Published in final edited form as:

J Phys Act Health. 2019 May 01; 16(5): 380–383. doi:10.1123/jpah.2018-0233.

Feasibility of a bike share program in adults with serious mental illness enrolled in an outpatient psychiatric rehabilitation program

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Abstract

Background: Individuals with serious mental illness (SMI) die 10–25 years earlier than the general population, partially due to cardiovascular disease (CVD). Those with SMI have poor CVD behavioral risk profiles, including low physical activity engagement. This study examined the feasibility of providing city bike share access to individuals with SMI.

Method: Participants were outpatients with SMI in a psychiatric rehabilitation program and were provided with a complimentary bike share program membership (Nice Ride). Demographic and clinical variables were extracted from medical records. Lab values, body mass index (BMI), 10-year CVD risk score, and tobacco use were collected at intake. Nice Ride provided ride frequency and duration data.

Results: Of 22 SMI patients enrolled, 72.7% completed 1 ride. Among users, median ride length was 9 minutes (IQR = 49.5) and 56.3% averaged 10 minutes of riding per week. Individuals living <.5 miles from a station were more likely to be users. Riding 10 minutes/week was associated with lower BMI and male gender.

Conclusion: These findings are currently being used for program adaptation to increase uptake. Further work is warranted to determine if bike share programs offer a feasible, scalable, and cost-effective method for increasing physical activity in those with SMI.

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Conflicts of Interest: The authors have no conflicts of interest to disclose.

Individuals with serious mental illness (SMI) have poor prognosis and shortened lifespan, partly attributable to higher incidence of cardiovascular disease (CVD).¹ The higher CVD burden in people with SMI has been explained by the preponderance of CVD behavioral risk factors including low levels of physical activity.² For example, a recent examination that measured physical activity levels in individuals with SMI using accelerometers found that individuals were sedentary during 84% of accelerometer wear time over five days and only engaged in moderate to vigorous physical activity for 6% of wear time.³ Large bodies of observational data show an association between increased physical activity and lower rates of CVD and improved longevity, establishing the basis for current recommendations of enhanced physical activity as an important intervention in reducing CVD burden by clinical practice guidelines.⁴

Recent efforts to conduct randomized trials targeting physical activity engagement in adults with SMI have shown some promise for successfully increasing physical activity among persons with SMI⁵ and being acceptable and feasible to participants.⁶ Unfortunately, the increased CVD risk in people with SMI is often under-recognized or inadequately addressed within routine clinical practice. Feasible, cost-effective interventions that support adoption of guideline-based lifestyle modification are needed in persons with SMI. However, multiple barriers explain the suboptimal uptake of physical activity in people with SMI including internal barriers (e.g., symptoms of SMI, medication side effects, lack of energy or interest),⁷ social barriers (e.g., stigma associated with SMI),⁸ and structural or environmental barriers (e.g., excess costs, remoteness of exercise facility, unfamiliarity of exercise, anxiety about unsafe conditions).⁷ Importantly, in a qualitative inquiry, Taiwanese adults with SMI identified encouragement from health professionals and access to exercise equipment as facilitators of physical activity engagement.⁸

Health behavior interventions housed within established psychiatric treatment settings may mitigate some of the access-related barriers to behavior change in SMI populations. Indeed, a behavioral intervention that connected to patients through outpatient psychiatric rehabilitation programs demonstrated promising effects on weight loss⁹ and cardiorespiratory fitness.¹⁰ However, most of the existing interventions are time-intensive and costly to implement.

Bike sharing programs may offer a lower cost physical activity intervention that could improve cardiovascular health and mitigate some of the access-related barriers to implementation of lifestyle modification programs. Cycling is associated with better cardiorespiratory fitness and improvements in cardiac risk factors.¹¹ Although the impact of bike sharing has not been investigated specifically in SMI individuals, modeling estimates suggest that the health benefits of increased physical activity resulting from bike sharing could reduce morbidity in the general population.¹² In addition to the health benefits, bike sharing is also likely to be easily accessible for individuals living in urban settings. The infrastructure of bike-sharing systems has increased in recent years and now exists in 55 U.S. cities with over 42,000 total bikes. In addition, nearly ¼ of cities with bike sharing programs offer discounted memberships based on income.¹³ Thus, if feasible and acceptable, promotion of bike share for leisure or transportation among individuals with

SMI could lead to a low-cost, yet widespread, method of increasing physical activity and reducing CVD risk.

