Developing a peer-based healthy lifestyle program for people with serious mental illness in supportive housing

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Abstract

Overweight and obesity disproportionately impact people with serious mental illness (SMI). Healthy lifestyle interventions can improve the health of people with SMI but may need to be adapted for this population. The aims of this study were: to (1) examine the feasibility and acceptability of delivering the Peer-based Group Lifestyle Balance (PGLB) intervention and (2) describe intervention adaptations for people with SMI in supportive housing. Peer specialists and social workers co-facilitated 12 weekly PGLB sessions for 14 supportive housing clients. We conducted structured interviews and collected qualitative data through field notes and two focus groups. Frequencies and measures of central tendencies were used to describe participant characteristics and PGLB feasibility and acceptability measures. Qualitative data was analyzed using directed content analysis. Participants on average attended 8 of 12 sessions, and reported that services were satisfactory and helpful. Intervention adaptations, ongoing throughout the study, focused on adding peer-specialists as co-facilitators, increasing individualized support and developing strategies to address socioeconomic barriers impacting participants' ability to engage in healthy lifestyle changes. Study findings suggest that participants with SMI in supportive housing perceived PGLB as feasible and acceptable. Expanding the relevance and reach of peer-based healthy lifestyle interventions in community settings serving people with SMI requires careful adaptations to the socioeconomic realities of this population and the complexities of living with co-morbid health and mental health conditions.

Keywords

Serious mental illness, Obesity, Healthy lifestyle interventions, Supportive housing, Peer specialists

Compared to people without mental health conditions, people with serious mental illness (SMI, e.g., schizophrenia) have higher rates of obesity and cardiovascular disease [1]. A series of risk factors contribute to these health disparities, including the cardiometabolic side effects of psychiatric medications, poor nutrition, lack of regular physical activity, smoking, and underutilization of medical care [2, 3]. Healthy lifestyle interventions that improve dietary habits and increase physical activity, such as the Group Lifestyle Balance (GLB) derived from the Diabetes Prevention

Implications

Policy: Healthy lifestyle intervention policies and programming should be responsive to cultural, geographic, and socioeconomic factors, as well as mental health concerns that may influence the engagement of people with SMI.

Research: The results of our pilot study suggest that future work should prioritize efforts to test the effectiveness of peer-based healthy lifestyle interventions that combine group and individual sessions, tailor and simplify self-monitoring strategies, and adapt intervention content and activities to the socioeconomic realities of people with SMI.

Practice: Healthy lifestyle interventions represent a promising component of a holistic approach to improve the physical health of people with SMI.

Program (DPP) [4], can help address many of these risk factors [5]. Yet these interventions tend to have limited reach among people with SMI since they are delivered mostly in clinical settings (e.g., outpatient mental health clinics) by healthcare professionals. Expanding the settings and providers that can deliver these interventions is an important step to increase the accessibility, reach, and impact of healthy lifestyle interventions in people with SMI [6].

Peer specialists are a viable workforce to deliver services to people with SMI [7, 8]. Peer specialists are individuals with experience successfully living with mental illness who use this experience, sometimes coupled with skills learned through formal training, to deliver behavioral health services to others with mental illness [9, 10]. Peers can use their own experiences to motivate clients to engage in healthy lifestyle changes and serve as credible role models to support health behavior change [11]. However, peer specialists have been underutilized in health and wellness interventions aimed at improving the physical health of people with psychiatric disabilities. Data on the feasibility and acceptability of peer-based programs delivered in community settings to improve the physical health of people with SMI is limited. Filling this gap is

a necessary step in the intervention development process to prepare effective health interventions for this population [12].

The aims of this study were: to (1) examine the feasibility and acceptability of delivering a peer-based health lifestyle intervention adapted from the GLB intervention and (2) describe how we adapted this intervention for people with SMI in supportive housing. Supportive housing agencies offer affordable, community-based housing units alongside health, mental health, and social services and tend to serve a diverse group of individuals with a range of health and mental health conditions [13]. Services provided through supportive housing have the advantage of being delivered at individuals' doorsteps [14], addressing access barriers. Many of these agencies provide group-based services and employ peer specialists, suggesting that peer-based interventions would be congruent with existing budgeting and staffing. Peer specialists may require more training and resources to take on this new role. Additionally, supportive housing residents in previous studies have expressed that they would prefer health interventions led by peer specialists [15].

