# Physical activity interventions in severe mental illness

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**Abstract**

Physical activity is a modifiable risk factor for several physical and mental health conditions. It is well established that people with severe mental illness have increased risk of physical health complications, particularly cardiovascular disease. They are also more likely to be physically inactive, contributing to the elevated cardiovascular and metabolic risks, which are further compounded by antipsychotic medication use. Physical activity interventions are a relatively low risk and accessible way of reducing physical health problems and weight in people with severe mental illness. They also have wider benefits on mental health symptoms and quality of life. However, many barriers still exist to the widespread implementation of physical activity interventions in the treatment of severe mental illness. A more concerted effort is needed to facilitate their translation into routine practice and to increase adherence to activity interventions.

**Learning objectives**

After reading this article you will be able to:

- Understand why physical activity is clinically important for people with severe mental illness
- Recognise the possible barriers and facilitators of physical activity engagement in people with severe mental illness
- Consider the next steps for commissioners, researchers, and practitioners in this area

## Introduction

Physical activity refers to any bodily movement that results in some degree of energy expenditure (Caspersen 1985). The importance of physical activity for treating and preventing many chronic diseases is well established. For example, population-level research shows that higher levels of physical activity are associated with lower incidence of cardiovascular disease, diabetes, cancer, and common mental health disorders (Wilmot 2012; Kyu 2016; Bennett 2017; Schuch 2018; Schuch 2019). A recent umbrella review of 27 systematic reviews found that physical activity is effective for treating symptoms of depression, anxiety and stress disorders, schizophrenia, and alcohol or substance use disorders (Ashdown-Franks 2019). These results are primarily based on data from randomised controlled trials (RCTs), with a total of 152 studies included in the review.

The importance of physical activity to public health is exemplified by a widespread adoption of standardised physical activity guidelines (World Health Organization 2015). In the United Kingdom, the Chief Medical Officer's report recommends that adults engage in at least 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous-intensity aerobic activity per week (Department of Health and Social Care 2019). Moderate-intensity activity might include brisk walking or riding a bike, whereas vigorous-intensity refers to running or sports, such as football and athletics.

Among other health benefits, aerobic activity improves cardiorespiratory fitness and helps with weight management. Cardiorespiratory fitness reflects the efficiency of the circulatory and cardiovascular system during activity in adults (Blair 1996). Low cardiorespiratory fitness is associated with a greater risk of several chronic conditions, cardiovascular disease, and common mental health disorders (Lee 2011; Kandola 2019). Guidelines also recommend engaging in strength training at least twice per week. Strength training refers to exercises that strengthen muscles, such as using resistance bands or lifting weights. These exercises improve muscular fitness, which is another important marker of chronic health conditions, common mental health disorders, and cognition (Celis-Morales 2017; Wu 2017; Firth, 2018; Kandola 2020).

Physical inactivity refers to not meeting national physical activity guidelines (Kohl 2012). While they belong to the same spectrum of activity, inactivity is widely recognised as different from sedentary behaviour. Sedentary behaviour refers to any activity in a sitting, lying, or reclining position with very low energy expenditure (Tremblay 2017). Watching television while seated or driving are examples of sedentary behaviours. Physical activity guidelines in the UK recently included recommendations for reducing sedentary behaviour, where possible (Department of Health and Social Care 2019).

Despite sustained global health campaigns, physical activity levels in the general population are still lower than recommended. Around 1.4 billion adults and 81% of students aged 11 to 17 are estimated to not be achieving national physical activity guidelines, with little improvement since 2001 (Guthold 2018, 2020).

Global cardiorespiratory fitness appears to have decreased in adults and children over the last few decades (Lamoureux 2019; Tomkinson 2019). Estimates suggest that around 5 million deaths are directly attributable to physical inactivity each year (Lee 2012).

Reducing physical inactivity has the potential to improve population physical and mental health. Approaches for increasing physical activity are generally safe, have few to no side-effects, are widely accessible, and cost-effective in the population (Roux 2008). The following sections will explore how and why people with severe mental illness (SMI) represent a high-risk group that would benefit from interventions to increase activity. We refer to SMI in this paper as people with a diagnosis of any bipolar, non-affective psychoses, or major depressive disorder. However, much of the current literature focuses on people with a schizophrenia diagnosis specifically.

