From Intervention to Evaluation: Assessing the Effectiveness, Acceptability and Feasibility of a Physical Activity Intervention for Individuals with Serious Mental Illness

by

Garcia Lorraine Ashdown-Franks

A thesis submitted in conformity with the requirements for the degree of Master of Science

Department of Exercise Sciences

University of Toronto

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Abstract

Individuals with serious mental illness experience physical health comorbidities and report a lower quality of life. Physical activity may be one way to target both the mental and physical health of this population. This study examined the feasibility and acceptability of a PA intervention with a local mental health housing organization. Program effectiveness was measured through changes in mental health, quality of life, and physical activity from pre- to post intervention. Repeated Measures Analysis of Variance and effect sizes were used to compare changes between intervention (N=5) and control (N=5) groups, while deductive thematic analysis was used to analyze interview responses. There were no significant group effects on the outcomes; there was a significant effect of time on total mental health scores, as well as anxiety and depression subscales. Participants, trainers and a key organizational stakeholder viewed the program as acceptable and feasible, and provided suggestions to improve future programs.
Acknowledgements

This project would not have been possible without the participation of Accommodation Information and Support (AIS). I’d like to thank their staff, particularly their nutritionist, for supporting physical activity programming and working tirelessly to make the collaboration between AIS and myself happen. Secondly, I want to thank the participants in this study. Thank you for your time, your efforts and your dedicated participation to this program. It was truly a pleasure getting to know each one of you and seeing your progress not only in this program, but also in other areas of your lives. Your feedback regarding this program will be used to inform the creation of similar programs in the future.

Thank you to my supervisor, Dr. Catherine Sabiston, for all the support you provided me throughout the past 2 years. I am very grateful for everything you’ve taught me, and it’s been an honour to work with such a successful researcher and such a positive individual. I would also like to thank my committee members, Dr. Kelly Arbour-Nicitopoulos and Dr. John Cairney for their guidance throughout this degree. A special thank you also goes out to Dr. Brendon Stubbs for your mentorship in the later stage of my degree, I am very grateful for the opportunities you’ve provided me in this field.

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Thank you to the Sablab for making the past two years fly by. I really appreciate everyone’s advice and feedback, and loved having so many positive (and mostly female!) influences to look up to. A special thank you to Douglas Rosa, without whom this project wouldn’t have been possible, and to Angela Fong for your non-stop technical help and patience! Last but certainly not least, thank you to all my friends; thank you for always being there for me no matter what.
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Preface

The Research Ethics Board at the University of Toronto granted ethics approval for this study (Protocol Reference #: 34001). This research was funded by an Ontario Graduate Scholarship and a Canadian Graduate Scholarship-Masters: Canadian Institutes of Health Research (CIHR).
Chapter 1
Introduction

Mental illness is the leading cause of disability in Canada, and carries an economic burden of $51 billion per year (Smetanin et al., 2011). The economic costs for individuals coping with serious mental illness (SMI) are associated with physical, social, and emotional challenges that are in part related to inabilities to work, persistent medication needs, and frequent hospitalization (Hoffman et al., 2014). People with SMI encounter many health related/lifestyle issues, report limited life satisfaction, and struggle with motivation (Lehman et al., 1982; Parabiaghi et al., 2006). In general, SMI refers to a group of mental health disorders that tend to emerge in early adulthood, including major depression, anxiety, and bipolar disorder (Hoffman et al., 2015).

For the purpose of this project, the focus will be on three types of SMI. Generalized anxiety disorder (GAD) refers to excessive worry over everyday problems (CMHA, 2017). It is characterized by avoidance of social situations or public places, and can often cause muscle tension and interfere with ones’ sleep (CMHA, 2017). The treatment for GAD typically consists of psychotherapy along with medication use, either antianxiety medication and/or antidepressants (CMHA, 2017). Bipolar disorder is characterized by fluctuating episodes of depression and mania (CMHA, 2017). Mania refers to an unusually high mood for the individual, and can materialize as feelings of unrealistic confidence or powerfulness or lead the individual to engage in risky behaviours they wouldn’t otherwise engage in (CMHA, 2017). Bipolar disorder can be treated with a combination of psychotherapy and mood stabilizer medication, and may be accompanied by the use of antipsychotic medication (CMHA, 2017). Major depressive disorder (MDD) is characterized by low mood and a loss of pleasure or interest in daily activities (American Psychiatric Association, 2013). Common symptoms of MDD range from overwhelming feelings of sadness or hopelessness, to difficulties with sleeping and eating (CMHA, 2017). MDD is usually treated with a combination of psychotherapy and antidepressant medication (CMHA, 2017).

It is important to identify factors that can mitigate the economic burden of SMI by positively impacting the health, well-being and quality of life of individuals. It may be that physical activity (PA) could be one such factor. PA, defined broadly as any movement
performed by skeletal muscles that results in above resting energy expenditure (WHO, 2015) has been linked to many positive outcomes among individuals with SMI, including improved self-esteem and self-efficacy (Knapen et al., 2005; Gorcynski et al., 2014), increased life satisfaction and providing resources to overcome lifestyle issues (Hoffman et al., 2014), while also positively impacting weight (Green et al., 2014). Furthermore, it has been found that sport participation (a specific subtype of PA) fosters a sense of belonging and a reduction in social isolation in those with mental illness (Soundy et al., 2015). Overall, the majority of research linking PA to positive and beneficial outcomes among individuals with SMI has focused on weight loss and physical health rather than mental health and quality of life outcomes (Happell et al., 2012). Thus, there is a need to investigate the mental health effects of PA participation among individuals with SMI.

As skepticism grows about the use of pharmacology and psychotherapy as the sole treatments for mental illness, support continues to grow for the use of PA as either an adjunct therapy or a monotherapy. Indeed, there have been various calls to action and guidelines created to advance the implementation of PA as a treatment for mental illness. In Australia, Stanton and colleagues (2015) emphasized that the time has come for physicians to incorporate the prescription of PA into their treatment plans for patients with mental illness. More recently in Canada, for the first time ever, PA was recommended as a first line treatment for mild-to-moderate severity Major Depressive Disorder (Ravindran et al., 2016). With these promising directives for using PA as a treatment for individuals with SMI, it is important to evaluate the usefulness of PA interventions in this targeted population.

To date, the majority of studies examining the links between PA and SMI have been Randomized Controlled Trials (RCTs). Although RCTs are viewed as the gold standard for interventional research, they are often conducted in a laboratory among highly targeted and volunteer samples, and thus fail to achieve external validity. Specifically, the findings from RCT studies must be examined critically, as the findings may be limited among “real life” populations (Patsopoulos, 2011). To date there has been very little research examining community-dwelling individuals with SMI participating in interventions within the community. In the SMI and PA literature, studies examining interventions set in the community and linked to support networks (i.e. mental health organization, housing organization) are extremely sparse. This type of support is likely needed for long-term sustainability of PA programs. Furthermore, many studies in this area have lasted 12 weeks or more and consequently noted that in order to maintain participant adherence and motivation, a shorter intervention would be preferable (Abrantes et al., 2009).
There also exists a lack of pragmatic trials that gauge the effectiveness of interventions among clinical populations. While the majority of research in this area focuses on PA and a specific mental illness (i.e. PA and depression), pragmatic research calls for heterogeneity—in terms of patients and settings (Patsopoulous, 2011). As such, research examining the effect of PA on various types of mental illness is warranted. Thus, in the SMI and PA interventional research, there is a need for studies to be community based and comprised of community samples, pragmatic in nature, with links to support networks, that are shorter in duration.

**Purpose and Research Questions**

The purpose of this study is to evaluate the feasibility of a pilot PA program tailored to individuals with SMI. More specifically, this study aims to evaluate the acceptability of a PA intervention and to assess the effectiveness of the intervention on participants’ PA and self-report quality of life and mental health. The specific research questions include:

RQ1: Is a PA program feasible and acceptable for local SMI housing organization clients?

RQ2: Does a PA program for individuals with SMI result in positive changes in PA, QOL and mental health, compared to a control group?

RQ3: What do participants qualitatively report about their program experiences, benefits, barriers and motives?

Hypothesis 1: A PA program will be evaluated as feasible and acceptable by both program participants and key organizational stakeholders. Feasibility will be defined as 80% of the participants attending all 6 PA sessions, while acceptability will be defined as more than 80% of the participants reporting more than modest satisfaction with the program.

Hypothesis 2: For this population with SMI, a PA intervention will result in increased PA and quality of life, and improvements in mental health facets (mood, depression and anxiety ratings).

Hypothesis 3: Based on participant interviews and researcher field notes, participants will report their program experiences as having been favourable and beneficial, and barriers and motives will vary by individual.
Mental Illness in North America

Mental illness is the leading cause of disability in Canada, and carries an economic burden of $51 billion per year (Lim et al., 2008). These costs are both direct (medication use, clinic visits) and indirect (decreased employment productivity, increased absenteeism). In fact, in a survey of various major employment industries, mental illness was found to be the primary reason for short-term and long-term disability in Canada (National Business Group on Health, 2010).

In addition to the mental illness itself, individuals with mental illness also frequently have physical comorbidities, including pulmonary disease and many weight-related illnesses including diabetes and metabolic syndrome (Insel, 2008). These issues can result in shorter life expectancies for individuals with serious mental illness. Indeed, Colton & Manderscheid (2006) found that in the United States, the lives of such individuals were 13.5 to 32.2 years shorter than the averages of their respective states when compared to similar individuals without SMI. It is estimated that 20% of Canadians will experience a mental illness at some point during their lifetime (Health Canada, 2002), More specifically, 5 million Canadians use mental health services each year (Public Health Agency of Canada, 2015). Furthermore, in Canada, mental illness has accounted for half of physicians billing, and has required more hospital beds than does cancer (Canadian Mental Health Association, 2004). Given these statistics, mental illness is a costly, serious burden on the health care system and affected individuals and their families.

Serious Mental Illness

Of particular concern are serious mental illnesses (SMI). SMI refers to a group of mental health disorders that tend to emerge in early adulthood, including major depression, schizophrenia, bipolar disorder and anxiety disorders (Hoffman et al., 2015). By definition, an individual with a SMI is someone over the age of 18, who presently or at some point in the past year has had a diagnosable emotional, behavioural or mental disorder (Substance Abuse and Mental Health Services Administration, 2013). The disorder must result in serious functional
impairment, which interferes with at least one of life’s major activities (Substance Abuse and Mental Health Services Administration, 2013). These can include impairments in relationships, self-care, recreation and employment (Substance Abuse and Mental Health Services Administration, 2013). Such impairments ultimately lead to worsened self-reported quality of life among individuals with SMI (Substance Abuse and Mental Health Services). In Table 1, a description of anxiety, depression and bipolar disorder, their symptoms, usual care and side-effects of treatment medications are presented. These specific SMI are the main focus of the current program of research and have lifetime prevalence rates of 11% for depression, 3% for bipolar disorder and 9% for generalized anxiety disorder in Canada (Pearson et al., 2012).
**Table 1**

*Overview of Mental Illnesses*

<table>
<thead>
<tr>
<th>Mental illness:</th>
<th>Description:</th>
<th>Unique symptoms:</th>
<th>Usual care</th>
<th>Potential medication side effects</th>
</tr>
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<tbody>
<tr>
<td>Generalized Anxiety Disorder</td>
<td>Defined by excessive worry over everyday problems, for a period last more than 6 months. This anxiety is frequently of greater magnitude than expected, such as overwhelming anxiety over a small concern.</td>
<td>- Muscle tension - Sleep problems - Avoidance of social situations or public places</td>
<td>- Psychotherapy - CBT - Antianxiety medication</td>
<td>Antianxiety medication: - Drowsiness - Dizziness - Confusion - Tiredness - Muscle and/or joint pain - Feeling unsteady, uncoordinated</td>
</tr>
<tr>
<td>Major Depressive Disorder (MDD)</td>
<td>Characterized by a depressed mood and/or loss of interest of pleasure in daily activities. These symptoms must last for more than two weeks to be classified as MDD.</td>
<td>- Feelings of sadness, hopelessness, guilt, and/or anxiety - Loss of interest in previously enjoyed activities - Difficulty focusing on tasks - Can affect individuals sleep, eating - Often accompanied by other physical health problems such as chronic pain</td>
<td>- Psychotherapy - CBT - Antidepressants</td>
<td>Antidepressants: - Suicidal thoughts - Nausea - Weight gain - Sleepiness - Sexual problems</td>
</tr>
</tbody>
</table>
### Bipolar Disorder

Mood disorder in which one experiences episodes of depression and episodes of mania. Mania is an unusually high mood for the individual. There are periods of wellness between episodes of depression and mania.

- During periods of mania:
  - Racing thoughts
  - Hyperactivity
  - Unrealistically confident or powerful
  - Not feeling the need to sleep
  - Engaging in risky behaviours they wouldn’t otherwise engage in

- Psychotherapy
  - Usually CBT
  - Mood stabilizers, may be accompanied by:
    - Antipsychotics

<table>
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<th>Mood stabilizers:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Excessive thirst</td>
</tr>
<tr>
<td>- Shakiness</td>
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<tr>
<td>- Fast or slow heartbeat</td>
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<tr>
<td>- Loss of coordination</td>
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<tr>
<td>- Hallucinations</td>
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<table>
<thead>
<tr>
<th>Antipsychotics:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Weight gain</td>
</tr>
<tr>
<td>- Muscle rigidity</td>
</tr>
<tr>
<td>- Muscle spasms</td>
</tr>
<tr>
<td>- Uncontrollable movements</td>
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<tr>
<td>- Low blood pressure</td>
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In summary, generalized anxiety disorder, major depressive disorder and bipolar disorder are three unique types of SMI. They each have different types of symptoms, are treated in varying ways and the medications used to treat them have a wide range of side effects. The presence of these illnesses on their own, or in conjunction with the side-effects of medication can lead to various health related issues that can ultimately result in shorter life expectancies in this population.
Current Treatment Options

For individuals with SMI, pharmacotherapy and psychotherapy are the two most commonly prescribed forms of treatment. However, these treatments are not without their side effects. These side effects have been outlined above in Table 1. Antipsychotics, used to treat bipolar disorder, frequently cause weight gain and sedation (Green et al., 2014). Furthermore, such medications also cause glucose dysregulation and lipid abnormalities (Kreyenbuhl et al., 2017). In addition, antidepressants have many troubling side-effects, which are linked to a high rate of discontinuation of their use (Goethe et al., 2007). Of most concern is the fact that antidepressants increase the risk of both suicidal ideation and suicide attempts (Goethe et al., 2007). Furthermore, antidepressants can cause sexual dysfunction, sleep disturbances, weight gain and hypertension (CMHA, 2017). Unfortunately, psychotherapy resources remain difficult to access in terms of both wait time and cost (Ekkekakis, 2013).

It is evident that individuals with SMI are faced with various life satisfaction, physical and mental health issues. These issues can sometimes be exacerbated by medication use, leading to even more life challenges and health-related issues.

Health Related Issues

The presence of a SMI can be associated with greater lifestyle issues among individuals with a SMI diagnosis. These lifestyle issues include cigarette smoking, poor fitness and inadequate nutrition, which are subsequently related to higher rates of medical issues in this population compared to the general population (Hoffman et al., 2015). Furthermore, life satisfaction tends to be low among such individuals due to factors such as unemployment and unhappiness with social relationships (Hoffman et al., 2015). Weight gain is a common side effect of many medications prescribed for individuals presenting with SMI (see Table 1), which can in turn negatively affect their moods and self-esteem (Hoffman et al., 2015). Furthermore, regardless of antipsychotic use, individuals with SMI are more likely to have cardiovascular disease, obesity and diabetes and a shorter lifespan, compared to the general population (Crump et al., 2013). It has also been shown that the onset of early depressive and anxiety disorders is associated with a greater risk of developing some chronic conditions later in adult life. These conditions include heart disease, asthma, diabetes and arthritis (Scott et al., 2011). This relationship between mental illness and subsequent physical illness can also operate in the
opposite direction. For example, depression has been associated with coronary heart disease, due to the burden of living with the chronic condition (Frasure-Smith & Lesperance, 2005). Given the important relationship between mental illness and health effects, it is important to identify factors that can mitigate both outcomes. Physical activity may be one viable option, with potential benefits for physical health, mental health and subsequently quality of life. Furthermore, physical activity as been deemed a safe and effective treatment for some of the common SMI’s.

**Physical Activity**

According to the World Health Organization, physical activity (PA) is defined as, “any bodily movement produced by skeletal muscles that requires energy expenditure” (WHO, 2015, para 1). This is similar to the U.S. Department of Health and Human Services [USDHHS], (2008) who define it as either aerobic or anaerobic movement, performed by skeletal muscles, that raises energy expenditure above that of resting levels. PA encompasses occupational, leisure, household activities and health-enhancing activities (USDHHS, 2008). Of importance, the definition of PA also includes exercise, which can be defined as planned and structured PA with the goal of improving health and/or fitness (USDHHS, 2008). In the following sections, PA will be used to refer to any type or intensity of PA, including exercise and sport.

Among the general population (e.g., healthy adults), it is widely accepted that PA has positive effects on individuals’ physical and mental health. PA reduces one’s risks of obesity, cardiovascular disease, diabetes and various cancers such as breast and colon (Edwards et al., 2017). PA can also reduce symptoms of anxiety and depression, and improve both self-efficacy and cognition (McKercher et al., 2014; McAuley et al. 2013; Smith et al. 2010; Utschig et al. 2013). It is evident that PA has positive effects on adults’ health and quality of life, however it may be even more beneficial for those with SMI. This is because they are faced with many more health related and lifestyle issues that physical activity may help mitigate. Physical activity may be one way to positively affect individuals with serious mental illness’ health.

**Benefits of PA for SMI**

**Improvements in PA behavior and fitness.** It is important to improve PA behavior among individuals with SMI. Specifically, PA levels are expected to be very low in this population, with less than 5% achieving the recommended weekly amount of 150 minutes of
moderate-vigorous activity (Jerome et al., 2009). Pearsall et al. (2014) found that aerobic PA programs for individuals with SMI lead to improvements in PA activity, while McDevitt et al. (2005) found significant improvements in vigorous physical activity specifically following a walking program. Furthermore, when comparing individuals with mental illness pre- and post-PA intervention, Pelletier et al. (2005) observed increases in submaximal PA test scores as well as increases in walking distance. PA interventions among individuals with SMI have also been shown to improve cardiorespiratory and muscular fitness (Beebe et al., 2005, Peuskens et al. 2003) as well as aerobic capacity (Blumenthal et al.,1999). Combined, these are important benefits since fitness improvements can lead to improved competence perceptions and greater self-esteem which are both important for sustained activity as well as general quality of life (Nieman, 2002).

**Physical health.** In terms of physical health benefits, physical activity interventions among individuals with SMI in general were shown to reduce body fat (Beebe et al., 2005). Belanger et al. (2013) found PA to reduce weight in individuals with SMI, which is particularly important as this can lead to improved blood sugar levels and heart rate fluctuations. This can ultimately reduce ones’ risk of cardiovascular disease (Belanger et al., 2013). Furthermore, among individuals with bipolar disorder, a 20-week lifestyle intervention including PA resulted in improved blood sugar, cholesterol levels and glucose levels (Sylvia et al., 2013b). These physical health benefits are particularly important in the SMI population, as they may help mitigate some of the negative side effects caused by their medications.

**Mental health and Quality of Life.** To date, research examining PA and SMI has mostly focused on physical health and fitness outcomes, as explained above. Thus, the amount of literature that explores the effects of PA on mental health and quality of life outcomes remains relatively sparse. Vancampfort et al. (2011a) found that physical health related quality of life was related to a lack of leisure time PA and a an increased BMI. This suggests that increases in leisure time PA would improve individuals with SMI physical health related quality of life (Vancampfort et al., 2011a). PA has been found to decrease levels of depression and anxiety in individuals with SMI (Browne, 2016). Further evidence relating to PA, SMI and mental health outcomes will be explored more in depth later in this document.
Medication adherence. In addition to improvements in fitness, physical and mental health, PA interventions – either changing behavior directly or educational and information in nature – have also demonstrated benefits to medication adherence. This outcome is extremely important as medication adherence tends to be poor for individuals with SMI in spite of the known strong effects of pharmacotherapy (Kreyenbuhl et al., 2016). Specifically, non-adherence to medication in this population is upwards of 60% (Kreyenbuhl et al., 2016). Reasons for low medication adherence among those with SMI include concerns about side-effects such as weight gain, lack of insight into their condition, and factors such as younger age and belonging to a racial minority (Kreyenbuhl et al., 2016). This high rate of non-adherence is troubling, as it can lead to many adverse outcomes such as worsening of psychiatric symptoms, impaired functioning and increased hospitalization (Kreyenbuhl et al., 2016).

Druss and colleagues (2010) assessed a peer-led medical self-management intervention among individuals with SMI (schizophrenia, bipolar disorder, depression, post-traumatic stress disorder), which included educational sessions about topics such as PA, diet, medication management, and pain and fatigue management. They compared the outcomes of medication adherence and PA levels between the group who had received the intervention and a group who had only received usual care (medication and/or therapy) (Druss et al., 2010). Six-months after the intervention, those who had completed the intervention had much greater medication adherence compared to those who had not. In fact, the control group displayed a 7% decline in medication in adherence, while the intervention group displayed a 14% improvement (Druss et al., 2010). Furthermore, also at the 6 month post intervention time point, those who had completed the intervention reported spending 40 more minutes/week in moderate-vigorous PA, compared to the control group (Druss et al., 2010). This represented a 27% improvement in moderate-vigorous PA in the intervention group, and a 2% decline in MVPA among the control group (Druss et al., 2010). These findings are particularly promising given the fact that the measures were taken 6 months after the end of the self-management intervention, suggesting long-term maintenance of PA behaviours and medication adherence (Druss et al., 2010). Furthermore, the benefits are promising since the intervention was not a direct behavior change focused on PA.
It is evident that physical activity has a wealth of benefits for individuals with SMI. PA has been found to have positive effects on physical health, mental health, quality of life, fitness and medication adherence. However, increasing levels of PA among individuals with SMI population is not without its difficulties, as many barriers to becoming active affect this population.

