Mobile phone and internet use among people who inject drugs: Implications for mobile health interventions

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Abstract

Background: Mobile health (mHealth) interventions have the potential to improve substance use treatment engagement and outcomes, and to reduce risk behaviors among people who inject drugs (PWID). However, there are few studies assessing mobile technology use among PWID and none have investigated continuity of mobile phone use.

Methods: We surveyed 494 PWID. We used bivariate (independent-sample t- and chi-square tests) and multivariate (logistic regression) analyses to determine whether mobile phone and/or internet use differed as a function of participant- and/or injection-related characteristics.

Results: Most participants (77%) had a mobile phone, with 67% having a phone that was free of charge. Participants with a phone were significantly less likely to be homeless (OR=0.28), to have shared syringes (OR=0.53), and to have reused syringes (OR=0.26) in the past 3 months. We observed high rates of phone and number turnover, with more than half reporting that they got a new phone (57%) and/or number (56%) at least once within the past 3 months. Most participants were familiar with using the internet (80% ever use), though participants who had ever used the internet were younger (OR=0.89), were less likely to be homeless (OR=0.38), were less likely to have shared syringes (OR=0.49), and were more likely to have injected methamphetamine by itself (OR=2.49) in the past 3 months.

Conclusions: Overall, mobile technology and internet use was high among our sample of PWID. Several factors should be considered in recruiting diverse samples of PWID to minimize

bias in mHealth study outcomes, including mobile phone access and protocol type (text- vs internet-based).

Keywords

People who inject drugs (PWID); mobile phone; internet; mHealth; ecological momentary assessment (EMA); technology

Introduction

Mobile technology used for health interventions (mHealth) includes remote data collection in participants' natural environment, facilitating participant engagement, and enhancing data reliability and validity[1]. Prior to the global COVID-19 pandemic, mHealth studies were becoming increasingly common among substance-using populations[2], and in the wake of COVID-19, remote data collection and service delivery is more important than ever for health researchers and clinicians. It's particularly important for vulnerable populations, like people who inject drugs (PWID), who may have low study retention rates due to participant-related barriers like unstable housing[3]. Indeed, some researchers are developing mHealth protocols to support substance use disorder treatment efforts[4–6], and mHealth has proven successful, at least in the short-term, in several U.S.-based studies using text-message or web-based interventions. For example, mHealth has been used to support smoking cessation[7,8] increase HIV anti-retroviral therapy adherence among patients with comorbid substance use disorders[9,10], and improve Hepatitis C testing and health outcomes among patients with an opioid use disorder[11]. mHealth has also utilized ecological momentary assessment methods to identify associations between mood, environment, drug cravings, and risk behaviors for various populations of tobacco users[12,13], methadone maintainance patients[14,15], and PWID[3,16–18]. These and other studies[19] demonstrate mHealth's potential for conducting health-related research among people who use drugs (see review by Carpenter et al.)[20].

Given that injection drug use rates and associated morbidities and mortality have been increasing since 2013[21–24], PWID are uniquely positioned to benefit from mHealth interventions. Indeed, mHealth has the potential to reduce the injection behaviors that place PWID at risk for bloodborne infections like HIV and Hepatitis C[4,25], thereby reducing morbidity, mortality, and overall healthcare burden. However, to develop effective mHealth protocols, researchers must first understand PWID access to and use of mobile phones and the internet. A limited number of published studies have assessed such technology use among PWID in nonrural areas of California[26], Maryland[27], Massachusetts, and Rhode Island[28]. In these studies, the majority reported owning a mobile phone, but relatively few reported having access to a smart phone with consistent internet service. Notably, PWID were not asked about phone or number stability/turnover, which may be especially important in this population given that unstable housing arrangements and phone loss or theft are common[28,29]. In addition to mHealth interventions, high rates of turnover are of concern to researchers interested in conducting cohort and/or longitudinal studies among PWID[28]. The purpose of the current study was to 1) expand upon prior work by evaluating the stability and continuity of mobile phone and internet use and 2) examine mobile phone and internet

use as a function of participant-, drug-, and injection-related characteristics among PWID recruited in California's Central Valley.

