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Gretl Glick Date

USE OF MOBILE HEALTH TECHNOLOGY AMONG MENTAL HEALTH CONSUMERS

BY

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Executive MPH

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USE OF MOBILE HEALTH TECHNOLOGY AMONG MENTAL HEALTH CONSUMERS

BY

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An abstract of
A Thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements of the degree of
Master of Public Health in the Executive MPH program
2014

Abstract

USE OF MOBILE TECHNOLOGY AMONG MENTAL HEALTH CONSUMERS

BY
Gretl Glick

Background: Mobile technology has been widely used to deliver primary health interventions, yet there has been relatively little research conducted on the use, adaptation, and efficacy in delivering mental health interventions on mobile devices. Mobile technologies hold promise in transforming the delivery of health interventions, particularly for people with serious mental illness [1]. The purpose of this thesis is to examine the current ownership, usage patterns, and existing barriers of mobile health interventions for people with serious mental illness.

There has been significant interest in delivering mental health interventions through mobile technologies. However, there is uncertainty as to the current rates of ownership of mobile devices among people with serious mental illness. As mobile devices have become increasingly available, less expensive to own, and cellular networks have grown more widespread, smartphone ownership has grown. Mobile technology has the potential to decrease barriers to access to mental health care and may be a useful tool for increasing patient engagement. As new technologies emerge, it will be important to develop a framework for assessing the impact of health interventions for people with serious illness.

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Introduction

Mobile technology has been widely used to deliver primary health interventions, yet there has been relatively little research conducted on the use, adaptation, and efficacy in delivering mental health interventions on mobile devices. Mobile technologies hold promise in transforming the delivery of health interventions, particularly for people with serious mental illness [1]. The purpose of this thesis is to examine the current ownership, usage patterns, and existing barriers of mobile health interventions for people with serious mental illness.

There has been significant interest in delivering mental health interventions through mobile technologies. However, there is uncertainty as to the current rates of ownership of mobile devices among people with serious mental illness. As mobile devices have become increasingly available, less expensive to own, and cellular networks have grown more widespread, smartphone ownership has grown. Mobile technology has the potential to decrease barriers to access to mental health care and may be a useful tool for increasing patient engagement. As new technologies emerge, it will be important to develop a framework for assessing the impact of health interventions for people with serious illness.

Examination of Context and Background:

Mobile health interventions have the potential to reach a large segment of the U.S. adult population. According to a national survey conducted by the Pew Institute, over 90% of U.S. adults own a mobile phone and over 50% own a smartphone [2]. Mobile technologies hold promise in expanding access to care and improving existing health interventions [3]. As cellular infrastructure improves and smartphones rapidly decrease in cost, there is an opportunity to expand mental health services beyond the traditional clinical office space and broadly distribute information and resources [4].

Serious mental illness, such as schizophrenia, bipolar disorder, and major depression, are among leading causes of disability globally [5]. There is increasing awareness of the potential in using mobile technologies to expand treatment options and assessment tools for people with serious mental illness [6]. Mental illness has been shown to be a risk factor for poverty and social isolation, which may contribute to barriers to accessing care [7]. Patient engagement and self-efficacy have been identified as some of the primary factors in achieving positive beneficial outcomes for people with serious mental illness [8]. Increasing patient engagement and self-efficacy through therapeutic activities between clinical visits is central to recovery. Mobile devices and health interventions show an encouraging avenue for improving patient engagement between clinical sessions and expanding the reach of evidence-based approaches [9].

However, little is known regarding the ownership and use of mobile applications for people with serious mental illness. There has been limited research on the efficacy and impact of existing mobile mental health interventions. Additional investigation on access, utilization, impact, and existing barriers for mental health consumers is needed and can inform integration with existing systems of care. As new technologies and mobile mental health interventions emerge, it will be important to understand the role mobile technologies can play in delivering innovative and effective care to people with serious mental illness.

Problem Statement, Purpose, and Research Question:

The purpose of this thesis is to examine the current ownership, usage patterns, and existing barriers of mobile health interventions for people with serious mental illness treated in public sector community mental health settings.

Research Question:

1. How are mobile technologies used among people with serious mental illness treated in public sector community mental health settings?
2. What are potential applications for mobile devices and health information technology in mental health interventions for people with serious mental illness?
3. What are the potential concerns and barriers to using mobile technologies to deliver health interventions among people with serious mental illness?

Literature Review

What is Mobile Health?

Mobile Health (or mHealth) is broadly defined as the "the use of mobile and wireless technologies to support the achievement of health objectives" [10]. Mobile health technologies can be used in a variety of different ways and settings, including education and awareness, diagnostic and treatment support, remote data collection and monitoring, training for healthcare workers, disease surveillance, treatment support, medication compliance, and as a tool for improved communication between patient and provider. Potential benefits of mobile health technologies include access to medical information, health records, healthcare services, enhanced opportunities for personal health monitoring, improved chronic disease management and treatment compliance, and potential cost savings from reduced need for emergency services [11].

In view of these potential benefits, users of mobile health interventions have dramatically increased during the last decade. According to a recent Pew survey conducted in 2012, 31% of smartphone owners have used their mobile device to search for health information [12] . The same survey found 19% have downloaded at least one health app onto their phone and use it to track and manage their health. Comparatively, a survey conducted in 2010 found only 17% of cell phone users had accessed health information on their phones [12].

From an economic standpoint, the expanded usage of mobile health technologies is massive, with some models forecasting annual revenues to reach well over $23 billion globally [13]. Remote monitoring, including wearable fitness devices, biometric sensors, behavioral analytics, and transmission of this data to medical providers, is predicted to be one of the main growth areas for mobile health technology. The rapid expansion and adoption of remote monitoring devices and availability of such sensors in smartphones will change the way in which health services are delivered, moving beyond traditional clinical spaces. This is particularly relevant for mental health services delivery, as mobile health tools have the potential to deliver interventions beyond the provider's office and incorporate real-time tracking and monitoring of disorders. The potential applications of mobile health technologies in the delivery of mental health interventions are numerous.