**Physical activity and SMI**

SMI populations are generally less physically active than the general population. A recent meta-analysis of 69 studies (N = 35,684) found that people with SMI engage in an average of 38.4 minutes of moderate to vigorous physical activity per day, around 13 minutes fewer than comparison groups without SMI (Vancampfort 2017). These findings are mostly from self-report questionnaires, and data from the UK Biobank suggest that these measures likely overestimate physical activity in SMI populations (Firth 2018). Using data from activity monitors in 1,078 people with schizophrenia from the UK Biobank, this study suggests that their total physical activity is 80% lower than that of the general population. There are also differences between diagnoses. For example, people diagnosed with bipolar disorder had higher sedentary behaviour but higher moderate to vigorous physical activity per day than those reporting a diagnosis of schizophrenia (Vancampfort 2017).

The lower activity levels in SMI populations have implications for physical health (Firth 2019). People with SMI have lower levels of cardiorespiratory fitness ($g$ = -1.01) than healthy controls, with no difference between those with bipolar or schizophrenia (Vancampfort 2017). Physical inactivity and high sedentary behaviour tend to cluster with other behavioural risk factors for physical health in SMI populations, such as smoking (Jackson 2015) and poor diet (Firth 2018). These unhealthy lifestyle factors likely contribute to the 1.4 to 2 times increased risk of cardiovascular and metabolic disease in people with SMI compared to the general population (Firth 2019). Data from primary care records indicate that the risk of premature mortality is elevated in people with SMI (HR = 1.79 for bipolar disorder and HR = 2.08 for schizophrenia) and this mortality gap from the general population appears to be widening (Hayes 2017). The co-development of physical health conditions in people with SMI creates an enormous healthcare challenge for the NHS (Naylor 2016). As set out in their long-term plan, the NHS is committed to improving physical health outcomes for people with SMI and reducing this mortality gap (NHS, 2019).

Physical inactivity is a major component of an unhealthy lifestyle that is likely to contribute to the physical health risks associated with SMI. It may also affect mental health symptoms. Physical activity conveys a range of mental health benefits for SMI populations, including reducing depression and anxiety symptoms, improving cognitive functioning, sleep, quality of life, and social adjustment (Rosenbaum 2014; Firth 2015; Firth 2016a; Firth 2017; Ashdown-Franks 2019). Increasing physical activity and reducing sedentary behaviour in SMI populations may have transdiagnostic benefits that improve psychiatric symptoms and wellbeing while reducing the risk of physical health complications over time.

**The effectiveness of physical activity interventions in SMI populations**

The British Association of Psychopharmacology (BAP) recommend the use of lifestyle interventions for managing weight and cardiovascular disease risk in treating SMI (Cooper 2016). A recent European Psychiatric Association statement highlighted that physical activity interventions also have wider physical and mental health benefits in SMI populations, and there is an increasing focus on increasing their acceptability and effectiveness (Stubbs 2018). These interventions use various types of physical activity, such as stationary cycling, walking, resistance training, jogging, or group-based aerobics sessions. Protocols are sometimes based on national activity guidelines or specific recommendations from authoritative bodies, such as the American College of Sports Medicine. But the content of these interventions may be perceived as unrealistically high for people with low activity. Some interventions consist of multiple short bouts of activity, such as 2 or 3 bouts of 10 minutes per day (Linke 2011). These approaches are less intense and allow greater flexibility to incorporate activity throughout the day.