**Physical Activity Barriers**

Despite the fact that physical activity has the potential to offer a variety of physical health benefits to this population, those with SMI participate in significantly less vigorous PA compared to healthy controls, and significantly higher amounts of sedentary behaviour (Stubbs et al., 2016). This is due in part to a wide range of barriers faced by this population. As outlined by Shor & Shalev (2016) these barriers can be classified as either accessibility barriers or bio-psycho-social barriers. Specifically, safety, transportation and lack of PA space and PA knowledge have been identified as key accessibility barriers (Browne et al., 2016; Shor & Shalev, 2016) in this population. However, lack of financial resources is the overarching barrier to PA among those with SMI (McKibbin et al., 2014). These barriers could be mitigated with community supports and access to PA programming.

In addition to the accessibility barriers, low mood, high stress and a lack of social support have been reported as very frequent barriers among those with SMI (Firth et al., 2016). Furthermore, in a qualitative study with mental health clients and clinicians, physical health complications, symptomatology, side-effects of medications, and motivation were reported as barriers (Browne et al., 2016). Finally, McKibbin et al. (2014) assessed the perspectives of community mental health workers. Again, they found that lack of motivation was a predominant barrier for their clients. Furthermore, they found that stigma about mental illness, including self-stigma, was a further barrier that prevented their clients from being active in the community setting such as at a local gym (McKibbin et al., 2014).

These findings highlight the unique nature of the SMI population; and the uniqueness of these barriers specifically to this population. This information is particularly important given the fact that this population is one that engages in much less PA than the general population (Stubbs et al., 2016) and as such could greatly benefit from PA interventions and their subsequent health
benefits. They also highlight the need for PA interventions to take such barriers into account when structuring and delivering interventions for those with SMI. In particular, Firth et al. (2016) suggested that having adequate social support, particularly in the form of supervised PA support is key in terms of creating successful PA interventions in the SMI population. Therefore, PA programs that are likely to be most effective and sustainable for this target population would address the common barriers. This might involve a program that is shorter in duration (to help with motivation), available at convenient times (to increase accessibility), individually-tailored (to garner self-efficacy and motivation) and supervised (to provide feedback and guide progress).

**Perceptions of PA importance in this population**

Despite the various aforementioned barriers, it is generally accepted in the literature that individuals with SMI value the importance of PA. In fact, a study of university students on antidepressant medication found that the individuals were generally very supportive of PA programs as a complimentary, adjunct, or replacement treatment (Omran, 2016). McDevitt and colleagues (2006) qualitatively examined the perceived barriers and benefits to PA among a group of individuals involved in an outpatient rehabilitation program. They found that the participants viewed the program as important and beneficial to both their physical and mental health, particularly in terms of feeling more energy, less stress, and being able to sleep better (McDevitt et al., 2006). Participants also felt being a part of the activity program helped them feel more involved in the world around them, and was a step towards recovery (McDevitt et al., 2006). Shor & Shalev (2014) also found those with SMI to perceive PA as beneficial. Interestingly, individuals reported valuing improvements in their bodies as significantly more important to them than improvements in their mental health in terms of reasons for initiating a PA program (Shor & Shalev, 2014). In another study, Faulkner and colleagues (2006) examined the physical activity interests of 120 psychiatric patients and found that more than half reported viewing PA as being valuable to their health and enjoyable. Interestingly, there was no clear preference for individual compared to group activity (Faulkner et al., 2006). This finding is in contrast to Omran (2015), who reported that participants expressed a desire for more individualized PA programming.

There has also been clear evidence on the preferences for social support. Faulkner et al (2006) reported that their participants would be more active if a PA professional or physician
advised them on PA. Hoffman et al. (2015) additionally noted that reassuring social relationships, rewarding leisure time, and the chance to have a sense of normality in their lives as being viewed as important aspects of a community-based PA program for individuals with SMI. Given these findings on the value and importance of PA for individuals with SMI, it is important that programs are developed with the features of PA that have been identified as valuable, manageable, and feasible.

Individuals with SMI are a unique population that face various physical and mental health challenges, in part due to side effects of medications as well as their greater propensity to engage in unhealthy lifestyle behaviours such as smoking and sedentary behaviour. As such, this is a population that could greatly benefit from PA interventions. Since individuals with SMI acknowledge the importance of PA and view it as a manageable treatment option, it is important to highlight the evidence of PA interventions and current gaps in the literature that can inform the current work.

**Evidence from PA interventions in SMI**

Overall, there are a number of systematic reviews and Cochrane databases demonstrating the effects of PA on mental health, illness, and symptoms (Penedo & Dahn, 2005; Cooney et al., 2013). Given the focus on SMI for the current research, only this evidence is explored in more detail.

**Bipolar Disorder.** Bipolar disorder remains relatively understudied in the PA and mental health literature. Ng et al. (2006) examined the effects of a walking group among those with a primary diagnosis of bipolar disorder in a psychiatric unit, compared to the patients who chose not to participate in the program. The program offered daily walking sessions of 40 minutes led by nurses, however participants could choose how frequently they wanted to participate. Following the walking program, participants had significantly lower scores of depression, anxiety and stress compared to the non-walking participants (Ng et al., 2006). The authors posited that these results provide preliminary support for the idea that PA may play a therapeutic role in bipolar disorder (Ng et al., 2006).

In a cross-sectional study by Sylvia et al., (2013a) less frequent PA was associated with more time spent depressed and more depressive symptoms, higher BMI and lower reported quality of life. Conversely, more frequent PA was related to more mania experiences in the past
year and more manic symptoms currently (Sylvia et al., 2013a). These findings suggest a mood-specific relationship between PA frequency and polarity (depression vs. mania) (Sylvia et al., 2013a). Furthermore, these results are in line with those of Wright et al. (2012) who examined the qualitative experiences of those with bipolar disorder and PA. Wright et al. (2012) described PA as a double-edged sword for this population, in that on the one hand it can assist them with emotional regulation and help to structure their lives, but on the other hand it can also over-stimulate them with affective dysregulation post-PA (Wright et al., 2012). These findings suggest that a unique and specific manner of employing PA as an intervention for those with bipolar disorder may provide the best results when it is tailored to the individual’s mood. As such, increased PA is prescribed when the individual has a depressed mood, but decreased PA is prescribed when the individual is experiencing mood elevation symptoms (Wright et al., 2012, Sylvia et al., 2013a). These findings highlight the importance of tailored, individualized programs that are amenable to frequent modifications.

Finally, Di Nicola and colleagues (2010) compared the prevalence of behavioural addictions (i.e. gambling, shopping, sexual, internet, work, physical PA) in individuals with bipolar disorder and healthy controls. Bipolar patients did not have a significantly higher prevalence of PA addiction compared to healthy controls (Di Nicola et al., 2010). These findings are promising and may point to the fact that PA is not addictive to bipolar patients, further supporting its legitimacy as a treatment for individuals with bipolar disorder (Di Nicola et al., 2010).

In a recent systematic review by Bauer et al. (2016), only six studies fit their inclusion criteria of lifestyle interventions targeting diet and exercise behaviour among individuals with bipolar disorder. Furthermore, only two of the studies (Sylvia et al., 2011; Sylvia et al., 2013a), focused on mental health and quality of life as their primary outcome measures. The rest of the studies focused on weight, BMI or blood pressure and cholesterol as the primary outcome measure (Bauer et al., 2016). This highlights the lack of studies looking at mental health and quality of life outcome measures in PA and bipolar disorder research. Indeed, Bauer and colleagues (2016) advocated for the inclusion of more studies that assess psychological and quality of life variables. Furthermore, Bauer et al. (2016) noted that the six studies lacked reliable assessment methods of diet and PA, and encouraged the use of more objective measures.
The use of accelerometry could be one such objective measure of PA. Finally, the need for interventions to be developed based on patients' needs and priorities was underscored (Bauer et al., 2016).

Thus, there is a need to examine PA and bipolar disorder with a focus on psychological and quality of life outcome variables rather than physical health outcomes such as weight or BMI. Furthermore, objective measures of PA must be utilized. Of high importance, is the need for PA interventions among those with bipolar disorder to be designed based on patients' needs and priorities. This will likely result in improved intervention adherence and satisfaction. Finally, as the area of PA and bipolar disorder remains relatively understudied, future studies are needed to elucidate the potential outcomes explaining the relationship between PA and improved bipolar symptoms.

**Anxiety.** Among individuals with anxiety disorders, PA is associated with less symptoms of anxiety and depression, lower levels of anger and stress and improved social functioning and vitality (Ekkekakis, 2013). To date, randomized control trials (RCTs) have looked at the effects of PA on various subtypes of anxiety- panic disorder, social phobia and generalized anxiety disorder (GAD). Overall, these studies have shown that PA is associated with significant decreases in general anxiety as well as specific anxiety symptoms (Herring et al., 2012; Broocks et al., 1998; Brown et al., 2007). Merom et al. (2008) found that moderate intensity PA, in combination with Cognitive Behavioural Therapy (CBT), significantly reduced symptoms of stress, depression and anxiety among individuals with GAD, panic disorder and social phobia. This was in comparison to a control group engaging in CBT alone (Merom et al, 2008). Furthermore, Herring et al. (2012) conducted a feasibility study comparing 6 weeks of aerobic or resistance training among individuals with GAD to a wait-list control group. Those involved in the PA group experienced significantly greater reductions in worry symptoms compared to the control group (Herring et al., 2012). The exact mechanisms explaining increased PA and decreased anxiety symptoms still remain to be confirmed.

For anxiety subtypes of panic disorder (Strohle et al., 2009) and obsessive-compulsive-disorder (OCD) (Abrantes et al., 2009,) therapeutic benefits of PA have also been found. Among individuals with OCD, a 12-week PA program resulted in reductions in negative mood and anxiety alongside decreased self-reported obsessions and compulsions (Abrantes et al., 2009).
The authors posited that these results might suggest an acute symptom reducing effect of PA on individuals with OCD (Abrantes et al., 2009). Strohle and colleagues (2009) found that not only is PA anxiolytic in both individuals with panic disorder and healthy controls, but an acute bout of PA may also reduce panic attack frequency and intensity among those with panic disorder.

Jayakody and colleagues (2014) conducted a systematic review on the effects of PA on anxiety disorders. They concluded that while PA on its own is not as effective as traditional pharmacotherapy, it is indeed an effective complimentary therapy (Jayakody et al., 2014). The authors found that there was not a clear consensus between the studies on the optimal intensity of PA for anxiety-reducing effects, and that this could be an area of future research (Jayakody et al., 2014). Jayakody and colleagues (2014) also stressed the fact that interventions that are targeted towards the individual are much more effective than interventions targeted towards people with anxiety and depression in general.

A more recent systematic review and analysis conducted by Stonerock and colleagues (2015) examined studies that used PA training among individuals with either an anxiety disorder or high levels of anxiety symptoms. Overall, they found that among the studies they reviewed, PA conferred benefits similar to CBT or medication, and above those of placebo or waitlist control (Stonerock et al., 2015). The authors also noted that the dose-response nature of PA and anxiety remains unclear, and thus future research is warranted to explore various intensities and frequencies of PA to determine the optimal dose that may reduce anxiety (Stonerock et al., 2015). Stonerock and colleagues (2015) found that many of the PA interventions were unsupervised. They noted that this was problematic in terms of lack of supervision meaning lack of ability to monitor PA adherence and intensity (Stonerock et al., 2015). It is imperative that future research employ supervised interventions in order to monitor adherence and intensity.

To date, the majority of PA interventions among those with anxiety have been clinically or laboratory based. Thus, there is a need for community-based, pragmatic interventions. The optimal intensity needed to achieve anxiety reducing benefits still remains to be elucidated. Furthermore, future research must target each individual specifically and be tailored to them, rather than simply to the population of individuals with anxiety. Finally, supervised interventions are key in order to monitor PA adherence and intensity.
Depression. The mental illness that has been most frequently examined in PA and mental health RCTs is depression. Stathopoulou and colleagues (2006) conducted a meta-analysis on the effects of PA on depression, and concluded that compared to nonactive controls, those in the PA groups showed large improvements in depression. A further meta-analysis from Mead et al. (2009) found that among six trials examining the effects of PA on depression vs. CBT, the results showed no difference between the two modalities. Furthermore, among two studies comparing the effects of antidepressant medication and PA on depression, no differences were reported (Mead et al., 2009). As such, while PA is not more effective than other treatment modalities, it is not harmful and may confer additional benefits that were not targeted.

PA may also improve other facets of a depressed individual’s life. Khatri et al. (2001) found that various measures of memory and executive function improved after a 16-week PA intervention, compared to an antidepressant only control group. Furthermore, among women with clinical depression, those participating in PA reported lower depression and higher coping self-efficacy compared to a control group (Craft, 2005). Cognitive coping thoughts among those with depression have also been reported to be improved following PA (Stathopoulou et al., 2006). Thus, it may be that PA not only decreases depression symptoms, but also improves other related facets of one’s life.

A Cochrane review conducted by Cooney and colleagues (2013) confirmed that PA is more effective than no therapy in decreasing symptoms of depression. However, PA is not more effective than antidepressants or psychotherapy at reducing symptoms of depression (Cooney et al., 2013). The authors found that the evidence around PA and quality of life remains unclear, and thus more research in this area is warranted (Cooney et al., 2013). The reviewers encouraged future research to examine what types of PA most benefit those with depression as well as the amount and duration of sessions that are ideal for this population (Cooney et al., 2013).

In a recent RCT, Helgadottir and colleagues (2016) examined the effects of the intensity of a 12-week PA intervention on individuals with mild to moderate depression. Participants were randomized to either a control group (usual treatment), a light intensity group (i.e. yoga), a moderate intensity aerobic PA group or a high intensity aerobic PA group (Helgadottir et al., 2016). They found that after the 12 weeks, individuals in the three PA groups had significantly
reduced their depression scores compared to individuals in the usual treatment for depression group (Helgadottir et al., 2016). Interestingly, no significant differences were found between the three exercise groups, suggesting any level of PA can be effective at treating mild to moderate depression and that low, moderate or vigorous PA may be equally as effective as usual treatment provided by a physician for depression (Helgadottir et al., 2016). The fact that light and moderate intensity PA were found to be just as effective as vigorous PA is promising, especially for individuals with depression who may struggle with low motivation and feel intimidated by PA initiation. Helgadottir and colleagues (2016) suggested that these findings indicate that the level of exercise intensity prescribed for depressed individuals should take into account the characteristics of the individual and their levels of fitness and motivation. The supportive context of this RCT (free gym memberships, weekly meetings with physiotherapist or trainer) was a key strength of this study, and is encouraged among future studies (Helgadottir et al., 2016).

Schuch and colleagues (2016) conducted a meta-analysis of PA interventions and quality of life (QoL) outcomes in individuals with depression. The effect of PA on four domains of quality of life was examined; social relationship, environment, physical and psychological QOL. It was found that among individuals with depression, PA can improve physical and psychological domains of QoL, however does not improve the other two domains (Schuch et al., 2016). The authors expressed a need for future PA trials examining QoL and depression to examine the impact of PA characteristics (i.e. duration, intensity, group vs. individualized) along with more research on individual characteristics such as age, gender and depression severity on QoL, compared to antidepressants (Schuch et al., 2016).

The available literature has various strengths but there are still specifics about the PA and depression relationship that remain unclear. It is evident that supportive PA contexts that include supervision and subsidized gym access are important in helping individuals adhere to a PA program and thus benefit from its rewards. The findings that any level of PA intensity may have therapeutic effects on mild to moderate depression are very significant, as they can provide evidence to individuals in this population who struggle with low motivation and exercise adoption, that even light PA can be beneficial for their mental health (Helgadottir et al., 2016). However, there remains a lack of clear evidence regarding what type of PA activity is most effective at yielding decreases in depression symptoms. Furthermore, the impact of PA duration,
intensity and type still need to be explored in order to further understand the relationship between PA, QoL and depression. Similar to the anxiety and bipolar disorder literature, there exists a lack of community-based, sustainable PA interventions. Finally, with PA interventions and every type of SMI, there is a lack of research examining risks and adverse effects of interventions, and these are important considerations when working in a field with vulnerable populations.

Overall, the evidence on PA interventions among individuals with SMI is promising, demonstrates some effectiveness for physical and mental health outcomes, as well as quality of life. Drawing on the evidence from the interventions, coupled with the evidence for acceptability of PA in this target population, there are many specific suggestions for PA program development and delivery. Wolffe and colleagues (2011) outlined specific suggestions for PA interventions among individuals with SMI that may make them more effective. They highlighted the need for programs to be individualized, professionally supervised, to take into account disorder-specific conditions of patients such as cognitions, attitudes or fears (Wolffe et al., 2011). In addition, they emphasized how caution must be used when interpreting results of mental health outcomes, as individuals’ baseline fitness level and PA history may affect these results. Finally, they stressed the need for patients’ compliance following the treatment- which further underscores the aforementioned need for sustainable, community based PA programs for those with SMI (Wolffe et al., 2011). In addition to Wolfe et al.’s suggestions (2011), the programs should also address the common barriers, perceptions, etc. that were previously identified. As such, building an intervention with community support, that is short in duration, is autonomy building and competence supportive is key.

Given this information on the benefits of PA, the barriers that need to be overcome for successful programming, and the evidence of positive outcomes, it is also important to understand the possible mechanisms that explain the relationship between PA and health outcomes.

**Potential Mechanisms Linking PA and mental health**

Although the exact explanation of the relationship between PA and improved mental health remains unknown, there are various possible mechanisms that have been suggested. As the exploration of PA and bipolar disorder remains relatively recent, the majority of the evidence is
based on PA and depression and anxiety and includes the distraction, social contact, endorphin, self-efficacy and self-esteem hypotheses.

**Distraction Hypothesis.** The distraction hypothesis was proposed by Barhrke & Morgan in 1978 and has been commonly been used in both the PA and depression and PA and anxiety literature. The hypothesis proposes that exercise acts as a distraction from worries and negative thoughts (Barhrke & Morgan, 1978). However, it remains unclear whether this hypothesis is useful or not. Indeed, Craft and colleagues (2005) found that following a 9-week PA intervention among depressed individuals, decreases in rumination were seen, however these were not accompanied by increases in distraction use. This suggests that distraction may not explain decreases in thought patterns associated with depression (Craft et al., 2005). The distraction hypothesis may explain reductions in state anxiety and negative affect following PA, however cannot account for increases in positive affect and does not explain what drives affective changes (Barnes et al., 2010). It may be that this hypothesis applies for individuals at specific stages of a PA program (for example at the beginning when the activity is novel), but be less relevant during other stages of PA participation (Ekkekakis, 2013).

**Social contact/social engagement.** The act of simply being around others may explain positive changes in well-being attributed to PA. Social engagement may explain the protective effects of PA on anxiety (Pasco et al., 2011), however to date there have been no studies directly examining how social engagement may play a role in the acute anxiolytic effect of PA. Harvey and colleagues (2010) also found an unclear relationship between the inverse relationship of PA and anxiety symptoms. However, they did find support for social support and engagement playing a key role in the inverse relationship between PA and symptoms of depression (Harvey et al., 2010). The role of social support in explaining the inverse relationship between PA and depression has also been supported in the sport and mental health literature (Babiss & Gangswich, 2009; Sabiston et al., 2016).

**Endorphin Hypothesis.** The endorphin hypothesis (Hoffman, 1997) posits that endogenous opioid peptides are released in the brain following exercise, and they consequently modulate affective processing and pain perception in the brain. Endorphins have been linked to
positive mood and enhanced well-being (Craft et al., 2004) and have thus been suggested to have a positive effect on depression. Endorphins contain pain-relieving properties that are similar to those of morphine (Ekkekakis, 2013). Although this hypothesis was contested for many years and proved very difficult to directly examine, Boecker and colleagues (2008) used a Positron Emission Tomography (PET) ligand imaging method to confirm that indeed endogenous opioids are released from the brain after prolonged exercise.

**Self-Efficacy.** Another potential mechanism for decreases in anxiety and depression following PA may be due to increases in self-efficacy. Bandura (1977) defined self-efficacy as the belief that one has the skills to complete a task, and the confidence that the task can be performed. Self-efficacy is determined by four antecedents: past performance (mastery), vicarious experiences (modeling), social persuasion (verbal persuasion), and physiological/affective states (Bandura, 1977). In turn, self-efficacy affects ones cognitions, affect and behaviours (Bandura, 1986). In an intervention among clinically depressed individuals, participation in stationary biking and martial arts were examined to see if changes in self-efficacy and mood occurred (Bodin & Martinsen, 2004). It was hypothesized that individuals would have high and stable self-efficacy with the biking task since it is relatively easy and familiar, but that self-efficacy would start low and potentially rise with the martial arts task as it is a generally unfamiliar task (Bodin & Martinsen, 2004). Indeed, the martial arts task elicited statistically significant increases in positive affect, reductions in negative affect and state anxiety (Bodin & Martinsen, 2004). Increased self-efficacy was also observed in this task, which may have contributed to these affective changes. As hypothesized, the stationary biking condition did not produce any changes in either self-efficacy or any of the affect measures, likely due to the fact that it was an activity with initially high self-efficacy ratings (Bodin & Martinsen, 2004). Nonetheless, these findings suggest that self-efficacy can be a catalyst to improved mental health.

Craft (2005) examined the antidepressant effects of a 9-week PA program and tested the potential mechanistic effects of self-efficacy and distraction. PA was associated with a decrease in depressive symptoms (Craft, 2005). Interestingly, the findings did not support distraction as a potential mechanism, but did support self-efficacy, as coping self-efficacy increased throughout
the 9 weeks (Craft, 2005). This supports the notion that self-efficacy may play a role in the depression-PA relationship.

**Self-Esteem.** Increases in self-esteem may also explain the relationship between PA and decreases in anxiety and depression. A key model that ties PA, self-efficacy perceptions, and additional mental health facets such as self-esteem is Sonstroem and Morgan’s PA and Self-Esteem model (EXSEM; 1989). Changes in self-esteem happen through changes in physical self-efficacy, physical competence and physical acceptance (Sonstroem and Morgan, 1989). Indeed, Knapen et al. (2005) found that among a group of nonpsychotic psychiatric inpatients, improvements in physical self-concept were associated with increased global self-esteem and subsequently significantly lower anxiety and depression levels following a 16-week PA program. These results provide support for the role of physical self-concept in explaining the relationship between PA and improved mental health (Knapen et al., 2005). Interventions specifically encouraging improvements in physical self-concept are warranted in the population of individuals with SMI, as they generally have lower physical self-concept and self-esteem compared to the general population. Indeed, Vancampfort et al. (2011b) found that individuals with schizophrenia had significantly lower physical self-concept compared to healthy volunteers. This can be exacerbated by self-stigma (Vancampfort et al., 2011b). Self-esteem is highly important to address in this population as increased self-esteem is related to increased social functioning as well as increased quality of life in individuals with severe mental disorders (Borras et al., 2009). The EXSEM model in general suggests that there is a strong relationship between the mastery and self-esteem mechanisms explaining the relationship between PA and mental health outcomes (Sonstroem and Morgan, 1989).

