A GROUP RANDOMIZED TRIAL TO EXAMINE THE FEASIBILITY AND EFFECTS OF PEDOMETER USE AND SELF-MONITORING OF DAILY WALKING IN PEOPLE WITH SEVERE AND PERSISTENT MENTAL ILLNESSES

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ABSTRACT

This randomized controlled pretest-posttest group comparison study aimed 1) to systematically examine the feasibility and acceptability of pedometer use and self-monitoring of daily steps, 2) to empirically evaluate the potential reactivity effects associated with pedometer use and self-monitoring of walking, and 3) to investigate the potential short-term treatment effects of pedometer use on health outcomes in people with severe and persistent mental illnesses (SPMI). Sixty participants (mean age 46.8, 67% men, 83.3% unemployed) were recruited from a Clubhouse and Community Mental Health Centers in Hawaii. The large majority of participants had a primary DSM-IV diagnosis of Major Depressive Disorder, Recurrent (45%), followed by Bipolar Disorder (30%) and Schizophrenia Spectrum Disorder (21.7%). After a pretest assessment, participants were randomly assigned to either unsealed pedometer with self-monitoring (n=20), sealed pedometer without self-monitoring (n=20), or control no pedometer group (n=20), and were asked to return for posttest assessment after two weeks. Pedometer users (n=40) also completed a Debriefing Survey to systematically examine their pedometer use experience. Results showed that (1) pedometer use and self-monitoring of daily steps procedures were feasible for, and regarded as acceptable and useful by, participants with SPMI living in rural areas and a subtropical climate; (2) there was no significant reactivity effect associated with pedometer feedback and self-monitoring of walking for two weeks; and 3) there were no significant treatment effects of pedometer use on promoting physical activity and health outcomes in short-term pedometer use for people with SPMI. With increasing affordability, functionality, accuracy, and acceptability of a pedometer as an assessment and motivational device for promoting
physical activity, its potential utility for people with SPMI should not be ignored, particularly given the good adherence and perceived utility of pedometer use found in this study. Future studies may continue to explore specific mechanisms that can account for and enhance the success of initiation and maintenance of pedometer-assisted self-intervention for people with SPMI.
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CHAPTER 1
INTRODUCTION

This introduction begins by presenting research highlighting the evidence of poor physical health & high premature mortality among persons with severe and persistent mental illnesses (SPMI). Next, this introduction reviews some of the current literature on the effects of physical activity on some specific physical and mental health outcomes in the general population and in people with mental illnesses or disorders. The physical outcomes reviewed will include cardiovascular risk factors and body weight. The mental health outcomes discussed will include depression, health related quality of life, and self-confidence in health management. Next, this introduction reviews extant literature on the effectiveness of interventions designed to promote physical activity in people with SPMI. Some potentially useful strategies used to study and promote physical activity among persons with SPMI will also be discussed. Finally, the rationales and purposes of the present study will be described.

High Incidence of Physical Health Morbidity & Premature Mortality in Persons with SPMI

Extensive evidence has shown that people with severe and persistent mental illnesses (SPMI) such as schizophrenia, bipolar disorder, and major depression, have higher rates of health morbidity and premature mortality compared with the general population (e.g., Brown, Inskip, & Barraclough, 2000; Dembling, Chen, & Vachon, 2004; Harris and Barraclough, 1998; Jones, Macias, Barreira, Fisher, Hargreaves, & Harding, 2004; Miller, Paschall, & Svendsen, 2006;). For example, Osborn, Nazareth, & King (2006) found that, controlling for age and gender, persons with SPMI were almost
twice as likely to have a raised 10-year risk of coronary heart diseases compared with persons without SPMI. This pattern is comparable to a number of studies that have also shown twofold excess death related to coronary heart diseases in persons with SPMI (e.g., Hansen, Jacobsen, & Arnesen, 2001; Lawrence, Holman, Jablensky, & Hobbs, 2003).

Further, in a longitudinal study of 319 participants (62% Female and 99.6% Caucasian) with schizophrenia or schizoaffective disorders seen at the Mayo Clinic from 1950-1980 and followed up until 2005, 44% of participants were deceased at the end of the follow-up. The study also found that the mortality rate of this group of individuals was significantly greater than the matched calendar year of birth, age, and gender Caucasian population in the United States (Capasso, Lineberry, Bostwick, Decker, & Sauver, 2008).

In addition, numerous studies have demonstrated that obesity, diabetes and hypertension were among the most prevalent medical comorbidities among people with SPMI (Daumit, Goldberg, Anthony, Dickerson, Brown, Kreyenbuhl, et al., 2005; Meyer and Nasrallah, 2003; Miller et al., 2006; Sokal, Messias, Dickerson, Kreyenbuhl, Brown, Goldberg, et al., 2004). In a recent study, Batki, Meszaros, Strutynski, Dimmock, Leontieva, et al., (2009) examined 80 participants with schizophrenia and found that 83% of them had at least one chronic medical illness, and hypertension was the most common (43%) medical comorbidity.

Moreover, numerous studies have also shown that the use of atypical antipsychotics was associated with undesirable metabolic side effects such as high rates of diabetes (Dixon, Weiden, Delahanty, Goldberg, Postrado, Lucksted, & Lehman, 2000;
Muir-Cochrane, 2006), hyperlipidemia (Henderson et al., 2005), and weight gain (e.g., Allison, Newcomer, Dunn, Blumenthal, Fabricatore, et al., 2009; Goldman, 1999; Sokal et al., 2004). Further, there is evidence to suggest that higher body mass index (BMI) predicts poorer quality of life in individuals with schizophrenia (Allison et al., 2009; Allison Mackell, & McDonnell, 2003; Faulkner, Cohn, Remington, & Irving, 2007).

Overall, substantial evidence has shown that individuals with SPMI had significantly lower overall health status than the general population (Dickerson, Brown, Daumit, LiJuan, Goldberg, Wohlheiter, et al., 2006). Service utilization studies have also found that, compared with the general population, people with SPMI receive less preventive and primary health care services and rely more heavily on expensive emergency room services for their medical conditions (Folsom, McCahill, Bartels, Lindamer, Ganiats, & Jeste, 2002; Goldberg, Seybolt, & Lehman, 2002).

**Improving Physical Health and Recovery-Oriented Mental Health Services**

Presently, although extensive evidence has demonstrated a lower overall health status and higher mortality among individuals with SPMI, research and programs that aim to identify and evaluate strategies to improve the physical health of individuals with SPMI are very scarce (Hutchinson, Gagne, Bowers, Russinova, Skrinar, & Anthony, 2006; Richardson, Faulkner, McDevitt, Skrinar, Hutchinson, & Piette, 2005b). More importantly, in addition to the escalating public health burden due to poor health, the health disparity experienced by people with SPMI is likely to contribute additional disabilities and challenges in their journey to recovery (Hutchinson et al., 2006).

Recovery-oriented mental health services aim to improve the overall quality of life of persons with SPMI (Anthony, 1993). Improving the physical health of persons
with SPMI is considered as an integral part of a recovery-oriented treatment (Anthony, Cohen, Farkas et al., 2002). More importantly, there is an urgent need to address the health disparity and promote health and physical well-being of people with SPMI (Daumit et al., 2005; Richardson et al., 2005). Others underscored that individuals with SPMI also have a right to optimal health (Hutchinson et al., 2006).

To promote the health status of people with SPMI is undoubtedly a formidable task. Policy, organizational, personnel, resource, and training support are all essential. Rigorous research to identify efficacious and cost-effective strategies to promote the physical health for this population is also necessary. Encouragingly, mental health rehabilitation experts have begun to tackle the issue by advocating an integration of systematic health monitoring, wellness promotion, and healthy lifestyle programs in mental health services for persons with SPMI (e.g., Hutchinson et al., 2006; Richardson et al., 2005). Identifying strategies to promote lifestyle health behavior change, such as increasing regular exercise and physical activity, may be a potentially effective approach to enhance the physical and psychological well-being of people with SPMI.

**Physical and Psychological Health Benefits of Regular Physical Activity**

Extensive evidence supports the physical and psychological health benefits of regular physical activity in the general population, and in populations of people with various chronic physical illnesses, such as diabetes, hypertensions, and heart problems (Lander & Arent, 2007; Phillips, Kiernan, & King, 2001). Specifically, compared with individuals who are sedentary, physically active individuals have reduced risk of developing heart problems (Hu, Stampfer, Solomon, Liu, Willett, Speizer, & Nathan, 2001; Williams, 2001), diabetes (Kavookjian, Elswick, & Whetsel, 2007; Knowler,

Further, numerous studies have found that compared with those who are sedentary, physically active individuals have better weight control and weight loss in the general population (e.g., Jebb & Moore, 1999; Ross, Freeman, & Jansen, 2000). A comprehensive review by Blair & Brodney (1999) on the effects of physical activity and obesity on morbidity and mortality also found that people who are obese but active are healthier than those who are physically inactive but not obese. The results have highlighted the beneficial effects of staying physically active even when weight loss is not the main concern (Blair & Brodney, 1999).

In sum, substantial evidence has suggested a very strong link between regular physical activity and improved physical health in the general population. Reducing risks of hypertension, diabetes and heart diseases, and improving weight control will help mitigate the tremendous public health burdens and human costs associated with these chronic health conditions (U.S. Department of Health and Human Services, 2000).

In addition to the physical health benefits, the positive effects of regular physical activity on mental health are impressive. For example, in a recent comprehensive review of physical activity on psychological health, Landers & Arent (2007) reported consistent positive effects of exercise on cognitive functioning, with effect sizes ranging from small to moderate (ESs= 0.29 to 0.62). Moreover, extensive epidemiological and longitudinal studies have consistently found that regular exercise is associated with reduced anxiety and depressive symptoms (e.g., Cooper-Patrick, Ford, Mead, Chang, & Klag, 1997; De

Results from a meta-analysis study showed that, compared to no treatment, exercise significantly lowered depression scores with standardized mean difference in effect size -1.10 (95% CI -1.5 to -0.6), and no significant difference between exercise and cognitive therapy with standardized mean difference -0.3 (95% CI -0.7 to 0.1) (Lawlor and Hopker, 2001). This study examined ten randomized controlled trials (RCT) that compared exercise with no treatment control, and four RCT studies that compared exercise with cognitive therapy. These studies included clinical patients or people with high score of depressive symptoms.

Furthermore, in a systematic review of the effect of exercise on depressive and anxiety symptoms, Landers and Arent (2001) also reported moderate to large effect sizes of physical activity on depression ranging from 0.53 to .72, and small to moderate effect sizes were also found on anxiety symptoms that ranged from 0.15 to 0.56.

Overall, meta-analyses findings of the large effect sizes of exercise as a treatment for depression are persuasive. However, more vigorous studies examining the effects of exercise for other clinical or co-morbid conditions in diverse settings with adequate randomization and follow up are also needed (Landers and Arent, 2001; Lawlor and Hopker, 2001).

Indeed, although physical activity is an intensively studied area in community populations and in some clinical populations with elevated depressive symptoms, only a
few studies have examined physical activity in persons with SPMI (Brown and Chan, 2006; Dubbert, White, Grothe, O’Jile, & Kirchner, 2006; Faulkner, Cohn, Remington, 2007; Richardson, Avripas, Neal, & Marcus, 2005a). Only recently researchers have begun to investigate the physical activity pattern, and the feasibility and effectiveness of physical activity programs for persons with SPMI. Randomized control studies that investigated the efficacy of physical activity interventions for this population are even more limited (Brown & Chan, 2006; Melamed, Stein-Reisner, Gelkopf, Levi, Sivan, Ilievici, et al., 2008; Richardson et al., 2005a).

**Physical Activity Pattern: Prevalence, Types, Preference and Barriers**

Several guidelines have recommended that the beneficial level of moderate physical activity can be achieved by walking briskly for about 30 minutes or walking minimum of 10,000 steps daily, or engaging in moderate physical activity (e.g., brisk walking, running, swimming, yard work) for 150 minutes per week for general health benefits, or 60 minutes per day for weight loss (American College of Sports Medicine Position Stand, 1998; Haskell, Lee, Pate, Powell, Blair, Franklin, et al., 2007; U.S. Department of Health and Human Services, 2000).

One of the few studies that examined the prevalence and types of physical activity in people with SPMI in the United States was conducted by Daumit et al. (2005). The study interviewed one hundred and eighty five (N=185) outpatients recruited from several outpatient clinics in the metropolitan areas in Maryland. The participants’ ages ranged from 18 to 65, with 25% diagnosed with schizophrenia, 25% with schizoaffective disorder, 25% with major depression, and 25% with bipolar disorder. Results showed that the individuals in the SPMI group were significantly more likely to report being
physically inactive in the past month compared to a national age-gender-race-matched sample (25.7% vs. 17.5%, p<0.01). In addition, the SPMI group reported walking as the most prevalent type of physical activity. Education was found to be positively associated with recommended level of physical activity, i.e., those with higher education were more likely to meet the recommended physical activity level. Also, in the SPMI sample, females were less active than males (Daumit et al., 2005).

A study by Ussher, Stanbury, Cheeseman, & Faulkner (2007) also found that the participants with SPMI (N=120) surveyed were less active than the general population in the United Kingdom. They also identified walking, followed by a structured exercise program, as the most popular types of physical activity among the participants with SPMI. The study also identified some of the potential barriers to engage in physical activity among persons with SPMI, with major barriers including low self-efficacy in their ability to exercise, lack of social support, fatigue, and negative mood. Results also revealed that the majority of the participants recognized the health benefits of regular exercise and enjoyed doing it (Ussher et al., 2007).

These results are similar to data obtained by a qualitative study (N=34) by McDevitt, Syyder, Miller, & Wilbur (2006) using a focus group format. In this study, the participants with SPMI also reportedly viewed regular physical activity as beneficial and desirable but lacked self-efficacy and social support to initiate and maintain a regular physical activity routine. The two studies reviewed above (Daumit et al., 2005; Ussher et al., 2007) used self-report measures that have been widely used in the general population but not yet been validated in the SPMI population.
A few studies used accelerometer, a device the size of a pager that records movements in triaxial vector magnitude (i.e., acceleration from vertical, horizontal, and anterior-posterior planes), to assess the occurrence and intensity of physical activity among people with SPMI (e.g. Dubbert et al., 2006; Jerome, Young, Dacin, Charleston, Anthony, Hayes, et al., 2009; Lindamer, McKibbin, Norman, Jordan, Harrison, Abeyesinhe, et al., 2008; McCormick, Frey, Lee, Chun, & Sibthorp, 2008). Acceleration counts are translated into minutes of vigorous, moderate and light physical activity with cutoff scores for each type of activity. The studies that used this measurement method have also found that individuals with SPMI have generally lower levels of physical activity compared with the general population (e.g., Jerome et al., 2008; McCormick et al., 2008).