There is evidence that these physical activity interventions can improve mental health outcomes. A meta-analysis of 20 studies suggest that aerobic exercise interventions of at least 90 minutes of moderate to vigorous physical activity per week can reduce positive (SMD = -0.54, 95% CI -0.95 to -0.13) and negative (SMD = -0.44, 95% CI -0.78 to -0.09) symptoms in people with schizophrenia (Firth 2015). The exercise intensities for these studies are typically based on individual factors, such as baseline fitness, activity levels, heart rate, and other health factors. For example, exercises may be set at 40% to 60% of a participant's maximum capacity. A systematic review of six studies found that strength training also reduced positive and negative symptoms in people with schizophrenia (Keller-Varady 2018). The strength training interventions in these trials typically focus on resistance exercises for large muscle groups, such as the legs, chest, shoulders, and back. Some interventions also include an aerobic component, such as running or walking. Interventions are delivered by a study investigator or trained exercise professional. Another meta-analysis of 10 studies with 20 to 60-minutes of aerobic exercise 2 to 4 times per week were associated with improved global cognition ($g$ = 0.33, 95% CI = 0.13–0.53) in people with schizophrenia (Firth 2017).

Far fewer studies exist that investigate the relationship between physical activity interventions and psychiatric symptoms in people with bipolar disorder (Ashdown-Franks 2019). One systematic review with 31 studies of varying designs found that higher exercise levels were associated with fewer depressive symptoms in people with bipolar disorder (Melo 2016). Associations with mania symptoms were inconsistent. However, this review included observational studies and some interventional studies, but no RCTs. Evidence for the utility of exercise in bipolar disorder is typically based on extrapolated evidence from trials in people with unipolar depression (Thomson 2015). For example, several meta-analyses of RCTs using physical activity interventions have consistently found moderate-to-large effect sizes for reducing symptoms of depression and anxiety disorders (Bridle 2012; Herring 2012; Cooney 2013; Josefsson 2014; Kvam 2016; Schuch 2016; Stubbs 2017). The role of exercise in bipolar disorder could be more complex than unipolar depression. For example, preliminary evidence suggests that exercise can help people with bipolar disorder manage their excess energy, but may exacerbate manic and hypomanic symptoms (Thomson 2015).

There is evidence that exercise can also improve physical health outcomes in people with SMI. A meta-analysis of 3 RCTs suggests that around 12-weeks of aerobic exercise 2 to 3 times per week can improve cardiorespiratory fitness in people with schizophrenia ($g$ = 0.40, 95% CI = 0.16 to 0.64) (Soundy 2014). A systematic review of 10 studies found that walking-based interventions can produce small reductions in body fat or body mass index (BMI) in people with schizophrenia (Soundy 2014). Another systematic review of 7 RCTs found that combined aerobic and resistance training for around 95 minutes twice per week, was effective for improving strength and overall mental health in people with schizophrenia (Martin 2017). While less research is available for bipolar disorder, regular aerobic exercise in people with mild to severe depression improves various aspects of physical health, including cardiorespiratory fitness, body fat, and blood glucose levels (de Souza Moura 2015; Vancampfort 2017).

Physical activity interventions also provide broader of range benefits to people with SMI. For example, two RCTs found at least 120 minutes of moderate to vigorous physical activity per week improved quality of life and reduced disability (Firth 2015). A meta-analysis of 8 RCTs using various types of exercise found large improvements in sleep ($g$ = 0.73, 95% CI, 0.18 to 1.28) in people with SMI (Lederman 2019).

Aerobic exercise can also stimulate a multitude of changes in the brain that are relevant to SMI (Kandola 2016). For example, aerobic exercise can increase the volume (Firth 2018) and functioning of the hippocampus (Erickson 2009), including in people with schizophrenia (Pajonk 2010; Woodward 2018). These improvements in hippocampal integrity may contribute towards reductions in overall symptoms and cognitive deficits in people with schizophrenia (Kandola 2016). Evidence from 160 RCTs also suggests that both aerobic and strength training over a median of 12-weeks can reduce several pro-inflammatory markers in predominantly healthy participants (Lin 2015). There is also some early evidence of this in psychiatric populations (Euteneuer 2017; Lavebratt 2017). Pro-inflammatory cytokine levels are elevated

in many people with SMI and could contribute towards both psychiatric symptoms and physical health risks (Khandaker 2015; Rosenblat and McIntyre, 2016).

