Brief Communication

Feasibility of Popular m-Health Technologies for Activity Tracking Among Individuals with Serious Mental Illness

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Abstract

Obesity prevalence is nearly double among individuals with serious mental illness (SMI), including schizophrenia spectrum disorders, bipolar disorder, or major depressive disorder, compared with the general population. Emerging mobile health (m-health) technologies are increasingly available and offer the potential to support lifestyle interventions targeting weight loss, yet the practical feasibility of using these technologies in this high-risk group has not been established. We evaluated the feasibility and acceptability of popular m-health technologies for activity tracking among overweight and obese individuals with SMI. We provided wearable activity monitoring devices (FitBit [San Francisco, CA] Zip™ or Nike Inc. [Beaverton, OR] FuelBand) and smartphones (Apple [Cupertino, CA] iPhone® 4S) for accessing the smartphone application for each device to participants with SMI enrolled in a weight loss program. Feasibility of these devices was measured by the frequency of use over time. Acceptability was measured through qualitative follow-up interviews with participants. Ten participants with SMI wore the devices for a mean of 89% (standard deviation = 13%) of the days in the study. Five participants wore the devices 100% of the time. Participants reported high satisfaction, stating the devices were easy to use, helpful for setting goals, motivational, and useful for self-monitoring. Several participants liked the social connectivity feature of the devices where they could see each other's progress on the smartphone application, noting that "friendly" competition increased motivation to be more physically active. This study supports using popular m-health technologies for activity tracking among individuals with SMI. These findings can inform the design of weight loss interventions targeting this vulnerable patient population.

Key words: *behavioral health, mobile health, commercial telemedicine, telepsychiatry, telemedicine*

Introduction

Obesity prevalence is nearly double among individuals with serious mental illness (SMI) compared with the general population.[1] SMI presents an especially difficult challenge for behavioral weight loss interventions as it includes schizophrenia spectrum disorders, bipolar disorder, and major depressive disorder with persistent impairment in multiple areas of functioning, including work, school, or self-care.[2] Despite significant socioeconomic disadvantages, a recent survey of low-income individuals with SMI found that over 70% own cell phones, of which a third reported using their devices for Internet activities.[3] In the general population, 90% of adults own cell phones, and 58% own smartphones, with the greatest increases in ownership occurring among low-income individuals.[4] Consistent with these trends, smartphone ownership is also expected to increase among individuals with SMI,[5] suggesting that emerging mobile health (m-health) technologies such as smartphone applications or wearable devices targeting exercise may present opportunities for supporting weight loss in this vulnerable group.

Studies in the general population highlight the potential for popular m-health technologies to promote weight loss given their low-cost and user-friendly design.[6,7] For example, a recent trial found that a wearable activity tracking device connected to a personalized online account contributed to significant weight loss among overweight and obese participants,[8] and a smartphone application for weight loss achieved greater adherence compared with a Web site or paper diary.[9] However, it is not known if popular technologies are feasible or acceptable for use among individuals with SMI.

Interventions targeting individuals with SMI are typically developed with consideration of cognitive impairments and social challenges affecting this population. Smartphone applications developed for mental illness self-management[10,11] and symptom monitoring[12] incorporate simple visual interfaces, use familiar phrasing and content presented at a low reading level, and avoid tasks requiring abstract reasoning.[13,14] However, popular m-health technologies may not be practical or appropriately tailored for the cognitive and functional challenges experienced by this group. Prior research shows that smoking cessation Web sites for the general public are difficult to navigate for many individuals with SMI.[15] Technologies available for the general public are believed to have poor usability among persons with SMI,[14] but whether this holds true for popular m-health technologies targeting physical activity has not been evaluated.

Our objective was to assess the feasibility of using popular m-health technologies for activity tracking among overweight and obese individuals with SMI. Our assessment of feasibility consisted of (1) frequency of use over time and (2) the extent to which participants judged the technology to be satisfying, appropriate, and something they would continue using.[16] Our overall aim was to inform future research on the effectiveness of m-health interventions for obesity in persons with SMI by determining if these technologies are usable and acceptable for this high-risk, challenging population.

Materials and Methods

We provided two types of commercially available, wearable activity tracking devices (FitBit [San Francisco, CA] Zip™ or Nike Inc. [Beaverton, OR] FuelBand) and smartphones (Apple [Cupertino, CA] iPhone® 4S) for accessing the smartphone application for each device to participants enrolled in a weight loss program delivered from July to November 2013 in Keene, NH. The weight loss program was adapted from the In SHAPE intervention for people with SMI[17] and consisted of weekly peer-led group and individual exercise and nutrition education sessions as well as individual meetings with a certified fitness trainer. Convenience sampling was used to recruit participants for the weight loss program from a community mental health center who met the following criteria: community dwelling, 21 years of age or older, body mass index of ≥ 25 kg/m^2, and SMI defined as diagnosis of schizophrenia spectrum disorder, bipolar disorder, or major depressive disorder, with impairment in multiple areas of functioning (e.g., work, school, self-care).[18] Committees for the Protection of Human Subjects at Dartmouth College and the New Hampshire Bureau of Behavioral Health approved all study procedures.

We provided Zip devices to half of our participants and FuelBand devices to the other half to assess the feasibility of each. The Zip is an accelerometer comparable in size to a pedometer that tracks steps, distance, and calories burned (www.fitbit.com/zip). The FuelBand is a wristband accelerometer that is slightly smaller than a wristwatch that also tracks steps, distance, and calories burned as well as Fuel Points for combined lower and upper body activity (www.nikeplus.nike.com).