There remains a great deal of uncertainty over which mechanisms explain the relationship between PA and improved mental health. Self-efficacy and self-esteem hypotheses are backed by a great deal of evidence, and seem to be the most promising explanations. Distraction hypothesis, social hypothesis and endorphin process have received less empirical support. More research is needed to examine the mechanisms linking PA and improvements in bipolar disorder, as to date this has not been examined and may be mechanistically different from anxiety and depression. Furthermore, the studies looking at mechanisms tend to be performed in a clinical or laboratory setting with highly targeted samples. Thus, these mechanisms need to be explored in community-
based settings, as they may exert differing effects in different settings. Also, many studies are not designed to test mechanisms but rather infer the mechanisms following the study findings.

Based on what is known about PA interventions targeting SMI, PA interventions are feasible in this population. Furthermore, despite a wide range of accessibility and bio-psycho-social barriers, individuals with SMI value the importance of PA. The current literature however highlights the fact that most studies are performed in a laboratory or clinical setting, rather than the community. As such, there exists a great lack of pragmatic studies in this field. Of particular concern is the fact that many studies are not informed by participant or mental health organizational input or support. Much more research is needed in community environments to further understand community-based PA programs. Such programs may have quite different effects on mental health and quality of life compared to clinical studies, and the potential mechanisms explaining the PA-mental health relationship may be different in these settings. Sustainable PA programs for individuals with SMI are vital, and to date there have been very few studies examining the sustainability of such community based programs. Finally, Firth and colleagues (2015) noted that while many PA interventions are unsupervised, supervised interventions (while costlier) may be better for this population.

As such, a pilot feasibility study is needed to examine a community based, pragmatic study that is informed by participants and stakeholders of a local community mental health organization.

**Research Designs and Pilot Studies**

The aim of a pilot study is to investigate if the protocol is feasible and acceptable to both participants and researchers (Czajkowski et al., 2015). A pilot study can be defined as a preliminary trial of an intervention, to test the plan and methodology of a future research study (Thabane et al., 2010). The ORBIT (Obesity Related Behavioral Intervention Trials) Consortium developed the ORBIT model (see Figure 1) to serve as a framework to translate basic behavioural science findings into behavioural science treatments for both the prevention and management of chronic diseases (Czajkowski et al., 2015). It is a systematic framework designed to link behavioural solutions to clinical problems (Czajkowski et al., 2015). This model is important for guiding researchers through the steps in developing evidence-based effective
feasible and accessible interventions. The relevant components of the model are explained below, and for the purpose of this particular study, the “treatment” will be supervised PA.

**Model Components**

**Phase 1: Design** - The goal is to create the necessary features of a behavioral treatment, or to adapt an existing treatment to a new problem (Czajkowski et al., 2015). The design of the program involves (a) defining and (b) refining stages. Specifically, the purpose of the first sub-phase is to define the basic elements of the intervention. This involves providing a basic behavioural basis for components of the treatment, as well as treatment targets and hypothesized pathways. At this point, subjects are also identified, and safety is assessed (Czajkowski et al., 2015). Based on the evidence to date, individuals with SMI can participate in PA interventions, heterogeneity in sample is needed to explore unique PA benefits and barriers across different mental illnesses, and individuals should be targeted who are part of a community support organization for potential sustainable programming. While PA medical screening should always be done, individuals with SMI are generally able to participate in PA, express interest in this type of program, and feel that PA may be effective for complimentary treatment.

Once the target population is identified, the purpose of the second sub-phase is to refine the study for strength and efficiency. This involves determining treatment components such as duration, delivery method, and any required tailoring (Czajkowski et al., 2015). For PA interventions among individuals with SMI, the evidence has been summarized as a program that is short in duration, available, individually-tailored, progressive, supervised, and is linked to community/organizational supports (Wolffe et al., 2011).

**Phase 2: Preliminary Testing** - The aim of this stage is to examine the ability of a fixed treatment package to yield a clinically significant improvement on a behavioural risk factor (Czajkowski et al., 2015). There are two sub-phases in the Phase 2 of the ORBIT model. In the first sub-phase, the proof-of-concept is explored. Specifically, the treatment manual and procedures are prepared for fidelity monitoring, and it is determined whether or not the treatment can have a clinically significant impact on the behavior itself (Czajkowski et al., 2015). For a PA intervention among individuals with SMI, the proof of concept can be explored in a number of ways, including evaluation of on-going and previous programs, discussions with stakeholders and end users (e.g., individuals with SMI), and communication with trainers and medical
community members. The second sub-phase is “pilot”, and the goal of this step is to assess the feasibility of the efficacy trial methodology, and see if logistically the trial is feasible for participants and researchers. At this point, numbers are also decided for required trial enrollment, sample size and length of follow-up.

The early phases of the ORBIT model involves a flexible and progressive progress, and allows for researchers to return to prior stages for refinement (Czajkoski et al., 2015). Various pilot studies have been conducted recently in the PA and mental health field to assess behaviour change (Gorcynski et al., 2013; Van Citters et al., 2010; Hoffman et al., 2015; Aschbrenner et al., 2017), however none of these programs have been focused on feasibility measures for sustainable, community-based PA programs. Most of the evidence has been focused on small convenience samples of non-community dwelling individuals. Based on the ORBIT model, Phase I (design) and Phase II (preliminary testing) are needed to develop the most ecologically-valid PA intervention for individuals with SMI.

The ORBIT model also includes Phase III (efficacy) and Phase IV (effectiveness). Efficacy trials are explanatory in nature and are used to investigate if an intervention yields the expected result under ideal circumstances, while effectiveness trials are pragmatic in nature and are used to assess how beneficial the treatment effects are in real world settings (Godwin et al., 2003). These phases would be next steps following the evaluation of a developed PA intervention for individuals with SMI.

Figure 1

The ORBIT Model for Behavioral Treatment Development
Summary, Research Questions and Hypotheses

In summary, this study aims to assess the feasibility and effectiveness of a physical activity program for residents of a community mental health organization with serious mental illness. Aligning with the ORBIT model, the PA intervention has been defined and refined using previous empirical evidence, an on-going PA intervention (e.g., MoveU.HappyU), and preliminary discussions with a community mental health support organization. The main purpose of the current research is to explore Phase II of the ORBIT model, specifically the proof-of-concept and pilot sub-phases that will provide a foundation for future efficacy and effectiveness trials.

Based on empirical evidence, theoretical constructs, and the ORBIT model, the following research questions and hypotheses have been proposed to target the pilot phase:

RQ1: Is a PA program feasible and acceptable for local SMI housing organization clients?
RQ2: Does a PA program for individuals with SMI result in positive changes in PA, QOL and mental health, compared to a control group?
RQ3: What do participants qualitatively report about their program experiences, benefits, barriers and motives?

Hypothesis 1: A PA program will be evaluated as feasible and acceptable by both program participants and key organizational stakeholders. Feasibility will be defined as 80% of the participants attending all 6 PA sessions, while acceptability will be defined as more than 80% of the participants reporting more than modest satisfaction with the program.
Hypothesis 2: For this population with SMI, a PA intervention will result in increased PA and quality of life, and improvements in mental health facets (mood, depression and anxiety ratings).
Hypothesis 3: Based on participant interviews and researcher field notes, participants will report their program experiences as having been favourable and beneficial, and barriers and motives will vary by individual.

In conclusion, the current literature supports the idea that a physical activity intervention in this population is feasible. The literature supports that for various serious mental illnesses; physical activity can confer both mental and physical health benefits. This is particularly important in this population who are at a higher risk of various health conditions and as such, premature
mortality. While little is known about PA interventions in this population, preliminary discussions with patients, caregivers, and service providers suggest that a PA intervention may be effective (AIS, 2016). Individuals with SMI want to “feel normal,” and belong, and don’t feel knowledgeable on PA (Hoffmann et al., 2014; Shor & Shalev, 2014). Working out in a fitness facility and with a specialized trainer may help foster these needs. As such, this PA program will be delivered in the community, for a local mental health organization and will involve preliminary discussions with participants and stakeholders in the intervention development stage. Feasibility (program attendance) and acceptability (program satisfaction) will be assessed following the intervention, and changes in PA, QoL and mental health outcomes will be examined from pre- to post- intervention.
Abstract

Individuals with serious mental illness (SMI) have a shorter life expectancy, experience many physical health comorbidities, and report a lower quality of life compared to healthy counterparts. Physical activity (PA) may be one way to target both the mental and physical health of this population. This study examined the feasibility and acceptability of a PA intervention in conjunction with a local mental health housing organization. Program effectiveness was also measured through changes in mental health, quality of life, and physical activity from pre- to post intervention, and compared to a control group. Repeated Measures ANOVA and effect sizes were used to compare outcome changes between intervention (N=5) and control (N=5) groups, while deductive thematic analysis was used to analyze interview responses. There were no significant group effects on any of the outcomes, however there was a significant effect of time on total mental health scores, as well as anxiety and depression subscales. Participants, trainers and a key organizational stakeholder viewed the program as acceptable and feasible, and provided suggestions to improve future programs.
**Introduction**

Mental illness is the leading cause of disability in Canada, and carries an economic burden of $51 billion per year (Lim et al., 2008). In addition to the mental illness itself, individuals with mental illness also frequently have physical comorbidities such as cardiovascular disease, obesity and metabolic disease. More specifically, individuals with severe mental illness (SMI), which includes major depression, bipolar disorder and schizophrenia, live 10 to 20 years fewer than the general population (Walker, McGee, & Druss, 2015). This large mortality gap is partially due to increased prevalence of metabolic syndrome (Vancampfort et al., 2015), cardiovascular disease (Correll et al., 2017; Gardner-Sood et al., 2015) and type 2 diabetes (Stubbs, Vancampfort, De Hert, & Mitchell, 2015; Vancampfort, Correll, et al., 2016). Individuals with SMI also experience worse quality of life compared to healthy counterparts ((Substance Abuse and Mental Health Services Administration, 2013). As such, there is a dire need to ameliorate both the mental health and the physical health of this population. Physical activity (PA) may be one such way to do so, however individuals with SMI engage in significantly less PA per week (Vancampfort et al., 2017). This is partially due to the various barriers they face to getting active including lack of motivation, lack of knowledge/resources, pain and the side effects of medication (Firth et al., 2016).

While individuals with SMI may experience barriers to becoming or staying active, they do value the importance of PA (Firth et al., 2016). Indeed, there are widespread benefits for both the physical and mental health of individuals with SMI. PA has been found to improve quality of life and depression symptoms among individuals with depression (Schuch et al., 2016; Helgadottir et al., 2016), and decrease symptoms of anxiety and depression as well as decrease levels of anger and stress among individuals with anxiety disorders (Ekkekakis, 2013). Among those with schizophrenia, PA has been shown to improve mental well-being (Sturludottir et al., 2015). Furthermore, among those with SMI, PA has been found to reduce body fat and weight, as well as improve blood sugar, cholesterol levels and glucose levels (Belanger et al., 2013; Sylvia et al., 2013b). Taken together, these findings are promising as they highlight that PA may improve the symptoms of individuals’ mental illness, but also may mitigate some of the negative side effects of medications.
However, the majority of the current evidence in this area is based on interventions that have been conducted in either laboratory or clinical settings, and as such there exists a lack of pragmatic, community based PA interventions. Of particular concern is the fact that many studies are not informed by participant or mental health organizational input or support. Much more research is needed in community environments to further understand community-based PA programs. Such programs may have different effects on mental health and quality of life compared to clinical studies, and the potential mechanisms explaining the PA-mental health relationship may be different in these settings. Individuals with SMI want to “feel normal,” and belong, and don’t feel knowledgeable on PA (Hoffmann et al., 2014; Shor & Shalev, 2014). As such, working out in a community-based fitness facility and with a specialized trainer may help foster these needs.

There are various mechanisms that have been proposed to explain the relationship between PA and improvements in mental health. Notably, the Self-Efficacy Hypothesis, or Mastery Hypothesis (Bandura, 1977) posits that increases in self-efficacy (i.e. the belief that one has the skills to complete a task and the confidence that the task can be performed) may lead to improvements in mental health. This has been suggested as a mechanism in the PA-depression relationship (Bodin & Martinsen, 2004; Craft, 2005). It has also been suggested that increases in self-esteem may explain the relationship between PA and decreases in anxiety and depression (Sonstroem & Morgan, 1989; Knapen et al., 2005). This is important as those with schizophrenia have been found to have lower physical self-concept (Vancampfort et al., 2011b) which is a key predictor of self-esteem (Sonstroem and Morgan, 1989), and increased self-esteem is related to increased quality of life in individuals with SMI. Finally, the role of social support in explaining the inverse relationship between PA and depression has also been supported in the sport and mental health literature (Babiss & Gangswhich, 2009; Sabiston et al., 2016). While more research is needed to examine these mechanisms, particularly in the context of community based PA interventions, the current evidence shows that PA instils improvements in mental health.

Given the hypotheses and mechanisms proposed above as well as the need for organization and participant-informed community programs, it is important that such programs focus on self-efficacy/mastery, self-esteem and social support. This can be fostered by tailoring activities to each individual, providing opportunities for self-monitoring, participant achievement
and trainer feedback, and having a one-on-one trainer led program led by someone who is qualified and supportive. To date, a program such as this has not been tested.

**Present study.** Based on theoretical constructs and previous evidence, the purpose of this mixed-methods study was to evaluate the feasibility of a pilot PA program tailored to individuals with SMI. More specifically, this study aimed to evaluate the acceptability of a PA intervention and to assess the effectiveness of the intervention on participants’ PA and self-reported quality of life and mental health, compared to that of a control group. Furthermore, participant experiences in the PA program were explored. The specific research questions included:

RQ1: Is a PA program feasible and acceptable for local SMI housing organization clients?
RQ2: Does a PA program for individuals with SMI result in positive changes in PA, QOL and mental health, compared to a control group?
RQ3: What do participants qualitatively report about their program experiences, benefits, barriers and motives?

Hypothesis 1: A PA program will be evaluated as feasible and acceptable by both program participants and key organizational stakeholders. Feasibility will be defined as 80% of the participants attending all 6 PA sessions, while acceptability will be defined as more than 80% of the participants reporting more than modest satisfaction with the program.

Hypothesis 2: For this population with SMI, a PA intervention will result in increased PA and quality of life, and improvements in mental health facets (mood, depression and anxiety ratings).

Hypothesis 3: Based on participant interviews and researcher field notes, participants will report their program experiences as having been favourable and beneficial, and barriers and motives will vary by individual.

**Method**

This was a quasi-experimental mixed-methods study involving a within- and between-group comparison to explore group differences and changes in mental health and quality of life over time, within-group assessment of feasibility and acceptability of the program, and interviews with participants of the intervention and key stakeholders.

**Participants**

Participants were purposefully recruited through Accommodation Information Support (AIS), a Toronto-based community organization for individuals with “significant and prolonged”
mental health challenges (AIS, 2016). AIS provides permanent supportive housing to individuals who have experienced mental health challenges and/or homelessness. Eligibility criteria included those who are over 18 years of age, those who are clients of AIS and those who are free of cardiac and musculoskeletal issues. All participants were cleared on the Physical Activity Readiness Questionnaire (PAR-Q). In addition, they provided signed consent from their medical physician before they began the PA intervention. Participants were also recruited for the control group if they were over the age of 18, were a client of AIS and were not participating in the PA intervention.

**Procedure**

Following university research ethics board approval, interested participants met with the researcher to discuss the program and complete a consent form (Appendix A), and were administered the Physical Activity Readiness Questionnaire (PAR-Q), and given a physician clearance form they were told to have completed before they could commence the program and complete the pre-intervention questionnaire. At a later date, participants completed the pre-intervention study questionnaire on a computer in the Athletic Centre. Following this, participants could set up their first PA session. The sessions were comprised of 1 hour of one-on-one, tailored training, once a week, for six weeks. Throughout the program, measures of PA (accelerometer) and attendance were recorded, and field notes were taken. Two trainers were responsible for running the program.

Following the completion of the program, participants completed the post-intervention questionnaires. They also scheduled a date/time for the post-intervention interview and were provided a $50 honorarium for completing the qualitative interview. Interviews were also conducted with the trainer and the key stakeholder from AIS. Control group participants also completed informed consent forms, and were given their first questionnaire, and then a second questionnaire six weeks later, in line with the timing of the intervention group questionnaire administration (see Appendix B for questionnaires).

**Measures**

**Pre-intervention measures**

**Demographics.** Following informed consent, participants completed baseline measures. These included age, sex, highest-completed education, ethnicity, medication usage over the last
30 days, cigarette, marijuana and alcohol usage over the past 30 days. Cigarette, marijuana and alcohol usage over the past 30 days are also assessed following the intervention. These measures were used for lifestyle descriptive purposes for study participants.

**Physical Activity.** The International Physical Activity Questionnaire Short Form (IPAQ-SF, Craig et al., 2003) was used to assess self-reported PA at baseline. This questionnaire asks participants to recall the last 7 days of their activity at four intensity levels: vigorous (i.e. aerobics), moderate (i.e. cycling), light (i.e. walking) and sitting. For each of these four categories, the participants are asked: a) how many days in the past 7 days did perform activity in that intensity; b) how much time (minutes) did you spend in that intensity? The IPAQ-SF scores have been demonstrated as reliable and valid (Dinger et al., 2006). The scores were used as a total met/mins spent in PA, with higher scores indicating greater PA.

Questions about PA history and barriers to PA were used for descriptive purposes. These questions were based on lifetime PA questionnaires and three life stages were asked: “Please describe your physical activity levels during the following times in your life during: childhood (Up to 12 years of age); adolescence (12 to 18 years); adulthood (19 years to present).” There are four response options, “not active at all,” “a little active,” “very active,” and “not applicable.” Furthermore, they were asked to list three barriers to current PA in an open-ended response format.

**Quality of Life.** Quality of Life and life satisfaction were measured using the Quality of Life Enjoyment and Satisfaction Questionnaire-Short (Endicott, Nee, Harrison, & Blumenthal, 1993). This questionnaire asks, “taking everything into consideration, during the past week how satisfied have you been with your (physical health, mood, work)...” on 16 items related to quality of life and life satisfaction. Response options range from, very poor (1) to very good (5). Scores are created by summing the first 14 questions (possible range from 14-70). Higher scores are indicative of more enjoyment/satisfaction with life. The 15th item regarding medications and 16th item regarding overall life satisfaction are reviewed qualitatively, and considered independently of that total score. This reliable and valid measure is one of the most often used outcome measures in psychiatric research (Stevanovic, 2011). For the purpose of the present study, only 11 items were summed to make a total score, as many of the participants left the
questions about satisfaction with work, economic situation, and sexual drive blank. As such, the scores ranged from (11-55).

**Mental Health.** The Mental Health Inventory-18 (MHI-18, Viet & Ware, 1983) measures general psychological distress and well-being in both positive (cheerfulness, enjoyment in life) and negative (anxiety and depression) aspects of well-being. The 18-item questionnaire instructs participants to, “Please read each question and tick the box by the ONE statement that best describes how things have been FOR YOU during the past month.” on a 6 point Likert scale. There are many different scoring protocols for the MHI. Subscales are calculated by summing and then averaging items assessing Anxiety (n\text{items} = 5; score range from 1-6), Depression (n\text{items} = 4; score range from 1-6), Loss of Behavioural/Emotional Control (n\text{items} = 4; score range from 1-6), Positive Affect (n\text{items} = 4; score range from 1-6). A total score is created by adding all 18 individual items and then averaging them, for a total score range from 1-6. Higher scores for the respective subscales and the total score indicate better mental health (Veit & Ware, 1983). The MHI-18 is valid and reliable, and can be used in clinical or research settings to identify mental health problems and/or assess pre-post mental health changes in intervention research (Khan et al., 2015).

**Within-intervention measures**

**Physical Activity.** Participants wore Actigraph GT3X accelerometers (Actigraph, Pensacola, Florida) on their hip for the duration of the six-week study to objectively measure PA. They were instructed to wear them at all times except for when they were participating in water activities or sleeping. Each week, participants were given a tracking sheet to keep track of when the device was worn/not worn, and what types of activity were done when it was worn. Each week the participant came in, they received a summary graph of their PA trends to serve as feedback. Data extracted from each participants’ first (week 1) and final (week 6) week of the program and were analyzed in order to evaluate objective changes in PA over the program. Data are extracted in 60-second epochs. While controlling for number of days worn, time spent in different PA intensities was calculated through the use of established cutoff points (Freedson, Melanson, & Sirard, 1998). These cutoff points include: Mild = \leq 1,951 \text{ counts/min}, Moderate=1,952-5,724 \text{ counts/min}, and Vigorous = \geq 5,725 \text{ counts/min} using the Actigraph software. As per the data usage guidelines, if participants had data that was extreme (> 20,000 counts/min), or
in the event that data was not available for at least 500 minutes, data was not used (Freedson, Melanson, & Sirard, 1998). After extracting and calculating the data, the total time spent in each PA intensity at week 1 and at week 6 was analyzed for each participant, if they had sufficient available data.

**Attendance.** Attendance was measured each week of the six-week program. Attendance was used to inform the feasibility of the program, defined as, 80% of participants completing all six sessions.

**Field Notes.** Throughout the entire process (from pre-intervention to post-intervention) the researcher, who was also one of two trainers (GAF) took self-reflected field notes. These field notes included points about program development as well as how the program and each participant was progressing. In addition, any participant or stakeholder feedback that was given throughout was recorded in these field notes. This process enabled the researcher to assess the feasibility of the study from the researcher standpoint, and keep track of ways that such a program could be modified or improved in the future. Data from the field notes was extracted to inform the feasibility and acceptability and refinement of the PA program and target sample.