Interventions to increase activity are a relatively low-risk approach for improving the mental and physical health of people with SMI. Exercise interventions do not substantially increase the risk of adverse events in mental health treatment, although more consistent data on safety would be beneficial (Czosnek 2019). Despite promising initial findings, there remains a lack of large-scale RCTs of activity interventions in SMI populations (Vancampfort 2019). While community-based exercise interventions are increasingly demonstrated as cost-effective in non-SMI populations (Kelly 2020), similar data in SMI groups is lacking (Czosnek 2019). There remain unanswered questions regarding dose-response (frequency, intensity, and duration of intervention) and safety. For example, people with SMI may experience balance or other musculoskeletal issues that increase the risk of falling during exercise (Hamera 2010). Tailored exercise programmes that incorporate balance and coordination exercises could be a useful method of addressing these concerns (Vancampfort 2016). The cardiovascular and metabolic benefits of exercise likely outweigh the risk of falls, which only represent a concern for a minority of people with SMI (Firth 2016). Achieving 150 minutes of moderate to vigorous physical activity is a viable target in many populations, but different targets may be necessary for people with SMI (Vancampfort 2015). For example, people with SMI may benefit from engaging in frequent bouts of light activity throughout the day to break up extended periods of sitting. Large RCTs are necessary to compare the relative benefits of different intensities, durations, and frequencies of activity in people with SMI.

**Barriers and facilitators for implementation**

While there is a growing evidence base for its transdiagnostic benefits, the clinical implementation of physical activity interventions for people SMI is lacking (Vancampfort 2015; Lederman 2017). Modifying physical activity behaviours is a challenge in any population group and requires varying approaches for different people (Heath 2012). There are several physical, psychosocial, and environmental barriers to increasing physical activity and decreasing sedentary behaviour in people with SMI (Soundy 2014; Firth 2016). These factors likely underlie the substantial dropout rates from activity interventions in SMI populations, which is estimate to be around 27% in people with schizophrenia (Vancampfort 2015). Although this is within the range of dropout rates for activity interventions found in other populations between 18% to 35%, such as in people with obesity (Linke 2011).

For example, medication side-effects and co-existing physical health conditions are examples of possible physical barriers to increasing activity in people with SMI. Physical activity is typically lower in adolescents and adults with SMI who also take second-generation antipsychotic medications (Cuerda 2014; Vancampfort 2016; Perez-Cruzado 2018). A qualitative study of 151 physical therapists working in

psychiatric services suggests that medication side effects are amongst the most commonly cited barriers to increasing activity in people with schizophrenia (Soundy, 2014). However, it remains unclear whether the medication or other factors explain the lower activity (Cuerda 2014).

Nurses and other healthcare staff also commonly report a lack of motivation and negative symptoms as common barriers to implementing physical activity interventions in people with SMI (Harding, 2013; Robson 2013; Soundy 2014). Related symptoms may also affect motivation. For example, social anxiety may reduce the likelihood of exercising outside or in a gym. Other motivational factors may relate to SMI treatment. For example, medication side effects can cause affect motivation to exercise through sedation and neuromuscular side effects (Soundy 2014; Firth 2016). Understanding factors that increase motivation for activity in people with SMI is an essential but understudied area. A systematic review of 79 studies in SMI populations was only able to identify one that included motivation for physical activity as its main outcome (Farholm and Sørensen 2016). The review suggests that interventional studies commonly use motivational interviewing and goal setting techniques without directly evaluating their effectiveness. Related factors include a reduced sense of self-esteem and confidence in people with SMI that limit motivation to increase activity (Soundy, 2014).

Other factors exist that facilitate the successful implementation of activity interventions in SMI populations. A meta-analysis of 19 activity interventions in people with schizophrenia found that having a qualified professional delivering the intervention moderated dropout (Vancampfort, 2015). For example, including a physical therapist or exercise physiologist to lead to activity intervention may increase adherence. A qualified exercise professional may increase the quality and enjoyment of exercise sessions. Social support is another facilitation of activity in SMI populations (Soundy, 2014). Peers and healthcare professionals can play an active role in fostering a supportive and encouraging environment to facilitate adherence to activity interventions. These factors may help with psychosocial barriers of self-esteem and motivation.

