patient onto a new phone each time his/her phone changes and patients can have unique usernames and passwords to ensure retention of treatment data between devices.

One interesting and clinically important avenue from this line of research is utilizing mobile apps grounded in evidence-based treatment principles specifically to engage younger patients in utilization of treatment skills. Our results as well as the results of McClure and colleagues (2013) suggest that younger patients are more likely to utilize technology including smartphones and mobile apps. Because younger age is also a risk factor for substance use treatment dropout (Brorson et al., 2013), mobile apps may be particularly well suited for addressing treatment needs for younger patients.

4.1 Conclusions

This study highlights the potential clinical relevance of utilizing mobile applications that adhere to evidence-based substance use treatment principles to foster continued use of treatment skills following substance use treatment completion. Strengths of the study include the relatively large sample size and the novel nature of the population. Limitations of the study include lack of assessment of frequency of mobile phone number changes, which has been suggested to be higher among substance users in treatment than among the general population. Additionally, although demographic characteristics of the sample were similar to demographic characteristics of other residential substance use patient samples (e.g., Banducci et al., 2013; Carroll et al., 2006; Compton III et al., 2003) and thus may extend to other low income urban inpatient substance use treatment centers, considering that patient participants were recruited from one treatment center in Washington, D.C., broader generalizability of results may be limited. Moving forward, it will be important to continue to collect descriptive data regarding technology utilization among this sample (e.g., length of technology ownership, duration of retaining the same phone number, number of mobile apps used, types of mobile apps used, etc.). Regarding treatment, it will be important to conduct

randomized clinical trials of mobile apps grounded in evidence-based treatment principles in order to determine the efficacy and effectiveness of these apps for substance use treatment across patient populations (Dallery et al., 2015). Additionally, it will be important to examine additional variables that may predict technology utilization, particularly among groups that were less likely to utilize technology in the current study, such as older, less educated patients. By understanding the factors that contribute to technology use, researchers and clinicians will be able to promote adoption of smartphones and mobile apps in order to increase access to evidence-based treatment materials.

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Highlights

- We examined technology use among patients in residential substance use treatment.
- Patterns of smartphone ownership were similar to that of the general U.S. population.
- Patients downloaded mobile apps on their phones and accessed the internet.
- Younger age and more education were positively related to technology use.
- Smartphones and mobile apps may be useful for substance use treatment.

Table 1

Demographics and Technology Use

DEMOGRAPHICS		
Age (*M*(SD)) (n=251)	43.21(11.74)	
Gender (n=250)		
Male	66.80%	
Female	32.80%	
Transgender	0.40%	
Race (n=251)		
White	1.60%	
Black	96.80%	
Hispanic	0.40%	
Other	1.20%	
Education (n=251)		
Less than GED	49.00%	
More than GED	51.00%	
Income (n=237)		
<$15,000	85.70%	
>$15,000	14.30%	
Court Mandated to Treatment (n=251)	72.10%	
Current SUD Diagnosis (n=250)		
Alcohol Dependence	25.60%	
Cannabis Dependence	10.00%	
Opioid Dependence	16.00%	
Cocaine Dependence	30.80%	
Hallucinogen/PCP Dependence	16.00%	
TECHNOLOGY USE		
Prior to Treatment	**Yes**	**No**
Own a mobile phone (n=251)	86.90%	13.10%
SMS capability (n=218)	95.90%	4.10%
Use text messages (n=218)	83.00%	17.00%
Own a smartphone (n=216)	68.50%	31.50%
Download mobile apps (n=217)	61.30%	38.70%
Use the phone to access the internet (n=217)	61.30%	38.70%
Contract Type (n=209)		
Pay-as-you-go	50.70%	
Annual contract	24.40%	
Government Issued/Safelink	23.90%	
Other	1.00%	
Post Treatment	**Yes**	**No**
Own a mobile phone (n=243)	92.60%	7.40%

DEMOGRAPHICS		
SMS capability (n=223)	96.40%	3.60%
Use text messages (n=222)	84.70%	15.30%
Own a smartphone (n=221)	72.40%	27.60%
Download mobile apps (n=221)	64.30%	35.70%
Use the phone to access the internet (n=223)	65.90%	34.10%
Contract Type (n=213)		
Pay-as-you-go	51.60%	
Annual contract	25.40%	
Government Issued/Safelink	21.60%	
Other	1.40%	

Note: SUD = Substance Use Disorder, SMS = Short Message Service. The total sample size for the study was 251. The respective n's next to each item represent the number of patients for whom we have data for that item. For demographic data and for owning a mobile phone post treatment, sample sizes less than 251 are due to missing data (e.g., the patient did not answer that question or ended the interview early). For the technology utilization items all patients were asked whether they owned a mobile phone prior to treatment and whether they anticipated owning a mobile phone post treatment. Only patients who endorsed “yes” for these items were queried with subsequent items.