**Post Intervention Measures**

The post-intervention questionnaires consisted of the same scales that were included in the pre-intervention questionnaire and additional study-specific questions on program satisfaction. Specifically, participants were asked to what extent the program met their needs, that they liked the program, and overall satisfaction on 7-point Likert scales with higher scores representing more favourable outcomes. Scores on these scales above the mid-point on the 7-point scales were used to represent favourable responses that helped to define acceptability.

**Participant interviews.** Participants were interviewed following the completion of the program, to assess their perceptions of and satisfaction with the program. These were completed within 3 weeks after their program completion, at a location convenient for the participant. The interview guide was developed based on empirical evidence (Gorcynski et al., 2014), and models of behavior change (Hardeman et al., 2000). As noted by Gorcynski et al. (2014), conducting interviews post-study to examine intervention acceptability is both practical and rigorous when
pilot testing PA interventions. The interview questions touched on program motives, barriers, and benefits, aspects of the program the participants liked, aspects they would change, as well as their activity since their completion in the program.

**Key stakeholder interview.** The key stakeholder from AIS (pseudonym: Jane) was interviewed following the intervention to assess her experience with the PA program and whether she viewed it as feasible and potentially sustainable in the future. The questions were informed by similar feasibility studies (Gorcynski et al., 2014). The questions included a focus on perceived barriers and enablers encountered with this program, questions about recruitment, as well as how valuable and resource-intensive their organization found the program to be.

**Trainer Interview.** The PA trainer (pseudonym: Dave) was interviewed following the program to assess his experiences with the program and the participants. This allowed the trainer to express any concerns he may have had, or any suggestions about changes to the program should it become a sustainable program in the future. The questions also assessed the trainer’s initial thoughts about working with this population (i.e. preconceived biases, general uncertainties, worries about safety or about lack of experience with this population). Furthermore, the questions asked the trainer if he found working with this population to be different than training other individuals without mental health concerns (i.e. having to explain things differently, having to repeat himself more than usual, having to be stricter etc.).

**Analytic strategy**

Descriptive statistics were computed and Repeated Measures ANOVA (RMANOVA) models were estimated to assess changes from pre- to post-intervention and between the experimental and control groups. Effect sizes were computed (Cohen, 1992) given the small sample size and were interpreted as small ($d=0.2$), medium ($d=0.5$) or large ($d=0.8$).

Deductive thematic analysis (Boyatzis, 1998) was used code and interpret the participants’ experiences in the program as they related specifically to their likes and dislikes and what they would keep and modify for future work. These participant perspectives are also individually described to provide further individual interpretation on the feasibility, acceptability, and effectiveness of the PA program. Similar analysis was used to code and interpret trainer and stakeholder interviews regarding program feasibility and acceptability.
Initial codes were informed by previous research, as well as theoretical tenets (EXSEM, Sonstroem & Morgan, 1989; Self-Determination Theory, Deci & Ryan, 2000; Self-Efficacy Hypothesis, Bandura, 1977). As such, codes included program likes and dislikes, recommended changes, program benefits, program barriers, activity motives and activity maintenance.

**Results**

**Participants.** Ten participants were recruited into this study (Control Group: n = 5, 60% female, Mean age = 60 years, 80% Caucasian; Experimental Group: n = 5, 60% male, Mean age = 42 years, 80% Caucasian). All participants were living with various mental illnesses such as major depressive disorder, bipolar disorder, schizophrenia, and past alcohol dependence issues. Participants reported taking tranquilizers ($n_{control\ group} = 1; n_{experimental\ group} = 1$), antidepressants ($n_{control\ group} = 4; n_{experimental\ group} = 1$), and anti-psychotics ($n_{control\ group} = 1; n_{experimental\ group} = 1$) in the last month. Two control group participants also reported taking medications to control type 2 diabetes. Only one participant reported smoking cigarettes during the past month, while 3 reported drinking alcohol and 3 reported smoking marijuana. Five participants had at least graduated high school. The majority of the participants (80%) reported being very active during childhood and adolescence, while most (70%) reported now being a little to not at all active in adulthood. Participants reported various barriers to why they weren’t currently active, such as their mental illness (40%), mobility problems (20%), low confidence (10%), lack of motivation (10%), and various physical health problems (30%) such as previous injuries, herniated discs in spine and fibromyalgia.

**Group Comparisons**

**Mental Health and Quality of Life.** One control group participant did not complete the post-intervention assessment and was removed from further analyses. The descriptives (means and standard deviations) for group comparisons on mental health and quality of life are presented in Table 1 in Appendix C.

**Time Effects.** There was a statistically significant effect of time on total Mental Health Inventory (MHI-18) scores, $F(1, 7) = 18.96, p=.003$ with both groups improving (higher scores) over time, control group $d = .30$ and experimental group $d = .32$. There was also a statistically significant effect of time on the anxiety subscale of the MHI-18, $F(1, 7) = 18.53, p=.004$ with
both groups improving (higher scores) over time, control group $d = .82$ and experimental group $d = .28$ and a similar trend for the depression subscale of the MHI-18, $F (1,7) = 15.61$, $p= .006$. with both groups improving (higher scores) over time, control group $d = .33$ and experimental group $d = .38$. No other significant time effects were observed (F-values = .417 to 1.42, $p > .05$), with small to moderate effect sizes for improvements in the MHI-18 subscales of behavioural control (control group $d = .28$, experimental group $d = .19$) and positive affect (control group $d = .04$, experimental group $d = .04$). There were moderate to large effects for change over time in QEL-LS quality of life raw score (control group $d = .66$, experimental group $d = .39$) and subscales for medication satisfaction (control group $d = .62$, experimental group $d = 2.04$) and a small effect for change in life satisfaction (control group $d = -.22$, experimental group $d = .15$). This latter score is the only one to demonstrate a decrease in the control group.

**Group Effects.** There were no significant group effects for any of the mental health or quality of life measures (F-values = .038 to .751, $p > .05$). Nonetheless, small to moderate effect sizes were calculated for group differences at baseline, with generally higher score reported for the control group participants. Specifically, the effect sizes comparing pre-test mental health scores between groups were: MHI-18 total score $d = .15$, and MHI-18 subscales of anxiety $d = .21$, depression $d = .30$, MHI-18 behavioural control $d = .03$, and positive affect $d = .46$. The effect sizes for the pre-test quality of life scores were: QEL-LS total score $d = .03$, medication satisfaction $d = 0$, and life satisfaction $d = .74$.

While all scores increased based on the time effects, post-test scores for the experimental group generally stayed lower than those reported by the control group participants. The effect sizes for the post-test scores on mental health included: MHI-18 total score $d = .11$, and MHI-18 subscales of anxiety $d = .43$, depression $d = .22$, MHI-18 behavioural control $d = .05$, and positive affect $d = .52$. The effect sizes for the post-test quality of life scores were: QEL-LS total score $d = .31$, medication satisfaction $d = 1.10$, and life satisfaction $d = .41$.

**Time x Group Interactions.** There were no significant time x group interactions for any of the outcomes. Specifically, measures of mental health ranged from $F (1-7) = .001$-$1.11$, $p \geq .05$, and measures of quality of life ranged from $F (1-7) = .269$-$2.032$, $p \geq .05$.

**Physical Activity.** There were no significant group ($F (1-7) = 2.51$, $p > .05$), time ($F (1-7) = 1.66$, $p \geq .05$) or time x group interaction ($F (1-7) = 1.66$, $p \geq .05$) effects for
met/minutes/week of PA based on the IPAQ, and both groups decreased following the intervention. The experimental group did however maintain higher levels of self-reported activity compared to the control group, from pre- to post-intervention. Effect sizes for time were $d=0.43$ for the control group and $d= 0.84$ for the experimental group, while effect sizes for group were $d= 0.92$ at pre-intervention, and $d= 0.87$ at post-intervention.

Accelerometer compliance was low in this group, and will not be reported further for group or time effects. One participant refused to wear the accelerometer. Of the 4 that wore them, the average compliance rate was 59%. However, 2 participants did not wear their accelerometers enough above the required daily wear-time (500 minutes/day) to be able to calculate pre- and post-activity rates. Further information about each individual’s accelerometer use is provided in the Participant Experiences section below.

**Participant Experiences.**

Given the small sample sizes for the group comparisons, a main analysis to better understand participants’ experiences in a PA program is needed. As such, each experimental group participant was assessed separately to better understand within-person experiences in the PA intervention. See Table 2 (Appendix C) for the full individual participant details, and pseudonyms are used to protect the identity of the participants in the study. The data in this section include results from interviews, researcher field notes and individual self-report questionnaire scores, where appropriate. These latter scores of individual changes in mental health and quality of life outcomes from pre- to post intervention are depicted in individual Figures in Appendix D (See Figures 1-5). As a summary, Dave (male trainer with a background in Kinesiology and 11 years of training experience) trained 2 participants including Mike and Matt, while GAF (female trainer with a background in Kinesiology and 2 years of experience) trained X participants including Claudia, Susan and Aaron.

**Claudia.** Claudia was a 55-year-old female with some post-secondary education. Prior to beginning the program, she noted that mental health issues, socioeconomic status and past injuries from accidents were her main barriers to PA. Claudia’s past injuries have affected her mental and physical health, and were a very salient topic during almost all of her sessions. Specifically, she broke her fibula in an accident a few years ago and depended on a cane to get around until recently. Her training in the intervention started slowly and first focused on
standing from sitting to build leg strength and confidence. Her workouts during the program generally consisted of walking around the track and rowing as well as resistance training to help her with her goals of strengthening her back, arms and legs. Claudia strongly disliked her accelerometer as she found it intrusive and annoying. She also noted that it reminded her of her overweight status, as the band went around her waist. As such, Claudia did not wear the accelerometer for enough consecutive days above the cut-off (500 mins/day) to be able to calculate pre-and post-activity counts. She wore the accelerometer for 27 days, but only 7 of those days (26%) were above the cut-off.

Claudia reported initially wanting to become involved in the program out of curiosity, and reported being slightly apprehensive and anxious because of having not been in a gym for a long time. She also noted her age as a primary motive for wanting to become involved:

Because I’m getting older…being in my menopausal years, it is something that I’m seriously thinking about, and I don’t want to end up being you know, if it so happens that I’m still, I’m still on this planet at 80 and 90, that I would have been happy to know that I started to do something. As they say, rather late, you know, sooner than later. And even though its late, and there was a span of time that I didn’t do anything, I can still pick up where I left off.

Claudia noted the far distance between her house and the gym as a perceived barrier to participation. She often also discussed money as being a challenge, and didn’t have a personal phone to use to contact the trainer when late for scheduled appointments. This point was substantiated by the researcher’s field notes, whereby timing was an issue for this participant on a few occasions and she showed up more than 30 minutes late for her first session. However, Claudia noted the ambience and environment of the intervention space were key motivators to staying involved, as well as the trainer:

You mostly, as I told you when I last saw you, you have a very approaching demeanor about you, so it makes me want to, makes me want to be motivated, it’s nice to have a person who can be able to be in that state, and not feel oh my god, I have to get away from this person, let me find an excuse I want to get the hell out of here you know?
Claudia noted various benefits derived from the program, both anecdotally throughout the sessions that were reported in the field notes, as well as in her interview. When she began the program, she expressed fear and apprehension because of her injuries from her accident, and low confidence for mobility. She initially wanted to work on relatively basic movements, such as being able to stand up from sitting without using her hands. She expressed to the primary researcher that she was very grateful to be shown the proper way to do this, and noted that no one had taught her those movements following her accident, “… now I’m sort of feeling that, that there is, that the muscle can be able to have ahh a piece of a sort of a space of safety to maneuver, so I’m feeling that. That invisible safety thing.”

As the weeks progressed, she reported feeling much more confident and competent, and feeling less anxious about going out and about, which was made evident in the researcher’s field notes. She felt better particularly in the context of public transportation, which she had previously found very inaccessible and frightening when she was struggling with low mobility. When asked about mental health benefits derived from the program, she reported feeling less irritated.

She also noted feeling slimmer, eating better and drinking more water. Claudia explained how when she was younger, she liked to attend the gym and used to work out regularly, and how this PA program experience had acted as a type of pleasant deja-vu for her. She emphasized how participating in the program made her realize how much her body has changed over the years, as a woman who is aging. In the field notes, GAF reported that on multiple occasions she brought up her dislike of the mirrors in the intervention gym, and how they made her feel badly about her body.

After the program ended, Claudia reported maintaining her activity levels through home exercises and walking. She said she attempts to do some exercises every day, and walks when it is nice out, but that weather is a limiting factor. She also noted feeling an increased awareness of her body and her muscles during activities, following the program.

**Matt.** Matt was a 27-year-old male and was quite unique in that he was the youngest participant and quite fit, and already had a really high level of exercise knowledge. He routinely walked many hours a week, and would consistently walk from his home to the intervention gym.
(1+ hour) for each session. He seemed initially very skeptical and critical of the intervention program and the potential benefits. Matt was also quite disappointed when he was matched with a male trainer as he had expected to work with the female trainer (GAF). The male trainer had much more training experience and could work with Matt on his goals. Nonetheless, in a later interview with a community stakeholder it was made apparent that Matt felt an attraction to the female trainer (whom he had met during the initial intake) and that explained his disappointment.

Matt’s workouts in the program generally consisted of resistance training to target strength, endurance and hypertrophy. These exercises involved combinations of both upper body and lower body, as he was keen to have full-body workouts. For him, this program was an opportunity to learn even more, and to get to work with an “expert.” He was always very curious and inquisitive, and would ask a lot of questions and for clarifications during each session. He didn’t seem overly motivated by mental or physical health reasons when joining the program, but rather to have this experience with an “expert” trainer at a state of the art facility.

Matt didn’t overtly express and barriers for joining/staying involved. His trainer Dave reported him starting the program with great eagerness and maintaining this eagerness and curiosity throughout the program. The trainer also noted that Matt’s mood increased as the program went on:

Like he was really into like oh I want to make sure that I get a training program at the end, like he was really excited to do it, like he was asking a lot of questions that…And then afterwards he was like really excited and we spent like the last session like a lot of time really going over like what we could do.

Matt reported finding the accelerometer acceptable, and also quite motivating. Matt had satisfactory compliance as he wore his accelerometer over the wear-time cut off 74% of the time. However, his activity levels remained relatively unchanged from pre-to post-intervention in terms of light (pre % time in LPA= 38%; post=37%), moderate (pre % time in MPA= 8%, post= 11%) and vigorous (pre % time in VPA= 2%, post= 1%) PA. While it is unclear what Matt has been doing since the completion of the program (an interview with him was not possible), he was very adamant about his trainer sending him home with a comprehensive take-home program.

Susan. Susan was a 52-year-old female with a college degree, who at the beginning of the program, reported taking antidepressants and tranquilizers during the past month. Susan
reported initially wanting to become involved in the program for pain relief of her chronic pain, and noted fibromyalgia, arthritis, a herniated disc in her back, depression and post-traumatic stress disorder (PTSD) were main barriers to PA at the beginning of the program. She reported not taking any opiates, only Tylenol, and always being in search of possible pain relief options. She initially thought this program might provide an avenue for pain minimization. Susan was unique in that she was very adamant from the beginning that PA had never positively affected her mental health. Despite keeping an open mind throughout the program, she more or less stuck with that belief that she would try the program out, but didn’t have much hope that it would improve her mental state. Susan’s individually-tailored workouts usually consisted of stretching for her back, body weight exercises, and cycling on the recumbent bike. The exercises had to be very specific to reduce back and leg pain.

Other than being sceptical that PA could improve mental health symptoms, Susan did not encounter any barriers to getting or staying involved in the program. However, like Claudia, she also brought up her strong dislike for the mirrors in the intervention space and that they made her very uncomfortable.

Susan reported various motivations for staying involved, primarily social reasons. She noted the social, one-on-one aspect as being extremely helpful for her. Other motivations included:

… the goal to stay healthy, keep my body moving as I age, you know pain relief, I want to be healthy, I want to go into my golden years with grace (laughs). And I know that the arthritis that I currently have will only progress, and so the more I move the better I’ll be later on. And it was always lovely seeing you [GAF].

Susan noted that she did derive physical health benefits from the program, due to the fact that she was given exercises that were different than ones she had previously been prescribed by her physiatrist. She noted liking the fact that there was continuity with the program, so that she could keep doing those exercises and progress with them. As she had a relatively healthy diet going into the program, she didn’t report any major changes to her diet following the program other than focusing on water intake and adding more protein in the form of chicken and eggs. From a mental health perspective, Susan maintained her strong views that exercise does not help her feel mentally better: “I’m not experiencing what others would say [a runner’s high], like my
depression has, it started at the age of 5, I had my first breakdown at the age of 5, so. I’ve been in therapy since age 5.” However, the social benefits were unanticipated and welcomed:

I appreciated your encouragement always umm I appreciated you know even if like, the non-judgemental ways. So it’s yeah it was encouraging. And I do support the whole you know if you’re going to exercise have a buddy. I think that really benefits, at least me.

Susan reported being much more active since the program. Before the program, she had regularly attended a boxing gym, but had since stopped as the gym was too far away from her home. Following the program, she got hired as a volunteer at the YMCA that was very close to her home and this granted her free gym access. She reported working out 3 to 4 times a week, and incorporating cardio as well as core work, and then alternating between upper and lower body workouts. She also noted walking 10,000 steps a day, and that she had recently been given a Garmin watch which she found quite motivating. She noted that even with being relatively active, she still experiences great pain and needing to use Tylenol quite often as well as analgesic rubs. She also consistently stretches in order to try and target the pain slightly.

Susan had the greatest accelerometer compliance of all participants throughout the program, as she wore it above the established cut-off for 79% of the time. She also noted that she enjoyed the accelerometer, and found the weekly activity charts to be helpful and motivating. Similar to Matt, her activity levels remained relatively unchanged from pre- to post intervention (pre % time in Light PA= 27%, post= 30%, pre % time in moderate PA= 3%; post= 1%) in spite of talking about engagement in more meaningful PA.

In the researcher’s field notes, Susan was described as the most difficult in terms of scheduling and maintaining a routine. She had various health issues come up over the course of the program- prior injury, kidney infection, double pneumonia. She ended up having to miss a few weeks so her program had to be extended beyond six weeks. By the end of the program and following her interview, it was clear that although she didn’t find exercise beneficial for her mental health, she still very much valued its importance, noting that a program like this for AIS is very beneficial.
Aaron. Aaron was a 32-year-old male who has completed some post-secondary education. He reported having taken mood stabilizers and antipsychotics at some point during the past 30 days at pre-intervention. He noted that his main barriers for being active at the beginning of the program were low confidence, lack of motivation and feelings of depression and anxiety. Aaron initially joined the program as he thought it would be something positive for his life:

I knew that like ah it was just the right fit for me. Cuz I was doing CBT at the time, and um I was just feeling better about myself and I wanted to, I knew that this was the answer to um like feeling better about myself and yeah…And being more confident and stuff like that.

He viewed the fact that it was at the University of Toronto, a good university, as a promising sign that it would be a good program. He also noted that he was happy to help a study out. He reported being motivated by both physical and mental health reasons when he initially signed up. Aaron also reported that the transition between hearing about the program and starting it, and from AIS to U of T, was very easy. He noted that Jane (the stakeholder/dietitian from AIS) was very helpful.

During his first session, Aaron participated in a range of bodyweight exercises such as lunges and squats, and also some upper-body workouts with weights (biceps curls, triceps curls etc.), as well as some walking around the track at the Athletic Centre. Following the first session, he expressed that he really preferred simply walking around the track, so from then on, most of the sessions comprised of walking around the track at the Athletic Centre at various intensities, as well as a little stretching and bodyweight exercises in the private gym.

Based on the researcher’s field notes, Aaron had a few off days where he either felt sick or tired due to trouble sleeping the night before, but other than that experienced no major barriers. He reported that the prime motivator throughout the program was himself, and the results that he was experiencing:

I think myself. I think the results that I was feeling when I started feeling better, and then at that time I started to weigh myself and I started to see you know like 2 lbs, 5 lbs, 7 lbs, 8 lbs whatever you know I started seeing results and then that just continued to um motivate me to keep going. And it’s motivated me up until now to keep going. And I see myself continue to go into the future and um keep doing what I’m doing.
This participant emphasized the fact that the biggest thing he achieved from the program was weight loss. He noted that he lost 23 lbs with the help of this PA program. Since the program ended, he reported drinking more water, eating less fast food, and choosing to grocery shop and cook food at home rather than have fast food. He reported still being very interested in losing weight and eating in a healthy way following the end of the program. He also mentioned that he was drinking a lot less alcohol by the end of the program.

Aaron reported that his mood had improved following the program, “… like mostly I’m more happier, I’m not umm like angry or depressed or upset or things like that. So I’m more consistently um in a better mood”. He reported feeling increased confidence, not really feeling depressed anymore and that his anxiety felt more under control:

Even now like just day to day anxiety I don’t notice much of it if I do it’s very minimal, compared to before. And ah hanging out with friends it’s just fun, like I’m spending more time with my friends which is great. Which I think before I was in a negative mood so I didn’t want to hang out with friends. But my whole outlook has gotten a lot better. He attributed these changes to PA. He also noted that he really enjoyed the fact that the program was somewhat far from his home (vs. a closer gym) as it really pushed him to overcome his anxieties related to social situations or public transit.

Since finishing the program, he reported maintaining his high levels of walking, mostly on the walking trails near his apartment. He also noted with his increased confidence and decreased anxiety, he had started to walk further downtown, which before he would not have done. He also noted doing home exercises such as squats, wall push ups and lifting weights, and was considering starting to bike around his area as well. While his walking had been maintained, Aaron noted his activity levels had declined since the end of the program, but that he was, “going as much as possible.” He reported completing the home exercises about twice a week and he emphasized the fact that he wanted to maintain the healthy habits he’d picked up from the program:

So I’m just trying to get into the habit of doing it. And I wanna keep up the habit. Like I don’t wanna um like start this and then gain weight or whatever, cuz I’ve been weighing myself um like everyday and I’m trying to make sure that I keep myself at a good weight.
Aaron tried the accelerometer for the first week then realized that he very strongly disliked it. However, he still wanted to track his activity so his daily step count was monitored using his IPhone and then he wrote down his steps and submitted his daily step count to his trainer each week. He was very diligent and regimented about this. When the step counts were calculated into weekly averages for pre- and post-intervention, it was clear that he had improved his activity levels (pre steps= 4504, post steps= 5807).