The existing peer-reviewed literature related to bike shares has primarily focused on patterns of use, safety, and infrastructure rather than the use of bike share as an intervention tool.¹⁴ Thus, the aim of the this pilot study was to examine the feasibility of offering bike share program membership to SMI patients enrolled in an outpatient psychiatric rehabilitation program in order to target CVD risk reduction through increased physical activity. To our knowledge, this is the first examination of implementation of a bike share program in an SMI sample. As this was a pilot study, analyses were exploratory and focused on characterizing use of the program and identifying potential predictors of use that can help us refine future iterations of the program.

Method

Clinical Setting

The Hennepin County Medical Center psychiatric day treatment program (DTP) provides intensive psychotherapy and rehabilitation therapy to patients with SMI who are deemed to benefit from several months of regular outpatient therapy. Patients attend half-day sessions for 4 days per week for approximately 2 – 6 months depending on severity of symptoms and assessment of needs.

DTP patients who have at least one CVD risk factor (e.g., obesity, smoking) and are interested in pursuing therapeutic life style changes are invited to join the Comprehensive Cardiovascular Prevention Program (C2P2) program, which provides cardiovascular risk reduction treatment embedded within the DTP. C2P2 patients are initially evaluated by a cardiologist for a complete history and physical examination and to establish baseline CVD risk. Factors necessary for determination of CVD risk including blood pressure, lipid panel, hs-CRP are obtained during this initial evaluation. Assessment of baseline functional capacity, prior history of exercise and baseline EKG are also obtained at the initial evaluation to assure the safety of proceeding with regular exercise and also to choose proper type and level of activity recommended for each patient. Recommendations for effective therapeutic life style changes are then constructed during this initial visit and the goals are discussed with the patient and the day treatment staff. Subsequently, the patients are followed regularly by the cardiologist as well as the day treatment staff with periodic review of goals and progress.

Participants

All participants were patients in the Hennepin County Medical Center psychiatric DTP and the C2P2 program. In addition, only patients meeting the following criteria were allowed to enroll in the bike share program: 1) can safely engage in moderate physical activity (as determined by the C2P2 cardiologist), 2) willing to set goals to increase physical activity, and 3) are comfortable riding a bike on public trails and streets.

Bike Share Program

For those deemed safe to pursue a biking program, an annual membership to a Twin Cities area bike share program (Nice Ride) was offered. The membership entitled the user to unlimited 60 minute rides (with re-docking at a station to reset the clock) and use of any of the 1700 bikes from the more than 200 stations within the larger metro area. The cost for the annual membership (\$75/participant for April – October riding season) as well as the need for membership accounts to get registered online and be linked to a credit or debit card were identified as significant barriers to participation. At our request, Nice Ride waved the annual membership fee for all persons enrolled in this pilot study. A small grant was obtained from a local bank (US Bank, Minneapolis, MN) allowed us to issue \$25 debit cards that were used to secure a Nice Ride account for each participant. The Nice Ride team came to the DTP and facilitated the registration of members as well as orientation to safety and proper etiquette of membership. Upon completion of registration and orientation, each member was given a Nice Ride bike helmet. Participants provided a written consent for their riding data to be shared with the treatment team. All procedures were approved by our institution's institutional review board.

The use of a personal trainer has been cited as a solution to overcoming anxiety and lack of motivation in people with SMI.¹⁵ In our study, no personal trainers were utilized. However, the program was highly embraced by the psychiatric rehabilitation staff and Nice Ride volunteers offered regular mid-day group rides during the weekdays to build a team spirit and motivate participants. Staff offered incentives such as water flasks and fruit snacks for frequent riding and provided assistance with locating convenient bike stations and routes as needed. In response to participant feedback, late in the summer 2016, we began providing free access to significant others of participants. One participant had a significant other join the program for support.

Measures

All data on demographics, mental health and physical health were pulled from the electronic medical record. Lab values, BMI, 10 year CVD risk score, and current tobacco use were collected at C2P2 intake. Nice Ride provided objective data on number of rides (i.e., how many times a bike was checked out from a station) and total duration of rides (i.e., total accumulative time between checking out a bike and returning the bike). This objective data was collected electronically based on when bikes were checked out under a participant's account and when they were returned to a station.

Analysis

Descriptive statistics on use of the bike share are reported. With continuous data, means and standard deviations are reported when data is normal and medians and interquartile ranges are reported when data is non-normal. We made the a priori decision to dichotomize distance to a nice ride station within .5 miles of participant home versus not to indicate if a station is within walking distance.