In sum, there is some evidence to suggest that although people with SPMI appreciate the health benefits of regular physical activity (e.g., McDevitt et al., 2006), they often fail to meet the recommended level (e.g., Ussher et al., 2007). Moreover, they report a perceived lack of social support and low self-efficacy as the main barriers for engaging in routine physical activity (e.g., McDevitt et al., 2006). Given the high prevalence of poor health status and weight gain problems among this population, the problem of inadequate physical activity needs to be addressed (Allison et al., 2009; Dubbert et al., 2006; Faulkner et al., 2007; Richardson et al., 2005). Particularly, there exists extensive evidence of the health benefits of regular physical activity for people in the general population.
Programs That Promote Physical Activity for Persons with SPMI

The following section reviews studies that evaluated the effectiveness of programs used to promote physical activity among persons with SPMI. It is noted that earlier programs mainly focused on offering a structured aerobic exercise curriculum that required more supervision, staffing, and equipment resources than lifestyle change programs. Earlier programs also often screened out those who were not yet ready for vigorous exercise. Recent programs have moved towards healthy lifestyle behavior change planning and self-monitoring, particularly in promoting walking behavior to enhance moderate physical activity level.

This trend is consistent with the current research focus of general population samples, in which results have shown that integrating moderate-intensity physical activity into daily routine is more cost-effective than a structured exercise program (e.g., Sevick, Dunn, Morrow, Marcus, Chen, & Blair, 2000). It should also be noted that, although the scope and breadth of the literature on promoting physical activity in people with SPMI is very limited, the extant evidence is encouraging.

The first systematic review on the effectiveness of structured exercise programs (e.g., jogging, aerobic exercise, and swimming) as adjunct treatments for people with schizophrenia examined thirteen studies published between 1978-1998, with a combined number of participants of 290 (Faulkner & Biddle, 1999). The authors found that there is some evidence to suggest that structured exercise programs could be useful for managing negative symptoms, reducing some depressive and anxiety symptoms, and increasing coping efficacy in people with schizophrenia. However, they also cautioned that the majority of the studies reviewed were case studies or group comparison studies with
small sample sizes and most without any randomization procedures or follow-up (Faulkner & Biddle, 1999). It is also noted that, among the 269 participants in the 13 studies reviewed, 119 were outpatient participants, and 150 were inpatients participants in two studies.

Faulkner, Soundy, & Lloyd (2003) conducted another systematic review of sixteen studies on weight management interventions for people with schizophrenia that included eight studies focused on pharmacological interventions and eight that used dietary & exercise as main components of behavioral interventions for weight control. Overall, the pharmacological intervention studies reported some small weight reduction but inconsistent results among studies (weight reduction in only in 5 out of 8 studies), and all behavioral interventions showed small but significant reductions in weight. However, it is noted that the behavioral intervention studies reported in the review mainly were dietary intervention studies, and the details of the exercise component were not reported.

There is one recent randomized control study (N=28) on lifestyle health promotion for people with SPMI in the UK (Brown & Chan, 2006). The health promotion program consisted of six, weekly sessions that used motivation interviewing and psychoeducational techniques combined with activity and diet diaries to target health topics of weight control, healthy eating, exercise, substance use issues, and structuring daily activity. Results showed a significant but small weight loss (mean 0.9kg) and trends to significance in improving subjective sense of fitness in the experimental group compared to the control no treatment group. However, there was no significant difference between the groups in terms of changes of resting pulse & systolic blood pressure. Worth noting is the attrition rate of this small RCT study, only 7 of the 15 participants (47%)
from the experimental group, and 10 of the 13 (77%) in the control group actually completed the study. More importantly, it is unclear who delivered the program and to what extent the treatment targeted increasing physical activity.

Four short reports on promoting physical activity in people with SPMI were published in a special column that focused on novel and creative approaches to mental health problems in the March 2005 issue of *Psychiatric Services*. One study reported the feasibility and efficacy of a structured exercise program (Hutchinson, 2005), another looked at the effects of a lifestyle physical activity program that incorporated walking and diet counseling (Richardson, 2005c), the third one evaluated the effects of a group based walking program (McDevitt, Robinson, & Forest, 2005), and the last one examined the effects of the use of CBT in a walking program (Piette, 2005). Although all four short reports noted some improvements of both physical and psychosocial indicators, because of insufficient information on the methodology of the studies, the validity and generalizability of the relations of specific physical activity components on specific physical or psychosocial outcomes remain uncertain.

Unfortunately, this is the state of the current body of knowledge regarding the feasibility and effectiveness of physical activity promotion interventions for people with SPMI. Very little is available and most studies are fraught with methodological problems (e.g., case studies, small sample size, lack of experimental control), without objective measures of physical activity level, or provide unclear specification of the active component in physical activity promotion intervention. As such, perhaps it would be more fruitful to begin investigating specific components or strategies of physical activity
interventions, particularly with increasing availability of objective physical activity measurement devices.

**Increasing Walking Behavior: Utility of Pedometer**

As walking is one of the safest, most inexpensive, and easiest to promote physical activity (Richardson et al., 2005a), and a preferred form of physical activity by people with SPMI (Ussher et al., 2007), identifying and evaluating specific strategies that promote daily walking may be an important first step in increasing physical activity in people with SPMI (Richardson et al., 2005a). The use of pedometers may be useful, as a device for the assessment and motivation of walking by people with SPMI.

A pedometer is a pager-size digital device designed to record and display step counts, motivate and self-monitor walking behavior (Richardson, Newton, Abraham, Sen, Jimbo, & Swartz, 2008). Users are advised to wear the pedometer around their waist during all waking hours (except when bathing or engaged in water activities). It provides an objective estimation of physical activity that has been shown to correlate well with more expensive devices such as accelerometers in both controlled and field conditions (Leenders, Cherman, Nagaraja, & Kien, 2001; Bassett, 2000; Tudor-Locke, Ainsworth, Thompson, & Matthews, 2002).

For example, in a randomized control study (N=314) of community-based walking promotion intervention in Australia, pedometer use was found to augment a self-help walking program (Merom et al., 2007). The study has a three-month intervention period with three groups: self-help walking without pedometer (N=123), self-help walking with pedometer (n=123), and control group (N=123). The completion rate was 85%. In addition, there is evidence to suggest an inverse relation between number of step
counts and obesity in general population samples (Dwyer, Hosmer, Hosmer, Venn, Blizzard, Granger, et al., 2007; Richardson et al., 2008). Specifically, a large population-based cross-sectional study (N=1,126) in Australia found that increasing daily step counts measured by a pedometer was linked to a decline in body mass index (BMI) and waist circumference (Dwyer et al., 2007).

Results from a recent meta-analysis of nine intervention studies (sample sizes ranged from 15 to 106 with a total of 307) also showed that there is modest (0.05kg/week) but significant effects of a pedometer-based walking program on weight loss (Richardson et al., 2008). The meta-analysis consisted of studies that did not have any dietary intervention, and used pedometer and step-count monitoring as a motivational tool to increase walking. The participants were sedentary and overweight or obese. The authors concluded that although the weight loss amount was only modest, average daily step count of participants increased (average ranged 1,827 to 4,556) across all studies. More importantly, the results suggest that pedometer-based walking programs help increase participants’ physical activity levels and that the modest weight loss effect, over time (i.e., 7% weight reduction in one year), have potential to translate to significant clinical benefits (Richardson et al., 2008). Indeed, the health benefits of the weight reduction would be particularly important for some who are at risk for or already suffering from physical health problems.

Currently, research results have suggested that pedometer use is feasible and useful in promoting walking and weight loss in the general population and in populations of people with chronic physical illnesses. However, no published randomized controlled study has been found that evaluates the feasibility and utility of pedometer use in people
with SPMI (The database searched: PsycINFO, PsycARTICLES, MEDLINE, EBSCOHost, ERIC; Keywords used: Pedometer, Exercise, Physical Activity, Obesity, Severe Mental Illnesses, Schizophrenia, Bipolar Disorder, Depression; Researched on: May 1, 2009). Given its low cost and wide commercial availability, pedometers have the potential to be used as a cost-effective assessment device and motivator for increasing physical activity level in people with SPMI.

**Pedometer Use and Self-Monitoring: Reactivity Effects**

An alteration of a target behavior in reaction to self-assessment of the behavior is referred to as the reactivity effect of self-monitoring (Nelson & Hayes, 1981). In the assessment contexts, this could create biases and impact the accuracy of the measurement of the target behavior (Foster, Laverty-Finch, Gizzo & Osantowski, 1999; Jackson, 1999). However, when self-monitoring is used as an intervention, the reactivity effect could be helpful (Korotitsch & Nelson-Gray, 1999). In fact, extensive evidence has suggested that self-assessment procedures can be used as interventions that facilitate behavioral changes (Febbraro & Clum, 1998; Fernandex & Beck, 2001; Haynes, 1978; Wilson & Vitousek, 1999), and particularly useful during the beginning of the intervention (Sigmon & LaMattina, 2006).

Results of a meta-analysis that examined the effectiveness of self-monitoring procedures for treating adult problem behaviors have also provided supportive evidence of the clinical utility of self-monitoring (Febbraro & Clum, 1998). Specifically, the meta-analysis found that compared to no intervention controls the effect size for self-monitoring interventions was $d = .29$ ($N = 10$ studies, $z = 1.71$, $p < .05$), supporting its therapeutic effects. In fact, self-monitoring procedures have been incorporated and
recommended within many empirically supported treatments (Korotitsch & Nelson-Gray, 1999).

Pedometer-based walking programs often ask participants to self-monitor their step counts, by checking the step counts throughout the day, or recording the total step counts at the end of the day using a log or diary. The self-monitoring procedures serve to provide baseline data and ongoing assessment of daily walking patterns. Pedometer readings also provide instant feedback and reference on performance that could assist goal setting in regulating walking behavior (Richardson et al., 2008).

However, most studies that incorporated pedometer use as intervention for promoting physical activity or walking behaviors did not explicitly identify and systematically examine the hypothesized mechanism of change. Most intervention studies also failed to account for the potential measurement reactivity associated with pedometer use and self-monitoring for assessing walking or physical activity pattern.

Only a few studies examined the potential of pedometer related reactivity effects and these studies yielded mixed results. One study used a randomized controlled crossover design (N=28), using sealed (1-week) and unsealed pedometers (1-week) with a washout period (2-week), found no reactivity effect of pedometer self-monitoring and concluded that reactivity did not pose a threat to validity of pedometer based measurement of walking (Matevey, Rogers, Dawson, & Tudor-Locke, 2006). However, this study’s design could not effectively rule out the potential reactivity effect of simply carrying a pedometer because the participants were all aware that the pedometers were assessing their walking (Beets, 2006). As such, if pedometers are solely used as an
instrument for measuring walking, this would still be a measurement reactivity problem (Beets, 2006). The non-significant findings from the Matevey’s study seem to suggest that compared to those who could not get the pedometer feedback, receiving feedback from pedometer did not appear to have additional effect on walking.

Contrary to this study, another two randomized controlled studies found that using an unsealed pedometer combined with daily step logs yielded a significantly greater increase of walking compared to conditions of simply carrying a sealed pedometer (Clemes, Matchett, & Wane, 2008), or using an unsealed pedometer without step logs (Clemes & Parker, 2009). These two studies (N=60 and N=53, respectively) both controlled for the potential reactivity effect associated with simply carrying a pedometer by instructing all participants to carry a sealed pedometer for one week but informed them that the device was a body posture monitor. Results from these two studies highlighted the need to account for the potential reactivity effects in using pedometer procedures to measure walking and physical activity (Clemes & Parker, 2009).

It should be noted that all three studies discussed above recruited only university staff and student participants who were relatively young, healthy, and of normal weight. It is still unclear about the nature and strength of reactivity effects of wearing a pedometer and recording daily steps counts on walking in populations of individuals who have chronic physical illnesses, overweight, or living with severe mental health challenges.
Promote Physical Activity: Promote Self-Efficacy and Quality of Life in Persons with SPMI?

It has been hypothesized that one possible mechanism of the beneficial psychological effects of regular physical activity is the increased sense of mastery and self-efficacy in people who engage in regular physical activity (Landers & Arent, 2007; Mutrie, 2002). It has also been argued that improving physical activity level could be a promising recovery strategy that augments the quality of life and self-efficacy in people with SPMI (Anthony et al., 2002; Daumit et al., 2005; Richardson et al., 2005a). However, the research that specifically investigates that claim is much needed (Richardson et al., 2005b).

The enhancement of the clients’ sense of self-efficacy in coping with their SPMI is part of the vision of promoting recovery (Carpinello, Knight, Markowitz, & Pease, 2000). Self-efficacy refers to the belief of one’s own ability and competency to carry out some behaviors in novel or stressful situations, and that one’s sense of self-efficacy plays a major role in determining one’s persistence in threatening situations, in selecting activities, and in using coping behaviors (Bandura, 1997). Indeed, results from several studies suggest that promoting self-efficacy helps facilitate the process of recovery from SPMI (e.g. Anthony, 1993; Coursey, Farrell, & Zahniser, 1991; Davidson & Strauss, 1992). In fact, improving self-efficacy has been proposed as one of the contributing factors in enhancing the subjective quality of life of people with SPMI (Rosenfield, 1992).

Many clinicians and researchers suggest that quality of life is a state of well-being that includes the evaluation of the clients’ physical, psychological, social, and
environmental domains (Anthony, 1993). The construct of quality of life has been widely used as a measure of clients’ well-being because it examines multiple indicators of their life situation, including health status and limitations as a results of health problems (e.g. Lehman, Possidente, & Hawker, 1986; Lehman, 1996; Levitt, Hogan, & Bucosky, 1990; Rosenfeld & Nees-Todd, 1993).

**Rationales of Proposed Study**

Extensive evidence has shown that people who have severe and persistent mental illness (SPMI) such as schizophrenia, bipolar disorder, and major depression, have higher rates of health morbidity and premature mortality compared with the general population (e.g., Brown, Inskip, & Barraclough, 2000; Dickerson et al., 2006; Harris & Barraclough, 1998; Miller, Paschall, & Svendsen, 2006). In addition, although recovery-oriented mental health services should aim to improve the overall quality of life of persons with SPMI (Anthony, 1993), and improving the physical health of persons with SPMI is an integral part of a recovery-oriented treatment (Anthony et al., 2002), programs and research that aim to identify and evaluate strategies to improve the physical health of individuals with SPMI is scarce (Richardson et al., 2005a).

Identifying strategies to promote lifestyle health behavior change, such as increasing physical activity level, may be a potentially effective approach to improve the physical and psychological well-being of people with SPMI. In fact, there is extensive evidence about the physical and psychological health benefits of regular physical activity in the general population, and in populations of people with various chronic physical illnesses, such as diabetes, hypertensions, and heart problems (Lander & Arent, 2007; Craft & Landers 1998; Phillips, Kiernan & King, 2001). In comparison, however, very
little is known about the effects of physical activity on the physical and psychological outcomes of persons with SPMI (Allison et al., 2009; Brown & Chan, 2006; Dubbert et al., 2006; Faulkner, Cohn, & Remington, 2007; Richardson et al., 2005).

