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A Pilot Evaluation of the In SHAPE Individualized Health Promotion Intervention for Adults with Mental Illness

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Abstract

This pilot study examined whether participation in the individualized, community-integrated In SHAPE health promotion program would result in improved physical activity and dietary behaviors, health indicators, and psychological functioning or symptoms in 76 adults with schizophrenia, bipolar disorder, major depression, or other mental disorders. Over a 9-month period, participation was associated with increased exercise, vigorous activity, and leisurely walking ($P<.01$), and a trend toward improved readiness to reduce caloric intake ($P = .053$).

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Participants demonstrated a reduction in waist circumference ($P<.05$), but no change in BMI. Satisfaction with fitness ($P<.001$) and mental health functioning ($P<.05$) improved, and severity of negative symptoms decreased ($P<.01$). This study demonstrated the feasibility and potential effectiveness of the In SHAPE program, which consisted of exercise and dietary modification. Based on these promising results, randomized controlled trials of the In SHAPE program are necessary to establish its effectiveness compared with usual care and alternative approaches to enhancing fitness.

Keywords

Fitness; Exercise; Diet; Serious mental illness; Health promotion

Introduction

A recent study of eight states showed that consumers of public mental health services die 15–30 years earlier than the general population (Colton and Manderscheid 2006). Lifestyle behaviors that contribute to poor health and premature mortality include low levels of physical activity, poor dietary behaviors, and heightened use of tobacco products (Brown et al. 1999; Kilbourne et al. 2007; McCreadie and Scottish Schizophrenia Lifestyle Group 2003; Osborn et al. 2007; Roick et al. 2007; Ryan et al.2003; Strassnig et al. 2003; von Hausswolff-Juhlin et al.2009). Medical comorbidity is common in people with mental illness (Felker et al. 1996; Jeste et al. 1996; Lawrence et al. 2001), and the prevalence of physical health disorders in people with mental illness often exceeds that of the general population (Beyer et al. 2005; Kilbourne et al. 2004; Lambert et al. 2003), including rates of cardiovascular disease and diabetes (Dickey et al. 2002; Sokal et al. 2004).

Regular exercise and healthy dietary behaviors offer a means to improve the health status of people with mental illness. Regular exercise has a beneficial effect on outcomes for numerous physical health disorders (Bauman 2004; Bauman and Craig 2005; Bianchini et al. 2002), as well as psychological symptoms and functioning (Callaghan 2004; Craft and Landers 1998; Faulkner and Biddle 1999; Mead et al. 2009; Stathopoulou et al. 2006). Healthy dietary behaviors are a component of management for obesity, diabetes, hypertension, and other physical health disorders. Likewise, nutrition and physical activity counseling is recommended for people taking antipsychotic medications (“Consensus development conference on antipsychotic drugs and obesity and diabetes” 2004). The relationship between improved health and either regular exercise or healthy eating behaviors has stimulated an emerging literature on health promotion for people with mental illness.

A growing but limited number of weight loss and fitness interventions have been evaluated for people with serious mental illness (SMI). In this report, we first provide a detailed overview of the existing research literature on weight loss and fitness interventions that combine exercise and dietary change for people with SMI. This overview provides the context for a pilot study report that contributes to the limited literature addressing combined physical exercise and dietary interventions that are *individually-tailored* and consider *longer-term* outcomes (greater than 3 or 6 month) in fitness and mental health.

Overview of Health Promotion Programs that Combine Exercise and Dietary Change for People with SMI

Most programs include physical exercise and/or dietary changes, with several programs incorporating both and demonstrating at least modest effects. Most of the health promotion programs that combine exercise and dietary change have been delivered in a group format, and several have demonstrated positive outcomes, including the following. Participation in a

12-week behavioral weight control program consisting of weight checks, self-monitoring, group education, and group walks resulted in a 5 pound average weight loss, improved diet, and improved quality of life for 35 overweight persons with SMI (predominantly schizophrenia) who were taking an antipsychotic medication (Kalarchian et al. 2005). Participation in weekly 1-h group sessions consisting of weigh-ins and discussion of healthy eating, exercise, and motivation was associated with an 11-pound weight loss in 70 people with SMI (predominantly schizophrenia) over follow-up periods ranging from 2 weeks to 3 years (Pendlebury et al. 2005). Participation in a 12-week group-based behavioral intervention including nutritional information and physical exercise among overweight people hospitalized with persistent schizophrenia and schizoaffective disorders who were receiving an antipsychotic medication showed a significant reduction in BMI at 3-months, with losses maintained at 1-year follow-up for participants (n = 28) compared to a waitlist control (n = 31) (Melamed et al. 2008). Participation in a reduced calorie diet and a program of regulated physical activity (walking and stair climbing) was associated with a significant decrease in body weight, body mass index (5.4% reduction), and waist and hip circumference (each 3.3 cm) after three and 6 months for 53 hospitalized, obese individuals with schizophrenia in Taiwan who were taking clozapine (Wu et al. 2007). Participation in a 10-week group behavioral intervention including nutrition counseling and exercise for 33 overweight people with schizophrenia or schizoaffective disorder in Taiwan was associated with a significant decrease in weight at both 10 weeks (4.6 pounds) and 24 weeks (8.2 pounds) for program completers, but significant weight gain at 24 weeks (6.2 pounds) for those who did not complete the program. Participation was also associated with improvements in triglyceride levels, psychiatric symptoms, and quality of life among those who completed the program (Chen et al. 2009). A program consisting primarily of group nutrition, exercise, and behavioral change sessions supplemented by a 15-min weekly individualized appointment was associated with a 6.6 pound weight loss and improvements in hemoglobin A_{1c}, blood pressure, waist and hip circumference, nutritional knowledge, and level of exercise at 1 year follow-up for overweight people with schizophrenia or schizoaffective disorder receiving atypical antipsychotics in a day treatment program (n = 31). In contrast, the matched control group (n = 15) gained an average of 7 pounds (Menza et al. 2004; Vreeland et al. 2003).