Methods

Study Site, Population, and Recruitment

The City of Fresno, located in Fresno County, is an urban hub in California's predominantly rural and agricultural Central Valley. Both heroin and methamphetamine use are firmly entrenched in this region, and in a 2008 study, Fresno had the second-highest rate of injection drug use among 96 U.S. metropolitan statistical areas studied[30].

For this study, 494 PWID were recruited via respondent-driven sampling (RDS)[31] between April and September, 2016. The RDS procedure included first selecting a group of 11 seeds that were heterogenous by age, gender, race/ethnicity, and drug(s) of choice. Seeds were each given three coupons to refer peers. As individuals participated in the study, they were each given three coupons to recruit additional peers. Eligible individuals were at least 18 years old, injected at least twice in the past 30 days, and were willing and able to provide informed consent. All procedures were approved by the Pacific Institute for Research and Evaluation's Institutional Review Board.

Data Collection

The current study included 10 questions about mobile phones and internet use, which were embedded within a larger survey focused on injection risk behaviors and structural influences on PWID health. All questions regarding use of technology were presented in a multiple-choice format with categorical response options. Surveys were interviewer-administered to participants via Qualtrics (Version 13; Qualtrics, Provo, UT) and took approximately one hour to complete. All participants were given $30 for survey completion, plus an additional $5 for each eligible RDS recruit (maximum $45).

Data Analysis

Homelessness was defined as self-report of sleeping most often in a vehicle, shelter, abandoned building, shooting gallery, or outside during the past 3 months. We examined differences in mobile phone and internet use by participant- and injection-related characteristics using independent-samples t-tests for continuous variables and chi-square tests for categorical variables. Variables that achieved a level of p .10 in these bivariate analyses were entered into two separate multiple logistic regression models in a manual stepwise fashion to identify factors significantly associated with 1) currently having a mobile phone and/or 2) ever using the internet. Variables were entered one by one, beginning with those that had the smallest p values in bivariate analyses. Variables with $p>.05$ were removed during each step and only variables with $p<.05$ were retained in the final models. We used this manual stepwise approach to obtain parsimonious models not affected by statistical suppression. Analyses were completed using R statistical software and comparisons were considered statistically significant when $p<.05$.

Results

Characteristics of mobile phone use are presented in Table 1. Most participants reported that they currently had a mobile phone (77%), but more than half had changed phones (57%) and/or phone numbers (56%) at least once in the past 3 months; 39% reported having their current phone and number for less than 1 month. Almost all participants with a phone had a smart phone with voice and internet service (88%), and most had a phone that was obtained and used free of charge (67%).

Characteristics of internet use are presented in Table 2. Most participants accessed the internet at least once in their lifetime (80%), with most accessing it within the past 3 months (77%). For those who never used the internet (n=97), the most common reasons related to lack of knowledge (e.g., 50% don't know how to get online). Participants who had used the internet reported using it to get information on a variety of topics, with the most popular being information on drugs (61%), employment (59%), housing (57%), and drug treatment services (45%).

Participant characteristics are shown in Table 3. Participants were primarily male (61%), White (43%), and the median age was 46 years (interquartile range (IQR)=33 to 54 years). Half were married or in a steady relationship, 31% were homeless, and 43% reported an income of more than $250 per week. Median years injecting was 22 (IQR=7 to 35 years), and the most commonly reported drugs injected in the past 3 months were heroin by itself (82%), methamphetamine by itself (57%), and/or heroin/methamphetamine together (40%).

Also shown in Table 3 is that technology use varied across certain characteristics in bivariate analyses. Specifically, participants who currently had a mobile phone spent, on average, fewer hours on the street per day. At the same time, fewer participants with a mobile phone were homeless, had injected heroin and methamphetamine or heroin and powder/crack cocaine together, had shared syringes, and/or had reused syringes in the past 3 months. Among those who had a mobile phone, more homeless PWID than those with stable housing had their current phone and phone number for less than 1 month (57% vs 34% and 58% vs 33%, respectively; p's<.001).

With regard to internet use, PWID who had never used the internet were older and fewer were married/in a steady relationship. In addition, more Hispanic/Latino, homeless, and low-income participants had never used the internet compared to those who had. For injection-related characteristics, fewer participants who had never used the internet had injected heroin by itself, while more had injected methamphetamine by itself and/or heroin/methamphetamine together in the past 3 months. Participants who had never used the internet also had longer injection histories.