Only recently researchers have begun to investigate the physical activity patterns (e.g., Soundy et al., 2007; Ussher et al., 2007) and feasibility and effectiveness of physical activity programs for persons with SPMI (e.g., Faulkner et al., 2003; Melamed et al., 2008). Studies that investigated the efficacy of physical activity interventions for this population are even more limited (Brown & Chan, 2006; Richardson et al., 2005a).

As walking is one of the safest, most inexpensive, and easiest to promote physical activity (Richardson et al., 2005b), and a preferred form of physical activity by people with SPMI (Ussher et al., 2007), identifying and evaluating strategies that promote daily walking may be an important first step in promoting physical activity in people with SPMI. Substantial evidence has suggested that pedometer use is feasible and useful in promoting walking in the general population and in populations of people with chronic physical illnesses (e.g., Richardson et al., 2008; De Cocker, De Bourdeaudhuij, & Cardon, 2008). However, no controlled study has been found that evaluates the feasibility and acceptability of pedometer use, and the potential treatment effects associated with the reactivity effects of pedometer use and self-monitoring of daily walking behaviors in people with SPMI. Thus, this study aimed to systematically examine the feasibility and acceptability of pedometer use, and to use a randomized pretest-posttest group comparisons design to investigate the potential reactivity effects of pedometer use and self-monitoring of step counts on walking behaviors and health outcomes in people with SPMI.
Study Purposes

This study had three specific objectives. First, this study was designed to systematically evaluate the feasibility and adherence of pedometer use in people with SPMI living in the community. The data stored in the pedometers provided objective data on days that participants used and did not use the pedometer during the study. The daily walking log reported by the participants also provided information about participants’ adherence to the self-monitoring procedure. During the debriefing session, a semi-structured interview was used to enquire about participants’ experience and expectations of pedometer use and adherence to the self-monitoring procedure. The debriefing session was specifically designed to collect both qualitative and quantitative data to evaluate potential facilitators and barriers associated with pedometer use and self-monitoring of walking behavior in people with SPMI.

Second, this study used a randomized controlled design to investigate the potential short-term effects of pedometer use and self-monitoring of daily walking on physical and psychological health among persons with SPMI. Using the block randomization procedure, participants were assigned into three groups: Group 1) unsealed-pedometer plus self-monitoring procedure, and Group 2) sealed pedometer without self-monitoring procedure, and Group 3) no pedometer control group. Physical health outcome variables examined included body mass index, resting blood pressure, resting heart rate, physical activity level, and health-related quality of life. Psychological health outcome variables investigated were measures of mental health self-efficacy and depressive symptoms. Assessments of the outcome variables were conducted at baseline and 2-weeks after baseline.
Third, this study aimed to systematically examine the potential reactivity effects associated with pedometer use and self-monitoring of pedometer step counts on walking. This study compared daily mean step counts between a sealed-pedometer group (Group 2) and an unsealed-pedometer plus self-monitoring group (Group 1) over a 2-week period.
CHAPTER 2

METHODS

Participants

The inclusion criteria of study participants were: adults between the ages of 18 to 65, had a primary diagnosis of a severe and persistent mental illness (SPMI; e.g., Schizophrenia, Bipolar Disorder, Major Depression), were self-identified as ambulatory, and were receiving ongoing community mental health services from the Hawaiʻi Department of Health (DOH), Adult Mental Health Division (AMHD) funded Community Mental Health Centers (CMHC) or Clubhouses (i.e., psychosocial rehabilitation centers) for people with SPMI. This study was approved by the DOH and University of Hawaiʻi Institutional Review Boards and participants provided written informed consent.

The sample consisted of sixty participants (N=60) recruited from a Clubhouse (n=39; 65%) and a CMHC (n=21; 35%) located in the South Hilo district of the island of Hawaii during April 2010 to June 2010. Among the 21 participants from the CMHC, ten were recruited from the main clinic in Hilo (n=10), eight were from a satellite clinic located on the Hamakua Coast (n=8), and three were recruited from a satellite clinic in the South Kohala area (n=3).

The mean age of the study sample was 46.8 (S.D.=10.9). 67% of the participants were men (n=40) and 33% were women (n=20). The large majority of the participants (n= 50; 83.3%) were not employed at a job. About half of the participants (n=31; 51.7%) completed high school or equivalent, and reported marital status as single and never married (n=32; 53.3%). The primary ethnic identification reported by the participants is
as follow: Caucasian (n=27; 45%), Hawaiian/Part-Hawaiian (n=10; 16.7%), and Asian/Hispanic/Other (n=23; 38.3%).

In terms of being identified as having SPMI, the large majority of participants had a primary DSM-IV diagnosis of Major Depressive Disorder, Recurrent (n=27; 45%), followed by Bipolar Disorder (n=18; 30%) and Schizophrenia Spectrum Disorder (n=13; 21.7%). One participant had a primary diagnosis of Post Traumatic Stress Disorder (n=1; 1.5%), and one participant was diagnosed with Anxiety Disorder, NOS (n=1; 1.5%).

Measures and Equipment

1) Depressive Symptoms: CES-D

Depressive symptoms were measured by the Center for Epidemiological Studies-Depressed Mood Scale (CES-D; Radloff, 1977). The CES-D is a 20-item self-report survey designed to assess current level of depressive symptomatology, including depressive cognition, dysphoric mood, and vegetative signs (see Appendix A). It uses a 4-point rating scale to measure the frequency of depressive symptoms during the past week [1= Rarely or none of the time (less than 1 day); 2= Some or little of the time (1-2 days); 3= Occasionally or a moderate amount of time (3-4 days); & 4= Most or all of the time (5-7 days)]. Scores may range from 0 to 60, with higher score indicating a higher level of depression.

In a study of 406 psychiatric outpatients, the mean CES-D scores were: 38.10 for acute depression (n = 148 and SD = 9.01); 14.85 for depression in remission (n = 87 and SD = 10.06); 22.97 for alcohol dependence (n = 61 and SD = 13.58); 17.05 for drug dependence (n = 60 and SD = 10.69); and 12.98 for schizophrenia (n = 50 and SD = 12.94), and a mean score of 16 was proposed as cut-off score for positive identification of
depression status (Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977). The following cut-off scores have also been used to classify depression severity: 0-9 = none or minimal, 10-16 = mild, 17-24 = moderate, and 25-60 moderate to severe (Greden and Schwenk, 1997).

Examples of the items in the CES-D are “My sleep was restless.” and “I enjoyed life.” Although it was originally designed to be used in the general population, it has also been widely used in clinical studies with good psychometric properties (Schwenk, Coyne, & Fechner-Bates, 1996; Scott, & Melin, 1998; Weissman et al., 1977). The CES-D has demonstrated good internal consistency with alpha of .90 for the psychiatric patients (Radloff, 1977). The use of the CES-D as a measure of depressive symptoms among different ethnic groups has also been supported (e.g., Beekman, Deeg, Van Limbeek, Braam, De Vries, & Van Tilburg, 1997; Hertzog, Alistine, Usala, Hultsch, & Dixon, 1990; Kim, Han, & Phillips, 2003; Mui, Burnette, & Chen, 2001). In the present study, the CES-D also had good internal consistency with an alpha of .90 for this study sample.

2) **Physical Activity: IPAQ-S7T**

Physical activity level was measured by the International Physical Activity Questionnaire: Short Form-Telephone Format (IPAQ-S7T; Craig, Marshall, Sjöström, Bauman, Booth, Asinsworth, et al., 2003). The original International Physical Activity Questionnaire (IPAQ) was developed as a self-report instrument for global surveillance and international comparisons of population level physical activity and inactivity (Craig et al., 2003). The IPAQ has four short versions and four long versions. All four short versions have the same questions (7 items), varying in terms of mode of administration (telephone vs. self-administration) and reference period (last 7 days vs. usual week). All
IPAQ versions and scoring guidelines are free and available for download at www.ipaq.ki.se. The telephone format was chosen for this study because the IPAQ-S7T (see Appendix B) has specific instructions for the interviewer to read to the participants during an assessment interview and this proposed study used an interview-based assessment protocol.

The IPAQ-S7T is a 7-item measure designed to assess the frequency (days/week) and duration (hours/day & minutes/day) of moderate physical activity, vigorous activity, walking, and inactivity on weekdays during the past seven days. The total IPAQ score is represented in terms of MET minutes/week (i.e., energy expenditure), with higher score indicating a high level of physical activity. The IPAQ-S7T has specific guidelines for data processing and analysis, which was used for this study. The scoring guidelines propose a classification system with three levels (i.e., High, Moderate, Low) of physical activity (Craig, et al., 2003). Category 1-“Low” level is defined as not meeting criteria for either Category 2 or 3. Category 2-“Moderate” level is defined as i) vigorous-intensity activity on at least three or more days of at least 20 minutes/day, or ii) moderate-intensity activity and/or walking on at least five or more days of at least 30 minutes/day, or iii) any combination of walking, moderate, or vigorous intensity activities on five or more days with a minimum of at least 600 MET-minutes/week. Category 3-“High” level is defined as i) vigorous-intensity activity on at least three days with a minimum total of at least 1500 MET-minutes/week, or ii) any combination of walking, moderate, or vigorous intensity activities on seven days with a minimum of at least 3000 MET-minutes/week.

The IPAQ-S7T has acceptable measurement properties, with test-retest Spearmen’s reliability coefficient of .74 (N=300), with no major differences in test-retest
coefficients between the “last 7 days” and the “usual week” reference periods or the telephone and self-administered modes of administration (Craig et al., 2003). In addition, in a recent study examining the reliability of physical activity measurements used for individuals with schizophrenia (N= 35), a Spearman's correlation coefficient of .68 for test-rest reliability (1 week) was found for the IPAQ-Short Form, suggesting that the IPAQ-Short Form has acceptable stability reliability in individuals with schizophrenia (Faulkner, Cohn & Remington, 2006).

3) **Health Related Quality of Life: SF-12**

Health related quality of life was measured by the Health Survey Short Form: SF-12 (SF-12; Ware & Kosinski, & Keller, 1996). The SF-12 (See Appendix C) is a 12-item survey designed to measure perceived health functioning (i.e., physical functioning, role limitation due to physical health problems, bodily pain, and general health) and mental health functioning (i.e., vitality, social functioning, role limitation due to emotional health problems, and mental health). It produces a physical composite summary (PCS) and a mental health composite summary (MCS), with higher scores representing better health functioning. As several scaling methods are used in the SF-12, including dichotomous, 3-point, 5-point, & 6-point rating scales, each item was standardized into a Z-score, weighing the score by a factor for analytic weight, and summing the scores into T scores (i.e., M = 50; SD= 10). SF-12 has a user manual to guide the scoring process, which was used for this study.

The SF-12 has good psychometric proprieties and been widely used to assess perceived health functioning in medical and mental health research in the United States and worldwide (Corcoran & Fischer, 2000; Maruish, 2004; Ware, 2004). Ware et al.
(1996) reported a 2-week test-retest correlations of .89 for the PCS and .76 for the MCS in a general US population sample (n=232). The SF-12 has also been widely used in schizophrenia research (e.g., Faulkner, Cohn, Remington, & Irving, 2007b; Meyer, Nasrallah, McEvoy, Goff, Davis, Chakos, et al., 2005) with acceptable psychometric proprieties for assessing health related-quality of life for people with SPMI (Salyers, Bosworth, Swanson, Pagone, & Osher, 2000). In the Salyers et al. (2000) study, they found a mean PCS of 47.1 (SD=10.3) and a mean MCS of 43.4 (SD=11.8) among 629 outpatients with SPMI. In this present study, the SF-12 showed modest internal consistency reliability with alphas of .62 and .54 for the PCS and MCS, respectively.

4) Self-efficacy: MHCS

Self-efficacy was measured by the Mental Health Confidence Scale (MHCS; Carpinello, Knight, Markowitz, & Pease, 2000; Appendix D). It is a 16-item instrument designed to assess three aspects of mental health self-efficacy, including confidence in the development of a sense of optimism (6 items), confidence in the ability to cope with symptoms and to manage emotions (7 items), and confidence in the ability to advocate for one’s needs and rights (3 items). The total composite scores may range from 16 to 96 with higher score indicating greater self-efficacy. Its development was guided by self-efficacy theory (Bandura, 1977) and qualitative research on self-help (Carpinello, Knight, & Jatulis, 1992). Examples of the questions include “How confident are you right now that you can: 1) Be happy; 2) Feel hopeful about the future; 3) Make friends; 4) Stay out of the hospital; 5) Face a bad day.” Participants are asked to rate on a six-point scale from 1 (Very Unconfident) to 6 (Very Confident). A study (N=544) by Carpinello et al., (2000) showed coefficient alpha reliability estimates of .94 for the full scale, and .91, .90
and .80 for the optimism, coping and advocacy subscales, respectively. That study also found that those who were involved in self-help program had a mean MHCS score of 68, whereas those who were not involved in self-help program had a mean score of 65 (standard deviations of the samples were not reported in that study). Test-retest reliability estimates and cut-off scores for the MHCS are also unavailable. The total composite score was used for this present study and the coefficient alpha reliability estimate for the full scale was acceptable at .89.

5) **Resting Blood Pressure (BP), Resting Heart Rate (HR)**

Resting blood pressure and resting heart rate were measured by a commercially available electronic blood pressure monitor (Model: Omron HEM-712C). This device starts the automatic inflation of the arm cuff at the push of a button and measurement are taken by the device automatically. The systolic and diastolic blood pressure (mm/Hg) and the pulse rate (beat/minute) would display on the screen. This electronic device is designed for blood pressure and heart rate monitoring at home. According to the manufacturer of the device, the Omron® home blood pressure monitors are tested and meet the criteria of the protocols of the Association for the Advancement of Medical Instruments, European Society of Hypertension and British Hypertension Society (http://www.omronhealthcare.com/find_out_more/186-blood-pressure-monitors); however, no data were available to the public.

Based on the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7), hypertension (elevated blood pressure) is defined as systolic pressure >140 mmHg and diastolic pressure > 90 mmHg, and pre-hypertension is defined as systolic pressure between 120
and 139 mmHg and diastolic pressure between 80-89 mmHg, and normal blood pressure is defined as systolic pressure < 120 and diastolic pressure < 80 mmHg (Chobanian, Bakris, Black, Cushman, Green, Izzo, et al., 2003). In terms of resting heart rate, the American Heart Association defines bradycardia (too slow heart rate) as < 60 beats per minute and tachycardia (too fast heart rate) as > 100 beats per minute (American Heart Association, 2010).

6) **Body Mass Index (BMI)**

Body weight and height of the participants were measured by a scale with a stadiometer located at either the CMHC or Clubhouse where the assessments were conducted. As the main objective was to measure change of weight, to ensure consistency, the same scale was used for the pretest and the posttest. Participants’ BMI were calculated by their weight in pounds divided by their height in inches squared and multiplied by 703. The BMI scores can be divided into three weight categories: Healthy weight (BMI= 18.5 to 24.9), overweight (BMI = 25 to < 30), and obese (BMI > 30) (National Heart Lung and Blood Institute, 2010).