Programs that were primarily delivered using an individualized approach have shown the following positive outcomes. Participation in a 12-week individualized diet and exercise weight management program resulted in a significant 8.7 pound weight reduction (n = 22) compared to a 3.3 pound weight reduction in the usual care control group (n = 14) among people with schizophrenia or schizoaffective disorder in Korea who were taking olanzapine (Kwon et al. 2006). Participation in a 24-week group diet and counseling intervention combined with individualized fitness instruction resulted in significant reductions in weight (13.2 pounds) and blood pressure at 24 weeks for 12 people with psychotic disorders who were prescribed antipsychotic medications and completed the program (17 people enrolled), with no significant changes over the following 24 weeks (Centorrino et al. 2006).

Other similar studies of interventions that included both exercise and diet for people with SMI have shown minimal health or fitness improvements. These include at least three group-based interventions and two individualized interventions. Weekly “Weight Watchers” group educational sessions to evaluate food choices, combined with exercise sessions, and token reinforcement for exercise and diet adherence was associated with a five pound weight loss in eleven patients with schizophrenia or schizoaffective disorder who experienced substantial weight gain after being prescribed olanzapine. No significant changes in psychiatric symptoms occurred during the 10-week evaluation period (Ball et al. 2001). Weekly classes on nutrition and exercise were associated with minimal weight change over 16 weeks for 35 outpatients with schizophrenia or schizo-affective disorder shortly after

initiating olanzapine (Littrell et al. 2003). Weekly group health information seminars coupled with cardiovascular and strength training exercise sessions four times per week over a 12 week period did not result in significant weight change among 9 people with mood or psychotic disorders who had initiated a psychiatric medication that caused 10 or more pounds of weight gain. Participation was associated with improvements in subjective ratings of general health and empowerment (Skrinar et al. 2005). An individualized exercise program with a personal trainer and counseling with a dietitian directed at 14 overweight inpatients with SMI who had recently started taking a second-generation antipsychotic was associated with a 16 pound weight increase, most of which occurred in the first 3 months of the 6 month program (Tweedell et al. 2004). Another individualized program that incorporated personal training sessions and encouragement to attend nutritional counseling and self-help programs was associated with improved quality of life for 49 people with major mental illness; however, other outcomes were not evaluated (Feeley et al. 2004).

Limitations of Health Promotion Programs that Combine Exercise and Dietary Change for People with SMI

The studies detailed above all described educational or behavioral programs involving both diet and exercise. Over three-quarters of the programs were provided in a group format and most were offered in inpatient or other settings where individualized food choices were limited. Only four of these health promotion programs provided individually-tailored health promotion (Centorrino et al. 2006; Feeley et al. 2004; Kwon et al. 2006; Tweedell et al. 2004). Many of the studies described above were limited by factors including brief follow-up periods (often 12 or fewer weeks), small sample sizes (typically 35 or fewer participants receiving the intervention), a small number of outcome measures (most were focused specifically on weight reduction), restricted sample populations (most focused only on overweight or obese people with schizophrenia or schizoaffective disorder who were taking antipsychotic medications), and provision of segregated services in mental health settings. Despite these limitations, syntheses of these studies suggest that behaviorally-based interventions may be effective in controlling weight (Alvarez-Jimenez et al. 2008; Bradshaw et al. 2005; Faulkner et al. 2007; Faulkner and Cohn 2006; Faulkner et al. 2003; Lowe and Lubos 2008). Combined, results from diet and exercise programs demonstrate the need to develop health behavior change interventions that: (1) address the unique and individualized needs of people with SMI, (2) generalize to heterogeneous diagnostic groups that are representative of the broad population of individuals with SMI receiving services in community mental health centers, and (3) are provided in community settings in which people with mental illness are fully integrated with people without mental illness, consistent with a recovery model preferred by many consumers of mental health services.