Mobile Health Applications for Mental Health

A recent review of mobile health apps found over 13, 000 health apps targeted for consumer use available for download in Apple's App store [14]. 5.8% of these apps targeted mental health outcomes, and an additional 18% focused on related mental health issues, including smoking cessation, sleep, stress, and relaxation [14]. Mobile devices can be used to reduce some of the potential barriers to accessing and sustaining clinical behavioral therapies. As noted by Ben-Zeev, use of mobile devices can increase patient and provider interaction between clinical visits [15]. This may result in a decrease in the number of visits or duration of therapy, thereby also reducing costs

associated with mental healthcare. Additionally, mobile devices can extend the benefits of therapeutic visits beyond the clinical space. Finally, mobile devices can reduce transportation barriers, often cited as a challenge to full and continued participation in behavioral therapy interventions [16]. This is of particular relevance to people with serious mental illness, as certain studies have indicated that the rate of attendance can be as low as one of every two sessions scheduled [17].

Mental health interventions delivered on mobile devices may have several advantages, including increased symptom monitoring and assessment, behavioral analytics, psycho-social education, increased medication adherence, skills training, enhanced communication with providers and access to resources, and tracking of treatment progress.

Clinical Assessment & Treatment Progress:

One of the primary challenges of clinical behavioral assessments is the reliance on retrospective recall and an inability to gather real-time information from the individual. Raento et al. note that with increased integration of smartphones in all aspects of daily life, it is now possible to collect behavioral data not previously accessible without constant observation or self-report [18]. Mobile devices can augment conventional behavioral treatment programs by helping patients assess and monitor symptoms. Patients completing self-assessments can share this data with provider care teams, track symptoms over time, and create visual presentations of treatment results.

Furthermore, patients can input data on mobile devices, track mood, sleep, and anxiety levels and transmit reports to providers, family, and other health caregivers. Consumers can monitor emotional states associated with mental health disorders. When shared with a clinician, self-monitoring data can be useful in providing insight into a patient's emotional state over time, and provide tools for self-help.

Skills Training:

Mobile mental health interventions may further enhance skills transference by providing both audio and visual instruction while a patient practices a skill in a naturalistic setting[11]. Providers often teach therapeutic skills training, such as stress reduction or relaxation breathing tactics, during clinical visits and which patients are supposed to practice later. When conducted in a clinical setting, skills transference may be constrained by the inability to apply skills in a naturalistic setting; patients are instructed to apply skills learned during a clinical visit to daily life, and are encouraged to remember techniques learned in a clinical setting. Mobile devices may enhance a patient's ability to apply skills based interventions outside of the clinical setting by prompting the patient to apply skills in real-time.

The transference of skills to everyday living may also be improved using virtual reality. Rita et al. pioneered the concept of Interreality [19], which studies the merging of mobile health interventions with virtual reality situations. Interreality used virtual

experiences, controlled by therapists, to teach healthy behaviors and coping skills. The virtual reality was then merged with real experiences to assess potentially stressful situations and clinical changes in behavior. Using smartphones and sensor technology, therapists were able to monitor and provide feedback on skills transference in real-time. Conventional therapy provides skills-based training within a clinical setting and is confined to the therapeutic space. Mobile health interventions provide an avenue to effectively bridge the gap between clinical office space and the application of the skills based training in real-time[19].

Enhanced Communication with Providers:

Mental health interventions rely strongly on the quality of the relationship between the patient and the provider, or therapist. Higher levels of patient engagement with their therapeutic care plan have been strongly associated with positive mental health outcomes [20], [21]. Carrying this relationship beyond the clinical space into daily living offers both patients and providers opportunities to bolster communication and address problems as they arise in real-world scenarios, including during mental health emergencies. Mobile technologies offer a convenient way to increase both the level of communication and quality of communication between patients and providers, facilitating real-time feedback to support reinforcement of therapeutic care plans.

Reminders & Medication Adherence:

One of the more promising avenues for mobile mental health interventions is the usage of reminders and push notifications to promote health behaviors. Medication adherence continues to be a challenging area for people with serious illness. Previous research has shown patients who were prescribed antipsychotics took "an average of 58% of the recommended amount…"[22] and noncompliance may be associated with increased rates of relapse and psychiatric hospitalization [22]. Adherence to medication schedules may be lower among patients with serious mental illness due to denial of illness, significant side effects, and poor therapeutic alliances with clinical providers[23].

Previous research examining the impact of mobile health interventions on improving rates of compliance with medication regimens is limited, but studies have shown significant improvement in medication adherence using text-based reminders [24], [25]. Interventions incorporating cognitive behavioral techniques, as well as text based reminders, have also demonstrated an improvement in medication regimen compliance for patients with serious mental illness [9]. For patients with SMI who are living independently, text based reminders may provide additional needed support for medication compliance. Mobile health interventions that incorporate reminders based on an individual's daily routine may significantly improve medication compliance in people with SMI [9].

Challenges of Mobile Health Technology for Behavioral Health:

Interoperability

Fragmented systems of care, siloed health information systems, and non-interoperable health records systems represent real, and on-going, challenges for the U.S. healthcare system. This is particularly true for behavioral health systems, which tend to remain separate from general medical systems of care and retain separate health information systems. While the growth of mobile mental health interventions is encouraging and represents unique opportunities for expanded treatment, behavioral health systems will need to address the integration of this data into existing health information systems.

Interoperability is defined as the ability of systems to communicate with one another and exchange data in a standardized way in order to achieve predictable results [26]. Several factors hamper the interoperability of health information systems, foremost among them is a lack of technical standards for clinical data and data transmission. Additionally, clinical data standards suffer from a lack of codification of data, structure and format of data, and a standardized health vocabulary that promotes comparable and consistent information[26].

Mobile mental health app developers will need to address the formidable challenge of designing interoperable, user-friendly, and engaging mobile interventions that integrate

patient-generated data into existing health information systems. While mobile mental health interventions rapidly expand, integration of this data into electronic health records systems continues to be limited. Interoperability should be an integral component of mobile mental health interventions.