7) **Pedometer Step Counts**

Daily walk step counts were measured by a commercially available pedometer (Omron HJ-720IT). This model of the pedometer resets the step count reading to zero automatically after midnight each day and can store up to forty one days of data and display the most recent 7 days data. Based on the instructions provided by the pedometer’s manufacturer, the pedometers used in this study were calibrated according to each individual participant’s stride length and body weight. According to the manufacturer of the device, this monitoring model has been tested, evaluated and shown
to meet the safety and accuracy standards set by independent organizations. A recent study (N=47) examining various mounting positions of the pedometer in self-paced and prescribed walking speed demonstrated that this pedometer model (Omeron HJ-720IT) has good validity and reliability for both overweight and healthy adults (Holbrook, Barreira, & Kang, 2009).

In terms of interpretation of step counts, it has been proposed that for healthy adults, a classification of “sedentary lifestyle” is less than 5000 steps/day, “low active” is 5000-7499 steps/day, “somewhat active” is 7500-9999 steps/day, and “active” is 10000 or more steps/day (e.g., McCormack, Giles-Corti, & Milligan, 2006; Tudor-Locke & Bassett, 2004b). In terms of the relation between step counts and distance, a study showed that walking or running a mile required approximately 1300 to 2000 steps (Welk, Differding, Thompson, Blair, Dziura, & Hart, 2000).

8) **Daily Step Log**

The Daily Step Log was designed specifically for this study to examine pedometer users’ adherence to the protocol of self-monitoring of step counts (see Appendix E). Only participants in Group 1 (pedometer plus self-monitoring; n=20) were asked to record their daily pedometer-based step count once nightly for the entire 2-week intervention period. They were asked to record the date, time, and total step counts for each day, and to write down any remarks of the day if they desired (e.g., stayed home, rainy day).

8) **Demographic Data**

The participants’ demographic information was collected by the Demographic Form (see Appendix F). The data on participant’s gender, birth date, marital and
employment status, the ethnic group that they most strongly identify with, and highest level of education completed were collected.

9) **Debriefing Survey**

The Debriefing Survey was designed specifically for this study to examine pedometer users’ experiences and attitudes of using a pedometer (see Appendix G). It is a 16-item survey administered in a semi-structured format. Questions 1 to 3 of the survey asked participants to identify three things they liked and did not like about using the pedometer, and to give suggestions on improving the feasibility of pedometer use. Questions 4 to 6A1 used a 4-point rating scale (ranging 1-“very difficult” to 4-“not difficult at all”) to assess difficulty in remembering to use a pedometer, difficulty in fitting the pedometer onto clothing, and difficulty in logging the pedometer step counts. Question 6A2 was designed to assess the frequency of pedometer users checking the step count during the day, with ratings anchored from “Very often >10 times”, “Often >5 times”, “Seldom <5 times”, to “Never.” Question 6B was designed to evaluate whether, and if so for what reasons, participants in the sealed pedometer group would like to find out their pedometer step counts during the experiment. Questions 7 to 14 were designed to assess participants’ beliefs on the usefulness of the pedometer. A 4-point rating scale was used for this set of questions, from 1-“very likely”, 2-“Not likely at all”, 3-“Maybe”, to 4-“Not likely at all.” Sample questions include “How likely is it that using a pedometer will help you to walk more?” “How likely is it that using a pedometer will help you to control your weight?”
Procedures

Posters about the study were posted at the CMHCs and the Clubhouses for recruiting participants to the study. Referrals from Clubhouse staff, nurses, case managers, psychologists, & psychiatrists at the CMHCs were also accepted. All research interviews took place at a private room at the CMHCs or Clubhouses. Either the principal investigator (PI) or a research assistant obtained the informed consent from the participants. The informed consent included participants’ agreements to participate in the study and to allow the PI to review their clinical charts for information about diagnosis.

After the informed consent was obtained, a 2-part baseline assessment was conducted at either a Clubhouse or a CMHC. To avoid potential order effects, the order of the administration for both Part A and Part B of the assessment was counterbalanced at both pre- and post-test.

Assessment Part A: Either the PI or a trained research assistant administered the IPAQ, CES-D, SF-12, MHCS, and Demographic Form through structured interviews in which the original questions from the questionnaires were read verbatim to the participants and responses were recorded for them. This procedure was taken in light of the possible difficulties (e.g. reading level) of participants to comfortably and accurately fill out the questionnaires.

Assessment Part B: Either the PI or a trained research assistant used commercially available electronic digital devices to measure participants’ body weight, resting blood pressure, and resting heart rates. As with measures in Part A, the order in which these measurements were taken was counterbalanced at each administration.
Immediately after the baseline assessment, participants were randomly assigned into either Group 1) pedometer plus self-monitoring (n=20), Group 2) sealed pedometer without self-monitoring (n=20), or Group 3) no pedometer control (n=20) using a block randomization protocol. Then a brief training about the functions and proper use of the pedometer was provided for participants in Group 1 and Group 2. Training was not provided to participants in Group 3, the control no-pedometer comparison group.

After the brief training, participants in Group 1 were given a pedometer (Omron HJ-720IT) and one blank Daily Walking Log sheet. They were told that the pedometer used in this study resets the step count reading to zero automatically after midnight each day. It can store up to 41 days of data, and it displays the most recent 7 days data. Participants in Group 1 were asked to wear the pedometer around their waist during all waking hours (except when in the water, such as swimming or taking a shower/bath). They were asked to record only once nightly the time and the pedometer step counts on the Daily Walking Log before bedtime. They were instructed to use the pedometer and record the Walking Step Log nightly for 14 consecutive days.

Same as Group 1, after the brief training, participants in Group 2 were given a pedometer and asked to wear the pedometer around their waist during all waking hours (except when swimming or taking a shower/bath). The same pedometer model was used for Group 2; however, an opaque tape and layers of black permanent marker sealed the display screen of the pedometer that prevented participants from reading the step counts. The sealed pedometer was designed to prevent self-monitoring of daily step counts and thus experimentally controlling for the potential reactivity effects of pedometer-feedback in this study. As participants in Group 2 were not able to read the pedometer step counts,
they were not be asked to log the step counts; however, they were instructed to use the sealed pedometer for 14 consecutive days.

Group 3 was the no-treatment control group. Participants in this group were only asked to complete Assessment-Part A and -Part B during baseline assessment. They were not asked to wear the pedometer or self-monitor walking behavior, and they did not receive the pedometer use training.

The baseline interview (pretest assessment and training) took approximately one hour for completion. All participants (Group 1, Group 2, & Group 3) were asked to return for a posttest assessment on the 15th day after the baseline assessment. Participants in Group 1 and 2 were asked to return the pedometer for downloading data at posttest and to complete a short semi-structured debriefing session after posttest assessment. They were instructed to contact the PI if their pedometer was lost or stolen. In such cases, a new pedometer would be provided and the experimental procedure would be restarted. All participants were asked not to discuss about their group assignment or treatment condition with other participants during the experiment period. All participants were reimbursed a $15 supermarket gift certificate for their participation in the baseline interview.

At posttest, the same 2-part assessment protocol and the same measurements used at pretest were administered for the posttest assessment for all three groups. Step counts stored in the pedometers were downloaded. In addition, participants in Group 1 and Group 2 completed a short semi-structured debriefing interview based on questions on the Debriefing Survey after the posttest assessment to enquire about their experience of pedometer use and adherence to the self-monitoring procedure. All participants were
debriefed at the end of the posttest assessment. Each participant received a $20 supermarket gift certificate for their participation at the posttest assessment. Figure 1 below shows a flowchart of participants through each study stage.

Figure 1: Flowchart of participants through each stage
Note: T1 = Pretest; T2 = Posttest Assessment; Group 1 = Pedometer with Self-monitoring; Group 2 = Sealed-Pedometer without Self-monitoring; Group 3 = No Pedometer Control
**Research Questions and Hypotheses**

This study attempted to address three specific research questions:

*Research Question 1*: Is pedometer use and self-monitoring of daily step counts feasible and acceptable among people with severe and persistent mental illnesses?

*Research Question 2*: Would there be a reactivity effect of self-monitoring of step counts on walking behavior?

*Research Question 3*: Would there be potential treatment effects of short-term pedometer use and self-monitoring of walking on physical activity level, body weight, mental and physical health status, depressive symptoms and self-efficacy?

Eight hypotheses were assumed and tested in this study:

*Hypothesis 1*: Pedometer use and self-monitoring of daily step counts would be feasible among pedometer users in this study.

*Hypothesis 2*: There would be a reactivity effect of self-monitoring of pedometer step counts, such that participants in the unsealed-pedometer plus self-monitoring group (Group 1) would have significantly higher daily step counts than those in the sealed-pedometer without self-monitoring group (Group 2) as measured by pedometer recorded step counts.
Hypothesis 3: Participants in Group 1 would report a small but statistically significant reduction in body weight compared with those in Group 2 and Group 3 (Control no pedometer), as measured by changes of body weight between pre- and posttest.

Hypothesis 4: Participants in Group 1 would report a significantly higher level of physical activity than those in Group 2 and Group 3, as measured by changes of IPAQ scores between pre- and posttest.

Hypothesis 5: Participants in Group 1 would report a significantly higher level of perceived physical health status than those in Group 2 and Group 3, as measured by changes of SF-12’s PCS scores between pre- and posttest.

Hypothesis 6: Participants in Group 1 would report a significantly higher level of perceived mental health status than those in Group 2 and Group 3, as measured by changes of SF-12’s MCS scores between pre- and posttest.

Hypothesis 7: Participants in Group 1 would report a significantly lower level of depressive symptoms than those in Group 2 and Group 3, as measured by changes of CES-D scores between pre- and posttest.

Hypothesis 8: Participants in Group 1 would report a significantly higher level of mental health self-efficacy than those in Group 2 and Group 3, as measured by changes of MHCS scores between pre- and posttest.
Data Reduction and Statistical Analyses

All participants enrolled in the study completed the pretest assessment. Of the 60 participants, 59 (98.3%) returned for the posttest assessment. All 20 participants in each of Group 1 and Group 2 who were given a pedometer in this study returned their pedometers and completed the debriefing session at posttest. Evaluation of feasibility and acceptability of pedometer use were based on these 40 participants. Preliminary analyses were based on all 60 study’s participants.

Four participants had one or two items unanswered on the CES-D and MHCS, the missing data were replaced with the average score of the answered items. Cronbach’s alphas were computed to evaluate the internal consistency of the CES-D, MHCS, and the Mental and Physical Component subscales of the SF12 at baseline. In addition to baseline and posttest scores, a difference score was calculated for each of the outcome variables by subtracting the posttest score from the pretest score.

For the baseline data, descriptive statistics were computed for the demographic variables, resting blood pressure, resting heart rate, height, weight, BMI, IPAQ, MHCS, CES-D, and SF-12 subscales by group. BMI scores at baseline were further delineated into three weight levels: Healthy weight (BMI= 18.5 to 24.9), overweight (BMI = 25 to < 30), and obese (BMI > 30). ANOVAs and Chi-square (χ2) were used to assess group difference at baseline. Cronbach’s alpha coefficients were calculated to examine the internal consistency of the MHCS, CES-D, and PCS and MCS subscales of the SF12.

To examine Research Question 1 regarding the feasibility and acceptability of pedometer use and self-monitoring, a two-part analysis was conducted. Part one of the analysis involved calculating the adherence rates of pedometer use and self-monitoring.
First, percentage of pedometers returned at the end of the study was calculated. Then, to estimate the adherence rate of pedometer use, the data stored in the pedometers were examined to see the days that participants used and did not use the pedometer. Next, to estimate the adherence rate of self-monitoring of step counts, percentage of Daily Walking Log returned and completed at the end of the study was calculated.

Part two of the analysis involved summarizing the qualitative (Questions 1 to 3) and quantitative (Questions 4 to 14) data of the Debriefing Survey. To summarize the qualitative data from Questions 1 to 3, a research assistant first organized the responses for each question by theme, and then the principal investigator independently also coded the responses by theme. Both raters then compared the themes for each question and clarified any discrepancy in the terminology of the themes. A list of themes was generated. Then both coders rated the frequency of each theme based on that list. Intraclass correlation coefficient (ICC) was calculated to examine the interrater reliability of the two coders. Both raters then compared the themes and frequency, and clarified any discrepancy. Percentages of responses by themes were also calculated based on the number of participants who responded to the specific question. To summarize the responses to Questions 4 to 14 of the Debriefing Survey, frequency counts and percentages were computed.

To test Hypothesis 2, a Mixed Model ANOVAs was conducted. The between-subjects variable was Group (unsealed vs. sealed pedometer groups) and the within-subject variable was Time (Step counts-Week1 and Week2). Means and standard deviations of weekly pedometer step counts for Group1 and Group2 were computed.
Daily step counts across the experimental period by groups were plotted for visual inspection.

To test Hypothesis 3 to Hypothesis 8, six separate one-way between subjects ANOVAs were used. In this set of analyses, the independent variable was Group (Unsealed, Sealed, Control). The outcome variables were difference scores (posttest - pretest) of IPAQ, MHCS, CESD, PCS, MCS, and body weight.

All outcomes scores were evaluated for the assumptions for analysis of variance. Shapiro-Wilk tests were used to examine normality assumption. Leven’s tests were used to assess equality of variance. Box’s test was used to examine the Homogeneity of Covariance for conducting repeated measure ANOVA. In the event of normality violation, log or square root transformation was used. For uniformity and clarity of presentation, only non-transformed data are presented. Statistical analyses were conducted using SPSS for Windows version 17 (SPSS Inc., Chicago, IL).
CHAPTER 3
RESULTS

First, this section presents the results from preliminary analyses, including participants’ clinical characteristics and descriptive statistics of the combined sample and across groups at baseline. Next, results of the internal consistency analyses of MHCS, CES-D, SF-12 subscales will be presented. Then, the findings of the main analyses will be presented, including results of the feasibility analysis (Hypothesis 1) with descriptive statistics and qualitative analysis of the Debriefing Survey, followed by the results of the analyses based on a mixed-model ANOVA (Hypothesis 2). Finally, the results of the six separate one-way between subjects ANOVAs (Hypothesis 3 to 8) will be presented.