Aaron was really happy with the program and all of its components. He enjoyed the fact that it was 6 weeks in length, once a week for about an hour. He also really enjoyed the fact that the exercises could be self-selected:

… For me I think the purpose is to lose weight and I lost weight and I did that by being comfortable in the exercises that I chose to do. So in the beginning we did do some stuff that we tried out and for me it didn’t work out, but um you always like gave me the option of doing whatever I wanted, to go back to that style of lifting weights or squats or in the smaller gym. But I preferred going on the running track.

For him, it also seemed like overall, the program in conjunction with his CBT course, and the particular timing, were a really nice starting point for other positive opportunities in his life. He was going to be going back to school at George Brown for a social service worker degree. He was also one of two participants to indicate an interest in sharing what they’d learned with other AIS residents. He also noted wanting to start a walking group at his community home.

Mike. Mike was 43 years old, did not complete high school, and had a previous history of alcohol abuse. Prior to beginning the intervention, he reported having taken tranquilizers during the past month. He was interested in losing weight and becoming generally stronger. His workouts generally consisted of full-body stretching, running on the treadmill, and supersets targeting his whole body. These involved body-weight, dumbbells, as well as TRX machines in the intervention gym.

Mike’s initial motivations for joining the program were to become healthier overall (both mentally and physically) and also to learn proper techniques for working out. He achieved this in working with his trainer:
… I wanted to teach what was taught to me by Dave you know. So, he taught me the right way, like if you’re gonna do it do it like this like don’t just curl and try to pump as many out, just a 5 lb weight you can make so heavy if you just do it right. Like just extend your arm like all the way, and curl it in you know do a 3 count. Like I mean there were so many things taught that were so good you know. Like you don’t need a lot of weight and you can do a good exercise. And be really fit, so yeah.

As the program progressed, Mike also noted that he was keen to stay involved so that he could share what he was learning with other AIS residents:

I’d love to share what was learned. And plus being healthy myself I’m gonna be doing it. So if people are in the building watching me, they can sit around and watch or they can join. And I’d be happy to teach them and participate with something they want to do you know?

Mike strongly disliked the accelerometer and found it very annoying. He wore it for 12 days but only 7 (58%) of those days were above the required number of minutes. As such, he did not have enough data to look at pre- and post program activity changes.

Mike noted he didn’t experience any barriers to getting or remaining involved. He lived quite close to the Athletic Centre so it was quite easy for him to access it. He noted that positive changes in affect were motivating in terms of keeping him involved and getting him to come back. He reported liking the fact that it was one hour, once a week, as he was always ready to work and very motivated for that one hour, because he knew he had to be focused and on. Furthermore, he expressed how he maintained his motivation throughout the program, and found that his trainer was perfect for him:

No ahh just coming to workout and knowing that you’re there at this time and you’re working out for that hour, and you’re gonna put in what you can. And that was the goal like when I showed up. I always was like ready to work. And that’s the thing you gotta feel. You’re like okay let’s do it! I don’t care how it feels lets just do it. And then when you leave you feel so good you almost want to go back in. Which sucks cuz you know its over with but you still want to go back in, “let’s do another hour!” But it’s good, one hour is good you know and yeah that’s perfect. But yeah that’s what it does, it makes you feel
really good. Every time I left there I always felt so good, my days were always happy, and ah yeah I always did fun stuff after.

Mike reported losing weight and being very pleased with this outcome, but also understanding that he still needs to work towards a healthy lifestyle, and that his “work” is not finished yet. He noted feeling stronger overall since beginning the program. This was echoed by his trainer who reported that in almost all the exercises, he was able to lift more weight, perform more repetitions, and rest for less time as the program progressed.

Furthermore, Mike noted that he feels more stable mentally, and like he is more motivated in life in general, “like in other ways you know, not just working out, but like do other stuff, like for myself… Which is good.” These gains were also noted by the trainer, who observed that Mike’s motivation greatly improved from beginning to end of the program. The trainer described that initially, Mike had quite low self-esteem and didn’t believe he could perform the exercises. According to the trainer, Mike would also body shame himself and say how he didn’t think he could complete an exercise because he was too fat:

And then after like, even after the first session, after the first 30 minutes he was like really like oh man like I couldn’t believe I could do this, like ah and then after the 3rd session like I remember we used to do a lot of things on the treadmill. And he was like okay let’s increase the weight let’s increase the resistance like, he was really, he wanted to just do more. Which at the first session he was always like more like oh I can’t do it, his self-esteem was a little bit low. So towards the end it was good to see that like he wanted to do things on his own.

Since finishing the program, Mike reported cycling about an hour every other day. He noted that he usually does so with a friend who also likes to bike. He also has been using a Gazelle machine (an elliptical trainer) as well as an ab buster in his home, and reported consistently completing 60 sit ups every day. He also had been continuing his workouts that he learned from the program on his balcony at his AIS home, using resistance bands. Again, he expressed his willingness to share what he had learned with his housemates, both during his
sessions and during his interviews. His trainer noted that during his last session, Mike asked a lot of questions about how he could create a program like this for the other people in his house, and that they would really benefit from it. In his interview, he additionally expressed, “I said I’d be happy to teach anybody if they’re around when I’m doing it. You know if I’m gonna be down there working out I’m happy to do it if other people would be there. And share equipment and stuff if they don’t have it.”

Mike’s trainer reported a few challenges with working this client, particularly his initial struggles with focus and physical health. He would usually take about 10 minutes to get focused enough for strength training. At times, he also would have slept very poorly the night before:

Like one session I think we had to stop short just cuz he was ah, he had a really rough night the night before, so physically, he wasn’t able to do anything. Ah so it was a little bit challenging in that sense. They have other things going on, on the side…

His trainer also expressed that he felt he had to be sensitive to and conscious of specific conversation topics, and stay away from those that might upset Mike:

And sometimes there was a few like trigger conversations, that he knew he was getting upset. So he himself decided to like you know what, let’s just not talk about that, let’s just keep exercising. So he did that a few times, and eventually I kind of knew like what kind of conversations we should be having, to make sure that we were maximizing the time right. Like a lot of the times he was really good at just recognizing look I’m getting really upset, let’s just keep working out. Like sometimes we’d be resting 40 seconds for one set, and just between the 40 seconds, like the 40 seconds weren’t done, but he wanted to keep going just because like in my mind I think like he wanted to keep his mind busy, instead of going to whatever his thoughts were that were leading to.

As this participant had also struggled with alcohol dependence in the past, his trainer had to be conscious of this and check in about this during every session, to ensure there were no safety concerns.

This participant was consistently on time and on schedule, and tended to book his session a week ahead of time and then arrive on time for it. The only time he needed to reschedule a session was following the death of his sister. Despite this setback, he continued participating in
the program, and noted that he felt it helped somewhat with his grief, and that it made him stronger.

Feasibility and Acceptability. Prior to beginning the intervention, feasibility and acceptability were defined. Acceptability was initially defined as having over 80% of participants indicate above the midpoint of the program satisfaction question in the post-intervention questionnaires. Indeed, all participants reported being very satisfied with the program (on a 1-4 scale), indicating a high level of program acceptability. Furthermore, researchers initially identified that the program would be viewed as feasible if over 80% of participants completed all 6 weeks of the program. Indeed, all 5 participants (100%) attended all weekly sessions and completed the program, indicating a high degree of adherence and retention, and a highly feasible program. To further understand the exact specifics regarding program feasibility and acceptability, interview findings are elaborated on in the sections below.

Program Development and Recruitment. Throughout the process of this program’s creation and delivery, the nutritionist at AIS (Jane) was a key champion. Her interview, as well as informal discussions before and during the program provided insight into the challenges of recruitment in this population. The first challenge was creating the connection with the University of Toronto and garnering buy-in from the community workers with AIS. Specifically, once the program was deemed appropriate to start, ethics took some time and this caused some issues with the staff at AIS:

I kind of did a bit of a reveal, but then there was nothing happening for a long time. So I would hear derogatory comments about that thing, or you know people would know, I guess some people in terms of my colleagues, their interest, or I guess they were a bit skeptical. Cuz at first they thought it was kind of cool, but then nothing happened, so then they got skeptical and um I had to keep them up to date, and hopefully keeping them lifted to the idea. Never my boss, but the community support workers you know who I need to rely on to build encouragement and use as an entry point into different high functioning AIS clients.

Besides this issue, the staff at AIS were generally very supportive of the program. However, some of them also voiced concerns about the fairness of the program, and the recruitment strategy. Jane had to emphasize that this program was a pilot, and that she had to
selectively choose people that she thought would participate and complete the program. In her interview, she explained various factors that were considered when telling AIS clients about the program:

You know, not just readiness but mobility, and I didn’t think it was appropriate for, I just thought individuals who needed wheel trans to get to MPARC was too much of an obstacle and barrier. It might have put at risk their ability to continue on the line and I didn’t, I wanted people who could power there on their own to participate in your program. I think it made more sense…. So in all fairness, we, you know, the program was offered to 10-12% of AIS clients, which I think is fine.

She also emphasized her lack of clarity on whether the program would work, and her relief that the participants adhered to the program:

…At the very onset of this program, I was told by my colleagues that you’ll never get them out the door, they won’t go. Or if they do go, they’ll go once but then you’ll lose them. And that, that really concerned me … that really worried me, that they would drop off, and that you would be left hanging. So that scared me, because it was your thesis right? So that was a worry, but they did! And that was wonderful, that made everybody sit up and take notice. Because the 5 that were involved, stayed involved, to the best of their ability… so that was a big a-ha for both of us you know, that was great.

The five experimental group participants were seen as a very positive outcome when compared to other programs offered by AIS. For example, Jane compared the program to other community events:

So for instance, we have a community development program right, and that calendar has upwards of 20 activities every month. And yet the same 6-10 people always go. So that is advertised across and promoted heavily every month to every AIS client. But still, only the same 6-10 people show. So I don’t think you know I think a PA program is going to be treated the same way, because of that community development programming, the same, included is a weekly yoga class, and weekly walks in different parks and neighborhoods. Which includes the provision of snacks and food, and that still isn’t necessarily a draw.
Jane also felt there were some individuals who would not be referred to the program and who tended to be severely mentally ill or unstable. As she explains:

I don’t think those [individuals] will ever be candidates for student programming, because the situation is just too dicey and too unpredictable, to put a young student in front of. I wouldn’t want that responsibility, because you never know.

To address this concern, the outcome of this pilot led to the formalization of a placement agreement with AIS to have a Kinesiology student work with AIS clients to build and deliver PA sessions. The staff at AIS have purposely structured her role so that she targets those individuals who were unable to participate in this PA program:

She has been positioned differently, she was introduced to all of them through Community Development programs, so she’s met and ah has had a lot more exposure…so her experience and her introduction to AIS clients has been completely different. So that a greater number of people have been exposed to her, so that those who, so her reach, or the way I created the opportunity for connections and interactions was different for her than for you.

…What I’m trying to do is not, is I’m trying to involve her in people that you didn’t [reach] so that she is um you know penetrating the AIS clients differently. And because there isn’t MPARC to go down the street to, [she] has to do it in home. So she can work with people who are unique, people who need wheel trans to get to MPARC who wouldn’t… so what I’m doing is I’m sliding her in with people that wouldn’t necessarily have completed 6 weeks.

This was a positive outcome of the pilot program, and addressed a concern that Jane had consistently throughout the development and implementation of the PA program. Specifically, she often discussed how best to target AIS clients who are not motivated to participate in a PA program. She noted that she viewed a home practice as the best option. However, she recognized that even with home practice, there would still be issues present. In reality, it really would not be feasible to be able to reach every client to provide PA:

…But even still, there is a majority who wouldn’t let you through the front of their door, and you may not want to go into their apartments either, for various reasons. For safety
reasons, personal comfort - I mean if they smoke three packs a day, I mean it’s pretty hard to get past the threshold. AIS clients are aging rapidly, not only, primarily from the disease state and its manifestation, but also from chronic drug use, of pretty strong medications right? So, they age fast, and a big part of the problem is that these people have nowhere else to go. So they are candidates for long term care at 60, 65. But there aren’t the beds. So they may not be you know, not all AIS clients are necessarily the right, are candidates for a PA program, because they’re getting closer to um needing care.

Finally, Jane had initial reservations about the resource-intensiveness of the program that were mitigated by the participation rates and the independence of the participants:

…Once they met you, they were able to establish their own meetings with you and get there and they called me when they needed me, but it was turnkey, it was turnkey, so I was really thrilled with that. I think they felt enough sense of agency, which was exciting, to you know make their appointments, follow through, and adhere to I assume? What you and Dave were teaching.

Program Benefits. There were three overarching aspects of the program that repeatedly came up in trainer, stakeholder, and participant interviews as well as researcher field notes as positive program elements, including the gym space at the University of Toronto, the trainers, and the individual-tailored and flexible program.

University of Toronto gym. When the program was initially being designed, through talks between U of T and AIS, it was unclear whether a program at U of T would be best, or whether it would be too far for participants. Other options included having a home practice, or meeting at a gym closer to the participant’s home. In the end, the sessions were delivered at MPARC at U of T, which was very well received. Some positive features included the general athletic atmosphere of the building, “whereas there, it felt like as if it was a whole aura of umm ahh physical stamina, you know what I mean? So there was stamina in the air (Claudia)” and the equipment, “I loved the fact that it was at U of T. I found the equipment extremely innovative. You know I had never seen equipment like that before (Susan).” Also, while initially anticipated to be a challenge, transportation to and from the program was seen positively by several participants:
It got me out of my apartment, out of my head and ah you know it forced me to take transit which was a major problem for me to do. .. I knew that I would be welcomed by someone who was friendly and comforting and you know it was enjoyable, it was. (Susan)

I liked the fact that I had a chance to get out of the apartment and take the TTC, so it’s better for me personally to go a little bit further to um meet with you and to exercise rather than just going here to the YMCA cuz here might be too easy. (Aaron)

Furthermore, the participants and stakeholder also discussed the respect for the trainers and use of the facilities [e.g., “U of T was good, it kinda made me work harder because I’m coming there and I don’t wanna waste anyone else’s time, and plus I wanna do good. So it worked out really well for me” (Mike); “Well you and Dave, but also the facilities. They made them feel special, definitely. There was a certain sense of privilege, that they experienced in the endeavor that, I mean they probably had never encountered before (Jane)].”

Though the location of the program was an initial uncertainty during program development, the choice of the University of Toronto gym ended up being positively regarded by all participants.

*The trainers.* The participants also reported very positive feedback about the trainers and their expertise. They noted that they felt very safe and secure, and that they were not pushed beyond their limits. As mentioned by two participants:

I’m gonna tell you Garcia you’re a phenomenal person. You know, I adore you. You know you’re easy to be with, um as I’ve mentioned previously, non-judgemental, caring, supportive, there you know, and I know that there were weeks where I couldn’t attend because I had pneumonia… And it was like, “No problem, no worries, whenever it works we’ll get together.” So no, I’m glad you were the person. You know, I felt welcomed, I felt safe, I felt secure, and I felt very comfortable just discussing anything with you. (Susan)

Mike also reported positive feedback towards Dave:

Yeah he was awesome! Very good, for someone who’s training someone to work out who’s never done it before, and the way he just kept saying you know do it like this, this
is the right way, you know. Now that teaches me so that when I do it, or if I show someone I show them exactly how I learned it. So that’s good, I liked that.

Jane also echoed the importance of the respect and relationship between the trainer and the participant. In the post-program questionnaires, participants were also asked if they would have preferred a trainer who was closer to their age, or who was another individual with a diagnosed mental illness (for example a peer from AIS). However, all participants reported preferring individuals with backgrounds and knowledge in exercise science, and as such reported high acceptability with the two trainers.

One-on-one, tailored, and flexible program. All the participants responded positively to the fact that the sessions were one-on-one. They noted that they preferred this to a group session, as Susan describes:

I enjoyed the one-on-one. Perhaps that’s a little selfish of me but at least I had your total attention. And you were acutely aware of you know what I can and cannot do…So it was good to have that type of support. In a group program, I don’t think. It would be hard right. It would be more challenging. I mean the person would have more people to connect with. So yeah, I did enjoy the one-on-one. I’d never had that before so, it was a positive.

Jane also discussed the value of the individualized training:

…The flexibility of client-centered, one-on-one interventions that were tailored so that was awesome, that you and Dave provided. Having MPARC to go to, that was the deal breaker, a lot of AIS clients and a lot of other people who suffer from schizophrenia feel like they’re on the journey alone, you know so people don’t understand them, they’re dealing with stigma, so the fact that they were invited to U of T, to have one-on-one consultations to help them feel better and be better, increased their sense of value and self-esteem, and optimism.

Furthermore, the program was flexible and this appealed to many of the participants. Aaron noted anecdotally that he loved the fact that he could choose what he wanted to do each week, and that he did not have a set program. Mike felt like the program and its weekly sessions gave
him a sense of routine in his life, which he appreciated. In their interviews, Claudia and Mike also expressed the value of autonomy:

I did like the fact that we had a nice little room to ourselves and I was able to you know go through all the machines. And you know all the machines took care of you know different parts of the body and you know, did some rowing. And you know, I felt after I was done, that I had had a workout. And because I was I guess doing it with another person, and doing it with a professional, that I was in and I was out. You know there was no lingering or you know someone looking at me, or I had to wait for the machines you know it was in and I was out. So I was very happy with that. (Claudia)

Mike explained that the autonomy and personalized program led to achievement:

Oh yeah, I thought it [the program] was beautiful. It was perfect yep, it went around my schedule of what I wanted to do and it got me from like walking really fast to almost a little jog there at the end.

Overall, participants, stakeholders and trainers reported that the one-on-one, tailored nature of the program fostered autonomy, achievement and self-esteem.

Program Challenges. Participants, trainers and Jane generally noted a few aspects of the program that they would modify for future implementation. The most consistent challenge was the program length, and all individuals felt that the program could be longer or at least incorporate more sessions per week. This is in retrospect, since there was initial uncertainty about whether the program would be feasible at all:

I think that it could have gone 8 weeks, um but we were both uncertain whether or not that was even going to be a possibility. So it was 6 weeks, but I think with the clients that were involved, they would have liked 8, 10 maybe 12 weeks. So I think that was key learning. Yeah cuz some of them, cuz they were slow starters or late adopters, it was over before they really got much purchase you know in the whole thing. (Jane)

As Claudia articulates, once a week may be beneficial as a starting point but then the program could become more intense over time:

I think once a week, once a week for maybe a couple of weeks, and then up it, twice, I think I would have got more from it, if I would have went more times. Although I was, I
anticipated going that once a week after not being in a gym setting or gym people for a long time, that once a week was good. But after I’d gotten the round of it then I realized hmm, maybe it would be good if I could just up this to twice a week.

Mike also addresses the possibility of making the program more intensive as time passes:

“So the one week [once a week] yeah it kind of yeah it’s good though cuz its just taking people for their first time and teaching them like the rules of how to like workout right and how to build your core and do all that. So I think that’s perfect. So yeah like once a week I’d start and then that could be like a first submission kinda thing and then from there whatever if someone wanted to do twice a week whatever, but yeah I think the one worked out perfect for me. Just made me want to work out harder.”

To Mike’s point, his trainer Dave articulates the challenge of only working with him once a week:

Like every session we had to do like a quick review of some of the things we’d done in the past, which I mean is understandable like if you’re not gonna be working out somewhere else, once a week it helps, but is not ideal. So yeah increasing the timing is probably better.

Susan mentioned wanting a longer and more extensive program, although she also recognized her health was already a barrier and there would need to be flexibility in a more intensive program, “if I were to re-enter a program like that, twice a week would be ideal, but with the understanding obviously that I’m not a well person and scheduling may be challenging at times.” Indeed, the primary researcher expressed in her field notes that this participant’s physical health issues led to numerous scheduling issues. With this in mind, the scheduling of programs such as this needs to be flexible to account for the comorbidities and consistent yet unstable barriers that arise in working with individuals with serious and persistent mental illness.

Both trainers also expressed concerns about their own scheduling difficulties, as busy Masters students, for example having to schedule a participant’s session on a different day than usual because of a conference the trainer had to attend. These factors must be taken into account when thinking of program sustainability and trainer selection.

Indeed, each participant was unique as a person in general but also in relation to their illness, symptoms and physical comorbidities. The primary researcher reported in her field notes
that different participants would divulge varying amounts of personal information, or information about their mental health. This proved to be a challenge as the trainers are not qualified as mental health professionals, and highlights the need for more clarity regarding the role and qualifications of trainers in such programs going forward. It may be that greater communication between the trainers and each participant’s mental health care clinician is needed, or that the trainers should have some level of mental health training. The field notes also noted the researcher’s challenges of constantly having to portray herself positively to participants. For example, if she was in a negative mood because of personal issues, she felt she had to control those emotions when in a session with a participant and appear as though she were in a good mood. Again, it may be that further training in mental health care may address how to present oneself when experiencing these emotional issues.

There is also likely added value to a program with greater volume of PA, in particular for physical health benefits. As mentioned by Dave:

It depends on the objectives. Because I felt like 6 weeks they were getting a lot out of it, um so if we want to do like for example if we want to make sure we see more physical changes, then I feel like maybe having more time would be better…so maybe twice a week I feel like in regards of like getting to know the client, it would have been a little bit better.

This feedback regarding program length can be used to inform future programs, while also taking into account available resources such as trainers and gym space.

Aside from the program length, Jane and Dave also expressed separate aspects that they might change to the program. For example, Jane discussed how if she had the opportunity to facilitate this program again, how it would be important to have more shared resources to follow up with participants once the program ended. She noted that she felt there was a discrepancy in communication between the participants, the trainers and her in terms of the details of the PA programs. She wanted more information that she could use to help them sustain the program:

I think I would have liked to have seen their home practice material, so that I could have helped with the continuity piece… You know, to help me help them, stay on line. Or, find alternatives in the community, you know, other ways. And so now I’m working with Levi [the Kinesiology placement student], and so having known what [Mike] was trained,
would be helpful for me to say to Levi listen, so this is what his instruction was, you know, talk about these points and maybe build on, it would help her to know, how to move forward.