Privacy and Security Challenges for Mobile Mental Health

Privacy and security are important for any health information system, but particularly for mobile health interventions. Mobile health data differs in several ways from medical data collected in clinical setting: data is generated continuously for extended periods of time, and mobile health data is more broad in scope than what may be collected during in episodic office visits. Mobile health data may contain information not only related to health-related activities, but information that is unrelated, such as location, social activities, and personal habits. According to Mathews et al., further considerations should be given to use of mobile technology in mental health and should address ethical requirements; given the continued stigma of mental illness, the privacy of behavioral health data should adhere to strict ethical guidelines and strong security parameters[27].

The HIPAA security rule establishes a national set of security standards for the confidentiality, integrity, and availability of electronic protected health information [28]. Mobile mental health interventions collecting PHI, and sensitive mental health data, should adhere to HIPAA regulations in securing and protecting data against potential

breaches. To reduce risks of security breaches, mobile health interventions should adhere to technical safeguards including secure logins, user authentication, and forced encryption of any personal health information stored on the mobile device. Additionally, mobile PHI data should be encrypted while in transmission and auditing capabilities to assess security breaches should be enabled. Finally, entities and individuals should have the ability to remotely delete all data on the mobile device if the phone is lost or stolen and secure backups of the information should exist. Given the substantive fines associated with HIPAA non-compliance, mobile health app developers should consider implementation of additional security parameters a top priority. Privacy and security safeguards may require additional technical and financial expertise to implement, and may come at the expense of usability, but should be considered a integral to a well-designed, secure mobile health app.

While extensive challenges exist for the safe, secure, and integrative use of mobile mental health interventions, there is great potential for innovative systems of care to be developed. Little research has been conducted about the usage of technology and mobile health applications among people with SMI, but these studies have shown a high level of interest in engaging in health related activities using mobile technology[1], [11]. As mobile technologies mature and incorporate more sophisticated technologies, mobile health apps will likely become more widespread, affordable, and easy to use. Preliminary research suggests that there is extensive interest among people with SMI to use mobile health interventions and incorporate these technologies in their daily lives.

Methodology

Overview of study design: A descriptive study was conducted to determine rates of ownership of smartphone devices among people with serious mental illness as well as identify any potential barriers such as affordability challenges. All surveys were conducted at Grady Hospital's outpatient mental health clinic, a community mental health center (CMHC) in Atlanta, GA providing psychiatric care, psychotherapy, and primary care services. All surveys were administered to convenience sample of 100 patients with serious mental illness at Grady's mental outpatient clinic. The study was reviewed and approved by Emory's Institutional Review Board as human subjects research (IRB# 00062439); additionally, this research was submitted to Grady Healthcare Research Oversight Committee for review and approval (ROC#00062439).

Aim 1: Describe rates of current ownership of smartphones among people with serious mental illness.

Aim2: Identify existing barriers to using mobile technology in the delivery of health interventions for people with serious mental illness.

Trained research interviewers distributed a survey of mobile health information technology usage among people with SMI. Participants answered questions about their ownership and usage of mobile phones, smartphones, and current usage of health apps

on mobile devices. Participants self-reported current mental health diagnoses, medical diagnoses, income level, education level, and demographic information.

Additionally, enrolled participants answered questions regarding barriers to mobile device ownership (including affordability, lack of interest, lack of necessity), and interest in potential mobile health app services and specific functionality (medication reminders, appointment reminders, communications with providers, and information about existing mental health services).

Recruitment and Eligibility:

Participants were approached in the waiting room of the CMHC and compensated for their time and effort. Eligibility criteria included the presence of a SMI diagnosis including bipolar disorder, schizophrenia, schizoaffective disorder, major depression, obsessive compulsive disorder (OCD), and post traumatic stress disorder (PTSD). The only exclusion criteria were an inability to provide informed consent based on a validated screener.

Subjects meeting eligibility criteria and providing informed consent were administered the Pew Research Center's Internet & American Life Project's Health Tracking Survey 2012 [29] and a 2011 mobile health survey among people with SMI[1]. All data was stored in a secure, HIPAA-compliant, research database, REDCap. 100 participants were enrolled in this study during August 2014.

Analysis Plan:

Survey data was compared to the Pew Research Center's Internet & American Life Project's Health Tracking Survey 2012, a national telephone survey of mobile health usage amongst the general U.S. population. Frequency distributions were used to describe ownership, usage, and demographics. Logistic regression analysis was used to examine the relationship between mobile device ownership and age, income, and health status. Additionally, survey data was compared to a 2011 mobile health survey among people with SMI to determine potential barriers and current usage of mobile health technologies among people with serious mental illness (Mobile Technologies Among People with Serious Mental Illness: Opportunities for Future Services) [1].

Frequency distributions were used to describe barriers to smartphone ownership and interest in mobile mental health services. Logistic regression analysis was used to examine the relationship between smartphone ownership, and age, income, and education.

Results:

The final sample included 100 participants with a mean age of 47 (SD = 10.73), 62.6% were male; 85.0% were African-American and 4.0% were Caucasian; 2.2% identified as Hispanic. 78% had a high school diploma or less years of education; 70.1% reported having an annual income of less than $5,000 and 12.4% reported having an income between $5,001-$10,000; 29.2% were diagnosed with schizophrenia or schizoaffective disorder, 33.3% with bipolar disorder and 52.1% with major depressive disorder. 42.1% were diagnosed hypertension, 23.2% with diabetes, and 18.9% with diabetes. (N.B: participants may have reported multiple, co-occurring medical and mental health diagnoses) Table 1 below shows respondent's demographic information, and medical and mental health diagnosis.

Respondents reported varying levels of health and wellness; 8.0% described their health as excellent, 43.0% as good, 36.0% as only fair, and 13.0% described their health as poor. Within the past 12 months, 20.2% of survey respondents had faced a medical emergency, 39.4% had gone to the ER or been hospitalized unexpectedly, and 42.6% had experienced a significant change in physical health.