Preliminary Analyses

Participants’ Baseline Characteristics:

Demographic and clinical characteristics of the combined sample and across groups at baseline are summarized in Table 1 for categorical variables and Table 2 for continuous variables. Chi-square analyses showed no statistically significant differences in ethnicity, marital status, sex, employment, educational and BMI status, and diagnosis across groups at baseline (see Table 1). There were also no significant differences between groups on age, weight, resting systolic and diastolic blood pressure, resting heart rate, BMI, IPAQ, CESD, MCS, PCS, and MHCS at pretest based on ANOVAs (see Table 2).
Table 1. Demographic and Clinical Characteristics of Study Participants (N = 60)

<table>
<thead>
<tr>
<th></th>
<th>Total (N = 60)</th>
<th>Group 1 (n = 20)</th>
<th>Group 2 (n = 20)</th>
<th>Group 3 (n = 20)</th>
<th>X²-value (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>40 (67%)</td>
<td>13 (65%)</td>
<td>13 (65%)</td>
<td>14 (70%)</td>
<td>X² = .15</td>
</tr>
<tr>
<td>Female</td>
<td>20 (33%)</td>
<td>7 (35%)</td>
<td>7 (35%)</td>
<td>6 (30%)</td>
<td>(n.s.)</td>
</tr>
<tr>
<td>Employment Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Working/Retired</td>
<td>50 (83.3%)</td>
<td>17 (85%)</td>
<td>16 (80%)</td>
<td>17 (85%)</td>
<td></td>
</tr>
<tr>
<td>Part-time employed</td>
<td>8 (13.3%)</td>
<td>2 (10%)</td>
<td>3 (15%)</td>
<td>3 (15%)</td>
<td>X² = 7.58</td>
</tr>
<tr>
<td>Full-time employed</td>
<td>2 (3.4%)</td>
<td>1 (5%)</td>
<td>1 (5%)</td>
<td>0 (0%)</td>
<td>(n.s.)</td>
</tr>
<tr>
<td>Highest Education Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School Graduate/</td>
<td>37 (61.7%)</td>
<td>12 (60%)</td>
<td>14 (70%)</td>
<td>11 (55%)</td>
<td>X² = .99</td>
</tr>
<tr>
<td>GED/ or less</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some/College Graduate</td>
<td>23 (38.3%)</td>
<td>8 (40%)</td>
<td>6 (30%)</td>
<td>9 (45%)</td>
<td>(n.s.)</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single/Never Married</td>
<td>32 (53.3%)</td>
<td>15 (75%)</td>
<td>8 (40%)</td>
<td>9 (45%)</td>
<td>X² = 5.76</td>
</tr>
<tr>
<td>Other</td>
<td>28 (46.7%)</td>
<td>5 (25%)</td>
<td>12 (60%)</td>
<td>11 (55%)</td>
<td>(n.s.)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>27 (45%)</td>
<td>7 (35%)</td>
<td>8 (40%)</td>
<td>12 (60%)</td>
<td></td>
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<tr>
<td>Hawaiian/Part Hawaiian</td>
<td>10 (16.7%)</td>
<td>2 (10%)</td>
<td>4 (20%)</td>
<td>4 (20%)</td>
<td>X² = 5.57</td>
</tr>
<tr>
<td>Asian/Hispanic/Other</td>
<td>23 (38.3%)</td>
<td>11 (55%)</td>
<td>8 (40%)</td>
<td>4 (20%)</td>
<td>(n.s.)</td>
</tr>
<tr>
<td>Primary Diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bipolar Disorders</td>
<td>18 (30%)</td>
<td>6 (30%)</td>
<td>5 (25%)</td>
<td>7 (35%)</td>
<td></td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>13 (21.7%)</td>
<td>4 (20%)</td>
<td>4 (20%)</td>
<td>5 (25%)</td>
<td></td>
</tr>
<tr>
<td>Spectrum Disorders</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Depressive Disorder</td>
<td>27 (45%)</td>
<td>8 (40%)</td>
<td>11 (55%)</td>
<td>8 (40%)</td>
<td></td>
</tr>
<tr>
<td>Posttraumatic Stress</td>
<td>2 (3.3%)</td>
<td>2 (10%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>X² = 5.15</td>
</tr>
<tr>
<td>Disorder/Anxiety NOS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(n.s.)</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy weight</td>
<td>20 (40%)</td>
<td>6 (30%)</td>
<td>5 (25%)</td>
<td>9 (45%)</td>
<td></td>
</tr>
<tr>
<td>Over weight</td>
<td>16 (26.7%)</td>
<td>7 (35%)</td>
<td>5 (25%)</td>
<td>4 (20%)</td>
<td>X² = 2.93</td>
</tr>
<tr>
<td>Obese</td>
<td>24 (33.3%)</td>
<td>7 (35%)</td>
<td>10 (50%)</td>
<td>7 (35%)</td>
<td>(n.s.)</td>
</tr>
</tbody>
</table>

Note: Group 1 = Unsealed-pedometer with self-monitoring group; Group 2 = Sealed-pedometer group; Group 3 = Control no pedometer group; n.s. = not significant based on (p < .05); Chi-square analyses indicated that there were no significant differences between study groups on any of the demographic and clinical variables listed above at baseline.
Table 2.
Baseline Clinical Characteristics of Study Participants (N=60)

<table>
<thead>
<tr>
<th></th>
<th>Total (N = 60) Mean± SD</th>
<th>Group 1 (n = 20) Mean± SD</th>
<th>Group 2 (n = 20) Mean± SD</th>
<th>Group 3 (n = 20) Mean± SD</th>
<th>ANOVA F-value (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>46.8±10.9</td>
<td>46.1 ±11.5</td>
<td>48.5±10.1</td>
<td>46.1±11.4</td>
<td>F=.372 (n.s.)</td>
</tr>
<tr>
<td>Height (inch)</td>
<td>66 ± 3.8</td>
<td>66 ± 3.4</td>
<td>67 ± 3.9</td>
<td>67 ± 4.3</td>
<td>F=.112 (n.s.)</td>
</tr>
<tr>
<td>Weight (lb)</td>
<td>193 ± 63.6</td>
<td>190 ± 61.2</td>
<td>205 ± 73.5</td>
<td>181 ± 55.7</td>
<td>F=.738 (n.s.)</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>30.2 ± 9.1</td>
<td>30.3 ± 9.6</td>
<td>32.2 ± 10.1</td>
<td>28.2 ± 6.5</td>
<td>F=.982 (n.s.)</td>
</tr>
<tr>
<td>Resting Heart Rate (beat/minute)</td>
<td>b80 ± 8.2</td>
<td>a85 ± 17.5</td>
<td>85 ± 17.5</td>
<td>78 ± 16.3</td>
<td>F=1.506 (n.s.)</td>
</tr>
<tr>
<td>Resting Systolic (mmHg)</td>
<td>b132 ± 18.6</td>
<td>a131 ± 15.2</td>
<td>132 ± 23.5</td>
<td>134 ± 16.7</td>
<td>F=.211 (n.s.)</td>
</tr>
<tr>
<td>Resting Diastolic (mmHg)</td>
<td>b80 ± 8.2</td>
<td>a79 ± 8.6</td>
<td>80 ± 8.2</td>
<td>81 ± 8.1</td>
<td>F=.137 (n.s.)</td>
</tr>
<tr>
<td>Physical Activity (IPAQ)</td>
<td>5158± 4556</td>
<td>4702± 4312</td>
<td>5058± 4178</td>
<td>5510± 4799</td>
<td>F=.162 (n.s.)</td>
</tr>
<tr>
<td>Depression (CESD)</td>
<td>22.5 ± 12.4</td>
<td>24.1 ± 12.4</td>
<td>19.3 ± 12.4</td>
<td>24.1 ± 12.4</td>
<td>F=1.0 (n.s.)</td>
</tr>
<tr>
<td>Self-efficacy (MHSC)</td>
<td>68.7 ± 14.4</td>
<td>64.7 ± 15.9</td>
<td>74.4 ± 11.9</td>
<td>67.2 ± 14</td>
<td>F=2.6 (n.s.)</td>
</tr>
<tr>
<td>Health Status (SF12: PCS)</td>
<td>43.3 ± 10.8</td>
<td>44.1 ± 10.9</td>
<td>39 ± 10.2</td>
<td>46.9 ± 10.3</td>
<td>F=2.95 (n.s.)</td>
</tr>
<tr>
<td>Health Status (SF12:MCS)</td>
<td>43.2 ± 11.8</td>
<td>42.4 ± 13.5</td>
<td>44.9 ± 12.6</td>
<td>42.4 ± 9.2</td>
<td>F=.312 (n.s.)</td>
</tr>
</tbody>
</table>

Note: Group 1= Unsealed-pedometer with self-monitoring; Group 2= Sealed-pedometer; Group 3= Control no pedometer; IPAQ= International Physical Activity Questionnaire (Craig et al., 2003); CES-D= Center for Epidemiological Studies-Depressed Mood Scale (Radloff, 1977); MHCS= Mental Health Confident Scale (Carpinello et al., 2000); SF12:PCS= Physical Component Scale and SF12:MCS= Mental Component Scale (Ware et al, 1996). a Based on n= 19; b Based on N= 59.
For the combined sample at baseline (N=60), forty percent (n = 20) had healthy weight (BMI: 18.5-24.99), 26.7% (n = 16) were overweight (BMI: 25-29.99), and 33.3% (n = 24) were obese (BMI: >30). In addition, 22% (n=13) had blood pressure within normal range (i.e., systolic pressure < 120 and diastolic pressure < 80 mmHg), and 3.3% (n=2) had hypertension (i.e., systolic pressure > 140 and diastolic pressure > 90 mmHg), and 75% (n=45) had either elevated systolic blood pressure or elevated diastolic blood pressure.

The mean CES-D score of the combined sample (N=60) at baseline was 22.5 (SD=12.4), the mean MHCS was 68.7 (SD=14.4), and the mean PCS and MCS subscales were 43.3 (SD=10.8) and 43.23 (SD=11.8), respectively. Further analyses of the baseline CES-D showed that 71% (43 of 60) of the participants scored above 16 on the CES-D. Among them, 28% (n=17) scored between 17-24 (moderate level of depressive symptoms), and 43% (n=26) scored above 24 (moderate to severe level of depressive symptoms).
Internal Consistency of MHCS, CES-D, and SF-12 Subscales:

Cronbach’s alpha coefficients were used to examine the internal consistency of the MHCS, CES-D, and PCS and MCS subscales of the SF12. Both the CES-D and MHCS had acceptable internal consistency estimates for this study sample, with Cronbach’s alphas of 0.90 and 0.89, respectively. The Cronbach’s alpha for the SF-12’s PCS subscale was 0.62, and for the MCS subscale was 0.54, suggesting the SF-12 had only modest internal consistency estimates for this study sample.

Table 3.
Cronbach’s alphas of MHCS, CES-D, PCS and MCS for this Study Sample

<table>
<thead>
<tr>
<th>Measure</th>
<th>Number of Items</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental Health Confidence Scale (MHCS)</td>
<td>16</td>
<td>.89</td>
</tr>
<tr>
<td>Center for Epidemiological Studies-Depressed Mood Scale (CES-D)</td>
<td>20</td>
<td>.90</td>
</tr>
<tr>
<td>Health Survey Short Form: SF-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Component Scale (PCS)</td>
<td>12</td>
<td>.62</td>
</tr>
<tr>
<td>Mental Component Scale (MCS)</td>
<td>12</td>
<td>.54</td>
</tr>
</tbody>
</table>

Note: Each item in the SF-12 was standardized into Z-scores of Physical Standardized Value and Mental Standardized Value. All twelve items in the SF-12 scale were used to generate both the PCS and MCS scores. As such, Cronbach’s alphas were computed using the standardized values of each subscales.
**Main Analyses**

*Research Question 1*: Is pedometer use and self-monitoring of daily step counts feasible and acceptable among people with severe and persistent mental illnesses?

To address this research question, first, this study assumed and tested Hypothesis 1. *Hypothesis 1* assumed that pedometer use would be feasible among pedometer users in this study. Second, this study evaluated the compliance of self-monitoring of step counts (Daily Step Log) in Group 1 and the overall responses to the Debriefing Survey by participants in both Group 1 and Group 2.

All 40 participants (100%) who were assigned a pedometer in the study returned their pedometers at the end of the study. However, one participant from the sealed-pedometer group (Group 2) lost the pedometer at the 7th day of the experiment. This participant was given a new pedometer the following day and was instructed to restart the 2-week intervention. The participant was able to complete the 2-week intervention and the pedometer was returned at the end of the study. The pedometer data of this participant was used for subsequent analyses.

Pedometer data of one participant was irretrievable due to malfunctioning of the pedometer and another participant’s data was also irretrievable because the posttest assessment was on day 56 from the pretest, which was beyond the storage capacity of the pedometer (41 days). These two participants, both from the sealed-pedometer group (Group 2) were excluded from subsequent analyses that were based on pedometer data but were included in the analyses that were based on the Debriefing Survey.

To test Hypothesis 1, the pedometer data were examined. The results showed that 58% (22 of 38) of the participants used the pedometer everyday during the experimental
period. About 29\% of the participants (11 of 38) had missing data for one to three days out of 14 days. Combined, 87\% (33 of 38) of the pedometer users were able to use their pedometers regularly (i.e., more than 10 days out of the 14-day intervention).

Among the 20 participants in the unsealed-pedometer with self-monitoring group (Group 1) who were also asked to complete the Daily Walking Log during the intervention period, 15 (75\%) participants returned the log sheet at posttest. Of the 15 logs, 13 (87\%) had all 15 days step counts recorded, and 2 (13\%) had missing step counts for 2-4 days. As the pedometer use adherence rate was estimated by stored pedometer data, although five participants did not return their Daily Walking Logs, they were included in pedometer use analysis.

All participants from the unsealed pedometer (Group 1; n=20) and sealed-pedometer (Group 2, n=20) groups completed the Debriefing Survey at the end of the study. This survey assessed participants’ experience and satisfaction of using a pedometer. Questions 1 to 3 of the Debriefing Survey asked participants to identify three things they liked and did not like about using the pedometer, and to give suggestions on improving the feasibility of pedometer use. The responses for each of these three questions were organized by theme and frequency, and rated by two independent raters. Percentages of responses by themes were calculated based on the number of participants who responded to the specific question. The intraclass correlation (ICC) showed excellent agreement between the two coders, with an ICC of .905 (95\% confidence interval= .642-.978). The three themes with the highest frequency for each question are reported below:
Debriefing Survey Question: “1. Can you please tell me three things you don’t like about using the pedometer?”

Six (15%) of a total of 40 participants did not respond to this question. Of the 34 (85%) who responded, 10 (29%) participants reported that they had not experienced any problems or difficulties using the pedometer. Among the 34 participants who answered this question, the three most commonly reported problems and difficulties in using the pedometer were:

1. Remembering to put the pedometer on in the morning or after changing outfits during the day (32%, n=11: Group 1, n = 6, Group 2, n = 5).
2. Difficulty in keeping the pedometer on their clothing throughout the day (29%, n=10: Group 1, n = 6, Group 2, n = 4). E.g., “It didn’t stay on my belt.” “My coordination is not very good. The clip was difficult.”
3. Did not like the responsibility of having to carry the pedometer (18%, n=6: Group 1, n = 4, Group 2, n = 2). E.g., “I had to think about not getting it wet.” “Worry about losing it.”

Debriefing Survey Question: “2. Now, can you please tell me three things you like about using the pedometer?”

Among the 39 (98% of 40) participants who answered this question, the three most commonly identified positive things about using the pedometer were:

1. Increased awareness of daily steps and walking pattern (39%, n=15; Group 1, n=11, Group 2, n=4). E.g., “I know how much I walked.” “Counts my steps.” “I can learn about how active I was.”
2. Increase motivation to walk or exercise (36%, n=14; Group 1, n=8, & Group 2, n=6). E.g., “It inspired me to walk more.” “Made me aware that even walking around the house makes a difference.”