METHODS

Setting—This pilot study was conducted at a supportive housing agency in New York City that serves adults with SMI using a Housing First model, a SAMHSA-recognized evidence-based practice in which clients are offered an apartment of their own without requiring them to participate in formal treatment [16]. Study procedures were approved by the Institutional Review Board of Columbia University.

Recruitment and sampling—Eligible participants were clients of the supportive housing agency who were 18 years of age or older, spoke English, had a chart diagnosis of SMI, had a body mass index (BMI) equal to or greater than 25, and had been cleared by their primary care physician to participate in light-to-moderate physical activity. We excluded individuals who were at risk of harming themselves or others, failed a capacity-to-consent questionnaire [17], were cognitively impaired as detected by the Mini-Cog examination [18], were in need of substance abuse detoxification services, or had mobility issues that precluded engagement in light-to-moderate physical activity.

We delivered the intervention to two cohorts recruited through provider referrals between August 2013 and March 2014. The first cohort was a single group open-trial, while the second cohort was randomly assigned to the intervention group or to a 12-week waitlist condition. The reason for randomizing the second cohort was to explore the feasibility and acceptability of this methodology in this setting and client population. Feasibility of randomization was evaluated by how many people invited to participate and screened in this second cohort enrolled in the study.

Acceptability of randomization was evaluated by examining participants' satisfaction with the intervention. For the first cohort, 17 people were referred, 15 were successfully contacted, and 13 agreed to be screened for eligibility. Of those 13, 5 were lost to follow-up during screening, 1 was ineligible due to mobility limitations, and 7 were enrolled to receive the Peer-based Group Lifestyle Balance (PGLB). The second cohort had 38 referrals, 33 of whom were successfully contacted and 15 of whom agreed to be screened for eligibility. Two individuals were ineligible due to mobility limitations, 1 individual was lost to follow up during screening, and 7 were randomized to the PGLB treatment condition. The remaining five were randomized to the waitlist condition and received the PGLB intervention after 12 weeks. Overall, 80% (12/15) who agreed to be screened and eligible to participate accepted the randomization procedure and enrolled in this study, thus providing initial evidence for the feasibility of randomization.

The PGLB–GLB is a manualized, group-based intervention that provides information on nutrition and exercise, as well as behavioral change techniques (e.g., problem solving) to improve dietary habits and increase physical activity [19] (see <http://www.diabetesprevention.pitt.edu/> for a detailed description of GLB). GLB consists of 12 weekly core sessions followed by 10 optional post-core sessions delivered on a bi-monthly or monthly basis. Sessions last about 1 h and are delivered to 6 to 10 participants who receive GLB handouts for each session. The intervention is designed to be delivered in community settings (e.g., primary care clinics, community centers) by trained facilitators who are often dietitians, nurses, social workers, or community health workers [20].

One aim of this project was to describe how GLB was adapted to fit the needs of people with SMI living in supportive housing. Adaptations were ongoing throughout the study. Most occurred before PGLB sessions began (e.g., incorporating peer specialists as facilitators) or during cohort 1 (e.g., prior to each session delivery, facilitators would modify or supplement GLB handouts to create a clearer presentation of content). However, during cohort 2, we further refined some adaptations already in place based on participants' individual needs. Another aspect of this adaptation aim was to explore the use of peer specialists to work alongside mental health professionals (e.g., social workers) as co-facilitators of PGLB. Because there is not an established protocol for using peer specialists as GLB facilitators, we designed this pilot to introduce and gradually increase the role of peer specialists in the delivery of GLB. For this reason, we do not title it a “peer-led” intervention, rather “peer-based,” with peer specialists playing a core role in co-facilitating the intervention. Peers also played a key role in adapting the GLB intervention to better fit our population. A total of four peer specialists (two for cohort 1 and two for cohort 2) were selected to co-facilitate the PGLB. They had graduated from a peer specialist training