These are valuable points for building a sustainable program, and emphasize the need to collaborate with community stakeholders to help participants adhere to a program. It was also clear that Jane was motivated to use PA within the individual care plans for her clients.

Another challenge that Jane mentioned was with participant recruitment, and she felt she wanted a program where every AIS resident would have access. The major challenge with this is the diversity of the clients:

“I guess my struggle is, I’d like to create a program that has open access to everyone, but because of the nature of the individuals that I’m working with, and their struggles with cognition, executive reasoning, and memory, I feel that um open access would create confusion, and possible problems that I couldn’t even predict or see coming.

It was clear that Jane struggled with recruitment and that her colleagues felt the program was not offered to all clients. This expectation was hard for Jane to manage, and she goes on to mention constraints with personnel that limit the program offering:

…So, how would I structure it [recruitment] differently. If I had a second research student like yourself come onboard, maybe open, have a couple open accessed events to see who shows up. So, I could say to my colleagues okay, there was free and open access opportunity for people to come… And then I could say to my staff or to my colleagues, you know what? They had an opportunity, they were all invited, and the same 10 people came. So that’s who I’m working with, and you know, then I would have felt off the hook that I had opened it up to everybody. And that’s probably what I would do differently, so that that open access democratic piece was ticked off.

Dave emphasized the fact that this program and study might have been more robust had there been more physical health measurements in order to see and measure these changes in the participants, “… if we could record like some data at the beginning like I mean like a few measurements, like maybe just in regards of like body composition assessment.” Nonetheless,
Jane mentions that these measurements might be valuable but are not needed based on what she heard from the participants:

…I think they felt, those who participated, that it reduced their feelings of stigma, I do, I really do. Which is a big thing. So even if you didn’t move you know push the penny forward on cardio metabolic benchmarks or A1Cs or Vo2 max values, even if none of that changed, if a person felt less stigmatized, within this population, I think that’s huge. I think that’s huge.”

In summary, there were no significant group effects for any of the mental health, quality of life, and PA outcomes. There were also no significant group by time interactions for any of those outcomes. For the Mental Health Inventory total score, and the scores of its anxiety and depression subscales, there were significant time effects. Notably, there was a very large effect of time on the experimental group, but not the control group. Based on participant, trainer and stakeholder interviews and researcher field notes, the program was widely viewed as feasible, acceptable, and very enjoyable.

**Discussion**

The purpose of this study was to assess the feasibility, acceptability and effectiveness of a PA program for individuals with SMI from a local mental health housing organization. Based on triangulation of quantitative survey data, accelerometer data, interviews with participants, key stakeholder and trainer and researcher field notes, it can be concluded that an individually-tailored PA program was feasible and acceptable for the small sample of heterogeneous individuals with serious and persistent mental illness.

Qualitatively, all participants expressed really enjoying the program and its various aspects. They also expressed that it made them feel better both physically and mentally. Program trainers and the key stakeholder at AIS also expressed their support for this program, and emphasized the fact that it was not resource intensive. Quantitatively, participants in the intervention group tended to increase in indicators of quality of life and mental health, from pre- to post- program. Levels of PA did not change significantly from pre- to post-program, however, the participants didn’t view the accelerometers as acceptable, and thus issues with compliance likely played a role with pre- and post- intervention activity levels.
Interestingly, the control group started higher, and increased on all measures. While the experimental group started lower, participants consistently increased on all measures. However, the effect of condition was not significant for any of the outcome measures. Similarly, in a large-scale study in the United Kingdom, mental wellbeing was maintained among controls and PA intervention participants over 12 months, however there was no significant effect of condition or time (Get Set to Go Consortium, 2017). This is in line with our wellbeing measurements (QEL-LS scale) which also showed no significant effects of time or condition. One possible explanation for the differences between control and experimental responses may be due to the cognitive and/or vision problems that were reported by two of the control group participants who wanted to be read some questions instead of filling out the questionnaires independently. While individuals in the intervention group may have also had similar problems, they did not ask the researcher for any assistance and thus completed their questionnaires independently. This may have lead those individuals in the control group to answer in more socially desirable ways. Furthermore, individuals with severe mental illness may experience issues with comprehension and introspective ability (Philippi & Koenigs, 2015). Depending on their mental illness, their introspective ability and self-reflection may either be diminished, heightened, or altered (Philippi & Koenigs, 2015) which may have also led to inaccuracies in reporting in either control or intervention groups. Furthermore, as symptoms of mental illness can vary greatly day to day self-reported mental well-being is difficult to ascertain (Holmes et al., 2016). Indeed, it may be that at the exact moment of completing the questionnaire, a participant is in one affective state, but shortly after that shifts completely. The timing and context specific nature of self-reported mental health measures may have also lead to inaccuracies in reporting in both groups.

At a group level, the experimental group improved in all aspects of mental health and quality of life. This is consistent with previous studies of PA interventions among individuals with SMI. For example, Hoffman et al. (2015) conducted a community based, tailored exercise intervention for people with SMI and found positive changes to participants’ mental health outcomes and mood. This was also found by the Get Set to Go Consortium (2017). Interestingly, the experimental group changed the most from pre- to post- on the medication satisfaction stand-alone item of the QEL-LS scale. This is promising and very important, as among individuals with SMI, non-adherence to medication is upwards of 60% (Kreyenbuhl et al., 2016). These
results are also in line with those of Druss et al. (2010) who compared medication adherence among individuals with SMI in a peer-led medical self-management intervention, and in a control group, and found those who had completed the intervention had much greater medication adherence (14% improvement). It may be that improved satisfaction could lead to improved adherence, and ultimately better control of their health mental illness. Future research should examine the exact mechanisms behind the relationship between PA, medication satisfaction and medication adherence.

Within the experimental group, various positive changes to mental health and quality of life were noted. In addition, based on the qualitative interviews and reflection in the field notes, many participants reported feeling increased confidence, competence and self-esteem, and noted improved physical health. These improvements in both mental health and physical health are in line with similar PA programs for individuals with serious mental illness, however, it is difficult to compare findings given the heterogeneity in PA delivery. For example, many PA programs in this population involved group based PA (Golberg et al., 2013; Beebe et al., 2013; Gomes et al., 2014). This was done to encourage social support among the participants, which is not only a known key mechanism for PA initiation and maintenance, but has also been linked to recovery in this population (Hoffman et al., 2015; Hendryx et al., 2009; Corrigan et al., 2004). Though our program involved one-on-one training, participants reported finding the social aspect between trainer-participant to be one of their favourite aspects of the program. Interestingly, it was only the females that spoke about this in their interviews. Other PA programs in this population have utilized a peer-support model, with individuals with SMI serving as the PA trainers/leaders (Get Set to Go Consortium, 2017). However, in the post intervention interviews, all participants noted that they preferred the trainers to be exercise specialists rather than peers. In future work, it may be important to measure the relationship between the trainers and the participants. For example, therapeutic alliance, the concept of the relationship between client and therapist that is characterized by warmth and support, could help to explain effects on mental health and quality of life (Ferreira et al., 2013). Indeed, in the PA and mental health literature the effect of the therapeutic alliance has yet to be tested and thus is a direction for future research.

The duration of the program may explain the lack of significant effects over time or between the groups. Many previous studies have been of longer durations, such as 10-12 weeks.
As this project was a feasibility study with AIS, a shorter timeline (6 weeks) was agreed upon with the key stakeholder, as the organization wasn’t even sure if the participants would show up, and thought a longer program might be too much for participants to commit to initially. However, after completing the program, it was clear that all participants would have preferred a longer program. Based on the existing evidence of PA leading to positive changes in mental wellbeing, interventions involving yoga, walking, aerobic exercise or resistance exercise reduced symptoms in populations with depression and anxiety, while general PA and yoga have had positive effects on the mental wellbeing of those with schizophrenia (Rosenbaum et al., 2016). However, the existing evidence does not provide concrete conclusions for ideal program length, frequency, or intensity, and varies greatly by population (i.e., schizophrenia, depression, anxiety, bipolar disorder). There is some clarity in the depression literature, which suggests the use of supervised aerobic exercise, performed three times a week, for at least 9 weeks, at moderate intensity, is effective (Stanton & Reaburn, 2014). In terms of increasing PA and decreasing sedentary behaviour in this population, the effectiveness of interventions remains unclear. As such, the exact conditions for creating PA change such as program length, frequency and intensity also remain unknown (Ashdown-Franks et al., 2018). It is clear that more research must be done to elucidate the exact intervention conditions to foster positive changes in mental wellbeing and PA levels for individuals with various SMI diagnoses.

This program did however share some similarities with other previous programs. Participants reported very much preferring the tailored nature of this program to a group-based program. This is in line with Hoffman et al. (2015) who prior to beginning their PA intervention, conducted focus groups with individuals with SMI and learned that a tailored program, rather than a more structured program was preferred. This also addresses the call of Firth et al. (2017) for future PA interventions in this population to consider the tailored nature of PA programs in order to address motivational issues, and to consider participant preference in order to maximize engagement. All 5 participants reported really enjoying the fact that the gym sessions were community-based, rather than home-based sessions. Indeed, there have been previous studies in the literature that were effective in community settings. Specifically, changes in IPAQ total met/mins have been seen follow other similar community-based programs (Hoffman et al., 2015;
Importantly, though there were only 5 participants in this study, this has been seen in similar studies that looked at PA counselling in individuals with depression (McFadden et al., 2017) and schizophrenia (Gorczynski et al., 2014). As such, the strengths of single subject designs have been reported, and this type of study can be used to support larger scale experimental research that may have generalizable results (McFadden et al., 2017; Gorczynski et al., 2014).

Overall, the study’s high rates of attendance and program completion support the feasibility of a PA program for individuals with SMI from a local mental health housing organization. This opposes much of the literature in this field which reported lower adherence rates in this population (5/14 participants dropped-out after 10 weeks, Firth et al., 2017, 44% of participants withdrew, Chapman et al., 2017), though our findings must be taken in the context of a small sample size. Adherence was high, likely because the program was individualized around each participant’s capabilities and goals. Indeed, Chapman et al. (2017) advocated for the need for community-based exercise programs to be tailored to participant abilities in order to maximize adherence and reduce withdrawal rates. The trainers and stakeholder also highlighted the fact that there were no adverse events, safety concerns or injuries throughout the program, also supporting the feasibility of this program. Furthermore, the acceptability of the program was highlighted through his program satisfaction ratings as well as interviews with trainer, stakeholder and participants. These levels of acceptability are consistent with recent research in this field (Chapman et al., 2017, Campos et al., 2015) and highlights the fact that PA may be an acceptable adjunct treatment for serious mental illnesses.

Limitations, Future Directions & Conclusion. This study is not without its limitations. Convenience and targeted sampling was used, and the study had a very small sample size. Furthermore, this population is one that may have lower cognitive ability than the general population, and may struggle with issues such as memory recall (Dickinson et al., 2007; Mann-Wrobel et al., 2011). As such, using self-report instruments that require them to recall the past week, such as the IPAQ, may present some measurement constraints.

The use of accelerometers in this study presented various problems. The participants generally found them quite annoying and intrusive, particularly the participants who were overweight. This contradicts what has generally been found in this population with the use of
accelerometers and other wearable devices, which have been widely accepted by SMI participants (Gorcynski & Faulkner, 2014; Naslund et al., 2016; Stubbs et al., 2017), however feelings of paranoia associated with such devices in this population have also been reported (Gay et al., 2016). One possible reason for this discrepancy in accelerometer acceptability between this study and others may be due to the fact that the accelerometers in this study were waist worn, while others are generally wrist worn. Future studies should consider using the wrist worn accelerometers and for only 7 days (i.e. one week pre, one week post) at a time, in order to maximize compliance.

In order to be able to gain a more complete understanding of both physical and mental health changes, some more physical health measurements may have been useful, as the one trainer mentioned. Measurements of weight, body composition and strength, before and after the intervention, might have helped with this. However, the program was intended to create positive changes in mental health and quality of life, so the messages behind these measurements would have to be delivered carefully so as not to emphasize weight for example, as many participants were self-conscious of their weight.

Finally, some measurements regarding acute affect may have made the results more robust. The PANAS Scale (Watson, Clark, & Tellegen, 1988) and Feeling Scale (Hardy & Rejeski, 1989) could have been given before and after each participant’s session, to assess acute changes in affect. Furthermore, if participants had been given accelerometers for only 2 weeks, they could have also been given Feeling Scales (for example in a daily journal) to complete for each day of those 2 weeks. This would have allowed associations to be inferred between amount of activity (or amount of sedentary time) and affect. This technique was employed in the community-based Get Set to Go study in the UK, which found significant associations between minutes of exercise and acute mood (Get Set to Go Consortium, 2017). In that study, they provided participants with PA and mood diaries, in which they self-reported PA, and completed the PANAS (Watson, Clark & Tellegen, 1988) and the Feeling Scale (Hardy & Rejeski, 1989) for 7 consecutive days. Having participants complete a mood diary and use accelerometers instead of self-reported PA could provide very useful insights into the relationship between objective activity and acute mood.
These limitations are inherent given the fact that this was a pragmatic study looking at the effectiveness of a real life, community based program. As AIS was very keen to have this program begin, and their clients knew about the program before it was able to be offered, decisions on which measurements were to be used had to be made somewhat quickly. As such, most measurements were based on the MoveU.HappyU program at University of Toronto (https://kpe.utoronto.ca/academics-research/research-units-labs-centres/mental-health-physical-activity-research-centre-2), rather than tailoring the measurements to this exact population. This speaks to the issue of feasibility and also efficacy vs. efficaciousness in a project such as this. A final consideration that also must be made with these results is that in previous research, individuals with SMI have reported a desire to please researchers, and their answers to questionnaire items and interview questions may have been altered due to the inherent power balance between participant and researcher (Grant, 2015). This re-iterates the concerns of using self-report with this population.

The small sample size of this intervention was mainly due to difficulties with recruitment, such as lack of interest, lack of motivation, safety concerns and mobility concerns. Such challenges are very common to lifestyle interventions in this population, and are in line with findings of Kanuch et al. (2016) who also noted transportation difficulties and intermittent telephone contact as further challenges. The key organizational stakeholder in this study also mentioned that difficulties with contacting potential participants, either by telephone or in person, proved to be difficult. Similar issues were faced by Firth et al. (2017) who only recruited 27.5% of their target population, and Lee et al. (2014) who recruited 55% of theirs. Taken as a whole, our results are in line with those of past research, and that of Hampton, White and Chafetz (2009) who expressed the difficulties of recruiting and retaining individuals with SMI in research.

In spite of the limitations, this PA program, in conjunction with a local mental health housing organization, was found to be feasible, acceptable and effective in some quality of life and mental wellbeing domains. However, various recommendations were given by participants, trainers and a key stakeholder in terms of creating an improved program in the future. The majority of the participants reported that a more extensive program, consisting of more weeks, or more sessions per week, would be preferred. A more sustainable program, for example with
more communication between University of Toronto and AIS when each participant finished the program, with their program specifics, would also have been preferred. More objective, robust and acute measurements would also be helpful for this type of program in the future. To conclude, the program was very successful, as described by the key stakeholder, “no one walked away with a deficit, everyone walked away feeling more empowered and special.”
Chapter 4
General Discussion

In Canada, mental illness is a primary cause of disability, and carries with it a large economic burden (Lim et al., 2008). In addition to the mental illness itself, individuals with mental illness also frequently have physical comorbidities and often live 10 to 20 years fewer than the general population (Walker, McGee, & Druss, 2015). This large mortality gap is disconcerting and strategies are needed to help improve both the mental health and the physical health of this population. While PA may be one such way to do so, individuals with SMI engage in significantly less PA per week (Vancampfort et al., 2017). This is partially due to the various barriers they face to getting active including lack of motivation, lack of knowledge/resources, pain and the side effects of medication (Firth et al., 2016). As such, the current study aimed to design and evaluate a community-based PA program, specifically tailored to each individual and their reported barriers, to examine if a PA program could be feasible, and if it could lead to changes in mental health, quality of life, and PA outside the program.

To address these study aims, 10 individuals with SMI were recruited to participate in a PA intervention (5 experimental group and 5 control participants). Self-report questionnaires were completed at pre- and post-intervention timelines (approximately 6 weeks apart) and the experimental group participants were asked to wear an accelerometer and to participate in a one-on-one interview following their involvement in the program. There were no significant differences on any of the self-report mental health or quality of life outcomes between the groups, however there were significant effects overall for time for symptoms of anxiety, depression, and the total score on the Mental Health Inventory, indicating improved mental health. Looking only at the five experimental group participants, each individual improved on all outcomes. Notably, there was a significant improvement in medication satisfaction among these individuals, which is of high importance as there are high non-compliance rates with medication in this population, which can lead to other health issues (Kreyenbuhl et al., 2016). Finally, all participants, key stakeholder and trainer supported the feasibility and acceptability of this program, while also offering some suggestions about sustainability and program length. Taken together, these findings can provide support and recommendations for similar tailored, one-on-one, community-based interventions among individuals with SMI.
Theoretical implications

While the current study did not focus on testing a specific theory, there were many important theoretical predictors incorporated in the design of the PA program and consequently the present study offers valuable insights and advancements into both the Exercise and Self-Esteem Model (Morgan and Soenstrom, 1989) and the Self Determination Theory (Deci & Ryan, 2000) in the context of a PA intervention for individuals with SMI. In this population that struggles with amotivation and consistently reports low motivation as a barrier to PA both in the current study and in empirical evidence (Firth et al., 2016), elucidating which components of these theories foster motivation is of utmost importance.

**Exercise and Self-Esteem Model (Sonstroem and Morgan, 1989).** Sonstroem and Morgan’s Exercise and Self-Esteem model (EXSEM; 1989) explains how PA can lead to changes in self-esteem through changes in physical self-efficacy, physical competence and physical acceptance. Indeed, various participants reported feeling changes in self-perceptions over time, which ultimately improved their self-esteem. In the present study, there were changes in physical competence and physical acceptance reported by participants and trainer, which were discussed as leading to improved self-esteem. This evidence is primarily based on the interviews since self-esteem was not assessed explicitly, but future interventions could focus on collecting relevant self-esteem data in this population.

**Physical Competence.** In this model, physical competence refers to the general evaluation of the self as having overall physical fitness (Sonstroem & Morgan, 1989). As one example, Mike’s participation in the PA program led to him discussing with his trainer changes in physical competence which lead to improved self-esteem. This is in line with previous research that found significant increases in self-esteem following the completion of exercise programs among adults experiencing mental health problems (Barton et al., 2012; Legrand, 2014). Furthermore, Baldwin & Courneya (1997) found a significant correlation between exercise participation and physical competence, while Sonstroem et al. (1994) found exercise among dancers to be associated with positive evaluations of physical condition. It has also been found that among a sample of healthy adults, PA had a direct positive influence on self-esteem, and was also found to be indirectly associated with self-esteem through perceived physical function which is consistent with physical competence (Zamani Sani et al., 2016). Taken
together with our findings, interventionists should place an emphasis on perceived competence when trying to increase PA and its effects, such as self-esteem, and to examine it as a motivating and mediating factor within the PA and self-esteem relationship (Zamani Sani et al., 2016). Drawing on self-efficacy models, perceptions of competence may be improved by offering feedback and ensuring self-monitoring, guiding a focus on physiological and imaginal states, offering opportunities for vicarious experiences, and considerations for previous accomplishments (Bandura, 1977). All of these elements were foundational to the current PA intervention and could serve as a template for future work in this area.

**Physical Acceptance.** Sonstroem & Morgan (1989) defined physical acceptance as the degree of feeling satisfaction (or non-satisfaction) with the body and it is proposed to be a key predictor of self-esteem. In a sample of patients with schizophrenia, it was found that body area satisfaction and appearance orientation scores were significantly correlated with self-esteem (Oh et al., 2017) which provides some evidence linking similar constructs to self-esteem in individuals with SMI. The males in the program reported changes in physical acceptance such as weight loss and increased muscle tone, and these changes were apparently tied to their self-esteem as described by Mike and Aaron. In fact, Aaron noted he felt his self-esteem had improved. These findings for the male participants are in line with those of Tennant (2016) who found that an increase in PA can lead to an increase in body satisfaction, however this was found in a sample of obese women. In the current study, the females did not seem to improve physical acceptance and expressed negative perceptions of the mirrors in the gym facility that highlighted their body form and function.

Taken together, research focused on understanding the links between PA and self-esteem for individuals with SMI should investigate the mediating effects of competence, acceptance and self-efficacy. These findings can be taken into account when designing future interventions in this population, and knowing which mechanisms to target for which individuals. Given the differences in the apparent perceptions of males and females in the current study, there may be unique PA interventions attributes that should be considered. Specifically, the mirrors seemed to be a deterrent for positive perceptions for the female participants.
**Self-Determination Theory.** Self-Determination Theory (SDT, Ryan and Deci, 2000) is a theory of motivation that has widely been used to explain PA motivation regulations (i.e. Teixeira et al., 2012). The theory explains how motivation lies on a continuum from being non-autonomous/extrinsic (i.e. for external rewards) to completely autonomous/intrinsic. SDT emphasizes the importance of intrinsic motivation in order to sustain PA behaviors (Ryan and Deci, 2000). Intrinsic motivation refers to when one performs an activity because of its inherent satisfactions, i.e. for feelings of enjoyment, accomplishment and excitement (Deci, 1975). SDT posits that in order to attain internal and autonomous forms of motivation, the fulfillment of three basic psychological needs are required; autonomy, competence, and relatedness (Ryan & Deci, 2000). Engaging in PA can be one context in which one’s psychological needs can be realized (Wilson et al., 2006). The fulfillment of these needs in this context can largely explain differences in motivation development (Deci & Ryan, 2000). Interestingly, in the context of the current program, different individuals emphasized different psychological needs that may be important in future program planning and implementation for individuals with SMI.

**Relatedness.** In the context of SDT, relatedness refers to feelings of personal connection with others (Teixeira et al., 2012). Relatedness can be fostered in PA contexts through creating an empathetic and supportive environment, and showing unconditional regard (Teixeira et al., 2012). In the current program, two females highlighted feeling that the program had very much supported their need for relatedness and this need primarily emanated from their relationship with the program trainer.