Cell phone ownership was common among survey respondents. 85% of participants reported that they owned a cell phone; of those, 36% reported that they owned a smartphone. 40.4% of respondents paid for mobile service using a month-to-month

plan, 40.4% indicated being covered by a government subsidized plan, and 7.4% responded as having a contract plan for mobile services. 75.5% reported that they used their mobile on a daily basis, 6.1% on a weekly basis, 9.2% on a monthly basis or less. Texting was common among survey respondents, with 77% reporting that they used texting on a regular basis. Among respondents who did not own a cell phone, affordability was commonly cited as a barrier to ownership, followed by lack of necessity.

Among survey respondents owning a smartphone, 15.0% reported having downloaded and used a health app on their mobile device. Common types of health apps used included exercise trackers, with 13.4% of participants tracking amount and duration of exercise. 8.2% reported using WebMD on their mobile device, 6.2% reported using sleep apps, 5.2% reported using blood pressure tracking apps, and 3.1% reported using apps for medication management.

78.5% of participants reported an interest in receiving reminders about appointments or medications on their mobile device; 57.0% wanted to receive information about health services, and 39.8% reported an interest in having regular check-ins with their provider on their mobile device. 60.6% of survey respondents were interested in receiving text messages on their mobile device to better manage their health, 48.9% in receiving phone calls, and 28.7% in receiving emails. A logistic regression model did not show age, income or education to be a significant predictor of owning a smartphone among this population.

Table 1 shows respondent's demographic information, medical, & mental health diagnosis.

Table 2 details self-reported health status among SMI and PEW Mobile Health Repondents

Table 3 details participant's mobile ownership rates and usage patterns.

Table 4 details common barriers to owning a mobile device.

Table 5 details usage and types of health apps

Table 6 details interest in health information delivery on mobile devices.

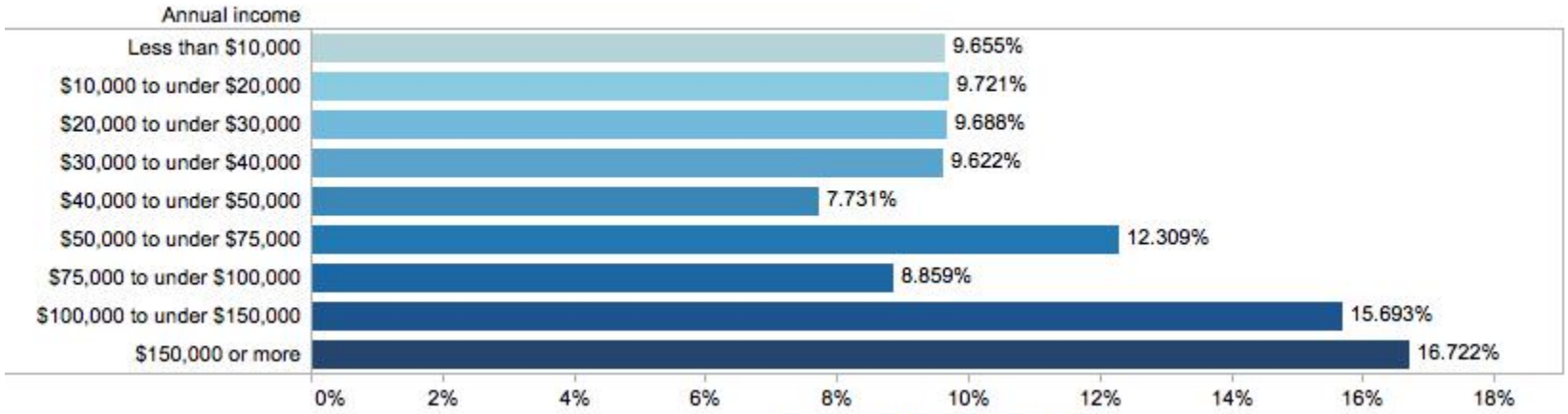
TABLE 1

SMI Safety Net & Pew Mobile Health 2012 Survey Respondents: Demographics

Survey Responses		SMI Safety Net Survey Responses	Pew Mobile Health 2012 Low Income (Under $20,000/yr) Respondents	Pew Mobile Health Survey 2012
Age	Mean	47	50	53
	Median	51	50	53
Gender				
	Male	63%	41%	49%
	Female	37%	59%	51%
Ethnicity				
	Not Hispanic or Latino	80%	94%	79%
	Hispanic or Latino	2%	3%	14%
	Unreported	17%	*	*
Race				
	White	4%	57%	75%
	Black (Born in the US)	85%	29%	19%
	Black (other)	3%	*	*
	Alaskan Native	1%	*	*
	More than one race	3%	4%	3%
	Unreported	2%	*	*
	Refused to answer	1%	*	*

Annual Income	$0-$5,000	70%	*	*
	$5,001-$10,000	12%	*	10% (Less than $10k)
	$10,001-$15,000	3%	*	10% ($10-20k)
	Greater than $15,000	5%	*	80% (More than $20k)
	Don't know	5%	*	
	Refused to Answer	4%	*	
Years of Education Completed	12 years or less	81%	61%	44%
	12 to 16 years	14%	25%	36%
	16+ years	5%	13%	27%
Mental Health Diagnosis	Schizophrenia	29%	*	*
	Bipolar Disorder	33%	*	*
	Major Depression	52%	*	*
	OCD	6%	*	*
	PTSD	19%	*	*
	Other	8%	*	*
Chronic Disease Diagnosis	Diabetes	19%	36%	11%
	Hypertension	42%	20%	25%
	Asthma	14%	12%	13%
	Heart Disease	6%	3%	7%
	Cancer	2%	2%	3%
	Hyperlipidemia	23%	*	*
	Other chronic condition	19%	*	16%
	NA	24%	*	*