Table 1 | Sample characteristics (*N* = 14)

Sample characteristics	Number	Percent	Mean (SD)
Age			48.07 (16.00)
Years of education			11.86 (3.01)
Female	7	50	
Race/ethnicity			
Hispanic	5	35.71	
African American	4	28.57	
Mixed race	3	21.43	
Other ^a	2	14.29	
Health indicators			
Weight (lbs)			218.49 (50.15)
BMI			34.99 (7.22)
Waist circumference			111.50 (19.53)
Self-reported medical conditions			
Asthma	7	58.33	
Arthritis	2	16.66	
Diabetes	3	25	
Hypertension	10	83	
High cholesterol	6	50	
Average number of medical conditions			4.36 (3.39)
Self-reported mental health conditions			
Schizophrenia or schizoaffective disorder	7	50	
Major depression	8	57	
Bipolar disorder	8	57	
Taking antipsychotic medication	12	86	
First generation	6	43	
Second generation	6	43	

^a Participants of other races include Native American and West Indian

program that prepared them to work in community mental health settings, were employed at the supportive housing agency, and were recommended to the project by their supervisors. The four peer specialists included two men and two women, two Latinos who spoke Spanish, one Haitian American, and one African American. All peer specialists self-identified as having a mental health condition (e.g., bipolar disorder) and were currently working to lose weight themselves.

All PGLB facilitators (peer specialists and social workers) attended a 6-h training based on the GLB facilitator training. Peer specialists also received ongoing supervision from the research team (doctoral level social workers trained in GLB) through weekly meetings. For both cohorts, the 12 weekly core sessions were co-facilitated by one peer specialist and one social worker. Peer specialists' role as co-facilitators included preparing session materials each week, delivering intervention content during group sessions, and conducting reminders calls to participants between group sessions.

Data collection—We used structured interviews, participant focus groups, and field notes to assess PGLB feasibility and acceptability and to document intervention adaptations. Although a randomized control trial (RCT) design was used in cohort 2, funding limitations precluded us from collecting feasibility and acceptability data from participants assigned to the waitlist

condition (receiving the PGLB after 12 weeks). Research assistants conducted structured interviews with participants at baseline, 6, and 12 weeks to collect information such as self-reported health and mental health histories, anthropometric measures, and satisfaction with the PGLB. In this article, we only report feasibility, acceptability, and intervention adaptation data collected from participants in cohort 1 and participants in cohort 2 randomized to the PGLB condition.

Feasibility and acceptability measures—Feasibility was measured via two types of PGLB attendance data: attendance to group and makeup (when participants missed group) sessions. In makeup sessions, participants met with PGLB facilitators one-on-one or in a small group. PGLB acceptability was measured with the Client Satisfaction Questionnaire (CSQ), an eight-item measure that captures participants' general views regarding the quality, satisfaction, and general acceptability of services [21]. For each cohort, the CSQ was administered at 12 weeks once participants had been exposed to the intervention.

QUALITATIVE DATA

Two focus groups were conducted at the end of the 12-week intervention for each cohort. A total of eight participants (five from cohort 1 and three from cohort

Table 2 Acceptability ratings									
Client satisfaction questions ^a	Cohort 1			Cohort 2			Total		
	M	SD	% High satisfaction ^b	M	SD	% High satisfaction ^b	M	SD	% High satisfaction ^b
How would you rate the quality of the services you have received from our program?	3.5	.84	83	3.5	.58	100	3.5	.71	90
Did you get the kind of services you wanted?	3.33	.82	83	3.25	.50	100	3.3	.68	90
To what extent has our program met your needs?	2.83	.75	67	3.5	.58	100	3.1	.74	80
If a friend were in need of similar help, would you recommend our program to him/her?	4.0	.00	100	4	.00	100	4	.00	100
How satisfied are you with the amount of help you received in this program?	3.33	.82	83	3.5	.58	100	3.4	.70	90
How have the services you received helped you deal more effectively with improving your health?	3.67	.52	100	4	.00	100	3.8	.42	100
In a general sense, how satisfied are you with the services you have received in this program?	3.5	.55	100	3.75	.50	100	3.6	.52	100
If you were to seek help again, would you come back to our program?	3.8	.41	100	4	.00	100	3.9	.32	100