Multiple logistic regression models revealed the factors independently associated with having a phone and/or ever using the internet. Participants who currently had a mobile phone were significantly less likely to be homeless (odds ratio (OR)=0.28; 95% confidence interval (CI)=0.18, 0.45), to have shared syringes (OR=0.53; 95% CI=0.33, 0.84), and/or to have reused syringes (OR=0.26; 95% CI=0.11, 0.63) in the past 3 months. Participants who had ever used the internet were younger (OR=0.89; 95% CI=0.86, 0.92), were less likely

to be homeless (OR=0.38, 95% CI=0.22, 0.66), were less likely to have shared syringes (OR=0.49, 95% CI=0.28, 0.86), and were more likely to have injected methamphetamine by itself (OR=2.49; 95% CI=1.41, 4.38) in the past 3 months.

Discussion

The current study assessed mobile phone and internet use among PWID in Fresno, California. Overall, use of mobile phones was high, with 77% currently having one. Importantly, 67% of those with a mobile phone reported having a free phone, referred to by many as an "Obama Phone." The Obama Phone program gives low-income individuals access to a free mobile phone with monthly voice, text, and/or internet services[32]. Those that are eligible choose between providers, with some providing limited voice, text, and internet services[33] that may introduce obstacles for researchers and clinicians conducting mHealth studies. The fact that most of our sample took advanatage of the Obama Phone program points to the importance of such a program for PWID. If the program were ended or restricted, which has been proposed in recent years[34], many PWID might lose access to mobile phone services.

Concerning is that certain subgroups of participants were less likely to have a mobile phone during the time of our study. Specifically, PWID without a phone were more likely to be homeless, to have shared syringes, and/or to have reused syringes in the past 3 months. Many mHealth studies require participants to have their own mobile phone for study use, which can lead to a more limited sample of participants and biased study outcomes [35]. Indeed, for mHealth studies requiring participants to have their own mobile device, our findings suggest that some of the most at-risk participants may be excluded. This is particularly concerning when mHealth studies are designed to reduce risky injection behaviors like syringe sharing. One cost-effective way to mitigate this issue is to provide participants with a "disposable" mobile phone pre-loaded with voice/text minutes for the study duration. Providing participants with mobile phones is not without its challenges, however. For instance, participants may use the pre-paid minutes for non study-related communication, though some work suggests that incidental benefits may be gained in this vein by participants experiencing enhanced social interaction[18]. Still, while PWID are paid to use a phone and complete certain tasks during the course of mHealth interventions, after study completion when these incentives are withdrawn, participants may not continue the behaviors established during interventions. Although beyond the scope of the current study, more work is needed to address these concerns and increase the real-world impact of mHealth studies among PWID.

Though most participants had a mobile phone, we observed high rates of phone and phone number turnover; almost all of the participants who reported getting a new mobile phone in the past month also got a new phone number. Such high turnover may be driven, at least in part, by PWID losing or having their mobile phones stolen, which is common among those with unstable housing[28,29]. Notably, the Obama Phone program allows for one replacement phone if the first is lost, stolen, or broken, but participants are not eligible to receive another free phone if something happens to the replacement[36]. Approximately one-fourth of our sample reported not having a phone at the time of the survey, with the majority being

participants who were homeless. At the same time, more homeless PWID had their current phone and number for less than one month compared to PWID with stable housing. Though not assessed in the current study, it is possible that fewer homeless PWID had a cell phone because they had already accessed the allotted number of free phones offered by the Obama Phone program. Still, incorporating study-provided phones would not mitigate obstacles to turnover caused by lost or stolen phones. Future work should investigate the reasons for turnover to determine the best strategies for mitigating obstacles and accomlishing mHealth interventions among PWID, especially homeless PWID.