We use T-tests and Fisher Exact tests in exploratory analyses of variables predicting any use and use averaging 10 minutes/week. We made the a priori decision to use 10 minutes/

week as a cut off for dichotomization in exploratory analyses if the distribution in minutes/week was non-normal.

Results

Twenty-two patients were offered the bike share program during summer of 2016. Start dates ranged from June 14, 2016 to August 29, 2016. The program ended for all patients on October 24, 2016. Thus, weeks with bike share access ranged from 8.0 to 18.9 weeks (mean = 16.8 weeks). Other characteristics of the sample are presented in Table 1.

Six patients never used the bike share program (i.e., 27.3% refusal rate). Sixteen patients (72.7% uptake rate) used the bike share at least once. Exploratory analyses regarding any use of bike share indicated that patients who lived less than half a mile from a station were more likely to use than those living farther (93.9% vs. 37.5%; Fisher Exact Test, $p = .01$). No other variables in Table 1 were related to ever use.

Among the 16 users, mean weeks in program was 17.0 (SD = 2.9). Median total rentals was 9 (IQR = 49.5). Median rentals per week 0.64 (IQR = 2.6). Median minutes riding per week 11.59 (IQR = 56.4). Nine (56.3%) users averaged 10 minutes riding per week of access.

Exploratory analyses regarding variables associated with using 10 minutes/week (among users only, $n=16$) indicate that women were significantly less likely to use 10 minutes/week (88.9% for men vs. 14.3% for women; Fisher Exact Test, $p = .01$). Furthermore, those who used 10 minutes/week had a significantly lower BMI (29.3, SD = 5.9) than those who did not (41.5, SD = 12.1; $t(14) = 2.7$, $p = .02$). Patients who lived less than half a mile from a station were also marginally more likely to have used 10 minutes/week than those living farther (69.2% vs 0.0%; Fisher Exact Test, $p = .06$). No other variables in Table 1 were related to use 10 minutes/week.

Discussion

Individuals with SMI have poor prognosis and shortened lifespan that is in part explained by high CVD burden. CVD behavioral risk factors including physical inactivity are to blame for this increased burden. Adoption of guideline based, easily accessible and low cost therapeutic lifestyle interventions is needed.

In this novel pilot study, we demonstrated the initial feasibility of a bike share program that may overcome some of the barriers to physical activity in SMI patients. Study participants were diverse (45% women, 63% minority) patients enrolled in an urban community-based psychiatric rehabilitation program. Consistent with the extant literature, participants were at high CVD risk as demonstrated by both high rates of existing CVD, tobacco use and obesity. Rates of elevated creatinine, hs-CRP, and calculated ASCVD risk score were also higher than what would be expected for similarly aged individuals in the general population.

While none of the participants had access to bike prior to initiation of the program, significant uptake of the bike share was observed (73% used at least once). More importantly, 56% of users averaged 10 mins riding per week of access. We recognize that

the data on the duration of rides available from Nice Ride is not an exact representation of the duration of biking since the duration will also include some idling time and moments taken to exchange bikes at docking stations. Per report of participants, all bikes were parked only at Nice Ride docking stations between rides minimizing the possibility of other unrecognized idling time (e.g. bike locked outside a store) beyond the moments used to exchange bikes at docking stations. As such, we consider the duration of use reported to be a close approximation of riding time.

Consistent with past studies that have explored barriers to physical activity,¹⁵ more uptake was seen in participants that resided in close proximity to bike share stations. Greater likelihood of riding 10 minutes per week of access was also seen in men and the less obese. Anecdotally, lack of motivation and energy as well as fear of unsafe riding conditions were repeatedly raised as barriers particularly by women participants. Patients also informally reported reduced utilization because of weather conditions, uncertainty with biking routes, and inability of family members to bike with the patient.

The increased participation by those who live less than 0.5 miles from bike stations is an important finding that we will explore to focus future biking programs to enhance enrollment and more use. The finding that obesity was linked to less participation in the biking program is not surprising in light of prior reports and we plan to identify the specific barriers for those with obesity as they stand to benefit greatly from increased physical activity.