^a All questions were scored on a four-point Likert scale (1–4), with higher values indicating greater satisfaction with the program

^b Percentage of high satisfaction indicates respondents who scored a given item 3 or 4, indicating that they were more satisfied with the program

2) attended these focus groups. Focus groups were moderated by the principal investigator and a research assistant and included questions such as “What did you think about the PGLB?” “What about the program did you find most helpful?” Focus groups lasted approximately 90 min, were audiotaped, and professionally transcribed. Field notes by the study team were also collected during the study to capture challenges delivering PGLB and to document intervention adaptations.

Data analysis—Quantitative data were entered into SPSS 21. Frequencies and measures of central tendencies were used to describe participant characteristics and PGLB feasibility and acceptability measures. Guided by Vendetti and Kramer’s framework of core components of healthy lifestyle interventions [22], we used directed content analysis to analyze qualitative data [23]. This analysis was iterative and occurred throughout the study. We independently reviewed the field notes collected during PGLB delivery to cohort 1 and the transcript of the cohort 1 focus group and then discussed lessons learned from these materials and developed an analytical memo summarizing key challenges and intervention adaptations identified through these materials. We then repeated this process with the field notes and focus group transcript generated from cohort 2, adding new lessons learned to our analytical memo.

The first author used the analytical memo, field notes, and focus group transcripts to develop a thematic matrix [24] that organized and summarized the core components of healthy lifestyle interventions (e.g., self-monitoring), challenges encountered in delivering each component, and our adaptations to address challenges. We used the following strategies to maximize the rigor and trustworthiness of our qualitative analysis: prolonged engagement with participants, audit trail documenting analytical decisions, and triangulation from multiple data sources [25].

RESULTS

Sample characteristics—Table 1 presents sample characteristics. Half of participants were female. The majority were Latino or African American (65%) and had an average age of 48 years ($SD = 16$). The average number of medical conditions reported was 4.36 ($SD = 3.36$), with hypertension, high cholesterol, and asthma being the most frequent. The most common mental health diagnoses were bipolar disorder, depression, and schizophrenia/schizoaffective disorder. Eighty-six percent of participants reported antipsychotic medication use. At baseline, participants’ average weight was 218.49 ($SD = 50.15$) and average BMI was 34.99 ($SD = 7.22$). The majority of participants relied on government programs for income (e.g., Social Security Income), 12 out of 14 received SNAP benefits, and 2 were applying for SNAP benefits.

PGLB feasibility—Participants attended an average of 6.79 of the 12 group sessions ($SD = 3.7$); 14% attended

no group sessions, 7% attended 1–4 sessions, 33% attended 5–8 sessions, and 42% attended 9–12 sessions. Participants attended an average of 1.93 makeup sessions ($SD = 0.68$); 14% attended no makeup sessions and 83% attended 1–4 sessions. Combining group and makeup session attendance, participants attended an average of 8.57 of 12 PGLB sessions ($SD = 5$).

PGLB acceptability—Participants’ ratings of PGLB acceptability are presented in Table 2. Overall, participants in both cohorts expressed high levels of satisfaction with the PGLB intervention. All participants indicated that they would recommend the program to a friend, that the program helped them deal more effectively with improving their health, that they were satisfied with the services they had received, and that they would come back to the program if they were to seek help in the future. As a cohort 2 participant indicated:

This worked for me better than any program I’ve tried with the weight loss over the years. And it didn’t affect my health. My health continued to improve with it, and that’s really important, because a lot of things that I’ve tried before always affected my health. It affected my medication; it affected a lot of things. But this didn’t.