Internet use was high among our sample, though ~12% reported not having internet access on their mobile phone and consistent with other work, homeless and older participants were less likely to access the internet than their counterparts[26]. Notably, a large portion of PWID in the current study accessed the internet via mobile device and did so to gain information about drugs, drug treatment services, and/or health services. Participants without access to mobile phones and/or the internet, or those who have high rates of device turnover, are at a significant disadvantage when it comes to information access, which may only isolate them further. Given that we found most PWID used the internet to access a variety of information, web-based mHealth studies may be feasible among this population. However, text-based studies may be better equipped for reaching a larger, more diverse sample of PWID, including those who have unstable housing[28]. Indeed, higher rates of EMA-study completion among PWID have been observed following the delivery of text as compared to email assessments[28]. On the other hand, using text- rather than web-based platforms may limit the number and types of assessments that can be completed while maintaining a reasonable level of protocol burden. Thus, a delicate balance must be reached among mHealth approaches, and researchers must consider several factors when deciding between method feasibility and bias reduction strategies.

Results of our study must be considered in light of some limitations. First, we asked participants whether they "had" a mobile phone but did not ask directly about phone ownership or access. It's possible that participants in our study did not own a mobile phone but had reliable access to one through friends and/or family members, which wasn't captured in our survey and may provide evidence for mHealth intervention feasibility despite not owning a phone. Second, our data are cross-sectional so we do not have information regarding mobile phone or internet ownership/access among our population prior to the current study or prior to implementation of the Obama phone program. Third, we did not include questions regarding phone, text, or internet limits associated with participants' mobile phone plans, making it unclear whether it would be feasible for participants to use their own mobile phones during mHealth studies. Finally, these data are somewhat dated given that they were collected in 2016. However, given that phone and internet costs have not changed appreciably since the time of our data collection and the Obama phone program is still operating, it is likely that similar technology use patterns would be revealed among more recent data.

Conclusions

The development of feasible mHealth studies for PWID relies on access to and utilization of mobile phones and internet among this population. We found that most PWID in Fresno had a mobile phone, though most of these participants relied on access to free phones and service, some did not have internet service on their phone, and there were high rates of phone/number turnover. Approximately one-fourth of our sample did not have a mobile phone at the time of the survey; more of these participants were homeless and engaged in risky injection behaviors like sharing and/or reusing syringes. Results highlight potential challenges in conducting longitudinal mHealth studies with PWID and add to the literature suggesting that relying on PWID to use their own phone/internet plans may contribute to a biased sample. Collecting multiple forms of contact information (e.g., phone number, social media accounts, email, friend/family contacts) may help overcome barriers to maintaining contact with PWID.

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Table 1

Characteristics of Mobile Phone Use among People who Inject Drugs (PWID) in Fresno, California (N=494).

	n	*%*
Currently have a cell phone	380	77
Have had current cell phone for		
Less than 1 month	149	39
Less than 3 months	64	18
Less than 6 months	43	11
Less than 1 year	52	14
More than 1 year	71	19
Have had current phone number for		
Less than 1 month	148	39
Less than 3 months	63	17
Less than 6 months	39	10
Less than 1 year	45	12
More than 1 year	81	21
Current phone is a smart phone	330	87
Current phone has		
Both, voice and internet service	289	88
Voice service only	33	10
Neither voice nor internet service	8	2
Internet service only	1	0
Phone is completely free of charge	254	67

Table 2

Characteristics of Internet Use among People who Inject Drugs (PWID) in Fresno, California (N=494).

	n	*%*
Ever used the internet on computer or mobile device	397	80
Reasons for never using the internet:		
Don't know how to get online	48	50
Don't know how to use a computer	44	46
Don't need to/not interested	41	43
Don't have access to a computer	15	16
Phone doesn't have internet service	2	2
Internet service is too expensive	2	2
Other	10	10
Locations where internet was accessed in the past 3 months		
Own phone or mobile device	334	84
Someone else's phone or mobile device	206	52
Home computer	131	33
Public library	112	28
Community center	52	13
Work	35	9
School	18	5
Didn't use internet in the past 3 months	11	3
Other	35	9
Used the internet to get information on:		
Drugs in general	243	61
Employment services	234	59
Housing services	227	57
Drug treatment services	180	45
How to treat abscesses or other injection-related problems	153	39
How to prevent or respond to an overdose	142	36
Where to get treatment for other physical health problems	134	34
Where to get treatment for mental health problems	120	30
Where to get tested for sexually transmitted infections	80	20
Safer injection methods	79	20
Where to get new syringes	70	18
Where to get HIV testing	66	17
Where to get Hepatitis C testing	61	15
None	47	12

Table 3

Factors Associated with Mobile Phone and Internet Use among People who Inject Drugs (PWID) in Fresno, California (N=494).