Pew Mobile Health 2012 Annual Income



SMI Respondents Annual Income of Smartphone Owners

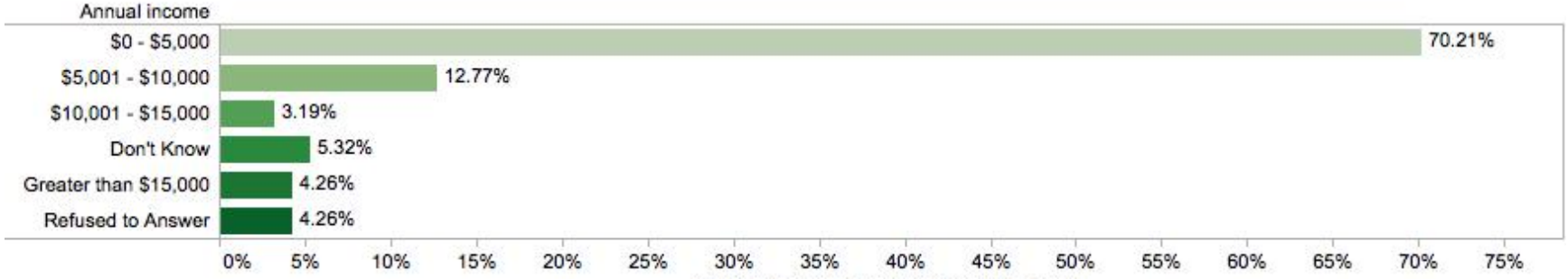


TABLE 2

SMI Safety Net Survey & Pew Mobile Health Respondents: Health Status

Survey Responses	SMI Safety Net Survey Respondents	Pew Mobile Health 2012 Low Income (Under $20,000/yr) Respondents	Pew Mobile Health 2012 Respondents
Health Status			
Excellent	8%	18%	28%
Good	43%	47%	52%
Only Fair	36%	26%	16%
Poor	13%	9%	4%
In the past 12 months			
Faced a Medical Emergency	20%	15%	11%
Gone to ER or been hospitalized unexpectedly	39%	23%	17%
Experienced Significant Change in Physical Health	43%	24%	16%

TABLE 3

SMI Safety Net Survey Respondents: Mobile Device Ownership & Usage Patterns

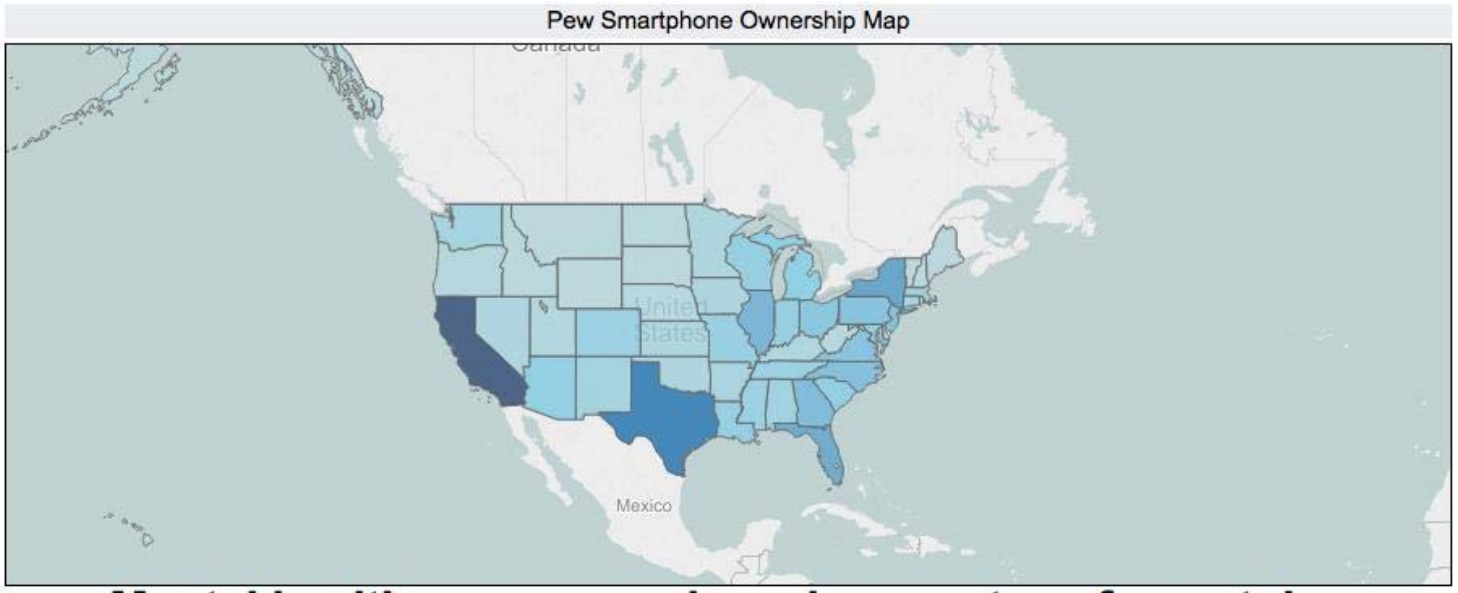
Survey Responses		SMI Safety Net Survey Responses	Pew Mobile Health 2012 Low Income (Under $20,000/yr) Respondents	Pew Mobile Health 2012 Respondents
Cell Phone Ownership	Yes	85%	78%	85%
	No	15%	22%	15%
Smartphone Ownership	Yes	37%	44%	53%
	No	52%	56%	47%
	Uncertain	8%		*
Payment Plan				
	Month to Month	40%	*	*
	Government Plan	40%	*	*
	Contract Plan	7%	*	*
	Pre-paid Card	2%	*	*
Functions Used				
	Text	77%	78%	80%
	Internet/Email	48%	52%	50%
Frequency of Use				
	Daily Use	76%	*	*
	Weekly Use	6%	*	*
	Monthly Use	5%	*	*