3. Like the responsibility of having the pedometer (13%, n=5; Group 1, n=4, & Group 2, n=1). E.g., “it made me feel responsible & special.” “Having something to do each day.” “Something to do.”

Debriefing Survey Question: “3. What do you think can be done to make it easier for people to use a pedometer?”

Seven (18%, 7 of 40) participants did not respond to this question. Among the 33 participants who responded to the question, seven (21%, 7 of 33) participants reported that they found the pedometer easy to use and does not need further improvement. Some of the suggestions provided by the participants on improving pedometer use included:

1. Providing alternative ways to wear the pedometer (27%, 9 of 33). E.g., “Put it with keys.” “Like a wristband or something would be better.” “Wear it on as neck chain.”

2. Reducing the size of the pedometer (12%, 4 of 33). E.g., “Maybe make it a little smaller.”

3. Making the pedometer waterproof (9%, 3 of 33). E.g., “Make them waterproof.”

Participants were also asked about difficulty in fitting the pedometer onto their clothing. Ten (25%) participants responded that it was “Very difficult” or “Somewhat difficult.” The majority (75%) reported “Not that difficult” or “Not difficult at all.”
The Debriefing Survey also asked the participants in the unsealed-pedometer group about difficulty of remembering to log the pedometer. Of the 20 participants, 15 (75%) reported “Not difficult at all” or “Not that difficult,” and 5 participants (25%) reported “very difficult” or “Somewhat difficult.”

The Debriefing Survey also asked participants in the unsealed-pedometer group (n = 20) the frequency of checking pedometer steps while using the pedometer during the day. Half of the participants (n=10; 50%) indicated that they checked the pedometer readings “very often > 10 times” or “often > 5 times” each day. Eight participants (40%) reported that they “seldom < 5 times” checked their pedometer readings and two participants (10%) reported that they “Never” checked their pedometer step count while using the pedometer during the 2-week intervention period.

Participants’ responses to Questions 7 to 14 of the Debriefing Survey are summarized in Table 4. Among the 40 participants who used a pedometer in this study, the majority indicated that using a pedometer would likely help them walk more (72.5%), improve health (67.5%), improve mood (57.5%), and control weight (57.5%). Over 67% of the pedometer users also reported that checking step count would likely motivate more walking. Similarly, the majority of the pedometer users stated that after the study they would likely recommend friends/family to use a pedometer (67.5%), likely participate in a pedometer-based walking program (62.5%), and likely use a pedometer (60%).
Table 4.
Participants' Responses on Questions 7 to 14 of the Debriefing Survey (N=40)

<table>
<thead>
<tr>
<th>Debriefing Survey Questions</th>
<th>Very Likely/Likely</th>
<th>Maybe/Not Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>7. Using a pedometer will help you to walk more</td>
<td>29</td>
<td>72.5</td>
</tr>
<tr>
<td>8. Using a pedometer will help you to control your weight</td>
<td>23</td>
<td>57.5</td>
</tr>
<tr>
<td>9. Using a pedometer will help improve your mood</td>
<td>23</td>
<td>57.5</td>
</tr>
<tr>
<td>10. Using a pedometer will help improve your health</td>
<td>27</td>
<td>67.5</td>
</tr>
<tr>
<td>11. Checking step count motivates more walking</td>
<td>27</td>
<td>67.5</td>
</tr>
<tr>
<td>12. Recommend friends/family to use a pedometer</td>
<td>27</td>
<td>67.5</td>
</tr>
<tr>
<td>13. Use a pedometer after the study</td>
<td>24</td>
<td>60.0</td>
</tr>
<tr>
<td>14. Participate in a pedometer-based walking program</td>
<td>25</td>
<td>62.5</td>
</tr>
</tbody>
</table>

Note: The Debriefing Survey was administered to and completed by all forty pedometer users in this study.

Some additional observations about the process of this study were noted. First, many case managers and care providers also recognized the importance of promoting wellness for the people with SPMI. They eagerly referred their clients to this study. In addition, at the end of the study, eight participants from all groups requested to try or continue to use the pedometers. Two case managers reported that they started a pedometer-based walking program with their clients. Two other case managers reported plans to incorporate a pedometer-based walking component in their wellness group.
Research Question 2: Would there be a reactivity effect of self-monitoring of step counts on walking behavior?

To address this research question, this study assumed and tested Hypothesis 2 below:

Hypothesis 2: There would be a reactivity effect of self-monitoring of pedometer step counts, such that participants in the unsealed-pedometer plus self-monitoring group (Group 1) would have significantly higher daily step counts than those in the sealed-pedometer without self-monitoring group (Group 2) as measured by pedometer recorded step counts.

All 40 participants in Group 1 and Group 2 who were given a pedometer in the study returned their pedometers and completed the posttest. However, pedometer step counts data for two participants were irretrievable due to malfunctioning and over extended storage capacity of the pedometer. Four other participants were also excluded from this analysis because of fewer than 3 days of pedometer readings for each intervention week. Therefore, to test Hypothesis 2- the reactivity of self-monitoring step counts on walking behavior, the sample size was 34. All the sealed pedometers (Group 2) were checked for signs of breakage of the seal at posttest. All seals were intact.

To compare difference in pedometer step counts between Week1 and Week2, this study used the mean steps from Day2 to Day7 as Week1 and mean steps from Day8 to Day13 as Week2. Data from Day1 and Day15 were not included because they were the days of pre- and posttest assessments (i.e., assessment time might vary from 8am to 4pm). Day14 was also not included to ensure Week1 and Week2 had equal number of days within a week for comparing weekly averages.
Means and standard deviations of mean daily step counts by group and interval are presented in Table 5. Based on the pedometer data, the mean steps counts for both groups at pretest and posttest were above 5000 steps. Of pedometer users, 44.1% (15 of 34), from both unsealed (n=8) and sealed (n=7) pedometer groups, increased steps between Week1 and Week2.

Table 5.
Means and Standard Deviations of Step Counts Between Unsealed Pedometer Group and Sealed Pedometer Group

<table>
<thead>
<tr>
<th></th>
<th>Unsealed Pedometer (n = 18)</th>
<th>Sealed Pedometer (n = 16)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M  (SD)</td>
<td>M  (SD)</td>
</tr>
<tr>
<td>Step Counts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week1 (Day2 to Day6)</td>
<td>5089 (3358)</td>
<td>5775 (4074)</td>
</tr>
<tr>
<td>Week2 (Day7 to Day13)</td>
<td>5472 (3603)</td>
<td>5299 (4421)</td>
</tr>
<tr>
<td>Step Count Change</td>
<td>+384 (1693)</td>
<td>-477 (2250)</td>
</tr>
</tbody>
</table>

Note: Step counts were based on pedometer-recorded data only. Participants’ step logs data were not included in this table.

Figure 2 shows the mean daily step counts by groups and Figure 3 shows the mean weekly step counts by groups. In the unsealed-pedometer group, the average step counts for Week1 was 5089 and Week2 was 5473, indicating an average increase of 384 steps between Week1 and Week2. In the sealed-pedometer group, the average step counts for Week1 was 5775 and Week2 was 5299, with an average decrease of 477 steps between Week1 and Week2.
A mixed-model ANOVA with repeated measures as one factor was conducted to test whether there was a statistical significance between the unsealed-pedometer (Group 1) and sealed-pedometer (Group 2) group on step count changes from Week1 to Week2. The independent variable included a between-subjects variable, Group (unsealed pedometer with self-monitoring group vs. sealed-pedometer group), and within-subjects
variable, Time (repeated measures of Week1 and Week2). The dependent variable was mean weekly step counts. Results for model assumptions of homogeneity of covariance, normality, and linearity were satisfactory. An alpha level of .05 was used for this analysis.

The mixed-model ANOVA indicated that the main effect of Time was not significant, $F(1, 32) = .02, p = .89$. The main effect of Group was also not significant, $F(1, 32) = .04, p = .84$. In addition, the interaction effect of Week and Group was also not statistically significant, $F(1, 32) = 1.61, p = .21$.

In sum, although there was an apparent difference in the direction of change between unsealed and sealed pedometer groups, results from the repeated measure ANOVA indicated that the step count changes between groups and from Week1 to Week2 were not statistically significant.

*Research Question 3:* Would there be potential treatment effects of short-term pedometer use on mental and physical health status, depressive symptoms, self-efficacy, physical activity level and body weight?

To address Research Question 3, Hypotheses 3 to 8 were assumed and tested by six separate one-way between subject ANOVAs. The independent variable was Group [unsealed pedometer with self-monitoring (Group 1), sealed-pedometer (Group 2), no pedometer control (Group 3)]. The dependent variable was the difference scores (posttest - pretest) of the outcome variables (i.e., Weight, IPAQ, CES-D, MHCS, PCS, and MCS).

One participant (n=1) from Group 3 dropped out from the study and did not have posttest data. Data from an additional six participants (n=6) were also excluded because the duration between their pretest and posttest exceeded the planned 2-week intervention
duration. A total of 53 participants, with pretest-posttest duration ranged from 14 to 19 days, were included in testing Hypotheses 3 to 8. To test Hypothesis 3, the sample size was 52 because one participant refused body weight measurement at posttest. The means, standard deviations, and results of the one-way between subjects ANOVAs on difference scores of Body Weight, IPAQ, PCS, MCS, CESD and MHCS are shown in Table 6.

*Hypothesis 3*: Participants in Group 1 would report a small but statistically significant reduction in body weight compared with those in Group 2 and Group 3 (Control no pedometer), as measured by changes of body weight between pre- and posttest.

The unsealed-pedometer with self-monitoring group (Group 1) had a reduction of body weight of .29 lbs. Although the control group (Group 3) also had a reduction of body weight (.01 lbs), it was less than the unsealed-pedometer group (Group 1). The sealed-pedometer group (Group 2) showed a gain of .06 lbs after two weeks. However, ANOVA showed that the effect of Group on change of body weight was not significant at the p<.05 level for the three study groups \(F(2, 49) = .09, p = .92\).

*Hypothesis 4*: Participants in Group 1 would report a significantly higher level of physical activity than those in Group 2 and Group 3, as measured by changes of IPAQ scores between pre- and posttest.

A one-way ANOVA showed no significant effect of Group on difference scores of IPAQ at the p<.05 level for the three study groups \(F(2, 50) = 1.65, p = .20\). The results suggested that, although there was a decrease in physical activity after the 2-week intervention period in all three study groups, the changes were not statistically significant.
Hypothesis 5: Participants in Group 1 would report a significantly higher level of perceived physical health status than those in Group 2 and Group 3, as measured by changes of SF-12’s PCS scores between pre- and posttest.

A one-way ANOVA also showed no significant effect of Group on difference scores of PCS at the p<.05 level for the three study groups [F(2, 50) = .004, p = .99]. The findings indicated that although all three study groups showed a decrease in physical health status, the group differences were not statistically significant.

Hypothesis 6: Participants in Group 1 would report a significantly higher level of perceived mental health status than those in Group 2 and Group 3, as measured by changes of SF-12’s MCS scores between pre- and posttest.

There was not a significant effect of Group on difference scores of MCS at the p<.05 level for the three study groups [F(2, 50) = .88, p = .42] based on a one-way ANOVA. Results showed that although there was an increase of mental health status in both the unsealed-pedometer and control group, and a decrease in the sealed-pedometer group, the differences between the groups did not reach statistical significance.

Hypothesis 7: Participants in Group 1 would report a significantly lower level of depressive symptoms than those in Group 2 and Group 3, as measured by changes of CES-D scores between pre- and posttest.

The effect of Group on difference scores of CESD was also not significant at the p<.05 level [F(2, 50) = 1.53, p = .23]. ANOVA results indicated that the pretest-posttest
changes in the depressive symptoms between the study groups were not statistically significant.

Table 6.
Means, Standard Deviations, and Results of One-Way Between Subjects ANOVA on Difference Scores of PCS, MCS, CESD, MHSC, IPAQ and Body Weight (N = 53)

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (n = 19)</th>
<th>Group 2 (n = 18)</th>
<th>Group 3 (n = 16)</th>
<th>ANOVA Factor: Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M</td>
<td>M</td>
<td>F-value</td>
</tr>
<tr>
<td>IPAQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>7154 (4430)</td>
<td>4537 (5122)</td>
<td>3536 (3192)</td>
<td>1.645</td>
</tr>
<tr>
<td>Posttest</td>
<td>5596 (4972)</td>
<td>3981 (4200)</td>
<td>3429 (3081)</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>-1558 (2487)</td>
<td>-556 (2906)</td>
<td>-107 (3861)</td>
<td></td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>182.70 (38.59)</td>
<td>207.2 (76.25)</td>
<td>176.4 (52.82)</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>182.38 (38.56)</td>
<td>207.3 (75.83)</td>
<td>176.4 (53.90)</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>-0.29 (3.16)</td>
<td>0.06 (4.24)</td>
<td>-0.01 (2.97)</td>
<td>.087</td>
</tr>
<tr>
<td>PCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>43.41 (10.40)</td>
<td>43.38 (12.11)</td>
<td>43.06 (11.68)</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>42.74 (10.28)</td>
<td>42.93 (9.85)</td>
<td>42.41 (10.52)</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>-0.67 (6.83)</td>
<td>-0.46 (9.53)</td>
<td>-0.65 (7.31)</td>
<td>.004</td>
</tr>
<tr>
<td>MCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>41.82 (13.15)</td>
<td>48.02 (8.57)</td>
<td>40.26 (11.89)</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>42.67 (12.00)</td>
<td>46.23 (10.58)</td>
<td>42.77 (13.86)</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>0.89 (11.34)</td>
<td>-1.79 (9.64)</td>
<td>2.51 (6.85)</td>
<td>.875</td>
</tr>
<tr>
<td>CESD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>24.31 (12.81)</td>
<td>19.00 (12.25)</td>
<td>25.79 (14.02)</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>22.79 (14.02)</td>
<td>21.22 (9.74)</td>
<td>22.88 (11.84)</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>-1.52 (6.01)</td>
<td>2.22 (8.97)</td>
<td>-2.22 (9.15)</td>
<td>1.53</td>
</tr>
<tr>
<td>MHCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretest</td>
<td>63.89 (15.99)</td>
<td>74.98 (11.64)</td>
<td>67.05 (14.71)</td>
<td></td>
</tr>
<tr>
<td>Posttest</td>
<td>64.16 (19.95)</td>
<td>75.91 (15.48)</td>
<td>66.95 (14.72)</td>
<td></td>
</tr>
<tr>
<td>Difference</td>
<td>0.26 (11.53)</td>
<td>0.93 (8.69)</td>
<td>-0.11 (9.19)</td>
<td>.048</td>
</tr>
</tbody>
</table>

^a ANOVA analysis was based on square root-transformed IPAQ total pretest and posttest scores. Means, standard deviation, and difference scores are non-transformed IPAQ data.

^n = 17; Group 1 = Pedometer with Self-monitoring; Group 2 = Sealed-Pedometer without Self-monitoring; Group 3 = No Pedometer Control.
Hypothesis 8: Participants in Group 1 would report a significantly higher level of mental health self-efficacy than those in Group 2 and Group 3, as measured by changes of MHCS scores between pre- and posttest.