	Total (N=494)	Phone (n=380)	No Phone (n=114)	p^a	Internet (n=397)	No Internet (n=96)	p^a
	n (%)	n (%)	n (%)		n (%)	n (%)	
Median age (IQR)	46 (33–54)	46 (32–53)	49 (36–56)	0.059	42 (30–51)	56 (51–59)	<0.001
Gender							
Male	299 (61)	228 (60)	71 (62)	0.450	234 (59)	64 (67)	0.153
Female	190 (38)	147 (39)	43 (38)		160 (40)	30 (31)	
Transgender	5 (1)	5 (1)	0 (0)		3 (1)	2 (2)	
Race/ethnicity							
White	211 (43)	164 (43)	47 (41)	0.129	194 (49)	17 (18)	<0.001
Hispanic/Latino	167 (34)	128 (34)	39 (34)		109 (27)	58 (60)	
American Indian/Alaskan Native	27 (5)	21 (6)	6 (5)		22 (6)	5 (5)	
Black/African American	26 (5)	25 (7)	1 (1)		22 (6)	4 (4)	
Multiracial	30 (6)	20 (5)	10 (9)		22 (6)	8 (8)	
Other	33 (7)	22 (6)	11 (10)		28 (7)	4 (4)	
Marital status							
Married or in a steady relationship	247 (50)	193 (51)	54 (47)	0.352	210 (53)	37 (39)	0.008
Single	187 (38)	146 (38)	41 (36)		147 (37)	40 (42)	
Divorced, separated, or widowed	47 (10)	33 (9)	14 (12)		33 (8)	13 (14)	
Average weekly income >$250	214 (43)	168 (44)	46 (40)	0.571	181 (46)	33 (34)	0.046
Homeless[b]	152 (31)	89 (23)	63 (55)	<0.001	110 (28)	41 (43)	0.008
Ever been enrolled in drug treatment	376 (76)	296 (78)	80 (70)	0.116	304 (77)	71 (74)	0.685
Median years injecting (IQR)	22 (7–35)	21 (7–34)	25 (9–38)	0.061	17 (5–32)	37.5 (26.75–42)	<0.001
Median times injected in past month (IQR)	40 (18–90)	40 (15–90)	60 (20–90)	0.815	42 (18–90)	40 (20–71.25)	0.129
Median hours spent on the street each day (IQR)[b]	10 (4–19.5)	8 (3–15.75)	16 (9–24)	<0.001	8 (4–18)	10 (5.75–24)	0.168
Injection drug use[b]							
Heroin by itself	407 (82)	310 (82)	97 (85)	0.470	318 (80)	88 (92)	0.012
Methamphetamine by itself	280 (57)	208 (55)	72 (63)	0.138	246 (62)	34 (35)	<0.001
Heroin and methamphetamine together	196 (40)	137 (36)	59 (52)	0.004	169 (43)	27 (28)	0.013
Heroin and powder or crack cocaine together	100 (20)	69 (18)	31 (27)	0.049	78 (20)	22 (23)	0.566
Powder and/or crack cocaine by itself	78 (16)	56 (15)	22 (19)	0.305	63 (16)	15 (16)	1.000
Syringe sharing (receptive and/or distributive)[b]	194 (39)	127 (33)	67 (59)	<0.001	147 (37)	46 (48)	0.065

	Total (N=494)	Phone (n=380)	No Phone (n=114)	p [a]	Internet (n=397)	No Internet (n=96)	p [a]
	n (%)	*n (%)*	*n (%)*		*n (%)*	*n (%)*	
Syringe reuse[b]	398 (81)	290 (76)	108 (95)	<0.001	315 (79)	82 (85)	0.228

IQR=interquartile range;

[a]Independent-samples t-tests for continuous variables and chi-square tests for categorical variables;

[b]Past 3 months.