	Less than Monthly Use	4%	*	*
Interest in Mobile Services				
	Reminders about appointments or medications	79%	*	*
	Regular check-ins with provider	40%	*	*
	Information about health services	57%	*	*
Preferred service delivery medium				
	Calls	49%	*	*
	Text Messages	61%	*	*
	Email	29%	*	*

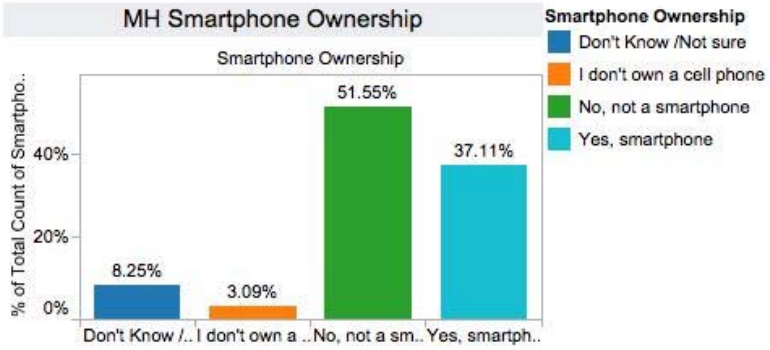
TABLE 4

SMI Safety Net Survey Respondents: Barriers to Ownership

Survey Responses	*Mobile Device Non-Owners*	*N*	*%*
Barriers to Ownership			
	Affordability	7	14.0%
	Lack of necessity	3	6.0%
	Lack of interest	1	2.0%
	Other	12	24.0%



Mental health consumers have lower rates of smartphone ownership than the general population.



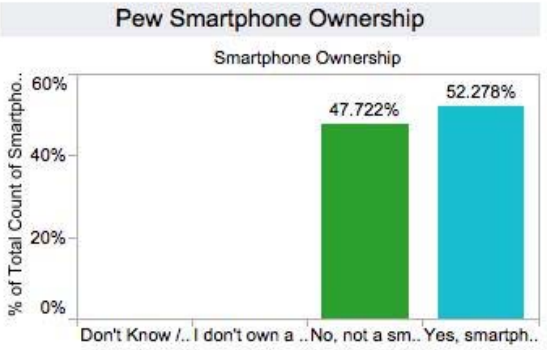
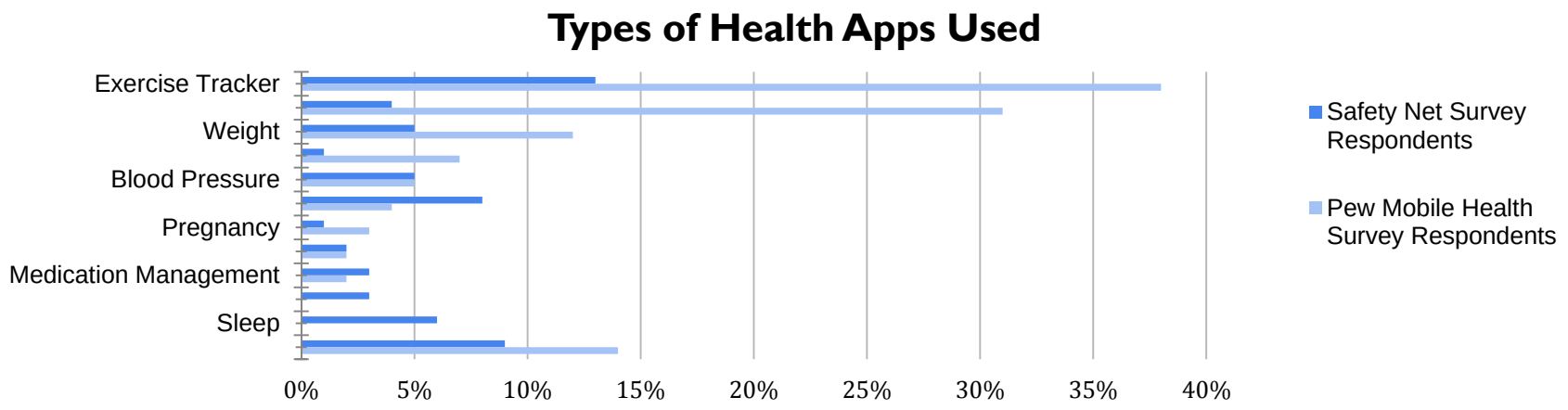


TABLE 5

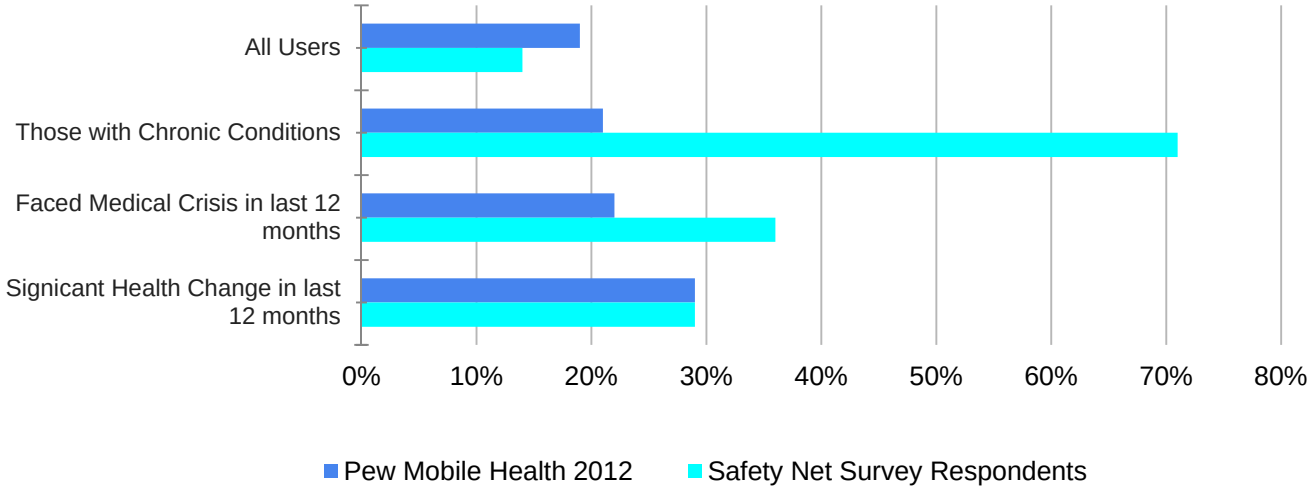
SMI Safety Net & Pew Mobile Health Survey Respondents: Texts for Health & Health Apps