There is evidence to suggest a connection between feelings of social support and the psychological need of relatedness (Ryan & Solky, 1996; Van den Broeck et al., 2010), such that increased feelings of social support lead to increased fulfillment of the relatedness need. The women emphasized how having the social connection with a trainer was very important and motivating. This is in line with research among individuals with schizophrenia and social support during PA interventions (Gross et al., 2016). In a recent systematic review, it was found that social support does in fact play an important role in assisting individuals with schizophrenia to start, comply with and adhere to PA interventions (Gross et al., 2016). While there are four main types of social support (emotional, informational, tangible, esteem; Cutrona & Russell, 1990), the female participants in this study specifically referenced they had felt emotional support (i.e. a
feeling of being cared for, an ability to receive security and comfort from others) and esteem support (i.e. the bolstering of self-esteem and competence) through their relationship with the trainer. Gross et al. (2016) outlined some recommendations to support PA in this population based on support, and noted that one way of supporting individuals with SMI is to give attention to individuals on a personal level. They also noted the importance of a friendly atmosphere in which individuals feel welcome and cared for and receive encouragement (Gross et al., 2016). It may be that the current program fostered the need for relatedness in the current sample as our program and trainers emphasized these features and the participants mentioned these features as positive attributes.

**Autonomy.** Autonomy can be defined as the freedom to make one’s own choices, and having a sense of personal control (Ryan & Deci, 2000). The participants involved in this study had a relatively high level of autonomy when they initiated the program, which was partly due to the fact that the organizational stakeholder informed individuals about the program based on level of independence and mobility. This was only anecdotally reported, and none of the psychological needs were measured. Nevertheless, the stakeholder did report being impressed by the autonomy of the program participants.

Previous research in SDT has emphasized that autonomy support can be provided through letting participants be involved in decision-making processes, taking their perspective, and giving them relevant choices (Teixeira et al., 2012). Indeed, this was done throughout the intervention and many of the participants acknowledged these attributes. Future work in this area is important to build on these features of autonomy-supportive environments for this target sample.

**Competence.** The final psychological need in SDT is competence, defined as the need to experience mastery over a task (Ryan & Deci, 2000). It has been proposed by Farholm & Sorensen (2017) that adapting the PA context so that participants can experience mastery, particularly for new activities, is of high importance to satisfy the need for competence. They also suggested that realistic goal setting, the provision of positive feedback, and providing coping strategies for overcoming barriers can also support the need for competence among individuals with SMI, in the context of PA (Farholm & Sorenson, 2017). The current PA program included features of building competence and this was reported by many participants as well as the trainer.
and stakeholder. The researcher field notes also helped to identify key features of the program that supported all of the psychological needs. Drawing from the discussion above on the EXSEM model, perceptions of competence are likely key to not only sustained PA but also self-esteem.

Taken together, these anecdotal findings on the psychological needs of SDT are in line with other SDT research in the PA context. While there are limited studies assessing SDT in PA interventions among those with SMI, as noted by Farholm & Sorensen (2016), motivational processes between those with SMI and the general population generally do not differ. One interesting difference in this work is that females in the current study highlighted the need for relatedness, whereas males tended to highlight the need for competence. Given that the current study was based primarily on qualitative findings, researchers interested in motivation and PA among individuals with SMI should quantitatively measure the constructs of SDT using valid and reliable scales such as the Behavioural Regulation in Exercise (BREQ) scale (Mullan et al., 1997), Relative Autonomy Index (Grolnick & Ryan, 1989), Basic Psychological Needs in Exercise Scale (Vlachopoulos & Michailidou, 2006) and Perceived Competence Scale (Williams et al., 1998) in order to further explore these anecdotal findings.

The ORBIT Model. The ORBIT (Obesity Related Behavioral Intervention Trials) Consortium developed the ORBIT model (see Figure 1) to serve as a framework to translate basic behavioural science findings into behavioural science treatments for both the prevention and management of chronic diseases (Czajkowski et al., 2015). It is a systematic framework designed to link behavioural solutions to clinical problems (Czajkowski et al., 2015). The model outlines that the aim of a pilot study is to investigate if the protocol is feasible and acceptable to both participants and researchers, and that a pilot study can be defined as a preliminary trial of an intervention, to test the plan and methodology of a future research study (Czajkowski et al., 2015). The model has 4 phases (see Figure 1 on page 41) however as this study was a small pilot feasibility study, only phase 1 and 2 will be discussed. The findings from phase 1 and 2 from this study can be used to inform phase 3 (Efficacy) and phase 4 (Effectiveness) in larger scale interventions.

Phase 1: Design. The goal of this phase is to create the necessary features of a behavioural treatment, and involves (a) defining and (b) refining stages. This defining phase involves providing a basic behavioural basis for components of the treatment, as well as
treatment targets. At this point, subjects are also identified, and safety is assessed (Czajkowski et al., 2015). The refining stage involves determining treatment components such as duration, delivery method, and any required tailoring (Czajkowski et al., 2015). Discussions with Jane and the researcher led to identification of subjects, and once the subjects were recruited, safety was assessed by administering the Physical Activity Readiness Questionnaire (PAR-Q) and having the participants obtain physician clearance before beginning the program. Further discussions with Jane, as well as empirical evidence in this population informed the duration and delivery of the intervention. Ongoing tailoring of the program was facilitated by the trainers, participants and Jane.

**Phase 2: Preliminary Testing.** The aim of this stage is to examine the ability of a fixed treatment package to yield a clinically significant improvement on a behavioural risk factor, in this case, levels of PA (and thereby changes in mental health and quality of life) (Czajkowski et al., 2015). There are two sub-phases in the Phase 2 of the ORBIT model. In the first sub-phase, the proof-of-concept is explored. Specifically, the treatment procedures are prepared for fidelity monitoring, and it is determined whether or not the treatment can have a clinically significant impact on the behavior itself (Czajkowski et al., 2015). For a PA intervention among individuals with SMI, the proof of concept can be explored similarly to the Design phase, through discussions with stakeholders and end users (e.g., individuals with SMI), and communication with trainers. The second sub-phase is “pilot”, and the goal of this step is to assess the feasibility of the efficacy trial methodology, and see if logistically the trial is feasible for participants and researchers. These aims were achieved through post-intervention participant questionnaires regarding program satisfaction, ongoing researcher field notes, as well as post-intervention interviews with participants, trainer and stakeholder. Indeed, the findings supported that logistically, the trial was indeed feasible for both participants and researchers.

The ORBIT model emphasizes the flexibility of the first two phases, which was key when working with individuals that were very unique to each other in their diagnosis, physical abilities and goals. In line with the ORBIT model’s aims of a pilot study, the current study found the PA program protocol to be feasible and acceptable, to both participants, researchers, and organizational stakeholders. Furthermore, the current study served as a preliminary trial of an intervention, and as such its findings can be used to inform the methodology of future larger-
scale community-based studies. Specifically, this study’s findings of the importance of tailored, one-on-one, supervised sessions delivered by expert trainers that foster social support and competence, can be used to inform phase 3 (Efficacy) and phase 4 (Effectiveness) of future studies in this area.

Methodological implications

Within this study, there were two main measurement issues, which can be used to inform research in this field in the future. The small sample size is clearly an overarching methodological issue as well, however since this was a pragmatic feasibility study, these results can be used to inform larger studies in the future. As such, that will not be focused on in this section. The two other issues were the nature of self-reporting in this population, as well as the use of accelerometers.

Self-report. The measurements of mental health, quality of life, demographic information and health behaviour information were all assessed in this study using self-reported measures. However, the use of self-report in this population may present issues of accuracy due to various factors, such as cognition or memory issues, which can make recall questions particularly difficult (American Psychiatric Association, 2013). Importantly, individuals with severe mental illness may experience issues with introspective ability (Philippi & Koenigs, 2015), as well as anosognosia, a lack of insight into their condition (Gerretsen et al., 2015). Depending on their mental illness, their introspective ability and self-reflection may either be diminished, heightened, or altered (Philippi & Koenigs, 2015) which may have led to inaccuracies in reporting in either control or intervention groups.

In addition, while self-report measures can exacerbate negative feelings in the general population such as feeling stressed from the unknown, feeling intruded upon, or feeling the need to reveal sensitive information, these dangers can be amplified in those with SMI as their symptoms may make them more likely to feel anxious when they are asked for information during data collection (Bibb & Skewes McFerran, 2017). There is always the potential for an inherent power balance between the researcher and the participant, which may make the participants feel as though they have to remain in a research study, perhaps as a desire to please the researcher, even if they’ve understood during the informed consent process that they may exit at any point (Grant, 2015). These factors emphasize the ethical issues surrounding self-report in
this population, and highlight the need for research participation to be recovery based and not disempowering for the participants (Bibb & Skewes McFerran, 2017). In addition, it has been reported by individuals with SMI that the length of self-report instruments is an issue, and that with increasing questions comes a decrease in the amount of time and attention they spend on each response. In this study, each pre-and post-intervention questionnaire took the participants about 20-30 minutes to complete, and as such, the above factors may have played a role. Finally, mental illness symptoms and mood may fluctuate greatly from day to day, for example with bipolar disorder which is characterized by mood instability (Holmes et al., 2016), and how a questionnaire is answered on one specific day may not be an accurate representation of the participant’s overall mental well-being. The nature of the questions, the length of the questionnaires, the fluctuation of symptoms and the comprehension levels of the participants may all have influenced the accuracy of these results and in particular may have masked important changes in mental health or quality of life.

As such, it may be time to stray away from measures of self-report. Recently, there has been a movement to use platforms of Digital or Mobile Health (MHealth) in mental health research, for example through the use of mobile phones (Torous et al., 2016). There has been a recent push for the use of digital phenotyping, defined as “moment to moment quantification of the individual level human phenotype in situ (Torous et al., 2018).” Mobile phones collect accelerometer data, GPS data, various physiological sensors (pulse, temperature), and call and text logs (to gage social interaction), which can all be used as social and behavioural markers. While issues of privacy and confidentiality must of course be taken into account with such technologies, there is evidence to suggest that those with schizophrenia find mobile health technology and apps to be feasible and acceptable (Firth et al., 2015; Firth & Torous, 2015). Importantly, while still in the very early stages, there is some preliminary evidence to suggest that data quality from phone sensor samples is associated with future symptom-related questionnaire responses amongst a small cohort with schizophrenia (Torous et al., 2018). Thus, there may be promise in the area of objective measurements for use in PA and mental health research, which might address the aforementioned problems inherent in the use of self-report measures in this population.
**Accelerometry.** It has been found that amongst those with schizophrenia, self-reports of PA tend to be inaccurate and over-reported (Firth et al., 2017). Thus, there is an imperative need to use objective measures of activity in those with SMI. However, the accelerometers in this study, which objectively measured PA, presented the participants and the data collection/analysis with many issues. This is in stark contrast with previous findings of accelerometer acceptability and feasibility among those with SMI (Chapman et al., 2015). In the current study, the accelerometers were waist worn (Actigraph GT3X accelerometer (Actigraph, Pensacola, Florida)). As most of the participants in this study were overweight, they reported that having to put the accelerometers on made them feel badly about themselves and their bodies, as they drew attention to their weight status. Furthermore, for this study participants were asked to wear the accelerometers for the duration of the 6 weeks. Typical accelerometry studies ask participants to wear them for 7 consecutive days (i.e. Chapman et al., 2015; Firth et al., 2017). For this study, we could have instead simply asked the participants to wear them for 7 days at the beginning of the study, and 7 days following the study to analyze pre- and post- activity levels. This would likely address the complaints that participants had about them being cumbersome or annoying. Going forward, it is recommended that accelerometers be wrist worn (i.e. Axivity AX3, GENEActiv) and be worn for a shorter duration. Alternatively, an even less cumbersome and intrusive way of capturing activity levels could be the use of accelerometers that are already present in mobile phones (Torous et al., 2018).

**Practical implications**

There are various lessons learned from this study that can be used to inform practice going forward. Based on participant feedback, it seems that a one-on-one, tailored program at a local gym is acceptable. The fact that the participants and the key stakeholder emphasized how much they enjoyed the fact that the program was tailored echoes the findings of Hoffman et al. (2015), who found such a program to be feasible in the same population. Nonetheless, participants noted they would have preferred a longer program and the organizational stakeholder emphasized that the program lacked sustainability, and that strategies to maintain participant activity would have been helpful.
In order to address issues of maintenance, sustainability and program length, future community-based programs could incorporate a peer-led PA program immediately following the tailored, one-on-one PA program. Indeed, two participants in this program noted a desire to share what they had learned with other residents of their homes. Furthermore, the Executive Director of AIS anecdotally expressed her support for such a program in the AIS housing units. There is evidence of the feasibility and acceptability of peer-led health behaviour interventions among individuals with SMI (Get Set to Go Consortium, 2017; O’Hara et al., 2017). This would also act as a way to target individuals who are unable to get to a gym in the community, either for mobility issues, motivation issues, or symptoms of their mental illness. The trainer from the initial one-on-one program could assist the participant in their transition from participant to trainer, through assisting them in teaching their first few classes and being available should they have any questions. Such a structure would also potentially allow many more people to be active, and be less resource demanding. As the program would involve the trainer also being more active, this would address the issue of participants reporting that they would prefer a longer program. Such a program would also provide a context to foster the relatedness-need of SDT, which could lead to greater PA motivation (Deci & Ryan, 2000).

Based on the findings of this program, it may be that participants need their PA programs to be delivered in order to target mechanisms specific to them. For example, the two women in this study both reported really benefitting from the relatedness and social support aspect of the program, and finding it quite motivating, while none of the males did. As such, it may be that going forward, this aspect of interventions may need to be emphasized for females more than males. As suggested by Gross et al. (2016), this could be fostered by pre-intervention interactions, having the participants feel cared about and supported throughout the intervention, and then incorporating ways to maintain their activity level following the intervention. Specifically, the participants highlighted esteem support and emotional support particularly motivating.

In contrast, the males found the changes their bodies were experiencing, in both appearance and function, to be motivating and helpful for their self-esteem. However, drawing attention to the body specifically and its parameters may have negative implications on the participants. Indeed, there is evidence that self-weighing can have very negative consequences
on mental health, and as such would not be advised among those with SMI (Ogden & Whyman, 1997; Dionne & Yeudall, 2005). Rather, it may be that tracking the participants’ progress in terms of weight lifted, repetitions, sets, or time spent on a specific activity may be preferred. For example, each week the trainer could update a table or a graph with the participants progress, and send it home with the participant. The participant would be able to track how they were doing from week to week. In line with Sonstroem & Morgan’s (1989) model, in the context of PA, fostering physical competence and physical self-efficacy can ultimately lead to increased self-esteem. Based on our findings, it may be that females may require more social support, while males may require more information about their fitness progress.

A final practical consideration going forward is the vital need to tailor the context of the PA sessions to the individual participant’s comfort, their illness and their symptoms. For example, it may be that someone with social anxiety initially may want to exercise in a private gym, and may be able to eventually exercise in the public gym. In this program, the two women both reported on multiple occasions their dislike of the mirrors in the gyms. They noted that they made them feel old and overweight, and served as a reminder of their body dissatisfaction. This is in line with findings from studies looking at sedentary women who exercised alone (Martin Ginis et al., 2003) or with others (Martin Ginis et al., 2007) and found that an environment with mirrors produced negative feelings. Similar results have been found among active women, with the presence of mirrors being found to elicit body-image concerns (Prichard & Tiggeman, 2010). The fact that only women reported these concerns, is in line with Objectification Theory (Fredrickson & Roberts, 1997), which posits that women in Western cultures are potentially objectified or evaluated by others. Because of these repeated exposures to objectification, women may come to internalise an observer’s view of the self, and view the self as an object in relation to their appearance, rather than value their internal qualities and abilities (i.e. self-objectification, Fredrickson & Roberts, 1997). Based on the findings of this study and the self-objectification literature in the context of gyms, various strategies can be used to ensure mirrors aren’t having negative repercussions. While completely removing mirrors from gyms may not be feasible, trainers can emphasize the importance of exercising for health and fitness rather than for appearance-related reasons. Furthermore, they may also draw attention to the fact that mirrors can be useful for monitoring and correcting exercise technique (Prichard & Tiggeman, 2010).
These strategies may be helpful for such women to view mirrors in a more positive light, and interventions with women with SMI and body image concerns must take these into consideration going forward.

A final practical implication is related to general training for working with individuals with SMI. Many of the features of traditional clinical trials, for example, are not conducive to success for this population. Many participants have health conditions that precluded consistent participation and therefore the program was longer than 6 weeks. As such, the flexibility of program delivery, and participant intake is critical. Furthermore, if such community programs are to be run by exercise specialists, it is vital that they receive mental health training. While it has been suggested that nurses and clinicians receive PA training (Rosenbaum et al., 2015), it is also vital for exercise clinicians to receive mental health training. This was mentioned in both the researcher’s field notes as well as Dave’s interview. Such training would be helpful for trainers to know for example how to handle a situation if a participant became upset, or simply knowing which personal topics can be discussed and which cannot.

Limitations and Future Directions

This study is not without its limitations. The study used a convenience sampling method, and the intervention group only consisted of 5 participants from one housing organization in Toronto. Thus, the results cannot be generalized. Data was collected pre-intervention and post-intervention, however there were no additional follow-up assessments. These would have been useful to gauge if changes in mental health, quality of life, and PA were experienced or maintained over time. Self-report questionnaires were also used, rather than objective reports. Though anecdotally, participants reported changes in motivation and mechanisms related to SDT (Ryan & Deci, 2000) and the Exercise and Self-Esteem Model (Sonstroem & Morgan, 1989), these were not tested. Thus, future research of community-based PA programs for individuals with SMI must empirically test these theories to assess the mechanisms that might explain the PA and mental health changes seen in such interventions. There were various issues with the accelerometers in this study, and the control group did not receive accelerometers. Going forward, it is advised that either wrist-worn accelerometers, or mobile phone accelerometers are used to avoid issues with compliance. Finally, future studies should strive to be one-on-one and
tailored to participants’ comfort levels, mental illness and symptoms, and consider the possibility of transitioning to a peer-led program once the initial program ends.

**Conclusion**

The present study provided important contributions to the literature theoretically, methodologically, and practically. The present findings support the acceptability of a community-based PA program for individuals with SMI from a local mental health housing organization. A key stakeholder, all participants and trainer reported the program as being feasible. Changes in mental health and quality of life were reported following the program, as were anecdotal improvements in self-esteem, confidence and mood. Different participants reported different program aspects as motivating, and others as limiting. These findings can be used to inform community-based PA programs for individuals with SMI by highlighting the strengths of a tailored, one-on-one program, designed in conjunction with the mental health organization itself.
References


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Appendices

Appendix A- Letter of Information and Consent

Letter of Information:

The University of Toronto, is conducting a research study to examine the effect of aerobic and resistance exercise on mental wellbeing among adults.

Research findings show that participating in exercise has been linked to improved mental health and well-being, improved physical health and more positive self-esteem. Unfortunately, Canadian adults consistently report rates of physical activity that do not meet the Canadian Guidelines for Physical Activity (150 minutes of moderate-vigorous activity per week). These findings suggest the important implications of conducting physical activity research to promote healthy mental well-being among Canadian adults!

Your participation in this study will consist of various phases:

1) Participants will meet with the researcher and complete a simple and brief written questionnaire package regarding their current mental well-being and current levels of physical activity, in a private room at the Mental Health and Physical Activity Research Centre at the University of Toronto (55 Harbord Street, Toronto). Following this, the researcher and participant will agree on a date and time for their first (of six) exercise sessions.

2) Participants will participate in a 6-week exercise and behavioural counseling intervention which will involve:
   a. Weekly one-on-one exercise training in a private gym at the Mental Health and Physical Activity Research Centre at the University of Toronto (55 Harbord Street, Toronto). These training sessions will be personalized to each individual’s strengths, abilities and interests. Opportunities for both aerobic and resistance training will be available. Training will be provided by Garcia Ashdown-Franks, who has an undergraduate degree in Kinesiology and a great deal of exercise training experience.

3) At the end of the 6-week program, participants will again complete the questionnaire package regarding mental well-being and activity levels, in a private room at the Mental Health and Physical Activity Research Centre at the University of Toronto (55 Harbord Street, Toronto).
4) At the end of the 6-week program, participants will also be asked to complete an approximately 30-minute interview to assess their experiences of the program and attitudes and beliefs towards exercise and its effects on their mental well-being. Again, this will take place in a private room at the Mental Health and Physical Activity Research Centre at the University of Toronto (55 Harbord Street, Toronto).

Participants will be compensated with access to the exercise facilities in MPARC, as well as with $50. Participation in this study will have future benefits on adult mental health by learning more about the mental and social outcomes of exercise participation.

Participation in this study is completely voluntary. Additionally, participants can withdraw from the study at ANY POINT IN TIME without any consequences until data analysis is complete and the research has been submitted for publication. At this stage the researchers will not be able to withdraw participant-specific information.

Before initiating this program, participants must receive clearance from their physician indicating they are in good enough health to initiate an exercise program. This requires their physician sign the “Physician Clearance form” and the “PAR-Q form”, both stapled to the back of this page. Please have your physician read over this Information Letter before they execute the “Physician Clearance Form.”

Interested participants can contact Garcia Ashdown-Franks, the researcher for this project:

Email: [garcia.ashdown.franks@mail.utoronto.ca](mailto:garcia.ashdown.franks@mail.utoronto.ca)

Phone Number: [416-389-0130](tel:416-389-0130)
INFORMATION AND CONSENT

Title of the study: Advancing Research on Physical Activity and Mental Illness
Primary Researchers: Dr. Catherine Sabiston, Ph.D., Faculty of Kinesiology and Physical Education, University of Toronto
Research Assistant: Garcia Ashdown-Franks, MSc Student

INTRODUCTION:
You are invited to participate in this study to better understand how physical activity can affect your mental health. We would like to know more about the effectiveness of exercise in alleviating the symptoms of stress, worry and/or feeling down. Your participation will help us determine if an exercise program for individuals seeking help for mental health challenges is worthwhile and feasible.

BACKGROUND:
Research shows that physical activity can play an important role in improving mental health outcomes among those with mental illness. This study will consider whether exercise is a feasible and worthwhile adjunct treatment for individuals living with mental illness.

