



Wearable devices and mobile technologies for supporting behavioral weight loss among people with serious mental illness



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ABSTRACT

Promoting physical activity is essential for addressing elevated cardiovascular risk and high obesity rates affecting people with serious mental illness. Numerous challenges interfere with exercise participation in this high-risk group including mental health symptoms, low motivation, and limited access to safe and affordable options for physical activity. Wearable devices and mobile health technologies may afford new opportunities for promoting physical activity and supporting behavioral weight loss efforts. This exploratory study examined whether daily step count measured using Fitbit wearable devices was associated with weight loss and improved fitness among individuals with serious mental illness enrolled in a 6-month lifestyle program. Participants ($n=34$) had a schizophrenia spectrum disorder (23.5%), major depression (50.0%), or bipolar disorder (26.5%), and wore Fitbits most of the days ($M=86.2\%$; $SD=18.4\%$) they were enrolled in the study. At 6-months, higher average daily step count was associated with greater weight loss ($F=5.07$; $df=1,32$; $p=0.0314$), but not improved fitness ($F=1.92$; $df=1,31$; $p=0.176$). These findings demonstrate that encouraging participants with serious mental illness enrolled in lifestyle interventions to collect more steps may contribute to greater weight loss. This suggests that wearable devices may offer a feasible and potentially effective strategy for supporting behavioral weight loss in community mental health settings.

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1. Introduction

Rates of obesity are nearly twice as high among people with serious mental illness, including schizophrenia spectrum and mood disorders, compared to the general population (Allison et al., 2009). This dramatic disparity in obesity prevalence is largely due to the combination of unhealthy lifestyle behaviors such as physical inactivity and poor diet, metabolic effects of psychoactive medications, poverty, and the impact of mental health symptoms on motivation and functioning (Allison et al., 2009). As a result, people with serious mental illness experience elevated risk of cardiovascular disease and significantly reduced life expectancy (Walker et al., 2015). Efforts are urgently needed to address the early mortality health disparity affecting these individuals.

Recent randomized controlled trials have demonstrated that promoting physical activity as part of lifestyle interventions for weight loss can contribute to clinically significant reduction in cardiovascular risk in as many as half of participants with serious mental illness (Bartels et al., 2013; Bartels et al., 2015; Daumit et al., 2013; Green et al., 2015). A robust body of evidence supports the numerous benefits of physical activity participation for people with serious mental illness. A systematic review of 39 trials found that engaging in regular physical activity resulted in fewer depressive symptoms, greater aerobic capacity, and improved quality of life among people with mental illnesses including schizophrenia and bipolar disorder (Rosenbaum et al., 2014). Recent meta-analyses have also demonstrated that physical activity contributes to reduction in mental health symptom severity among people with serious mental illness (Dauwan et al., 2015; Firth et al., 2015a).

Despite well-documented benefits of physical activity for people with serious mental illness, there are numerous challenges to effectively promoting more active lifestyles in this high-risk group. Compared to the general population, people with serious mental

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illness are less likely to participate in exercise (Daumit et al., 2005) and more frequently engage in sedentary behaviors (Stubbs et al., 2016). Among individuals with schizophrenia, fewer than one in five report engaging in moderate exercise at least once per week, and nearly 40% are physically inactive (Brown et al., 1999). People with serious mental illness report many barriers to physical activity including low confidence and low motivation due to symptoms of depression, stress, fatigue and anxiety, as well as fears of discrimination, limitations due to physical health conditions, and concerns about neighborhood safety (Browne et al., 2015; Johnstone et al., 2009; McDevitt et al., 2006; Ussher et al., 2007). Consistent with other low-income groups (Powell et al., 2006), inadequate access to safe and affordable options for exercise such as local parks or recreation facilities is a likely contributor to physical inactivity among people with serious mental illness. In addition, few public sector mental health facilities offer supported opportunities for people with serious mental illness to participate in physical activity programs (Dixon et al., 1999; Jeste et al., 1996; Richardson et al., 2005). Finally, the effects of debilitating mental health symptoms, impaired information processing capabilities, and low-motivation likely create challenges for planning ahead to meet weekly activity goals, prioritizing exercise over competing demands, and adhering to a set exercise regimen over time (Richardson et al., 2005).