Rationale for the Individualized In SHAPE Health Promotion Program

This report describes such an intervention, the In SHAPE individualized health promotion program, which was developed to promote healthy lifestyle behaviors across a broad spectrum of people with mental illness. The In SHAPE program follows a general framework for health promotion services recommended for people with psychiatric disabilities, as outlined by Hutchinson et al. (2006), in that it promotes access to community-based health and fitness services, recognizes the potential for wellness, encourages active participation in health promotion activities and health education, and acknowledges the need for services that are tailored to the individual's personal health goals, needs, and readiness to change. Our evaluation of the In SHAPE study advances the scientific literature by evaluating a model that: (1) is individually-tailored to address the unique needs of people with SMI, (2) provides the opportunity to access community-based fitness facilities utilized by those with and without mental illness, (3) includes a range of diagnoses (primarily psychotic and affective) that is more representative of the clientele at community mental

health centers, (4) includes individuals who were responsible for their own meals (as opposed to inpatients or group home residents who are provided with meals), and (5) exceeds the follow-up period of most published studies by evaluating the sustainability of health behavior change over a 9-month period. This 9-month, prospective pilot study sought to identify whether individuals who participated in the In SHAPE program would demonstrate improved: (a) physical activity and dietary behaviors, (b) health indicators, and (c) psychological functioning and symptoms.

Methods

Participants

Participants consisted of adults aged 18 and older with a primary DSM-IV Axis I or Axis II diagnosis who were enrolled in an ongoing health promotion program ("In SHAPE") sponsored by Monadnock Family Services (MFS), a public-sector community mental health center in Keene, New Hampshire. Physician approval was required for individuals with a history of physical illness, no physical examination in the prior year, or who indicated a potential medical problem on the Physical Activity Readiness Questionnaire (Thomas et al. 1992). Individuals with dementia (as defined by a Mini-Mental State Examination (Folstein et al. 1975) score less than 24) were excluded from participation. The Dartmouth College and State of New Hampshire Department of Health and Human Services Committees for the Protection of Human Subjects approved the study protocol and informed consent document. Written informed consent was obtained after complete description of the study to participants.

Program Description

In SHAPE is an individualized health promotion program that was developed and piloted at MFS with substantial involvement from a consumer advisory panel. In SHAPE is a multi-faceted intervention that promotes healthy eating and exercise behaviors and is provided in mainstream community settings. The program is based on principles of social inclusion and community integration. In SHAPE partners with or receives funding from multiple community organizations to achieve its goal of improving the health behaviors and overall health of people with mental illness. Participants are supported in identifying personal fitness goals and managing individualized health promotion plans.

The In SHAPE program is described in a standardized treatment manual (Monadnock Family Services 2009). The program included multiple components that were provided by a health mentor (i.e., fitness trainer). Each participant was assigned a health mentor who had certification in fitness training and CPR. Health mentors received additional training in goal setting, motivational interviewing, and healthy eating behaviors. They also received instruction from registered dietitians in setting dietary goals. Health mentors did not have formal education in care or services for people with mental health disorders, but were provided with an overview of symptoms and treatments of mental illnesses. Six mentors provided services to participants and carried a caseload of approximately 15 participants per .5 full-time equivalent. Participants considered the health mentor to be an integral component of the In SHAPE program (Shiner et al. 2008).

Several features of the In SHAPE program were tailored to the needs of people with SMI, differentiating the program from other health promotion programs for this population. First, fitness and diet plans developed between the mentor and participant were individually-tailored based on an assessment of the participants' fitness status, dietary behaviors, personal fitness goals, and their preference for type of exercise and setting. This approach is consistent with recent initiatives from the National Institute for Mental Health (NIMH 2008)

that call for individually-tailored interventions, based on the assumption that engagement, adherence, effectiveness, and efficiency is improved when interventions respond to the specific needs, abilities, and preferences of consumers. Second, weekly individual meetings with a health mentor to review goals and achievements were provided to overcome motivational challenges confronted by participants with mental illness and provide structure, reinforcement, and recognition. Such support is consistent with reported physical activity preferences among persons with SMI (Ussher et al. 2007). Moreover, when necessary, mentors conducted assertive outreach to re-engage participants when they discontinued active involvement in the In SHAPE program. Third, individual instruction was provided to accommodate cognitive challenges and social deficits that are often present in people with SMI. Finally, the In SHAPE program was offered to all interested consumers receiving mental health services at MFS, thus reflecting a broad spectrum of individuals with SMI. Fourth, consistent with a recovery-oriented model of achieving community integration, fitness activities occurred in the local YMCA, as opposed to segregated, mental health settings. These and other components of the program are further described below.

Individualized Fitness and Healthy Lifestyle Assessment—During initial sessions, the health mentor (i.e., fitness trainer) and participant established a relationship and identified the participant's goals and desired activities. Health mentors also administered a health questionnaire, conducted an individualized fitness assessment, and reviewed dietary habits and preferences.

SHAPE Fitness Plan with Exercise and Diet Goals—Participants and their health mentors collaborated to develop a SHAPE fitness plan (Self-Health Action Plan for Empowerment), which included exercise and diet goals. Health mentors helped participants identify objectives based on goals, motivation, and readiness for making behavioral changes. The SHAPE plan could address related health goals, such as tobacco reduction and preventive healthcare. Health mentors referred participants for nutritional or medical consultation when indicated.

The frequency, duration, and types of activities were selected based on the participant's fitness, health status, goals, and aspirations. Exercise activities included, but were not limited to, attending classes at local fitness facilities (including primarily the local YMCA), walking, swimming, tai-chi, yoga, strength training, or cardiovascular fitness training. Work on changing eating habits was dependent on readiness to address dietary behaviors. For example, some participants actively identified targets of change in their daily eating habits, whereas others were only willing to discuss eating a healthier diet but were not ready to make actual changes.