The provision of information about the activity is another possible facilitator of activity (Soundy, 2014). People with SMI may lack knowledge about the benefits of the activity or how to perform activities that most interest them (Matthews 2018). Providing this information contributes to a supportive environment and promotes self-efficacy, which can lead to increased activity. Goal setting and creating personalised activity plans are also likely to provide complementary benefits for promoting sustainable improvements in activity (McEwan 2016). For example, the PRIMROSE trial for reducing cardiovascular risk in SMI groups obtained good adherence to the intervention through the use of behavioural change techniques that included goal-setting, action plans, progress tracking, providing positive feedback, and dealing with setbacks (Osborn 2018).

## Future directions

Implementing physical activity in the treatment of SMI will be an important step in the NHS achieving their long-term goal of improving physical health outcomes for SMI groups (NHS, 2019). Studies of activity in SMI populations are increasingly moving beyond demonstrating efficacy to establishing effectiveness in real-world settings, including the application of behavioural change techniques (Farholm and Sørensen 2016). Increasing adherence to interventions will be key to improving the quality of physical healthcare in SMI populations in accordance with NICE guidelines (NICE 2014). Further research must directly examine successful methods for designing and implementing activity interventions in SMI populations, particularly in people with bipolar disorder where there is a paucity of work. The field may benefit from developing novel methods for motivating people with SMI to increase their activity. For example, 'exergaming' interventions target motivation through enjoyable video games that promote exercise and bodily movements. An exergaming study in 16 outpatients with schizophrenia found good acceptability, feasibility, and an attrition rate of around 19% (Campos 2015). However, no improvements in fitness, mobility, or symptoms resulted from the intervention.

A recent trial also integrated self-management concepts and social cognitive theory to promote adherence in people with SMI to a cardiovascular risk reduction intervention delivered through community mental health settings (Daumit 2020). For example, they used motivational interviewing and solution-focused therapy session tailored to minimise the impact of memory and executive functioning deficits. The intervention also included a points system to encourage participants to attend sessions and achieve goals. Further interventions in community settings that utilise novel techniques to promote adherence would be beneficial.

It will also be necessary to develop better activity interventions in SMI populations through a practical and realistic lens. Maintaining good activity levels across the life course will be necessary to improve long-term physical health outcomes. But activity interventions typically last between 12 to 24 weeks in SMI populations and follow up periods rarely exceed 36 weeks (Firth 2016b). It remains unclear whether increased activity levels during the study period reflect sustainable changes in activity habits.

More research should focus on establishing safety and outlining the cost of activity interventions in mental health settings (Czosnek 2019). While developing personalised activity plans and hiring exercise physiologists will likely promote adherence, they will also increase the cost. Managing cost-effectiveness will be essential as activity interventions are most suitable as part of complex, multifactorial treatments approaches to mental illness (Firth 2019). Developing personalised approaches also requires accurate assessments of baseline activity and fitness. The use of devices to monitor activity levels could be prohibitively expensive in many clinical settings, where self-report measures are more feasible. However,

just one physical activity questionnaire has been specifically designed and validated for recording activity in people with mental illness to date (Rosenbaum 2020).

A recent meta-review of 33 reviews found no available data on the cost of implementing activity interventions in mental health settings (Czosnek 2019). The long-term benefits of activity may outweigh the immediate costs of interventions. For example, physical activity may reduce cardiovascular risk, potentially offsetting future treatment costs for cardiovascular disease. More careful consideration of cost will be necessary to translate research into practice (Czosnek 2019).