Moreover, 90% of participants indicated that the quality of services was excellent or good, that they got the services that they wanted, and that they were mostly or very satisfied with the amount of help they received from the PGLB. The majority of participants (80%) also reported that the program met their needs. Participants also shared suggestions for improving the PGLB intervention, including more hands-on activities, such as healthy cooking and exercise classes; more opportunities to move beyond manual content to topics of interest, such as food shopping on a budget; more opportunities to “bring the fun in” and engage as a group in less structured ways; and more discussion around the relationship between physical and mental health. Participants in both cohorts mentioned their needs would be better met through additional contact with PGLB facilitators, such as more opportunities to check in with facilitators in between sessions. They also requested support after the intervention concluded; as a cohort 1 participant suggested, there could be follow up “... for the people who want to lose some weight and are having problems losing weight at home, trying to do everything that I’ve learned in the group.”

PGLB CHALLENGES AND ADAPTATIONS

In this section, we summarize the challenges and intervention adaptations organized by five core components of healthy lifestyle interventions, including

Table 3 | Summary of challenges and adaptations

Intervention components	Challenges	Adaptations
Committing to the program	<ul style="list-style-type: none"> • Attending groups session • Completing medical clearance 	<ul style="list-style-type: none"> • Offered makeup sessions at participants' convenience • Coordinated appointments with local primary care physicians
Self-monitoring	<ul style="list-style-type: none"> • Remembering and recording daily food intake and physical activity 	<ul style="list-style-type: none"> • Developed a menu of self-monitoring tools including picture-based options for lower literacy and mobile app-based options • Added in-between session contacts and increased one-on-one time before sessions to support self-monitoring
Building healthy eating patterns	<ul style="list-style-type: none"> • Changing entrenched dietary habits, unhealthy eating patterns • Experiencing economic limitations to purchase healthy foods 	<ul style="list-style-type: none"> • Added new content on how to measure food portions using hands and household items • Supplemented content on how to make culturally congruent dietary changes • Provided additional resources on how to purchase healthier items using SNAP and how to purchase fresh fruits and vegetables at reduced cost
Increasing physical activity	<ul style="list-style-type: none"> • Engaging in regular physical activity 	<ul style="list-style-type: none"> • Introduced intervention content regarding walking and using a pedometer earlier in the intervention to get participant moving • Leveraged weekly weigh-in sessions and in-between session contacts to provide individual support and motivation regarding physical activity • Developed a menu of apartment-based exercise options • Developed a list of no-cost and low-cost community resources for physical activity
Behavioral components	<ul style="list-style-type: none"> • Lacking motivation to apply behavioral techniques • Struggling with examples of GLB behavioral techniques incongruent to participants' lives 	<ul style="list-style-type: none"> • Leveraged weekly weigh-in sessions and in-between session contacts to provide individual for applying behavioral strategies • Leveraged peer-specialist on-site support • Encouraged participants to support each other and to reach out to other professional staff for additional support

committing to the program, self-monitoring, building healthier eating patterns, increasing physical activity, and using behavioral strategies to support healthy lifestyle changes (see Table 3 for a summary of these challenges and adaptations). We describe peer specialists' unique roles in delivering and adapting these core components where applicable.

Committing to the program—This component encompasses both committing to the 12-week PGLB program and setting goals to lose weight (i.e., losing 7% of starting weight). Although some participants wondered if their weight loss goal was too high or too low, they generally did not have trouble setting these goals. However, participants expressed concerns regarding their ability to attend all of the PGLB group sessions due to their health and mental health conditions, and several participants did experience absences over the course of the project. This led us to offer makeup sessions in which a PGLB facilitator would meet participants individually or in a small group to cover missed sessions.

Another difficulty was participants' ability to obtain medical clearance prior to engaging in physical activity. This clearance is part of the GLB protocol and necessary to ensure that a medical professional viewed the physical activity component of the PGLB as safe for our participants given their complex physical and mental health conditions. However, most participants did not have a regular primary care physician, and those who did sometimes had trouble making and keeping appointments. To address this barrier, PGLB facilitators made medical appointments and accompanied participants to a local physician who offered low or no cost appointments to obtain medical clearance.