Weekly Meetings with a Health Mentor—Health mentors were expected to meet with participants once a week for approximately 45–60 min. During individual meetings, mentors reviewed progress toward objectives identified in the SHAPE plan and provided individualized exercise instruction and education about healthy eating. Sessions incorporated modeling, positive reinforcement, and strategies to bolster self-efficacy for exercise and diet change. Health mentors used problem-solving techniques to explore barriers to exercise and diet change and to help participants modify objectives to achieve successive approximations of target goals. Mentors used motivational approaches to encourage continued involvement, and to re-engage participants when there were lapses in participation.

Free Access to Local Fitness Facilities—In cooperation with local community partners (e.g., YMCA), participants received memberships to fitness facilities (non-profit

and for-profit) at no cost. Memberships entitled participants to full privileges and access to activities.

Group-Based Fitness and Nutritional Education and Instruction—Health mentors encouraged participation in group-based exercise and nutritional education activities that were offered both by the health mentors as part of the In SHAPE program and by professionals at local fitness facilities and other community settings. Participants could attend a monthly weight management group with the In SHAPE program manager. These 1-h meetings typically consisted of 6–8 participants and included a weigh-in, healthy eating education, and group discussion aimed at sharing strategies and providing support.

Incentive Program for Meeting Physical Activity and Nutritional Goals—Rewards were offered for progress toward objectives in the form of points, which could be redeemed for prizes.

Group Motivational "Celebrations"—Support and reinforcement were provided through group "celebrations" that were held every 6 weeks in community settings (e.g., meeting rooms at a public library or fitness facility). Activities included: (a) prizes awarded for meeting objectives; (b) verbal recognition of participant' accomplishments; (c) activities such as stretching and relaxation exercises, dancing lessons, or games; (d) healthy food options; (e) announcement of upcoming events; and (f) educational activities related to nutrition.

Procedures

Participants were recruited by the In SHAPE program manager or referred by peer support organizations, mental health professionals, and friends or family members. For interested individuals, the program manager explained the study and its voluntary nature using a cued script. Recruitment occurred between August 2004 and October 2005. Structured interviews were conducted between August 2004 and August 2006 by a trained research interviewer who was independent from the In SHAPE program.

Measures

This report focuses on three domains of outcomes assessed at baseline, 3-, 6-, and 9-months.

Physical Activity and Dietary Behaviors—Physical activity was rated with the Yale Physical Activity Scale (YPAS) (Dipietro et al. 1993). We report total time spent in physical exercise during a typical week in the past month; the vigorous activity index (range: 0–60); the leisurely walking index (range: 0–48); and the season-adjusted overall activity index (range: 0–197), which is based on the summary of the vigorous activity, leisurely walking, moving on feet, standing, and sitting activity indices. Higher scores indicate greater intensity of activity.

Self-reported frequency, intensity, and type of exercise and dietary behaviors were collected by health mentors on a weekly basis. Health mentor logs of exercise and dietary behaviors were used to create a dichotomous variable that identified the number of participants engaging in physical exercise or progress toward dietary goals on a weekly basis. Health mentor logs also were used to identify the types of physical activity that participants pursued, the total amount of time per week engaged in physical activity, and the total number of weeks in which exercise or dietary goals were met.

Readiness to engage in nutrition and exercise behaviors was rated with four questions from the Weight Loss Behavior-Stage of Change Scale (WLB-SOC) (Sutton et al. 2003)

including: (a) “limit how much you eat so you don’t eat more calories than you need”, (b) “eat a low fat diet”, (c) “eat at least five servings of fruits and vegetables per day”, and (d) “exercise regularly” (exercise was defined as planned physical activity performed to increase physical fitness and performed 3–5 times/week for 20–60 min/session). Responses ranged from 1 to 5, with higher scores indicating greater readiness.

Health Indicators—Health indicators included height, weight, blood pressure, and waist circumference.

Psychological Functioning and Symptoms—Mental and physical health functioning were assessed with the Medical Outcomes Study Short Form SF-12 (Ware et al. 1996, 1998). Scoring yields a mental component score (MCS) and a physical component score (PCS), which are norm-based with a mean of 50 ± 10. Higher scores indicate better health functioning. Depressive symptoms during the prior week were rated with the Center for Epidemiologic Studies-Depression Scale (CES-D) (Radloff 1977). The 20-item CES-D yields a total score ranging from 0 to 60, with higher scores indicating more severe symptoms. Self-efficacy was rated with the Revised Self-efficacy Scale (RSES) (McDermott 1995). Respondents rated confidence in their ability to perform social behaviors and manage negative symptoms on a scale from 0 to 100, with higher scores indicating greater self-efficacy. Severity of negative symptoms was assessed with the Scale for the Assessment of Negative Symptoms (SANS) (Andreasen 1981). The 24-item SANS evaluates negative symptoms over the prior 2 weeks, yielding a total score ranging from one to five, with higher scores indicating more severe symptoms.

Statistical Analyses

Exposure to the In SHAPE program was determined by counting the number of participants who reported meeting with their health mentor on a weekly basis. We also calculated participation in exercise or dietary behaviors based on weekly health mentor records.