Finally, there was also not a significant effect of Group on difference scores of MHCS between the three groups \[ F(2, 50) = .05, p = .96 \] based on one-way ANOVA. The findings suggested no significant differences in changes of mental health self-efficacy across study groups.
CHAPTER 4
DISCUSSION

This study used a randomized controlled pretest-posttest group comparison design to examine the feasibility and effects of pedometer use and self-monitoring of daily steps on walking behaviors and health outcomes in people with SPMI. This study yielded three main results: (1) pedometer use and self-monitoring of walking procedures were feasible for, and regarded as acceptable and useful by, a small sample of people with SPMI living in rural areas in Hawai‘i; (2) there was no significant reactivity effect associated with pedometer-based feedback and self-monitoring of steps on walking behavior in two weeks; and 3) there were also no significant treatment effects of pedometer use on promoting physical activity and health outcomes in short-term pedometer use for people with SPMI.

Feasibility and Acceptability of Pedometer Use

Research Question 1: Is pedometer use and self-monitoring of daily step counts feasible and acceptable among people with severe and persistent mental illnesses?

To address this research question, first, this study assumed and tested Hypothesis 1. Hypothesis 1 assumed that pedometer use would be feasible among pedometer users in this study. This hypothesis was supported. This study demonstrated that regular pedometer use was feasible for people with SPMI, as indicated by all 40 (100%) pedometer users returned their pedometers at the end of the study, and over 87% of the pedometer users were able to use the pedometer regularly (i.e., more than 10 days of the 2-week intervention).
Second, this study evaluated the compliance of self-monitoring of step counts using a Daily Step Log in Group 1. The return rate of step logs was also good (i.e., 75%; 15 of 20), with 87% (13 of 15) recorded step counts daily for the entire two weeks trial and only a small (13%; 2 of 15) percentage of participants had minimal 2-4 days missing days.

In addition, participants in this study reported overall positive attitudes and experiences towards pedometer use. This finding is consistent with other studies that examined attitudes on pedometer use in individuals with or without chronic health problems (e.g., De Cocker et al., 2008). Specifically, as indicated by the results from the Debriefing Survey, participants in both Group 1 and Group 2 reported a high level of perceived feasibility, utility and motivational functions of pedometer use and self-monitoring procedures (See table 4).

This study was the first to systematically investigate the feasibility, compliance, and acceptability of pedometer use and self-monitoring of daily step counts in people with SPMI. Combined with the overall positive feedback from the pedometer users, the good adherence of pedometer use and self-monitoring provide some preliminary evidence to support the feasibility of incorporating pedometers in future research of walking behavior and physical activity in people with SPMI.

This study also systematically identified some potential barriers and facilitators associated with pedometer use for people with SPMI. Some potential barriers identified include 1) difficulty in remembering to use the pedometer, 2) difficulty in keeping the pedometer on clothing throughout the day, and 3) dislike of having the responsibility to carry the pedometer. It should be noted that of the 34 participants who responded to the
question of “dislike” about pedometer, ten (29%) reported that they had not experienced any problems or difficulties in using the pedometers. In addition, although pedometer data showed that over 87% were able to use the pedometer regularly, 35% (12 of 34) of the participants reported experiencing difficulties in remembering to use the pedometer regularly. Future pedometer-based intervention studies and programs may incorporate additional strategies to aid pedometer user to remember to wear the pedometers, for example, providing post-its for participants to place on doors or tables at home as memory cues.

Some facilitators associated with pedometer use for people with SPMI were participants’ high level of perceived feasibility and utility of pedometer use and self-monitoring procedures. Specifically, in this study the three most commonly identified positive experiences and beliefs associated with pedometer use were 1) increased motivation to walk or exercise, 2) increased awareness of daily walking pattern, and 3) the responsibility of regular pedometer use. It has been suggested that some specific behaviors strategies (e.g., motivational enhancement, goal-setting, and social support) may be more important for the initiation of physical activity (Marcus, Dubbert, Forsyth, McKenzie, Stone, Dunn, et al., 2000). Given the high perceived utility of pedometers as assessment and motivational aid for promoting physical activity, future research may further explore ways to maximize the positive attitudes that may help facilitate initiation of behavioral changes.

In sum, this study provides evidence that pedometer use is feasible for and regarded as acceptable and useful by people with SPMI. Combined with the positive feedback from the care providers, low cost and easy to use characteristics of pedometers,
future studies or treatment programs targeting walking or physical activity in SPMI may consider using pedometers as an objective assessment or self-management device. It should be noted that this study was conducted in rural areas in Hawaii where the subtropical climate and environment are conducive to outdoor walking. Future research may also need to investigate the feasibility and perceived utility of regular pedometer use for people with SPMI living in climates or areas where walking indoors may be more viable or safe. Additional considerations and suggestions for promoting walking indoors may include using staircase, treadmill, and indoor shopping malls or sports facilities.

**Reactivity effects associated with pedometer use and self-monitoring of steps**

*Research Question 2:* Would there be a reactivity effect of self-monitoring of step counts on walking behavior?

To address this research question, this study empirically tested Hypothesis 2. It assumed that there would be a reactivity effect of self-monitoring of pedometer step counts, such that participants in the unsealed-pedometer plus self-monitoring group (Group 1) would have significantly higher daily step counts than those in the sealed-pedometer without self-monitoring group (Group 2) as measured by pedometer recorded step counts.

Results showed that the unsealed pedometer with self-monitoring group (Group 1) increased 387 mean daily steps, and the sealed pedometer group (Group 2) decreased 477 mean daily steps between Week1 and Week2. However, contrary to study hypothesis, the difference of step changes between the two groups was not statistically significant based on the ANOVA tests. This result is consistent with another study that examined the reactivity effect of pedometer self-monitoring in young, healthy, and normal-weight participants (Matevey, et al., 2006).
The non-significant ANOVA result from this study would suggest that there was no significant reactivity effect associated with pedometer-based self-monitoring of walking in two weeks of pedometer use. Based on this result, adding self-monitoring of step counts procedures for two weeks did not seem to significantly impact walking behavior in people with SPMI. It should be noted that this present study, however, could not rule out the possibility of the presence of reactivity effect associated with simply carrying a pedometer. It is because participants in both Group 1 and Group 2 carried a pedometer and were told that they were using a device to measure walking behavior. Thus, participants were likely to be aware that the pedometers were being used to monitor their walking behaviors regardless the availability of step counts feedback from the pedometers. As pre-pedometer use step counts were unavailable, this study could not empirically rule out the possibility of reactivity effects generated by simply carrying a pedometer.

In fact, results from the Debriefing Survey showed that participants in both Group 1 and Group 2 reported that using the pedometer increased their awareness of their walking behavior and enhanced their motivation in walking and exercise. This result from self-report suggests that, even without the step counts feedback from the pedometer, carrying a pedometer alone may have the potential to promote awareness and motivation in walking for people with SPMI. Specifically, over 72% (29 of 40) of the pedometer users reported that they expected that using a pedometer would likely to help them to walk more. Among the 15 participants (unsealed and sealed pedometer users) who showed increased steps between Week1 and Week2, 80% also reported that using a
pedometer increased their awareness of walking behavior and enhanced their motivation to walking and exercise.

This finding has implications in understanding the role of using pedometers in the assessment and intervention of physical activity and walking behavior in people with SPMI. The positive beliefs and expectations about wearing a pedometer for promoting walking may help facilitate actual behavioral change of increasing walking behaviors. This would be a desirable outcome if a pedometer were used as an intervention strategy to promote walking. Such that increasing expectation of effectiveness of pedometer use would help promote walking. However, if pedometers were used in the assessment and surveillance of physical activity or walking alone, the expectancy and potential reactivity effects associated with simply carrying a pedometer may create additional concerns for accurate assessment of walking behaviors.

Currently, very little is known about the effects of perceived feasibility and utility of pedometer use on actual walking behaviors. To date, there are also no published studies that systematically examine the intensity and duration of the reactivity and expectancy effects of pedometer use and self-monitoring of walking in the SPMI populations. Thus, this study provides some much needed preliminary information for understanding and improving pedometer-based assessment and development of pedometer-based intervention for people with SPMI. Based on the self-report results, this study showed that simply carrying a pedometer has the potential of increasing awareness and motivation in walking for people with SPMI. Although how those positive attitudes and beliefs would be translated into actual behavioral change is still unclear, the potential
for measurement reactivity and impacts on initiating and maintaining physical activity should not be ignored.

Second, based on the ANOVA result, although the difference was not statistically significant between Group 1 and Group 2 from Week1 and Week2, mean daily counts in Group 1 increased whereas mean steps counts in Group 2 decreased over time. The small sample size combined with large standard deviations of steps counts in this study may have resulted in low power and increased chance of Type II error.

In addition, it is possible that the reactivity effects of pedometer use helped promote walking in both Group 1 and Group 2 during Week1 but only with the combined effects of pedometer use and self-monitoring of daily steps that help sustained the initial gain, thus showing increase steps in Group 1 but decrease steps in Group 2 during Week2. Although this study did not empirically test this hypothesis, the preliminary findings from this current study may help guide future studies in better understanding the nature, intensity and duration of the potential reactivity effects in pedometer use and self-monitoring steps in people with SPMI.

Future research may continue to explore questions such as participant burden, frequency and duration of self-monitoring, and whether certain individuals who might be more or less likely to be reactive to self-assessment procedures (Affleck, Zautra, Tennen & Armeli, 1999). Incorporating these information will further guide the daily process design of measurement and intervention studies that incorporate pedometer use and self-monitoring of walking and physical activity.
Effects of Short-term Pedometer Use on Health Outcomes

*Research Question 3:* Would there be potential treatment effects of short-term pedometer use on mental and physical health status, depressive symptoms, self-efficacy, physical activity level and body weight?

To address this research question, Hypotheses 3 to 8 were assumed and tested by six separate one-way between subject ANOVAs. Contrary to study hypotheses, the results showed no statistically significant changes across study groups on any of the outcome variables. These results suggest that short-term use (2-3 weeks) of pedometer (Group 1 and 2) and self-monitoring of step counts (Group 1) does not have a significant impact on physical activity, self-efficacy, or health status, weight or depressive symptoms for people with SPMI. Specifically, when pedometer users are only given a pedometer and minimal instruction on self-monitoring, even with pedometer step counts feedback and combined with positive attitudes and perceived motivational attributes of pedometer use, the effects were insufficient to generate significant beneficial changes on physical activity or health outcomes when pedometer is used short-term.

These findings are inconsistent with findings from a study by De Cocker et al., (2008) and another study by Furber, Monger, Franco, Jones, Laws, & Waters (2008) showing significant increase of physical activity and walking with short-term (2-3 weeks) pedometer use. The study (N=226) by Furber et al. (2008) showed that only 2-week pedometer use and step-recording promoted walking behavior as well as total physical activity level in people with type II diabetes. The study by De Cocker et al. (2008) examined the effects of short-term pedometer use (3-week) in combination with cognitive behavioral support materials on physical activity measured by IPAQ in a non-clinical
population (N=103). That randomized study also found that simply providing a valid pedometer significantly promoted physical activity. Interestingly, it also found that adding cognitive behavioral materials (strategies on self-monitoring and goal-settings) only promoted positive attitudes on pedometer use but not on actual physical activity.

In addition, an RCT that examined pedometer-based structured exercise group program in diabetic patients found significant group difference between treatment and control group on step counts but not on any health outcomes after 16 and 24 weeks of intervention (Tudor-Locke, Bell, Myers, Harris, Ecclestone, Lauzo, et al., 2004a). Therefore, the present study results that short-term (2-week) pedometer use did not have significant impact on walking behaviors, physical activity, and other health outcomes may suggest that a longer intervention period or additional behavioral strategies (such as goal-setting and structured support) may be needed for the SPMI population.

Although there were no statistical significant differences between groups on the changes of any of the outcome variables between pretest and posttest, this study found the desired direction of changes of the outcome variables, i.e., weight reduction, reduced depression, increased mental health confidence, and increased mental health status for the intervention group (Group 1) at posttest. These findings are encouraging. Particularly in the context that the recent meta-analysis of nine intervention studies (sample sizes ranged from 15 to 106 with a total of 307) found that there was modest (0.11lbs/week) but significant effects of pedometer-based walking program on weight loss (Richardson et al., 2008). The intervention group (Group 1) in this present study had 0.29 lbs weight reduction in 2 weeks (i.e. approximately .14lb/week), indicating similar weight reduction rate as estimated by the meta-analysis. It is likely that the small sample size combined
with short-term intervention might have resulted in low power to generate or detect significant group difference in weight in this present study.

Given a high proportion of individuals in this sample were depressed (i.e., 71% of the participants had CES-D scores above 16) and were either overweight (26.7%) or obese (33.3%), intervention that can help even slight weight loss or depression reduction may still be clinically significant for these individuals. Particularly, this study showed that pedometer-based walking programs were positively regarded and welcomed by people with SPMI. A pedometer-based walking program is simple to implement and promotes self-management skills (Richardson, 2008; Tudor-Locke and Lutes, 2009) that may further promote self-efficacy in people with SPMI. Future intervention studies may focus on exploring ways to harness the positive attitudes and expectations regarding pedometer use, enhancing the potential desirable reactivity effects from self-monitoring, and identifying specific strategies to translate the positive attitudes and increased self-awareness into increasing actual walking behaviors.

In addition, given very little is known about the dose-response relationship of physical activity and disease prevention and rehabilitation (Dubbert, 2002), future study of pedometer-based lifestyle physical activity promotion programs for people with SPMI should also consider the effects of short- and long-term use of pedometer. Future intervention studies may also look into the additive effects of combining pedometer use with recommended step goals (e.g., Tudor-Locke, 2004), individualized goal-setting strategies (e.g., Bravata et al., 2007), environmental support (e.g., Merom, Bauman, Phongsavan, Cerin, Kassis, Brown, et al., 2009), and increased self-monitoring strategies (e.g., Tudor-Locke & Lutes, 2009) on actual walking behaviors.
Study Limitations and Strengths

This study has a number of limitations. First, the sample size in each group was small. Combined with the large standard deviations of walking and physical activity measures, this limitation might have resulted in a low power to statistically detect group differences. Second, it was noted that some participants had questions about, and some had difficulties responding to the past 7-day physical activity questions in the IPAQ at pretest. Specifically, a number of participants had difficulties estimating the hours for the IPAQ questions and required prompting to recall. In this study, the prompting involved asking follow up questions to identify their typical daily schedule and helping them to summarize the hours of physical activity. At posttest, however, fewer participants had questions about these IPAQ questions and participants were more readily able to recall and estimate their hours spent on physical activity. It is unclear how the additional prompting questions affect the reliability, validity, and sensitivity of the IPAQ at this time. Third, this study only recruited participants residing in the rural communities on Island of Hawaii where public transportation is also very limited. These specific environmental characteristics might have limited the generalizability of the study findings to participants living in urban areas and a cold climate. Fourth, this study only examined the effects of a very brief period of pedometer use (2-3 weeks). Longer periods may be required to generate significant changes and improvement in walking and health outcomes.