Self-monitoring—While most participants were able to weigh themselves weekly with scales provided for home use, self-monitoring their diet and physical activity was a significant challenge. Memory problems (related to older age, mental health symptoms, and medication side effects), low education and literacy levels, and existing physical health symptoms (e.g., arthritis) made it difficult for participants to remember and record their daily food intake and physical activity minutes. Additionally, participants experienced problems related to living in poverty, such as housing instability, unemployment, and frequent appointments to see a variety of health, mental health, and social services providers. These problems consumed much of their time, leaving less time for self-monitoring. To address these challenges, we developed a menu of individualized self-monitoring tools including: a more structured, portable booklet version of the GLB monitoring log; a monitoring log depicting a [MyPlate.gov](https://www.myplate.gov) graphic for each meal of the day, allowing participants to record dietary intake using check marks; and blank pocket-sized notebooks to jot down information in a free-form way. For a few participants with smart phones, we created a list of

apps (e.g., Fooducate) and instructions on how to use them to facilitate self-monitoring.

We also implemented one brief in-between session contact per participant per week. PGLB facilitators called, texted, or spoke to participants in person to remind them about the next group session and to ask them about their eating and physical activity. These contacts were usually brief (about 10 min per participant); they allowed participants to provide information verbally that they might not write down. Facilitators took notes and provided feedback during these encounters. Finally, we offered increased one-on-one discussion during the individual weekly weigh-ins before each PGLB session to encourage participants to verbally report self-monitoring, even if they did not use their logs.

Building healthy eating patterns—Building healthy eating patterns includes two components: (1) reducing calories and (2) developing eating patterns that include healthier, more nutrient-rich foods [23]. While participants expressed great interest in learning about calories and nutrients, they reported several difficulties applying these concepts. Entrenched dietary habits (e.g., eating red meat daily) and unhealthy eating patterns (e.g., midnight snacking) were hard to break. In some instances, participants linked dietary habits to their culture and worried that changes toward healthier eating patterns conflicted with their cultural identity. For example, a Latina participant shared that her family always expected rice and beans at family gatherings and she could not convince them to try other side dishes or healthier ways of preparing the dish. Participants' extremely limited financial resources also hindered their ability to obtain healthier food options. Many did not purchase fresh fruits and vegetables because they were expensive in local grocery stores, and they could receive free canned fruits and vegetables from food pantries.

We created several adaptations to address these challenges. First, to address dietary habits, we helped participants learn how to accurately measure portion sizes using their own hands and household objects (e.g., a deck of cards). Providing participants with readily available portion measuring strategies allowed them to gain a better understanding of how many calories they consumed as well as how they might cut calories. Next, peer facilitators, themselves from diverse cultural backgrounds, helped participants discuss how dietary changes might be made in culturally congruent ways. For example, one peer specialist shared how to cook vegetables using typical southern recipes while eliminating higher calorie ingredients (e.g., eliminating pork seasoning from collard greens). Finally, we provided [USDA.gov](https://www.usda.gov) and New York City resources (e.g., New York City Greenmarket handouts) to inform participants about using SNAP to purchase healthy items like fresh fruits and vegetables. Peer specialists, themselves current or former SNAP recipients, provided hands-on assistance with these purchases.

Increasing physical activity—Participants showed interest in learning about physical activity but found it

challenging to exercise. Some participants had health conditions (e.g., arthritis) that made even low-impact activities like walking difficult. Others reported that psychiatric medications caused severe lethargy, making it difficult to exercise regularly. Neighborhood safety and extreme heat and cold weather were also deterrents to exercising outside the household. For participants living with a roommate or in congregate settings, lack of privacy was a challenge. Finally, participants' economic limitations also meant that they had little to no money to afford gym membership, appropriate footwear for exercising, or even to afford transportation to parks or gyms.

We developed several strategies to address these challenges. Given that most participants reported no established exercise routines, we presented content on walking and using a pedometer in week 4 of the intervention (instead of the usual week 10) in order to help participants start walking earlier. We also provided individualized support for physical activity to participants during weekly weigh-ins and in-between session contacts. This allowed us to help participants find ways to exercise that were comfortable and safe for them: participants with arthritis were encouraged to stretch and engage in low-impact exercise (e.g., swim at public pools); participants with severe lethargy were encouraged to consider how their energy levels might fluctuate throughout the day and to find times when they had more energy to exercise (e.g., consider when they took most of their medications and try exercising before this time); and we simply encouraged participants to explore activities they might find fun (e.g., one participant found walking more enjoyable with his dog, in a particularly scenic park).