We conducted mixed-effects linear modeling with unstructured covariance to compare differences over time in physical activity and dietary behaviors, health indicators, and psychological functioning and symptoms. Mixed-effects models have advantages over traditional repeated-measures analyses of variance in that they accommodate missing data, thereby allowing for the inclusion of all subjects with data in the analyses (Fitzmaurice et al. 2004; Hedeker and Gibbons 2006; Laird and Ware 1982). Interactions between time and gender, age group (aged 18–49; aged 50+), diagnosis (depression/bipolar disorder; schizophrenia/schizoaffective disorder), and number of quarterly contacts with the health mentor were assessed. Post-hoc analyses of significant time effects were used to identify differences between baseline, 3-, 6-, and 9-month time points. All analyses were conducted with the Statistical Package for Social Sciences (SPSS, release 17.0); $P<.05$ was used as the level of significance.

Results

Sample

Ninety-eight people consented to participate in the evaluation, of which 76 completed the enrollment process (at least two sessions with a health mentor). Among the 76 enrolled participants, 66 (86.8%) completed 3-month assessments, 65 (85.5%) completed 6-month assessments, and 57 (75.0%) completed 9-month assessments. There were no differences at baseline between those who completed the enrollment process ($n = 76$) and those who had one or fewer sessions with a health mentor ($n = 22$) with respect to demographic characteristics (psychiatric diagnosis, gender, marital status, education, employment status,

and residential status), physical health status (weight, BMI, systolic and diastolic blood pressure, waist circumference, number of physical health problems, SF-12 PCS, and total time exercising), or readiness to change health behaviors (limit caloric intake, eat fruits and vegetables, eat a low fat diet, and participate in regular exercise). Mental health status (CESD, SANS, RSES) also was similar between these groups, with the exception of higher mental health functioning (SF-12 MCS) in the excluded group (n = 21, mean = 38.1, SD = 10.3) compared to the included group (n = 75, mean = 32.2, SD = 12.0) ($t(94) = 2.033$, $P = .045$). Characteristics were also similar between the groups of enrolled participants with complete (n = 51) and incomplete (n = 25) follow-up data, with two exceptions. Compared to those with incomplete data, the group with complete follow-up data had a lower proportion of females (n = 32, 62.7% vs. n = 22, 88.0%) ($\chi^2(1) = 5.202$, $P = .023$) and had a greater readiness to eat a low fat diet (mean = 2.9, SD = 1.4 vs. mean = 2.2, SD = 1.0) ($t(62.61) = 2.509$, $P = .015$).

Demographic Characteristics

Study participants (n = 76) had a mean age of 43.5 ± 11.4 years, with nearly one-third (n = 24, 31.6%) aged 50 and older. Nearly three-quarters of participants were female (n = 54, 71.7%) and most were Caucasian (n = 69, 90.8%). Psychiatric diagnoses primarily included major depressive disorder (n = 30, 39.5%), bipolar disorder (n = 19, 25.0%), and schizophrenia or schizoaffective disorder (n = 18, 23.7%). Other primary diagnoses included PTSD (n = 4, 5.3%), anxiety disorder (n = 2, 2.6%), alcohol dependence (n = 2, 2.6%), and mental disorder due to a medical condition (n = 1, 1.3%). One-fifth of participants (n = 16, 21.1%) were never married. Over half (n = 39, 51.3%) pursued education beyond high school. Most (n = 59, 77.6%) lived independently. One-third (n = 24, 31.6%) engaged in volunteer or paid work activities.

At baseline, participants weighed an average of 202.5 ± 44.2 pounds, with an average waist circumference of 101.7 ± 19.6 cm. Twenty percent (n = 15) had a normal weight (BMI: 18.5–24.99), 14.5% (n = 11) were overweight (BMI: 25–29.99), and 65.8% (n = 50) were obese (BMI ≥ 30). Participants had an average of 2.3 ± 2.0 physical health disorders. Arthritis (n = 29, 38.2%), asthma (n = 20, 26.3%), and hypertension (n = 15, 19.7%) were most prevalent. Most participants indicated an intention to make dietary changes within the next 30 days.

Exposure

Over half of participants reported meeting with their health mentor at least weekly at 3 months (n = 39, 59.1%), 6 months (n = 36, 55.4%), and 9 months (n = 33, 57.9%). During the 9-month period, participants reported an average of 17.2 ± 10.9 weeks of exercise (median = 16.5 weeks; data from health mentor activity logs for 97.4% (n = 74) of participants) and 10.5 ± 9.5 weeks with progress toward dietary goals (median = 6.0 weeks; data from health mentor activity logs for 77.6% (n = 59) of participants). Figure 1 shows weekly participation in goal-oriented physical exercise or dietary changes, as documented within the health mentor logs.

Physical Activity and Dietary Behaviors

As shown in Table 1, mixed effects linear modeling indicated a significant increase in hours of exercise from baseline through 9-month follow-up ($P<.001$). Post-hoc analyses indicated an increase of 1.1 h of exercise per week between baseline (1.6 ± 2.6 h/week) and 9-months (2.7 ± 2.8 h/week) ($t(56) = -3.195$, $P = .002$). Participants reported significant increases in YPAS overall activity ($P<.001$), vigorous activity ($P<.001$), and leisurely walking indices ($P = .030$). There was a significant improvement in readiness to engage in regular planned exercise ($P = .007$). There also was a significant interaction between time and quarterly

contacts with a health mentor with respect to increasing readiness to limit caloric intake ($F(2,68.650 = 3.978$, $P = .023$).