Feasible and effective strategies are needed to overcome these diverse challenges and to promote physical activity participation among people with serious mental illness. Mobile health technologies and wearable devices are particularly promising for supporting physical activity as part of lifestyle interventions for these individuals. In a series of pilot studies, we demonstrated the feasibility and acceptability of using popular wearable devices among people with serious mental illness (Naslund et al., 2015a, 2016b). These devices offer a user-friendly platform and interface that includes several features that are motivating and make being physically active enjoyable such as reminders, goal setting, rewards for achieving milestones, social connection and competition with peers, and ability to track individual performance over time (Patel et al., 2015). As mobile technologies become increasingly affordable and more widely available among people with serious mental illness (Firth et al., 2015b), there are opportunities to use wearable devices to support broader health promotion efforts targeting weight loss and cardiovascular risk factors in this vulnerable group. However, it is not clear whether these devices can support a lifestyle intervention targeting weight loss and fitness, and whether data captured using wearable devices is associated with improved outcomes.

In this exploratory study, participants with serious mental illness who were enrolled in a community-based group behavioral weight loss program were given Fitbit wearable devices to support their physical activity and weight loss goals. We examined whether average daily step count measured using the wearable devices over the 6-month study duration was associated with weight loss and improved fitness. We hypothesized that higher average daily step count would be associated with greater weight loss and improved fitness at 6-months. We then explored whether changes in step count over time (such as increasing or decreasing steps) was associated with weight loss or improved fitness (i.e., a time-varying relationship). We did not have a specific hypothesis regarding timing of steps and associated changes in weight and fitness, but we hypothesized that increased steps at any time during the course of the study would be associated with greater weight loss and improved fitness.

2. Methods

2.1. Participants and setting

Participants in this study were enrolled in a 6-month group behavioral weight loss program targeting fitness and healthy eating through an urban community mental health center in southern New Hampshire. Participants were age 21 or older; had serious mental illness defined by an axis I diagnosis of schizophrenia, schizoaffective disorder, major depressive disorder, or bipolar disorder; spoke English; were on stable pharmacological treatment defined as receiving the same psychiatric medications over the prior 2 months; and had obesity defined as body mass index (BMI) ≥ 30 . Participants were excluded if they had any medical contraindication to weight loss; were pregnant or planning to become pregnant within the next 6 months; or had a current diagnosis of an active alcohol-use or substance-use disorder. Participants received medical clearance from a primary care provider prior to starting the program and had to be able to walk at least one city block. Committees for the Protection of Human Subjects at Dartmouth College and the New Hampshire Department of Health and Human Services approved all study procedures.

2.2. Wearable devices

Participants were given Fitbit Zip wearable devices and smartphones to use for the 6-month study duration. The Fitbit Zip is a compact wearable accelerometer that clips onto participants' clothing. It tracks number of steps and it syncs wirelessly with a free companion smartphone application. The Fitbit rewards milestones such as reaching daily step goals with colorful trophies, and it allows users to compare steps and progress with others through the smartphone application. We elected to use Fitbit Zip wearable devices because in our previous work we found that these devices were both feasible and acceptable for use among people with serious mental illness (Naslund et al., 2015a, 2016b). Participants attended two brief 30-min training sessions with a member of the research staff for instruction in using the Fitbit wearable devices and syncing the Fitbit with the companion smartphone application. Technical support for using the Fitbit or companion mobile application was provided to participants on an as needed basis by a member of the research team over the study duration.

2.3. Group-based lifestyle program

The group-based lifestyle program focused on achieving weight loss through healthy eating and increasing physical activity. The program was modeled after the evidence-based Diabetes Prevention Program, and included weekly group sessions led by lifestyle coaches. Full descriptions of the program are available elsewhere (Aschbrenner et al., 2015, 2016). Participants shared an activity goal of reaching 150 min of exercise each week. As part of the program, participants received 3–5 text messages from research staff each week as reminders to attend optional exercise classes, to be more active as part of their daily routines, to provide encouragement for finding new ways to be more active, and to support participants in reaching the program's weekly physical activity goal. Additionally, participants were encouraged to set daily step goals on their Fitbits, and they were given the opportunity to review and revise these goals each week. Participants had varying capabilities to engage in physical activity, and some participants had mobility issues. As a result, the goal-setting component of the program was personalized to meet participants' physical abilities, whereby participants set individual daily step goals that they felt that they could reach.

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