Each device syncs wirelessly with its own smartphone application downloaded to the iPhone 4S from the iTunes Store. The smartphone applications for each device reward milestones (e.g., reaching 20,000 steps), track activity over time, and allow users to compare steps and progress with others through a closed social network. Participants could choose if they wanted to share their activity information with others. Participants attended a 1-h training session on using the devices and smartphone. We provided ongoing individual technical assistance as needed.

We downloaded data on frequency of device use over the duration of the pilot study from each participant's smartphone application account. Frequency of use was calculated as the number of days a participant wore and synced the device divided by the number of days in the study. We were also interested in whether participants continued using the devices over time because frequent and continued use of m-health interventions is associated with more positive health behavior change.[19,20] To further explore feasibility, we conducted follow-up in-depth semistructured interviews with participants. We used an interview topic guide with questions about participants' behavior, experiences, and preferences using the wearable activity tracking devices and smartphone. In our qualitative

CATEGORY	SAMPLE QUOTES
Motivating	"The little FitBit was very helpful. The FitBit was great….It was good to keep track of, you know, how many minutes I did one day and if I could improve the next day and if I could go up higher on my minutes." (Participant #2) "Well, I think it's [FuelBand] helpful because it helped me, I don't know, get more motivated. I was trying to get a lot of points and stuff." (Participant #5) "I wanted to get more steps on my FitBit, so I would call my girlfriend and say, 'Let's go apple picking.' Or, it was always, 'Let's go do something.'" (Participant #8)
Goal setting	"I started at a thousand and I upped it to 2,000. It helped me set goals throughout the day." (Participant #9) "And I set a goal like each day, I wanted to achieve 1,500 steps and see, I've just overachieved." (Participant #10)
Social connectivity and competition	"You will see the rewards that [other people] got. It was definitely helpful. It kinda wants you to get going more when you see that you're gonna be higher than a certain person." (Participant #3) "She was up [in steps] and then I was up. We'd take turns. I liked that….It's just fun. You can see who beats. That's all." (Participant #7)
Self-monitoring	"I noticed a big difference in the days that I come up to the Y and days that I'd stay at home. Like, I'd get up and go to 1,000 [steps] at the Y. That was what my goal was. But then the days I don't come to the Y, I was only at 500, so it made a huge difference on the exercise I'd get in a day." (Participant #6) "It was actually something I look forward to like each day doing, you know. Going at the end of the day, logging in how much I did and it's like 'Ooh look, I walked this much,' you know." (Participant #10)
Ease of use	"After a while, it's like it's not even there." (Participant #3) "The band was easy." (Participant #6)

Table 1. Participants' Views on the Benefits of Using Popular Wearable Mobile Health Technologies (Fitbit Zip or Nike Fuelband) for Activity Tracking

analyses, our team used data reduction[21] to independently summarize participants' responses, followed by matrix analysis[22] to group responses into broad categories. Differences were discussed until consensus was reached.

Results

We recruited 10 people with SMI ($n=3$ with schizophrenia spectrum, $n=1$ with bipolar disorder, $n=6$ with major depressive disorder) ranging in age from 30 to 58 years (mean=47.7, standard deviation=9.0) with a mean body mass index of 42.4 kg/m^2 (standard deviation=14.5). Participants were predominantly white (90%), and most were women (90%). Participants wore the devices for a mean of 89% (standard deviation=13%; range, 66–100%) of the days in the study, demonstrating frequent and continued use. Five participants wore the devices 100% of the time. Participants had the devices between 80 and 133 days depending on date of enrollment, except for one participant who dropped out after 39 days because of a serious medical condition unrelated to study participation. All participants learned to use the devices and smartphones within 2 weeks, with only one individual requiring ongoing assistance for the first 2 months. At study completion all devices and smartphones were returned undamaged.

Nine participants completed follow-up interviews. Findings are summarized in *Table 1*. Participants reported high satisfaction, stating the wearable activity tracking devices were easy to use, helpful for setting goals, motivating, and useful for self-monitoring. Several participants stated that they enjoyed seeing each other's steps on the smartphone application as a form of competition and motivation to do more activity. Few participants had any negative comments about use of the devices, and most expressed interest in using similar devices in the future. Some participants voiced frustration if they forgot to sync their device with the smartphone or if they forgot to wear it. Participants viewed these devices as expensive and difficult to obtain for low-income individuals. There appeared to be no feasibility differences between the devices, except that some participants did not like always wearing the wristband associated with the FuelBand. Participants indicated that they enjoyed the trophy rewards and "smiley face" on the Zip display as well as the more colorful animation rewards on the FuelBand. No privacy concerns about using these mobile technologies were reported.

Discussion

Our study shows that popular m-health technologies for activity tracking are feasible and acceptable for use among overweight and obese individuals with SMI, consistent with reports in non-SMI populations.[23] It is possible that our findings reflect the user-friendly design of new wearable devices and corresponding smartphone applications.[24] At the same time, participants expressed concerns about affordability of these devices, highlighting broader concerns regarding the feasibility of using emerging m-health technologies in low-income patient populations. However, we contend that as m-health technologies become more affordable and widely available, establishing feasibility in high-risk populations is necessary to inform the design of future interventions. It was not possible for us to determine whether different psychiatric diagnoses were associated with differing responses to the devices or whether feasibility varied by diagnosis given our small sample. We are currently using these preliminary feasibility findings to inform a future larger study aimed at evaluating the effectiveness of these devices for promoting physical activity participation in this population. Our findings of frequent and continued use of popular m-health technologies support the feasibility of using these devices for health promotion among overweight and obese persons with SMI.

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Disclosure Statement

No competing financial interests exist.

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