Over the 9-month study period, health mentors reported that participants engaged in 2.0 ± 1.0 h of exercise per week during weeks with exercise activity, and met dietary objectives for 7.7 ± 8.3 weeks. Most participants engaged in general, non-specific physical activity (i.e., walking or swimming) ($n = 62$, 83.8%), cardiovascular activities ($n = 55$, 74.3%), or resistance activities ($n = 52$, 70.3%). A smaller proportion engaged in exercise classes ($n = 20$, 27.0%) or activities to enhance flexibility ($n = 10$, 13.5%).

Health Indicators

Mixed effects linear modeling indicated a significant reduction in waist circumference between baseline and 9 months ($P = .011$). A post-hoc comparison showed an average 3.2 cm loss in waist circumference between baseline (103.8 ± 15.9) and 9-month follow-up (100.6 ± 20.1) ($t(51) = 2.049$, $P = .046$). There were no significant changes in weight or blood pressure. However, participants with hypertension ($n = 13$) had a 6.3 ± 18.5 mm Hg reduction in systolic blood pressure (ES = −0.49). Overall satisfaction with fitness improved, as rated on a seven-point Likert scale ($P<.001$). A post-hoc comparison showed that participants had an average improvement of 0.8 points on the Likert scale for satisfaction with physical fitness between baseline (2.7 ± 1.4) and 9-month follow-up (3.5 ± 1.6) ($t(55) = −3.620$, $P = .001$).

Psychological Functioning and Symptoms

Results of the mixed effects linear models showed that mental health functioning (measured by the SF-12 MCS) improved over time ($P = .024$) and severity of negative symptoms (measured by the SANS) decreased ($P = .003$). Post-hoc comparisons showed significant improvements in the SF-12 MCS between baseline (31.8 ± 12.9) and 9-month follow-up (36.2 ± 13.4) ($t(53) = −2.411$, $P = .019$) and significant reductions in negative symptoms between baseline (2.5 ± .7) and 9-month follow-up (2.3 ± .6) ($t(56) = 2.128$, $P = .038$). There was a significant interaction between time and number of quarterly contacts with a health mentor, such that people who engaged more frequently with their health mentor were more likely to show improved mental health functioning ($F(2,75.634) = 9.466$, $P<.001$).

Discussion

People with mental illness who enrolled in the In SHAPE health promotion program accrued health benefits in a variety of domains. They increased participation in regular exercise, reduced waist circumference, improved satisfaction with their fitness, and reported improvements in mental health functioning and negative symptoms. They also demonstrated trends toward increased readiness to limit caloric intake and improved self-efficacy for participation in activities. These findings confirm that a community-integrated, individualized health promotion program can substantially benefit consumers of public mental health services.

The In SHAPE program was successful in encouraging people to engage in physical activity, particularly in low-intensity walking and swimming, as well as other cardiovascular and resistance exercises. We suspect that this willingness to substantially increase exercise behavior may be due to the fact that exercise activities were offered in integrated, community settings, although without a comparison group in a segregated setting we could not test this hypothesis. In spite of the positive outcomes on increased exercise, significant weight loss was not observed overall. We suspect that this was due to a lack of change in dietary behaviors, which may reflect the challenges of modifying these behaviors in

community-residing participants, including financial limitations and reliance on food pantries. We also found that health mentors focused on exercise goals over dietary behaviors, consistent with their training in fitness and lack of expertise in nutrition.

Participants did however, demonstrate a significant reduction in waist circumference, which is an important predictor of certain metabolic diseases, and has been noted to be a more useful indicator of risk for cardiovascular disease than weight or BMI (Chan et al. 1994; Lemieux et al. 1996; Woo et al. 2002). To our knowledge, only Menza et al. (2004) and Wu et al. (2007) have evaluated waist circumference for people with SMI participating in health promotion programs that included both diet and exercise components. Their multi-modal interventions found similar waist circumference reductions. The published literature on programs that combine exercise and diet change for people with SMI consists of mixed results with respect to changes in weight or BMI. While several studies report a moderate weight reduction (Centorrino et al. 2006; Chen et al. 2009; Kalarchian et al. 2005; Kwon et al. 2006; Melamed et al. 2008; Menza et al. 2004; Richardson 2005; Vreeland et al. 2003; Wu et al. 2007), others show no change in weight (Ball et al. 2001; Skrinar et al. 2005; Tweedell et al. 2004) or weight gain less than that of a control group (Littrell et al. 2003). In the presence of a significant reduction in waist circumference, our minimal changes in BMI likely indicate a positive redistribution of body weight and increase in muscle mass.