Another adaptation was to develop apartment-based exercise options, such as dancing to music or stretching and to encourage participants who frequently stayed home to keep track of steps with the pedometer, motivating them to walk more around their apartment. We also supported participants living with roommates or in congregate settings to exercise with other residents in common areas, turning their lack of private exercise space into an opportunity to gain support from others interested in physical activity. A final adaptation was to develop a list of no- and low-cost resources like gyms and public pools. Peer specialists were involved in all physical activity adaptations and played an additional role in encouraging engagement in this component of PGLB by offering to accompany participants on a walk or other exercise activity. By offering to exercise alongside participants peer specialists helped them feel more comfortable with initiating new, potentially daunting activities.

Behavioral components—GLB uses several behavioral strategies to support healthy lifestyle changes including managing environmental and social cues, reducing self-defeating thoughts, relapse prevention, managing stress, and problem solving. For many of our participants, these strategies were familiar from past behavioral health groups and treatments. However, this

familiarity was sometimes a challenge; some participants already conversant on a given behavioral strategy seemed less motivated to try it again or to try it in the new context of changing diet and increasing physical activity. Another challenge was the original GLB materials, which presented behavioral strategies using examples incongruent with participants' lives, including their low socioeconomic status and their health and mental health conditions. For instance, participants found that manual content that referenced managing diet and exercise while on vacation, during holidays, and in sit-down restaurants is largely irrelevant as they rarely found themselves in these situations.

To make behavioral strategies more relevant to participants' lives, we used individualized support during in-between session contacts and weekly weigh-ins to help participants learn more about behavioral strategies best matched to their eating or exercise challenges. For example, several participants benefitted from talking more about how to reduce self-defeating thoughts during weight loss plateaus. Another participant asked to talk on his deceased mother's birthday in order to apply relapse prevention strategies for eating during this emotional time. Additionally, participants supported and motivated each other by exchanging phone numbers and talking outside of group sessions. We also encouraged participants to reach out to the peer specialists, who were on-site at the supported housing agency several days a week, to support them beyond PGLB group sessions. Finally, the agency's professional staffs (e.g., case managers) were briefed on the PGLB and participants were encouraged to access them as additional source of support.

DISCUSSION

Findings indicate that it was feasible and acceptable to deliver a peer-based healthy lifestyle intervention for our participants in this supportive housing agency serving people with SMI. Participants attended most intervention sessions, particularly when makeup sessions were available. Missed appointments and low rates of attendance are critical barriers to engage people with SMI in psychosocial interventions [26]. Providing participants the option to make up sessions allowed them to remain connected to the intervention even when health, mental health, and/or socioeconomic concerns impeded their participation.

Consistent with studies enrolling people with SMI in health interventions, our participants reported high levels of satisfaction with the intervention and perceived it as useful, helpful, and relevant [27–29]. The combination of providing practical knowledge and social support to participants was critical to help them learn and try out PGLB's core components. We identified several intervention adaptations to address challenges faced by people with SMI that impact their ability to engage in health behavior change, including

living with complex physical and mental health comorbidities, how to cope with medication side-effects impacting motivation and energy levels, and living with serious economic and structural constraints linked to poverty. These adaptations consisted of practical strategies to increase the relevance and usefulness of the intervention's core components.