PURPOSE OF THE STUDY:
The purpose of this study is to evaluate the effectiveness and feasibility of implementing an exercise program for individuals diagnosed with mental illness. Specifically, we will examine changes in participant’s mental health and day-to-day functioning as they complete an exercise program. We will also be studying how well participants adhere to the program.

STUDY PROCEDURES:
Before beginning the study, your physician must sign the physician clearance form. Your involvement in this study will involve a one-on-one meeting with a research assistant to complete a questionnaire package on questions regarding personal demographics, physical activity and mental health at the Mental Health and Physical Activity Research Center (MPARC). You will then be asked to attend weekly exercise sessions using the MPARC equipment for 6 weeks. Each week, you will meet with a researcher to complete activities regarding your exercise routine (goal-setting, planning, etc) and mental health. After 6 weeks (end of intervention), you will be asked to complete the same questionnaires as you did at baseline. You will also be asked to complete a follow-up interview some time in the week after the program is complete. This interview will be one-on-one with a research assistant, will be audio-recorded, and will ask you questions about your experiences with the physical activity
program (e.g., what you liked and didn’t like), as well as general attitudes and beliefs toward physical activity.

The research study you are participating in may be reviewed for quality assurance to make sure that the required laws and guidelines are followed. If chosen, (a) representative(s) of the Human Research Ethics Program (HREP) may access study-related data and/or consent materials as part of the review. All information accessed by HREP will be upheld to the same level of confidentiality that has been stated by the research team.

**POTENTIAL BENEFITS**
While participating in this study, we hope you notice improvements in your mental health and day-to-day functioning. You may also discover positive changes in your physical endurance and strength as the program continues. We also hope that the information from this study may benefit other individuals by increasing our understanding of how exercise can help with mental health concerns.

**POTENTIAL RISKS AND/OR DISCOMFORTS:**
You should be aware that there are risks associated with participation in any exercise program. Serious inherent risks are rare, but include cardiac events and musculoskeletal injuries. To reduce the risk of sustaining any injuries, you will be required to fill out the Physical Activity Readiness Questionnaire (PAR-Q) and complete the exercise program under the supervision of a researcher. You are not required to perform any exercise that you are uncomfortable with and you should not continue to exercise if you experience sharp pain, nausea, dizziness or light-headedness.

You may also feel anxious when meeting with the researchers or during an exercise session. Although some levels of anxiety can be expected, you are not required to remain in any situation causing extreme anxiety or discomfort. You are not required to answer any questions or complete any exercises that make you feel uncomfortable.

The main potential social risk is that participants would be identified as individuals with mental illness. However, this will be mitigated in a number of ways. Participants will not exercise in groups (and will not know which other AIS participants are partaking in the intervention). The MPARC space houses numerous research projects, thus an individual seen exercising in the MPARC would not necessarily be identified as being from AIS. Finally, AIS informed all their clients about the possibility of participating in this program, and did not single out any particular individuals.

**COMPENSATION:**
You will be compensated $50 in the form of a gift card for your participation in this study. You will receive a summary report at the completion of the project that will report on the general
trends that have been found during the study. No personal information will be included in this report.

**CONFIDENTIALITY:**
All information collected for this study will be kept strictly confidential and there will be no identifiable information in the questionnaires as your responses will be **coded by participant number**. The results from this study may be published and presented at scientific conferences, however your identity will not be revealed in the combined results. By signing this consent form, you give us permission to use your data in the preparation of published articles and research presentations.

**VOLUNTARY PARTICIPATION AND/OR WITHDRAWAL:**
Your participation in this study is strictly voluntary. You may refuse to participate or you may discontinue your participation at any time without explanation, and without penalty, until the data have been analysed and written up for publication. If you decide not to participate, or if you discontinue your participation, there will be no consequences for your medical care or your participation in any other research studies. Any data you have provided will be destroyed and will not be used.

**QUESTIONS AND CONTACT INFORMATION:**
If you have any questions concerning the procedures of this study or desire further information please contact Dr. Catherine Sabiston by telephone: [number] or email: [email]. If you have any questions about the treatment or rights of research participants, you may anonymously contact the Office of Research Ethics at [email] or [number].

**DECLARATION OF CONSENT**

**Title of the study:** Advancing Research on Physical Activity and Mental Illness

I have read the content of this consent form, and I agree to participate in this research study. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction. I have been given sufficient time to consider the above information and to seek advice if I choose to do so, I will be given a copy of this signed consent form. By signing the consent form, I have not given up any of my legal rights.

**Participant:**

I have read and reviewed the Information and Consent Form and the study was explained to me. My questions were answered to my satisfaction. I was given the time to think about whether I want to take part in this study. I am aware that my involvement in this study will involve:

- Completion of questionnaires at the beginning and end of study (6 weeks)
- Attendance of at least one weekly exercise sessions for 6 weeks;
- Exercise on my own for at least 40 minutes a week for 6 weeks;
• Completion of personal activities such as goal-setting and planning with the guidance of a researcher each week for 6 weeks;
• Involvement in one individual interview in the final week of the program that will be audio-recorded

I agree to take part in this study according to the conditions set in this Information and Consent Form. A dated and signed copy of this Information and Consent Form will be given to me.

----------------------------------------------------------------------------
Name                                     Signature of the research participant  Date

Researcher:

I have received the consent form dated: ______________________________________

----------------------------------------------------------------------------
Name                                     Signature of researcher
Appendix B- Questionnaires

Pre-intervention questionnaire package

Demographics:
Date: _____________________ ID: ______________
Age (yrs): _____________________
Sex: Male ______ Female ______

1. People living in Canada come from many different cultural and racial backgrounds. Are you (check all that apply):

☐... White?
☐... Chinese?
☐... South Asian (e.g., East Indian, Pakistani, Sri Lankan)?
☐... Black?
☐... Filipino?
☐... Latin American?
☐... Southeast Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese)?
☐... Arab?
☐... West Asian (e.g., Afghan, Iranian)?
☐... Japanese?
☐... Korean?
☐... Other – Specify __________________________________________________________

2. What language you speak most often at home?
☐ English ☐ Portuguese
☐ French ☐ Punjabi
☐ Arabic ☐ Spanish
☐ Chinese ☐ Tagalog (Pilipino)
Cree  Ukrainian
German  Vietnamese
Greek  Persian
Dutch  Hindi
Hungarian  Russian
Italian  Tamil
Korean
Other, specify: __________________________

3. What is your highest level of education?

- Did not complete high school
- High school diploma
- Some post-secondary, but did not complete diploma or degree
- College or technical diploma or certificate (CEGEP, community college)
- University undergraduate degree
- Post-graduate degree

4. What is your marital status?

- Single
- Married or living with a life partner
- Separated
- Divorced
- Widowed

**Employment Status:**

- Full-time
- Part-time
- Not employed
- Student
- Retired
- Other: _______________

**Living Arrangements:**

- Independent
- Residence (meals provided)
- With Family
- Residence (no meals provided)

**Tobacco, Alcohol and Drugs:**

Within the last 30 days, how many days did you use:

- Cigarettes ___
- Alcohol (beer, wine, liquor) ___
Marijuana ____
Cocaine (crack, rock, freebase) ____
Methamphetamines (crystal meth, ice) ____
Other amphetamines (diet pills, bennies) ____
Sedatives (downers, ludes) ____
Hallucinogens (LSD, PCP) ____
MDMA (Ecstasy) ____
Opiates (heroin, smack) ____
Other illegal drugs ____

In the past month, did you take any of the following medications, either prescription or over-the-counter (Yes/No)?
Pain relievers (aspirin, Tylenol) ____
Tranquilizers (Valium, Ativan) ____
Diet Pills (Ponderal, Fastin) ____
Antidepressants (Prozac, Paxil, Effexor) ____
Codeine, Demerol or morphine ____
Mood stabilizers (Lithium, Epival) ____
Major tranquilizers, anti-psychotics, neuroleptics (Risperidol, Olanzapine, Seroquel) ____
Sleeping pills (Imovane, Nytol, Starmoc) ____
Other (specify) ______________________________

Measurements:

Height (cms): _________________________

Weight (kgs): _________________________

Waist circumference (cms): _________________________

Physical Activity History:

Please describe your physical activity levels during the following times in your life during:
Childhood (Up to 12 years of age)
Adolescence (12 to 18 years);
Adulthood (19 years to present).

Response options:
- Not active at all
- A little active
- Very active
- Not applicable
Please list your top three barriers to PA at this point in your life:

1.
2.
3.

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

1a. During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   Think about *only* those physical activities that you did for at least 10 minutes at a time.
1b. How much time in total did you usually spend on one of those days doing vigorous physical activities?

_____ hours _____ minutes
2a. Again, think *only* about those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do *moderate* physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
2b. How much time in total did you usually spend on one of those days doing moderate physical activities?

_____ hours _______ minutes

______ days per week

0  none

or
3a. During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for recreation, sport, PA or leisure.
_________ days per week  

3b. How much time in total did you usually spend walking on one of those days?

or

0 none

______ hours _______ minutes
The last question is about the time you spent sitting on weekdays while at work, at home, while doing course work and during leisure time. This includes time spent sitting at a desk, visiting friends, reading, traveling on a bus or sitting or lying down to watch television.

4. During the last 7 days, how much time in total did you usually spend sitting on a week day?

_____ hours _______ minutes

This is the end of questionnaire, thank you for participating.
**INSTRUCTIONS:** Please read each question and tick the box by the ONE statement that best describes how things have been FOR YOU during the past month. There are no right or wrong answers.

1. How much of the time, during the past month, has your daily life been full of things that were interesting to you? *(Tick one)*

   |   |   |   |   |
---|---|---|---|---|
1 | All of the time | 4 | Some of the time |
2 | Most of the time | 5 | A little of the time |
3 | A good bit of the time | 6 | None of the time |
2. Did you feel depressed during the past month? (Tick one)
1 ☐ Yes, to the point that I did not care about anything for days at a time
2 ☐ Yes, very depressed almost every day
3 ☐ Yes, quite depressed several times
4 ☐ Yes, a little depressed now and then
5 ☐ No, never felt depressed at all

3. During the past month, how much of the time have you felt loved and wanted? (Tick one)
1 ☐ All of the time
2 ☐ Most of the time
3 ☐ A good bit of the time
4 ☐ Some of the time
5 ☐ A little of the
6 ☐ None of the time

4. How much of the time, during the past month, have you been a very nervous person? (Tick one)
1 ☐ All of the time
2 ☐ Most of the time
3 ☐ A good bit of the time
4 ☐ Some of the time
5 ☐ A little of the
6 ☐ None of the time

5. During the past month, how much of the time have you felt tense or “high-strung”? (Tick one)
1 ☐ All of the time
2 ☐ Most of the time
3 ☐ A good bit of the time
4 ☐ Some of the time
5 ☐ A little of the
6 ☐ None of the time

6. During the past month, have you been in firm control of your behaviour, thoughts, emotions or feelings? (Tick one)
1 ☐ Yes, very definitely
2 ☐ Yes, for the most part
3 ☐ Yes, I guess so
4 ☐ No, not too well
5 ☐ No, and I am somewhat
6 ☐ No, and I am very disturbed
7. During the past month, how often did you feel that you had nothing to look forward to?

(Tick one)
1 ☐ Always
2 ☐ Very often
3 ☐ Fairly often
4 ☐ Sometimes
5 ☐ Almost
6 ☐ Never

8. How much of the time, during the past month, have you felt calm and peaceful?

(Tick one)
1 ☐ All of the time
2 ☐ Most of the time
3 ☐ A good bit of the time
4 ☐ Some of the time
5 ☐ A little of the
6 ☐ None of the time

9. How much of the time, during the past month, have you felt emotionally stable?

(Tick one)
1 ☐ All of the time
2 ☐ Most of the time
3 ☐ A good bit of the time
4 ☐ Some of the time
5 ☐ A little of the
6 ☐ None of the time

10. How much of the time, during the past month, have you felt downhearted and blue?

(Tick one)
1 ☐ All of the time
2 ☐ Most of the time
3 ☐ A good bit of the time
4 ☐ Some of the time
5 ☐ A little of the
6 ☐ None of the time

11. How much of the time, during the past month, were you able to relax without difficulty?

(Tick one)
1 ☐ All of the time
2 ☐ Most of the time
3 ☐ A good bit of the time
4 ☐ Some of the time
5 ☐ A little of the
6 ☐ None of the time
12. How often, during the past month, have you felt so down in the dumps that nothing could cheer you up? *(Tick one)*

1  Always
2  Very often
3  Fairly often
4  Sometimes
5  Almost
6  Never

13. During the past month, how much of the time have you felt restless, fidgety, or impatient? *(Tick one)*

1  All of the time
2  Most of the time
3  A good bit of the time
4  Some of the time
5  A little of the
6  None of the time

14. During the past month, how much of the time have you been moody or brooded about things? *(Tick one)*

1  All of the time
2  Most of the time
3  A good bit of the time
4  Some of the time
5  A little of the
6  None of the time

15. How much of the time, during the past month, have you felt cheerful, lighthearted? *(Tick one)*

1  All of the time
2  Most of the time
3  A good bit of the time
4  Some of the time
5  A little of the
6  None of the time
16. During the past month, have you been anxious or worried? (Tick one)
   1  Yes, extremely to the point of being sick or almost sick
   2  Yes, very much so
   3  Yes, quite a bit
   4  Yes, some, enough to bother me
   5  Yes, a little bit
   6  No, not at all

17. During the past month, how much of the time were you a happy person? (Tick one)
   1  All of the time
   2  Most of the time
   3  A good bit of the time
   4  Some of the time
   5  A little of the
   6  None of the time

18. During the past month, how much of the time have you been in low or very low spirits? (Tick one)
   1  All of the time
   2  Most of the time
   3  A good bit of the time
   4  Some of the time
   5  A little of the
   6  None of the time
Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form
(Q-LES-Q-SF, Endicott et al., 1993)

Taking everything into consideration, during the past week how satisfied have you been with your........

<table>
<thead>
<tr>
<th></th>
<th>Very Poor</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Very Good</td>
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<tr>
<td>.....physical health?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
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<td></td>
<td>5</td>
<td></td>
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<tr>
<td>.....mood?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td></td>
<td>5</td>
<td></td>
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<tr>
<td>.....work?</td>
<td>1</td>
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<td>3</td>
<td>4</td>
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<td>5</td>
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<td></td>
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<tr>
<td>.....household activities?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td>3</td>
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<td>5</td>
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<tr>
<td>.....family relationships?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td></td>
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<td>.....leisure time activities?</td>
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<td>2</td>
<td>3</td>
<td>4</td>
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<td></td>
<td>5</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>.....ability to function in daily life?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td></td>
<td>5</td>
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<td>Question</td>
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<td>3</td>
<td>4</td>
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<tr>
<td>------------------------------------------------------------------------</td>
<td>---</td>
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<td>---</td>
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<tr>
<td>.....sexual drive, interest and/or performance?*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.....economic status?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>.....living/housing situation?*</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>.....ability to get around physically without feeling dizzy or unsteady or falling?*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>.....your vision in terms of ability to do work or hobbies?*</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>.....overall sense of well being?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>.....medication? (If not taking any, check here _and leave item blank.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>.....How would you rate your overall life satisfaction and contentment during the past week?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

*If satisfaction is very poor, poor or fair on these items, please UNDERLINE the factor(s) associated with a lack of satisfaction.
**Post intervention questionnaire**

For the sake of paper/space---- post-intervention questionnaire are identical to the pre-intervention questionnaire, as such, only the measures that were not included on the pre-intervention questionnaire will be included here.

**Program Satisfaction:**

To what extent did this PA program meet your needs?

- from 1= “None of my needs were met” to 7 = “All of my needs

How much did you like participating in this program?

- from 1 (not at all) to 7 (very much).

How satisfied were you with the program?

- from 1= “very dissatisfied” to 7 = “very satisfied”

Please list up to 3 likes and 3 dislikes about the program:

Like 1.
Like 2.
Like 3.

Dislike 1.
Dislike 2.
Dislike 3.

Please indicate (from 1 to 7) your thoughts on this PA program in terms of:

-Interest?
-Enjoyment?
-Effort?
-Importance?
-Value?
Please indicate (from 1 to 7) your thoughts on PA in general in terms of:

- Interest?
- Enjoyment?
- Effort?
- Importance?
- Value?
- Time commitment?
Appendix C - Tables

Table 1

*MH, QOL and PA outcomes*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Scale range</th>
<th>Control Pre (M, SD)</th>
<th>Control Post (M, SD)</th>
<th>Experimental Pre (M, SD)</th>
<th>Experimental Post (M, SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>1-6</td>
<td>3.75 (.97)&lt;sup&gt;a&lt;/sup&gt; 4.48 (.81)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.48 (1.53)&lt;sup&gt;a&lt;/sup&gt; 3.92 (1.65)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Depression 1-6</td>
<td>3.75 (1.47)&lt;sup&gt;a&lt;/sup&gt; 4.19 (1.14)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Behavioural Control</td>
<td>1-6</td>
<td>4.00 (1.47)</td>
<td>4.31 (.59)</td>
<td>3.95 (1.68)</td>
<td>4.25 (1.46)</td>
</tr>
<tr>
<td>Positive Affect</td>
<td>1-6</td>
<td>3.69 (1.48)</td>
<td>3.75 (1.24)</td>
<td>3.05 (1.27)</td>
<td>3.10 (1.26)</td>
</tr>
<tr>
<td>MHI total score</td>
<td>0-100</td>
<td>55.56 (24.15)&lt;sup&gt;a&lt;/sup&gt; 62.22 (20.43)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>51.78 (25.83)&lt;sup&gt;a&lt;/sup&gt; 59.78 (24.05)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>QEL-LS (raw score) 11-55</td>
<td>33.50 (9.85)</td>
</tr>
<tr>
<td>Medication satisfaction</td>
<td>1-5</td>
<td>3.00 (1.00)</td>
<td>3.67 (1.15)</td>
<td>3.00 (1.00)</td>
<td>4.67 (.58)</td>
</tr>
<tr>
<td>Life satisfaction/contentment</td>
<td>1-5</td>
<td>3.75 (1.26)</td>
<td>3.5 (1.00)</td>
<td>2.8 (1.30)</td>
<td>3.00 (1.41)</td>
</tr>
<tr>
<td>IPAQ met/mins/week</td>
<td></td>
<td>699.2 (890.44)</td>
<td>397.63 (424.67)</td>
<td>2961.8 (3354.17)</td>
<td>928.58 (746.27)</td>
</tr>
</tbody>
</table>

Note, <sup>a</sup>= pre to post difference, <sup>p<.05</sup>= Within (TIME)
<sup>b</sup>= experimental to control group difference, <sup>p<.05</sup>= Between (Condition)
<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Sex</th>
<th>Medications taken in past month</th>
<th>Education</th>
<th>Barriers to PA at start of program</th>
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<tbody>
<tr>
<td>Claudia</td>
<td>55</td>
<td>F</td>
<td>None</td>
<td>Some post-secondary</td>
<td>-Mental health issues</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-Injuries from accidents</td>
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<td></td>
<td></td>
<td></td>
<td>-Low income status</td>
</tr>
<tr>
<td>Matt</td>
<td>27</td>
<td>M</td>
<td>None</td>
<td>Completed high school</td>
<td>-Lack of support</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-Smoking too much marijuana</td>
</tr>
<tr>
<td>Susan</td>
<td>52</td>
<td>F</td>
<td>Antidepressants, Tranquilizers</td>
<td>College degree</td>
<td>-Herniated disc in spine</td>
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<td></td>
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<td></td>
<td>-Fibromyalgia</td>
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<td>-Arthritis</td>
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<td>-PTSD</td>
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<td>-Depression</td>
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<td>-Low confidence</td>
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<td></td>
<td>-Lack of motivation</td>
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<td></td>
<td></td>
<td></td>
<td>-Feelings of depression, anxiety</td>
</tr>
<tr>
<td>Aaron</td>
<td>32</td>
<td>M</td>
<td>Mood stabilizers, Anti-psychotics</td>
<td>Some post-secondary</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mike</td>
<td>43</td>
<td>M</td>
<td>Tranquilizers</td>
<td>Did not complete high school</td>
<td>-Physical health/fitness</td>
</tr>
</tbody>
</table>
Appendix C - Figures

Figure 1. Claudia’s changes in mental health and quality of life outcomes.

Figure 2. Matt’s changes in mental health and quality of life outcomes.
Figure 3. Susan’s changes in mental health and quality of life outcomes.

Figure 4. Aaron’s changes in mental health and quality of life outcomes.
Figure 5. Mike’s changes in mental health and quality of life outcomes.
Appendix D- Ethical Approval

PROTOCOL REFERENCE # 34001

March 17, 2017

Dr. Catherine Sabiston
FACULTY OF KINESIOLOGY AND PHYSICAL EDUCATION

Ms. Garcia Ashdown-Franks
FACULTY OF KINESIOLOGY AND PHYSICAL EDUCATION

Dear Dr. Sabiston and Ms. Garcia Ashdown-Franks,

Re: Your research protocol entitled, “Advancing research on physical activity and mental illness”

ETHICS APPROVAL

Original Approval Date: March 17, 2017
Expiry Date: March 16, 2018
Continuing Review Level: 2

We are writing to advise you that the Health Sciences Research Ethics Board (REB) has granted approval to the above-named research protocol, for a period of one year. Ongoing research under this protocol must be renewed prior to the expiry date.

Any changes to the approved protocol or consent materials must be reviewed and approved through the amendment process prior to its implementation. Any adverse or unanticipated events in the research should be reported to the Research Oversight and Compliance Office - Human Research Ethics Program as soon as possible.

Please ensure that you submit an Ethics Renewal Form or a Study Completion/Closure Report 15 to 30 days prior to the expiry date of your current ethics approval. Note that ethics renewals for studies cannot be accepted more than 30 days prior to the date of expiry.

If your research is funded by a third party, please contact the assigned Research Funding Officer in Research Services to ensure that your funds are released.

Please note, all approved research studies are eligible for a routine Post-Approval Review (PAR) site visit. If chosen, you will receive a notification letter from our office. For information on PAR, please see http://www.research.utoronto.ca/wp-content/uploads/documents/2014/09/PAR-Program-Description-1.pdf.

Best wishes for the successful completion of your research.

Yours sincerely,

Elizabeth Peter, Ph.D.
REB Chair