Our study is consistent with other literature which shows that mental health consumers participating in a health promotion program can significantly improve mental health functioning (Callaghan 2004; Craft and Landers 1998) and reduce severity of negative symptoms (Faulkner and Biddle 1999). Changes in mental health functioning (as measured by the SF-12 MCS) reflect an increased ability to perform social roles, similar to that seen by Chen et al. (2009) in their 10-week group-based health promotion program. These changes may be fostered by encouragement from health mentors and reinforcement for participation in community activities. Improved mental health functioning may be associated with positive health behaviors, such as our trend findings of greater self-efficacy to engage in social situations, or findings by others which show improved consumer empowerment associated with a exercise-focused health promotion program (Skrinar et al. 2005). Reductions in negative symptoms, which are strongly related to social competence and psychosocial functioning (Mueser et al. 1991; Pogue-Geile and Harrow 1985), suggest that support provided by health mentors (Shiner et al. 2008) may reduce apathy and improve motivation and social skills. Improved mental health functioning and reduced negative symptoms were not primary goals of the In SHAPE program, yet clinically important changes were observed in some participants. For example, one woman described rarely leaving her house for a period of 9 years before enrolling in the In SHAPE program. While participating in In SHAPE and engaging with her health mentor, she gained the confidence to use YMCA resources and return to competitive employment. Gains were unique and clinically important to each individual, yet are not easily captured with available measures of functioning and symptoms. Improved psychosocial functioning in the context of physical health promotion is noteworthy and warrants further study.

There are a number of limitations to this study. First, this pilot study did not include a control group, thus we are unable to comment on the usual course of exercise and dietary behaviors, health indicators, and psychological functioning. However, the literature on obesity, poor diet, lack of exercise, and cardiac risk associated with early mortality suggests that fitness among people with SMI is generally poor in the absence of targeted interventions. Second, despite including a dietary component, engagement in dietary changes remained low. Third, despite the importance of the health mentor relationship (Shiner et al. 2008), we did not control for the effect of specific health mentors. Fourth, we do not report on exercise capacity, which we believe was enhanced based on anecdotal

reports from health mentors. Anecdotal reports align with previous research which has found that exercise capacity of people with schizophrenia and depression can significantly increase following participation in an exercise program (Blumenthal et al. 1999; Pelletier et al. 2005). Our assessment battery included the 6-min walk test (Peeters and Mets 1996), however, low completion of this test at baseline and inconsistent data collection methodology prevented us from reporting on this outcome. Fifth, while our finding of lower negative symptoms following participation in the In SHAPE program align with previous findings for people with schizophrenia (Faulkner and Biddle 1999), this finding is based on the Scale for the Assessment of Negative Symptoms (SANS) which has not been validated among persons with non-psychotic disorders. However, symptoms assessed using this instrument (i.e., apathy, anhedonia, asociality, and amotivation) are common to people with mood disorders and are likely to affect an individual's engagement and success in a health promotion intervention. Post-hoc analyses did not indicate differential SANS response patterns in persons with psychotic and non-psychotic disorders. Sixth, although several psychiatric medications commonly prescribed to people with mental illness are associated with weight gain (Allison and Casey 2001; Allison et al. 1999), the modest sample size and observational nature of this study did not allow for examining the differential effects of these medications on weight outcomes. Finally, post-hoc analyses should be interpreted with caution due to the potential for Type I error.

Several strengths of the study also should be noted. First, the 9-month duration of this evaluation allowed for an assessment of the sustainability of change over time and showed that participants can maintain health benefits with substantial personal supports and reinforcement. To our knowledge, only four health promotion studies that focus on both exercise and diet behaviors have evaluated outcomes beyond a 6-month period (Centorrino et al. 2006; Chen et al. 2009; Melamed et al. 2008; Menza et al. 2004). Of note, we found the strongest outcomes in the first 3-month evaluation period, with a leveling of improvement for most indicators thereafter. This may represent heightened motivation and enthusiasm to engage in a new health promotion program. The sustainability of these changes has important implications for creating lasting health behavior change and health benefits in people with SMI. Second, findings extend prior research by demonstrating health improvements across a broad array of outcome indicators. Third, our study demonstrates the feasibility and value of providing a health promotion program in an integrated, community setting. Finally, the heterogeneous diagnostic composition of our sample is representative of populations commonly served by public sector mental health service providers. As such, results are likely to generalize to populations that receive services from these types of settings.

In summary, people with mental illness can experience significant improvements in physical exercise, waist circumference, satisfaction with fitness, mental health functioning, and negative symptoms by participating in the In SHAPE individualized health promotion program. Based on these promising findings, the effectiveness of In SHAPE is being tested by our research group in randomized controlled trials funded by the Centers for Disease Control and Prevention and the National Institute of Mental Health.

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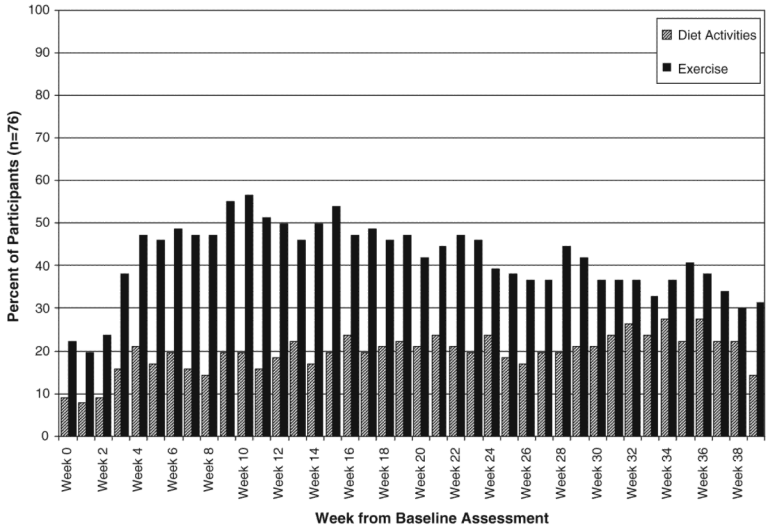

Fig. 1.