Studies on physical activity attitudes in women with SMI have shown that offering exercise within a group can enhance participation.¹⁶ Group rides organized by psychiatric rehabilitation staff were well attended by women and allowed several anxious participants to overcome their fear of riding a bike in the urban setting. However, the usage data shows that women rarely began regular use on their own. Based on input from participants, we experimented with offering the free biking membership to significant others late in summer 2016, but too few participants were offered this option to evaluate if it improved participation among women.

There are several limitations to keep in mind when interpreting our findings. First, the sample size in the current study was small and there was no control group. The findings would benefit from a larger sample size and a randomized comparison with physical activity levels of individuals not offered the bike share program.

Second, the riding season was truncated by logistical start up issues, with the planning phase (~3 months) consuming a significant portion of the available Minnesota bike riding season (~7 months). However it is notable that this planning phase allowed us to find the right exercise program and forge the right community partnerships needed for an accessible, low cost program.

Third, the modest average weekly duration of exercise seen on this pilot study is far less than the dose of exercise recommended as part of a therapeutic intervention in CVD risk management.³ Nevertheless, every incremental change in physical activity behavior is valuable and this was communicated with the participants during the regular review of

therapeutic goals. Anecdotally, participants were generally inactive at enrollment and informally reported that the biking program did not displace another regular physical activity and was the main regular outdoor exercise for our participants. Additional information is needed to determine whether bike riding was for leisure or to meet transportation needs. Future research is needed to more fully assess physical activity time and forms in order to better understand the incremental value to time spent in physical activity provided by the bike share opportunity. We have incorporated such assessment into ongoing follow-up studies.

Finally, generalizability may be a limitation of our study since the success of our program relied heavily on the pre-existing infrastructure of urban bike trails and partnership with a bike sharing program. However, the availability and popularity of bike share programs is rising in many cities and we expect a similar setup to be feasible elsewhere with the right confluence of stake holders. The total system cost of 47 cents/day/member (i.e., (\$75 registration fee + \$25 debit card)/213 days riding season = .47) in the ride share program is an attractive alternative to similar urban settings where access to a viable exercise program has been limited for those with SMI.

Future directions for our program will include increasing the number of participants focusing on those who live in close proximity to a Nice Ride station, prolonging duration of the intervention to the full riding season, offering more group rides and analyzing the pre/post impact of access to bike share on CVD risk markers and psychological factors such as mood and self-esteem. Formal intervention acceptability assessment will also be performed to better understand detailed use patterns, psychological barriers, and psychological effects of participation. In particular, more feedback will be solicited from obese and women participants so their needs can be better addressed. Since regular physical activity should be pursued throughout the year, in the longer term, we will explore the possibility of supplementing the current program with a winter indoor activity (gym membership) as the biking program is only applicable for a maximum of 2/3 of the year in Minnesota.

We conclude that our study demonstrated the initial feasibility of a novel intervention of a low cost urban bike riding program to enhance regular physical activity in patients with SMI who are enrolled in an outpatient psychiatric rehabilitation program.

Acknowledgments

Funding: US Bank provided free \$25 debit cards for each participant. NiceRide provided free memberships and a bike helmet for each participant. Dr. Gathright's effort was supported by the National Heart, Lung, and Blood Institute [T32 5T32HL076134–10 to R. Wing].

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Table 1.

Characteristics of Participants (n = 22)

	<i>M ± SD or n(%)</i>
<u>Demographic</u>	
Age	44.1 ± 12.8
Female	10 (45.5)
Race/Ethnicity	
Non-Hispanic Caucasian	8 (36.4)
Non-Hispanic African American	12 (54.5)
Non-Hispanic Multiracial	2 (9.1)
Lives .5 miles from bike station	8 (36.4)
<u>Mental Health/Addiction</u>	
Primary SMI diagnosis	
Major Depression	16 (72.7)
Bi-Polar Disorder	4 (18.2)
Schizoaffective Disorder	2 (9.1)
1 Co-morbid DSM Axis I diagnosis	17 (77.3)
Substance Abuse History	15 (68.2)
Co-morbid DSM Axis II diagnosis	7 (31.8)
Current Tobacco use	12 (54.5)
<u>Physical/CVD Health</u>	
BMI	33.3 (9.8)
Comorbidity	
Hypertension	8 (36.4)
Major CVD or circulatory disease	7 (31.8)
Diabetes	8 (22.7)
hs-CRP ≥ 3	6 (37.5)*
Elevated Creatinine	4 (18.2)
10 year CVD risk score ≥ 7.5%	4 (18.2)

Note.

* N = 16.