		SMI Safety Net Survey Responses	Pew Mobile Health 2012 Low Income (Under $20,000/yr) Respondents	Pew Mobile Health Survey 2012
Survey Responses		%	%	%
Receive texts or updates about Health or Medical Issues from Provider	Yes	34%	9%	9%
	No	64%	91%	91%
Health Apps on Smartphone				
	Yes	15%	7%	19%
	No	75%	93%	81%
	Don't know	7%	NA	NA
Types of Health Apps Used				
	Exercise Tracker	13%	21%	38%
	Diet & Nutrition	4%	23%	31%
	Weight	5%	10%	12%
	Menstrual Tracking	1%	17%	7%
	Blood Pressure	5%	10%	5%
	WebMd	8%	6%	4%
	Pregnancy	1%	*	3%
	Blood Sugar Tracking	2%	1%	2%

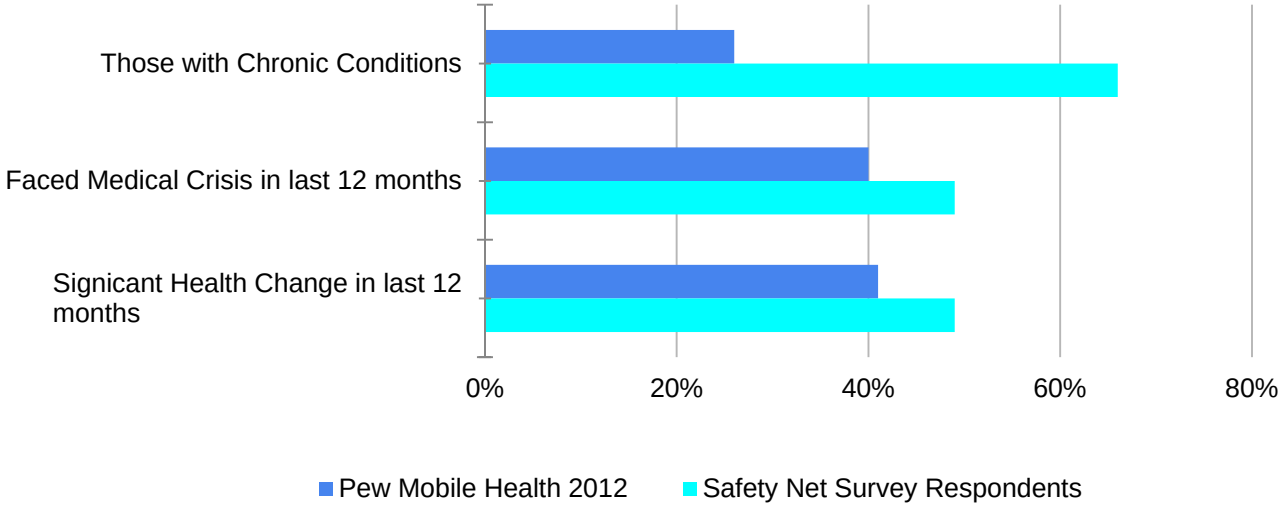
Medication Management	3%	*	2%
Mood	3%	*	*
Sleep	6%	*	*
Other	9%	*	14%



Health Status: Percentage of Cell phone Owners within each group who have software applications on phone to track or manage health



Health Status: Percentage of Cell phone Owners Within Each Group who Use Phone to Look for Health or Medical Information Online



Health Status: Percentage of Cell phone Owners within each group who receive health or medical information via text

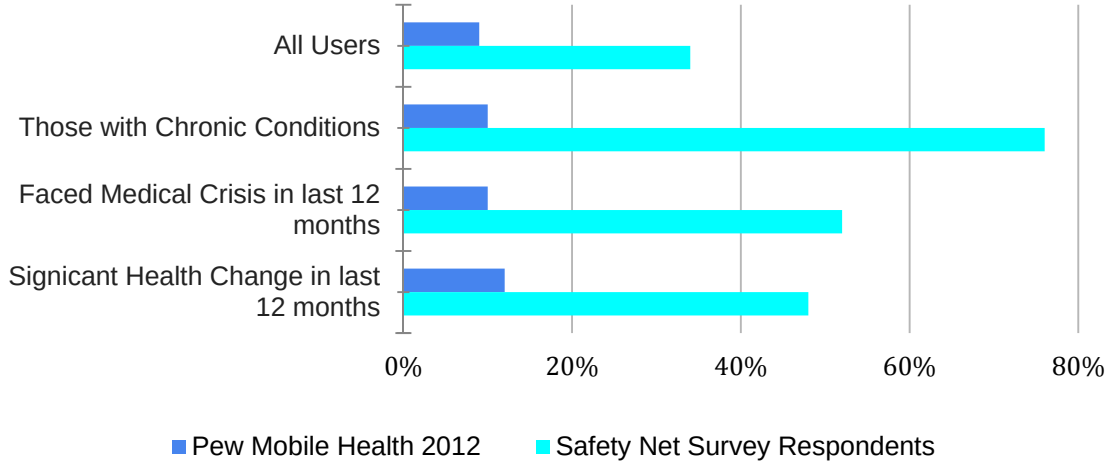


TABLE 6

SMI Safety Net Survey Respondents: Interest in Mobile Delivery of Health Information

Survey Responses	*Mobile Device Non-Owners*	N	%
Interest in Mobile Services			
	Reminders about appointments or medications	73	78.5%
	Regular check-ins with provider	37	39.8%
	Information about health services	53	57.0%
Preferred service delivery medium			
	Calls	46	48.9%
	Text Messages	57	60.6%
	Email	27	28.7%

Discussion

Mobile Ownership:

Among survey respondents, 85% of people with a serious mental illness reported owning a cell phone and used it on a regular basis for a variety of functions. This is on par with mobile phone ownership in the general U.S. adult population, with 85% reporting cell phone ownership in 2012 [12], as well as a survey of adults with serious mental illness reporting ownership rates of 81% [1]. Our research showed a 16% lower rate of smartphone ownership than found in the general population, with 37% of participants with SMI reporting owning a smartphone. Comparatively, Pew Research found 53% of the general US population reported owning a smartphone in 2012; this difference has likely decreased over the previous years since the survey has been conducted and smartphone costs have decreased.