Participants engaging in diet and exercise activities by week in program, based on health Mentor' records

Table 1

Physical activity and dietary behaviors, health indicators, and psychological functioning and symptoms between baseline and 9-months

	Baseline (*n* = 76)	3 month (*n* = 66)	6 month (*n* = 65)	9 month (*n* = 57)	Mixed-effects linear model	*P*-level
Physical activity						
Hours/week exercising	2.0 ± 3.3[b,c,d]	4.5 ± 5.9[a,c,d]	2.5 ± 2.1[a]	2.7 ± 2.8[a]	$F(3,59.1) = 5.828$	.001
YPAS Overall activity index (adjusted score)	33.3 ± 19.8[b,c,d]	43.7 ± 24.2[a]	38.8 ± 20.2[a]	37.3 ± 19.6[a]	$F(3,58.3) = 8.325$	<.001
YPAS Vigorous activity index	8.8 ± 10.0[b,c,d]	19.4 ± 16.8[a]	14.4 ± 14.9[a]	16.0 ± 16.6[a]	$F(3,60.8) = 12.290$	<.001
YPAS Leisurely walking index	8.5 ± 8.7[b]	10.3 ± 11.1[a]	9.5 ± 9.1	7.2 ± 8.3	$F(3,56.5) = 3.192$	.030
Readiness to change weight loss behaviors						
Limit total amount eaten	3.1 ± 1.3	3.1 ± 1.3	3.4 ± 1.2	3.5 ± 1.3	$F(3,64.6) = 2.697$	.053
Decrease fat intake	2.7 ± 1.3	3.0 ± 1.4	3.1 ± 1.4	3.2 ± 1.4	$F(3,65.0) = 2.003$	.122
Increase fruit & vegetable intake	2.9 ± 1.2	3.1 ± 1.3	3.0 ± 1.3	2.8 ± 1.3	$F(3,63.3) = 0.807$	.495
Exercise regularly	3.0 ± 0.8[b,c,d]	3.4 ± 1.0[a]	3.4 ± 1.2[a]	3.3 ± 1.2[a]	$F(3,64.6) = 4.396$	.007
Health indicators						
Waist circumf. (cm)	101.7 ± 19.6[b,c,d]	99.1 ± 16.7[a]	98.9 ± 17.6[a]	100.5 ± 19.9[a]	$F(3,59.1) = 4.076$	.011
Weight (lbs)	202.5 ± 44.2	202.7 ± 42.7	203.9 ± 48.7	205.1 ± 48.6	$F(3,64.2) = 0.625$	.602
Body mass index	32.9 ± 7.3	32.8 ± 7.1	33.1 ± 8.2	33.4 ± 8.2	$F(3,63.6) = 0.480$	.697
Systolic blood pressure	128.4 ± 18.5	128.7 ± 17.5	125.3 ± 16.9	129.6 ± 18.4	$F(3,58.6) = 0.874$	.460
Diastolic blood pressure	80.4 ± 10.8	82.3 ± 12.7	79.7 ± 10.7	81.3 ± 11.6	$F(3,62.2) = 0.762$	.519
Satisfaction with fitness	2.8 ± 1.5[b,c,d]	3.8 ± 1.5[a]	3.6 ± 1.5[a]	3.5 ± 1.5[a]	$F(3,63.6) = 11.584$	<.001
Psychological functioning and symptoms						
Mental health functioning (SF-12 MCS)	32.2 ± 12.0[b,c,d]	36.2 ± 13.1[a]	35.8 ± 12.6[a]	36.4 ± 13.4[a]	$F(3,62.2) = 3.352$	.024
Physical health functioning (SF-12 PCS)	44.7 ± 12.5	44.5 ± 12.3	43.3 ± 11.8	44.3 ± 11.1	$F(3,62.6) = 0.508$	.678
Depression (CESD)	28.6 ± 13.0	26.3 ± 15.2	26.3 ± 15.3	26.0 ± 15.4	$F(3,59.8) = 1.986$	.126
Self-efficacy (RSES)	53.3 ± 18.5	58.1 ± 19.6	57.8 ± 19.7	57.4 ± 18.4	$F(3,60.3) = 2.429$	.074
Negative symptoms (SANS)	2.4 ± 0.7[b,c,d]	2.3 ± 0.7[a]	2.2 ± 0.6[a]	2.3 ± 0.6[a]	$F(3,65.4) = 5.203$	.003

[a] Post-hoc analyses indicate significant difference from baseline values ($P<.05$)

[b] Post-hoc analyses indicate significant difference from 3-month values ($P<.05$)

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[c] Post-hoc analyses indicate significant difference from 6-month values ($P<.05$)

[d] Post-hoc analyses indicate significant difference from 9-month values ($P<.05$)