Increasing the amount of time and opportunities that participants had to meet individually with group facilitators allowed us to provide more individually-tailored behavioral strategies and to clarify and reinforce session content. Individualized support has been shown to be beneficial for people with SMI as it increases the frequency and duration of interventions [30] and helps address motivational and cognitive issues associated with the numerous challenges this population faces. Peer specialists, whose duties typically include a “linkage to services” function [9], are especially well-positioned to offer increased individualized support to intervention participants, as this type of support is already part of their role in managing clients' engagement with services and other service providers. However, a potential trade off that could impact the scalability of PGLB is that peer specialists in this intervention are being asked to go beyond the linkage service function and provide more individualized support around lifestyle coaching, thus requiring more training and supervision to support these new responsibilities. Individual attention was critical to address the immense challenge of self-monitoring, which has been documented in other studies of people with SMI engaged in healthy lifestyle interventions [27, 29]. PGLB facilitators used one-on-one interactions to help participants choose from a menu of self-monitoring strategies to increase their chances of reporting on eating and physical activity patterns and then reinforced participants' reporting through ongoing feedback. Given the importance of self-monitoring in supporting and maintaining healthy lifestyle changes [31], our study suggests that self-monitoring tasks and tools need to be simplified and tailored to individuals' needs, abilities, and literacy levels and supported by a graded-task approach in which the process is broken down into small, manageable steps, building participants' interest, motivation, and confidence [32]. These modified self-monitoring options are consistent with those offered in other healthy lifestyle interventions for people with SMI [27, 33].

Another critical adaptation was to include peer specialists as co-facilitators. Peer specialists' lived experience and local knowledge were vital to develop practical adaptations and advice to support participants. Peers' familiarity with participants' neighborhoods and socioeconomic limitations allowed them to share information about the best places to shop for healthy food as well as safe and affordable places to exercise. Their shared cultural backgrounds also enabled peers to provide practical advice on how to use healthier

ingredients to prepare traditional dishes. Our findings suggest that peer specialists can enhance the ecological validity of healthy lifestyle interventions for people with SMI.

Lastly, a critical focus of our adaptations was to develop strategies to address the socioeconomic barriers impacting participants' ability to engage in healthy lifestyle changes. Diet and physical activity are influenced by SES, and people living in poverty are disproportionately impacted by obesity [34]. Many of our participants lived in communities where access to affordable healthy foods and safe spaces for physical activity were scarce, while fast food was, in contrast, abundant and accessible [35]. Similar neighborhoods have been described in other studies examining the lives of people with SMI [36], reinforcing the need for adaptations that help participants navigate challenging food environments. Strategies for building healthy eating patterns must also be sensitive to participants' budgets and address all stages of healthy eating from planning and shopping to preparing meals. Similarly, recommendations for physical activity should focus on feasible strategies people can use in their homes, in safe public spaces, and without having to purchase exercise-related resources. Our experience also suggests that further enhancements to the intervention are needed to help participants apply healthy lifestyle strategies in their daily lives. For instance, structured in vivo activities that take the intervention into the community, like visiting a grocery store to shop for healthier food items, can help participants learn and apply healthy lifestyle strategies in real-world settings.

The study had several limitations. It was conducted in one supportive housing agency in New York City, so findings may not be generalizable to other agency contexts or geographic locations. Since we excluded people who did not speak English, the feasibility and acceptability of PGLB in this population remain unknown. Future studies are needed to examine how best to adapt and deliver interventions like PGLB in other agencies and geographical contexts and to non-English speaking populations. Finally, our small sample did not have sufficient statistical power to rigorously test the effectiveness of PGLB on weight outcomes and other health indicators. An effectiveness trial is currently underway comparing the effectiveness of PGLB versus usual care in a large and diverse sample of overweight or obese clients with SMI in three supportive housing agencies [6].

CONCLUSION

Healthy lifestyle interventions represent one of the many approaches (including healthcare manager programs, peer navigators, and smoking cessation interventions) that are being used worldwide to improve the physical health of people with SMI [5, 28, 37]. The results of our pilot study suggest that future work should prioritize efforts to test the effectiveness of peer-based healthy lifestyle interventions that combine group and individual sessions, tailor and simplify self-

monitoring strategies, and adapt intervention content and activities to the socioeconomic realities faced by people with SMI.

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Compliance with ethical standards

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was approved by the Columbia University Institutional Review Board.

Informed consent: Informed consent was obtained from all individual participants included in the study.

The findings reported here have not been previously published nor is the manuscript being simultaneously submitted elsewhere. The authors have full control of all primary data and will agree to allow the journal to review de-identified data if requested.

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