Table 2

Logistic regressions predicting technology outcomes

Prior to Treatment	**Own a mobile phone (n=202)**				**SMS capable (n=182)**				**Use text messages (n=182)**				**Own a smartphone (n=181)**				**Download mobile apps (n=181)**				**Access internet (n=181)**				**Other Contract vs Annual Contract (n=173)**			
	β	S. E.	95%	CI	β	S.E.	95%	CI	β	S. E.	95%	CI	β	S. E.	95%	CI	β	S. E.	95%	CI	β	S. E.	95	% CI	β	S. E.	95%	CI
Age	-0.01	0.02	0.96	1.03	-0.06	0.03	0.88	1.00	**-0.12****	0.03	0.85	0.94	**-0.08****	0.02	0.90	0.96	**-0.09****	0.02	0.88	0.94	**-0.09****	0.02	0.88	0.94	**-0.05****	0.02	0.92	0.98
Male vs. Female	0.12	0.49	0.43	2.94	0.61	0.83	0.36	9.27	-0.27	0.49	0.29	1.99	-0.33	0.38	0.34	1.52	-0.35	0.38	0.33	1.48	-0.11	0.38	0.43	1.89	0.14	0.40	0.52	2.52
Less than GED vs. More than GED	0.49	0.45	0.67	3.96	0.26	0.68	0.35	4.90	**1.46****	0.48	1.67	11.05	0.59	0.35	0.90	3.58	**0.76***	0.36	1.06	4.29	**0.80***	0.36	1.11	4.48	0.73	0.39	0.97	4.44
<$15,000 vs. >$15,000	0.62	0.78	0.40	8.49					1.84	1.10	0.74	53.25	0.84	0.56	0.78	6.86	0.86	0.54	0.83	6.78	0.37	0.50	0.54	3.89	0.52	0.48	0.65	4.33
Voluntary vs. Court mandated	**0.92***	0.46	1.02	6.12	0.26	0.74	0.31	5.49	0.38	0.51	0.54	3.98	- 0.14	0.40	0.40	1.90	- 0.03	0.40	0.45	2.12	0.14	0.40	0.53	2.49	-0.46	0.40	0.29	1.37
Post Treatment	Own a mobile phone (n=194)				SMS capable (n-183)				Use text messages (n=182)				Own a smartphone (n=182)				Download mobile apps (n=182)				Access internet (n=183)				Other Contract vs Annual Contract (n=177)			
	β	S. E.	95%	CI	β	S. E.	95	% CI	β	S.E.	95%	CI	β	S. E.	95	% CI	β	S. E.	95%	CI	β	S. E.	95	% CI	β	S. E.	95	% CI
Age	**-0.06***	0.03	0.89	0.996	**-0.07***	0.04	0.87	0.999	**-0.10****	0.03	0.86	0.95	**-0.08****	0.02	0.90	0.96	**-0.08****	0.02	0.89	0.95	**-0.10****	0.02	0.88	0.94	**-0.04****	0.02	0.93	0.99
Male vs. Female	0.37	0.69	0.38	5.62	0.30	0.85	0.26	7.17	0.06	0.51	0.39	2.85	-0.12	0.40	0.41	1.93	-0.09	0.38	0.43	1.92	0.03	0.40	0.47	2.24	0.07	0.39	0.50	2.30
Less than GED vs. More than GED	0.25	0.57	0.41	3.94	0.03	0.71	0.25	4.14	**0.94***	0.46	1.03	6.31	0.58	0.36	0.88	3.61	0.67	0.35	0.98	3.87	**0.75***	0.36	1.04	4.33	0.64	0.37	0.91	3.93
<$15,000 vs. >$15,000	0.82	1.07	0.28	18 .61	0.35	1.11	0.16	12.49	0.99	0.80	0.55	13 .10	0.26	0.50	0.48	3.45	0.40	0.48	0.58	3.85	- 0.13	0.48	0.34	2.25	0.23	0.48	0.49	3.23
Voluntary vs. Court mandated	0.03	0.63	0.30	3.57	-1.16	1.09	0.04	2.64	0.20	0.51	0.44	3.21	-0.48	0.42	0.27	1.41	-0.27	0.39	0.36	1.65	-0.16	0.41	0.39	1.90	-0.60	0.38	0.26	1.15

Note: SMS = Short Message Service. N's refer to the sample size for the individual regressions. The first group of predictors listed served as the comparison group for the binary logistic regression analyses and were coded as 0, while the second group was coded as 1 (e.g., male = 0, female = 1). All technology outcomes except for contract type were coded dichotomously with no = 0 and yes = 1. Contract type was also coded dichotomously with other contract = 0 and annual contract = 1. Significant results are shown in bolded text. Cell size for individuals who had an annual income greater than $15,000 and did not own an SMS capable mobile phone was sufficiently small to make logistic regression estimates unstable. Thus, results are not reported to income predicting SMS capability prior to treatment.

* $p < .05$

** $p < .01$