A number of strengths of the study should also be noted. First, this was the first study that used a randomized controlled design to systematically evaluate the feasibility and effects of pedometer use and self-monitoring on walking behaviors and other health
outcomes in people with SPMI. The RCT pretest-posttest design allowed for causal inferences of each specific condition (no pedometer, sealed pedometer without self-monitoring, pedometer with self-monitoring) on outcomes. Second, this study used self-report as well as objective methods to investigate walking behaviors and health outcomes. The pedometer provided an objective measure of step counts. The IPAQ self-report questionnaire also provided some estimates of pattern of walking and physical activity. Third, by using a community sample and testing basic components of pedometer use protocol in naturalistic environments, this study has high ecological validity in understanding the feasibility and effects of pedometer use and self-monitoring procedures in real life conditions for people with SPMI. Fourth, a recent systematic literature review found that ethnic and racial minority groups were underrepresented in current research on lifestyle interventions for people with SPMI (Leopoldo, Ezell, & Lewis-Fernandez, 2010). This study sample included individuals from diverse ethnic backgrounds (i.e., 45% Caucasian, 38.3%, Asian, Hispanic and Others, and 16.7% Hawaiian or Part-Hawaiian). As such, this study also helps address this limitation in the current research. In particular, this study provides some much needed information regarding the feasibility and perceived utility of pedometer use as a potential lifestyle intervention to promote health for people with SPMI from diverse ethnicity backgrounds.

Conclusion

In sum, the results from this randomized controlled study suggest that pedometer use and self-monitoring of daily steps procedures were feasible for and perceived as motivational by people with SPMI living in rural areas and a subtropical climate. However, simply providing a pedometer with minimal self-monitoring instructions (i.e.,
Group 1) would be insufficient to initiate promotion of actual walking and physical activity for individuals with SPMI. Adding a self-monitoring component alone also did not have significant reactivity effect compared with simply carrying a pedometer in short-term use. Some of the suggestions provided by the study participants on improving pedometer use included providing viable alternative ways to wear the pedometer (e.g., wristband or neck chain), and making the pedometer smaller in size and waterproof.

With increasing affordability, functionality, accuracy, and acceptability of a pedometer as an assessment and motivational device for promoting physical activity, its potential utility for people with SPMI should not be ignored, particularly given the good adherence and perceived utility of pedometer use found in this study. Future studies may continue to explore specific mechanisms that can account for and enhance the success of initiation and maintenance of pedometer-assisted self-intervention for people with SPMI. Future research may explore ways to augment the potential treatment benefits by combining additional self-intervention components, such as additional goal-setting (e.g., Eastep, Beveridge, Eisenman, Ransdell, & Schultz, 2004) or structured support strategies (e.g., Damschroder, Lutes, Goodrich, Gillon, & Lowry, 2010) into basic pedometer self-assessment protocol. Extended follow-up may also be needed to fully understand its potential efficacy in initiating and maintaining healthy physical activity lifestyle in this population.

In addition, currently, research that examined the associations of perceived feasibility and utility of pedometer use and actual walking behaviors is very limited (De Cocker, De Bourdeaudhuij, & Cardon, 2008). Information regarding the intensity and duration of the reactivity and expectancy effects associated with pedometer use and self-
monitoring on actual walking behaviors may help guide physical activity research and intervention development targeting people with SPMI. Examining questions such as participant burden, self-monitoring schedule, and whether certain individuals who might be more or less likely to be reactive to self-assessment procedures (Affleck et al., 1999) may also help identify and improve pedometer use protocols for people with SPMI. It is hoped that the findings from this present study will provide some much needed preliminary information on feasibility, potential measurement reactivity and intervention effects of minimal instruction of pedometer use procedures for people with SPMI.
Appendices

Appendix A

**CES-D:** Using the scale below, indicate the number which best describes how often you felt or behaved during the past 7 days.

0 = Rarely or none of the time (less than 1 day)
1 = Some or a little of the time (1-2 days)
2 = Occasionally or a moderate amount of time (3-4 days)
3 = Most or all of the time (5-7 days)

**DURING THE PAST WEEK**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I was bothered by things that usually don’t bother me</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>I did not feel like eating; my appetite was poor</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>I felt that I could not shake off the blues even with help from my family or friends</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>I felt that I was just as good as other people</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>I had trouble keeping my mind on what I was doing</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>I felt depressed</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>I felt that everything I did was an effort</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>I felt hopeful about the future</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>I thought my life had been a failure</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>I felt fearful</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>My sleep was restless</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>I was happy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>I talked less than usual</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>I felt lonely</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>People were unfriendly</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>I enjoyed life</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>17</td>
<td>I had crying spells</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>I felt sad</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>19</td>
<td>I felt that people disliked me</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>I could not get “going”</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Appendix B
Short Last 7 Days Telephone IPAQ

READ: I am going to ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

READ: Now, think about all the vigorous activities which take hard physical effort that you did in the last 7 days. Vigorous activities make you breathe much harder than normal and may include heavy lifting, digging, aerobics, or fast bicycling. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities?
   ______ Days per week
   8. Don't Know/Not Sure
   9. Refused

[Interviewer clarification: Think only about those physical activities that you do for at least 10 minutes at a time.]
[Interviewer note: If respondent answers zero, refuses or does not know, skip to Question 3]

2. How much time did you usually spend doing vigorous physical activities on one of those days?
   _ _ Hours per day
   _ _ _ _ Minutes per day
   998. Don't Know/Not Sure
   999. Refused

[Interviewer clarification: Think only about those physical activities you do for at least 10 minutes at a time.]
[Interviewer probe: An average time for one of the days on which you do vigorous activity is being sought. If the respondent can't answer because the pattern of time spent varies widely from day to day, ask: "How much time in total would you spend over the last 7 days doing vigorous physical activities?"

   _ _ Hours per week
   _ _ _ _ Minutes per week
   9998. Don't Know/Not Sure
   9999. Refused
READ: Now think about activities which take *moderate physical effort* that you did in the last 7 days. Moderate physical activities make you breathe somewhat harder than normal and may include carrying light loads, bicycling at a regular pace, or doubles tennis. Do not include walking. Again, think about only those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities?

   ___ Days per week

8. Don't Know/Not Sure

9. Refused

[Interviewer clarification: Think only about those physical activities that you do for at least 10 minutes at a time]

[Interviewer Note: If respondent answers zero, refuses or does not know, skip to Question 5]

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

   ___ ___ Hours per day

   ___ ___ Minutes per day

998. Don't Know/Not Sure

999. Refused

[Interviewer clarification: Think only about those physical activities that you do for at least 10 minutes at a time.]

[Interviewer probe: An average time for one of the days on which you do moderate activity is being sought. If the respondent can't answer because the pattern of time spent varies widely from day to day, or includes time spent in multiple jobs, ask: “What is the total amount of time you spent over the **last 7 days** doing moderate physical activities?”]

   ___ ___ Hours per week

   ___ ___ Minutes per week

9998. Don't Know/Not Sure

9999. Refused

READ: Now think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

   ___ Days per week
8. Don't Know/Not Sure
9. Refused

[Interviewer clarification]: Think only about the walking that you do for at least 10 minutes at a time.
[Interviewer Note]: If respondent answers zero, refuses or does not know, skip to Question 7.

6. How much time did you usually spend **walking** on one of those days?
   __ __ Hours per day
   __ __ __ Minutes per day
998. Don't Know/Not Sure
999. Refused

[Interviewer probe]: An average time for one of the days on which you walk is being sought. If the respondent can't answer because the pattern of time spent varies widely from day to day, ask: “What is the total amount of time you spent walking over the last 7 days?”
   __ __ __ Hours per week
   __ __ __ __ Minutes per week
9998. Don't Know/Not Sure
9999. Refused

READ: Now think about the time you spent sitting on week days during the last 7 days. Include time spent at work, at home, while doing course work, and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television.

7. During the last 7 days, how much time did you usually spend **sitting** on a **week day**?
   __ __ Hours per weekday
   __ __ __ Minutes per weekday
998. Don't Know/Not Sure
999. Refused

[Interviewer clarification]: Include time spent lying down (awake) as well as sitting.
[Interviewer probe]: An average time per day spent sitting is being sought. If the respondent can't answer because the pattern of time spent varies widely from day to day, ask: “What is the total amount of time you spent sitting last **Wednesday**?”
   __ __ Hours on Wednesday
   __ __ __ Minutes on Wednesday
998. Don't Know/Not Sure
999. Refuse
Appendix C

SF-12™

This questionnaire asks for your views about your health. This information will help keep track of how well you feel and how well you are able to do your usual activities.

Please answer every question by marking one box. If you are unsure about how to answer, please give the best answer you can.

1. In general, would you say your health is:
   - Excellent
   - Very good
   - Good
   - Fair
   - Poor

   The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

   Yes, limited a lot
   Yes, limited a little
   No, not limited at all

2. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf
3. Climbing several flights of stairs

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

   Yes
   No

4. **Accomplished less** than you would like
5. Were limited in the kind of work or other activities

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of emotional problems (such as feeling depressed or anxious)?

   Yes
   No

6. **Accomplished less** than you would like
7. Didn’t do work or other activities as **carefully** as usual

During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

   - Not at all
   - A little bit
   - Moderately
   - Quite a bit
   - Extremely
These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks:

<table>
<thead>
<tr>
<th></th>
<th>All of the time</th>
<th>Most of the time</th>
<th>A good bit of time</th>
<th>Some of the time</th>
<th>A little of the time</th>
<th>None of the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Have you felt calm and peaceful?</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>10. Did you have a lot of energy?</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>11. Have you felt downhearted and blue?</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>12. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>
Appendix D
Mental Health Confidence Scale

Instructions: The following questions will ask you about your confidence to deal with things that commonly influence people’s lives. For each item, rate your confidence on a scale form 1 (very unconfident) to 6 (very confident). Do you have any questions before we begin?

How confident are you right now that you can:

<table>
<thead>
<tr>
<th>Question</th>
<th>Very Unconfident</th>
<th>Unconfident</th>
<th>Slightly Unconfident</th>
<th>Slightly Confident</th>
<th>Confident</th>
<th>Very Confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Be happy</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2  Feel hopeful about the future</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>3  Set goals for yourself</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>4  Get support when you need it</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>5  Boost your self esteem</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6  Make friends</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7  Stay out of the hospital</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>8  Face a bad day</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>9  Deal with losing someone close to you</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>10 Deal with feeling depressed</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>11 Deal with feeling lonely</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>12 Deal with nervous feelings</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>13 Deal with symptoms related to your mental illness diagnosis</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>14 Say no to a person abusing you</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>15 Use your right to accept or reject mental treatment</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>16 Advocate for your needs</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
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</table>
Appendix E

Daily Walking Log

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<tr>
<th>Date</th>
<th>Time</th>
<th>Step Counts</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Participant Code: ______________  Researcher Code: ___________

PLEASE RETURN THIS RECORD AND THE Pedometer AT THE NEXT INTERVIEW

ON____________________AT___________________AT_____________________.

If you have any questions or need assistance during the study, or need to change the next interview date or time, please contact puihan joyce chao at (808) 937-4587.
Appendix F

Demographic Information

1. Participant Code: ______________________

2. Gender: 1) Male 2) Female

3. Birth Date: __________

4. Marital Status: 1) Married 2) Cohabiting 3) Other (please specify) __________

5. Employment status: (Please circle one)
   1) Working full time
   2) Working as a homemaker
   3) Working part time
   4) Not working (not due to pain)
   5) Retired (not due to pain)
   6) Retired early because of pain
   7) Working part time because of pain
   8) Not working because of pain

6. Which ethnic group do you most strongly identify with? (Please circle one):
   1. African American
   2. Caucasian
   3. Chinese
   4. Filipino
   5. Hawaiian or Part Hawaiian
   6. Japanese
   7. Korean
   8. Pacific Islander
   9. Asian other than listed above (please specify) __________
   10. Multiethnic (please specify) ___________________________
   11. Other (please specify) ________________________________

7. Highest level of education completed: (Please circle one)
   1. 9th grade or less
   2. Grade 10-11 (some high school)
   3. High school graduate or GED
   4. Vocational or technical school
   5. Some college
   6. College graduate
   7. Graduate school or professional School
Appendix G

Debriefing Session

We are interested in knowing more about your experience using the pedometer.

Questions:

1. Can you please tell me three things you don’t like about using the pedometer?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________


2. Now, can you please tell me three things you like about using the pedometer?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

3. What do you think can be done to make it easier for people to use a pedometer?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Now, I’m going to ask you some more specific questions about your experience using the pedometer.

4. During the past two weeks, how difficult was it for you to remember to wear the pedometer?

☐ Very difficult  ☐ Somewhat difficult  ☐ Not that difficult  ☐ Not difficult at all

5. When using the pedometer, how difficult was it for you to fit the pedometer onto your clothing?

☐ Very difficult  ☐ Somewhat difficult  ☐ Not that difficult  ☐ Not difficult at all

[Unsealed Pedometer group only]

6. A1. During the past two weeks, how difficult was it for you to remember to log the pedometer step count at the end of the day?

☐ Very difficulty  ☐ Somewhat difficulty  ☐ Not that difficulty  ☐ Not difficulty at all

A2. During the past two weeks, when you were using the pedometer, how often did you check the pedometer readings during the day? [Unsealed Pedometer group only]

☐ Very often >10 times  ☐ Often > 5 times  ☐ Seldom < 5 times  ☐ Never

[Sealed Pedometer group only]

6. B. During the past two weeks, was there a time when you felt you would like to know the reading on the pedometer? If yes, why?

Comments

__________________________________________

__________________________________________

__________________________________________

7. How likely is it that using a pedometer will help you to walk more?

  Very likely  ☐  Likely  ☐  Maybe  ☐  Not likely at all  ☐

8. How likely is it that using a pedometer will help you to control your weight?

  Very likely  ☐  Likely  ☐  Maybe  ☐  Not likely at all  ☐
9. How likely is it that using a pedometer will help you to improve your mood?

   Very likely  ❑  Likely  ❑  Maybe  ❑  Not likely at all  ❑

10. How likely is it that using a pedometer will help you to improve your health?

    Very likely  ❑  Likely  ❑  Maybe  ❑  Not likely at all  ❑

11. How likely is it that checking the step count on a pedometer can motivate you to walk and get around more?

    Very likely  ❑  Likely  ❑  Maybe  ❑  Not likely at all  ❑

12. How likely is it that you would recommend a friend or family members to use a pedometer?

    Very likely  ❑  Likely  ❑  Maybe  ❑  Not likely at all  ❑

13. How likely is it that you would use the pedometer after the study?

    Very likely  ❑  Likely  ❑  Maybe  ❑  Not likely at all  ❑

14. If there is a pedometer-based walking program in the community, how likely is it that you would participate in such a program?

    Very likely  ❑  Likely  ❑  Maybe  ❑  Not likely at all  ❑
REFERENCES


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