Mobile Health

36% of survey participants with an SMI reported having looked for health or medical information online using their mobile device. This is remarkably lower than the general U.S. adult population, 52% of whom reported in 2012 using their smartphones to gather health information[12]. Among smartphone owners, 15% of respondents with SMI reported having downloaded and used a health app on their smartphone. This is similar to the general population, where 19% of smartphone users reported using health apps to manage their personal health in 2012 [12]. Survey respondents reported exercise,

sleep, and the WebMD app among the most commonly used health apps on their mobile devices; comparatively, Pew Research reported in 2012 that exercise, diet, and weight apps were among the most popular health apps in the general population.

Surprisingly, 34% of respondents with SMI reported receiving text updates regarding health or other medical issues from their providers or pharmacists. The Pew Research Mobile Health 2012 survey found only 9% of the general adult U.S. population as having received text alerts about health or medical issues [12]. This could be due to advancements in health information technology to send text alerts to patients in the past few years.

Limitations

Several limitations to this research should be noted. The study was conducted in a single, community mental health center. The sample size was relatively small (n=100) and was conducted among convenience sample. The survey did not assess whether mobile devices were provided to consumers as part of a family plan or if they were purchased independently. Additionally, all data was self-reported by survey respondents. These results may not be generalizable to other mental health settings or to the general population. Further research is needed to ascertain generalizability to other mental health populations.

Mobile Health and Wellness

Ownership of mobile devices, particularly of smartphones, is rapidly increasing; while rates of smartphone ownership among people with serious mental illness continue to lag behind the general population, this study has demonstrated that the gap in ownership is quickly decreasing. Our research showed a high level of interest among people with SMI in using their smartphones to better manage their personal health, providing further support for mental health interventions to be delivered using mobile platforms.

Numerous benefits may be derived through delivery of mobile health interventions for people with serious mental, including enhanced skills-training opportunities in real-world settings, continuous, on-going support from clinical providers, improved medication management, enhanced potential for treatment plan compliance, and additional tools for self-monitoring mental health symptoms. Additionally, a growing number of interventions are being developed that focus on providing support for general wellbeing, health, and overall wellness for people with SMI. These tools focus on empowering patients to make well-informed decisions, but also provide feedback that assists consumers in making healthy lifestyle choices.

The rapid expansion of mobile mental health interventions is certainly exciting particularly when considering the potential for innovation and expansion of therapeutic activities beyond the clinical space. However, there is still limited evidence regarding the efficacy of mobile health interventions in improving both mental health and medical health. To date, very few studies have been conducted assessing smartphone

ownership[1] and usage of mobile health among mental health consumers. While our findings of mobile device rates were similar[1], consideration must be given to the impact of low-income individuals being able to purchase smartphone technology and ability to access mobile health interventions. Among non-owners, cost was cited as an obstacle.

Mobile health interventions for both general populations and people with serious mental illness would benefit from rigorous clinical testing. Continued research and data collection would provide information not only for providers and patients, but also for mobile health app developers who could use the data to refine and improve mobile health interventions.

Furthermore, attention must be given to privacy and security of health information stored and transmitted through mobile platforms. While presumably most mobile health interventions incorporate strong security procedures in storing and transmitting personal health information (PHI), there is little guidance in federal statutes, including HIPAA, regarding the appropriate level of security parameters for mobile health apps. HIPAA was written more than 20 years ago, far before mobile health interventions were developed. Utilization of wireless networks may present additional vulnerabilities to attempted security breaches. Given the rapidly changing environment of mobile technology, more attention must be paid to updating federal regulations surround security of mHealth applications.

At minimum, mobile health apps using PHI should consider inclusion of secure logins with user authentication, forced encryption of any PHI stored on mobile devices, encryption of data while in transmission, auditing capabilities to assess security breaches, remote deletion of all data on the mobile device if lost or stolen, and secure backup of data in case of failure, loss of device, or accidental deletion. These security parameters may entail additional resources, both financial and technical, to develop. Given the hefty fines associated with HIPAA non-compliance, mobile health app developers should consider implementation of additional security parameters a top priority.

Finally, mobile health interventions should promote integration of both medical and mental health data with existing electronic health records systems and access to provider care teams. Interoperability continues to be a primary obstacle for EHRs, and will continue to represent a challenge for mobile health developers. One of the most complex challenges facing the public health system is a decided lack of interoperability between IT systems housing clinical data. In addition to a lack of existing or competing standards for clinical data and messaging systems, electronic health records tend to be proprietary software systems. Very few EMRs are able to transmit data and store data from external systems. The integration of patient-generated medical and mental health data from mobile devices to EHRs represents a very real, and very challenging, obstacle.

In conclusion, mobile mental health interventions offer a great opportunity for both patients and provider to increase patient engagement, improve supportive therapy

options outside of the clinical space, and collect continuous patient-generated health data that can be used to tailor health interventions at the individual level. Our research shows increasing penetration of mobile device and smartphone technologies among SMI, safety-net populations. In order to fully maximize this potential, additional research is required to further to understand the role mobile technologies can play in delivering innovative and effective care to people with serious mental illness.

Journal Article

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