A recent Lancet Psychiatry Commission on physical health in mental illness called for more routine implementation of lifestyle approaches in mental healthcare, including the involvement of physical therapists and exercise specialists (Firth 2019). This integrative approach to routine care reflects a need to manage the physical health of people with SMI more effectively, both with and without physical comorbidities. A greater integration of lifestyle approaches will contribute to the prevention or reduction of physical health problems over time and help to close the mortality gap between SMI and the general population. It will also help to mitigate some long-term medication side-effects, such as weight gain. Lifestyle approaches aiming to counteract weight gain in people with SMI are most effective when combining exercise with dietary changes, rather than exercise alone (Gurusamy 2018). Implementing these lifestyle approaches as part of routine care in SMI groups may require changing staff perspectives and culture, such as by implement brief lifestyle interventions in clinical and non-clinical staff (Rosenbaum 2020). Practitioners' lacking knowledge of physical activity interventions is a common barrier to their prescription in mental health services (Way 2018).

There has also been an increase in local and national initiatives to highlight systemic changes that facilitate the integration of physical and mental healthcare. For example, the World Health Organisation have published guidance on individual, health systems, and societal level changes for reducing health inequalities in SMI groups (World Health Organisation, 2017). Similar reports from Public Health England highlight location actions necessary to reduce these inequalities, including addressing the social determinants of poor health and early detection and intervention (Public Health England 2018). Co-producing these initiatives with SMI groups will be an important strategy for their successful implementation (Deenik 2020).

It remains unclear to what extent these new ideas and best practice guidelines will produce meaningful improvements for SMI groups. However, the growing recognition of these issues may promote a wider-scale adoption and implementation of strategies that do produce sustainable improvements ahead. Current interventions are based on theory and behavioural science and BAP guidance highlights the limited evidence on long-term maintenance of lifestyle interventions (Cooper 2016). Demonstrating sustainable improvements in physical health risks may require further investment in long-term

approaches with several years between follow-up assessments. The long-term maintenance of these interventions may also require environmental changes that facilitate greater incidental physical activity, such as accessible and comfortable walking and cycling areas (Vancampfort 2013).

Despite a growing number of studies in the area, there is still no consensus over the type, frequency, duration, and intensity of activity most suitable for treating people with SMI (Cooper 2016; Lederman 2017). A recent systematic review of 32 studies found inconsistent and low-quality evidence that interventions can increase activity or reduce sedentary behaviour in people with SMI (Ashdown-Franks 2018). Large-scale RCTs are necessary to establish the type, frequency, duration, and intensity of activity that will be most beneficial for people with SMI.

**Conclusions**

The challenges of implementing successful activity interventions in SMI populations does not detract from their importance. People with SMI are at an elevated risk of physical health complications over time, including obesity, cardiovascular and metabolic disease, and premature mortality. Low sphysical activity, low fitness, and high sedentary behaviour are modifiable risk factors for many of these health complications. These risk factors are highly prevalent in SMI populations and likely compounded by other risk factors, including smoking and poor diet.

Activity interventions for people with SMI are an essential adjunction to treatment. Promoting activity will reduce the risk of these physical health complications. It will also have a positive impact on mental health symptoms and have wider benefits, including improving sleep quality and quality of life. However, large-scale RCTs will be necessary to provide further information on dose-response and other fundamental aspects of treatment. There is also a paucity of research focusing on translation. Details on practical considerations are still lacking, such as cost and safety. Amongst the greatest challenges in the area relate to improving adherence to activity in people with SMI. A more direct approach is necessary to identify methods to address poor adherence, such as developing novel ways of increasing enjoyment of activity and motivation.

**Multiple choice questions**

- Why might the inclusion of physical activity in SMI treatment be beneficial for patients?
    - physical activity can reduce feelings of stress and improve sleep
    - physical activity can improve psychiatric symptoms
    - physical activity reduces the long-term risk of physical health complications
    - **all of the above**
- Which is a key factor in moderating drop out from activity interventions in people with SMI?
    - a lack of peer support
    - physical limitations and discomfort
    - cost of travel to sessions
    - **a qualified exercise professional leading sessions**
- What is a commonly cited barrier for physical activity engagement in people with SMI?
    - **medication side effects**
    - positive symptoms
    - unrealistic goal setting
    - difficulty of activity
- To facilitate the widespread implementation of physical activity interventions into treatment for SMI, a priority for future work is to…
    - establish longer-term effects of activity on physical health
    - **establish the safety and cost-effectiveness of activity interventions in SMI groups**
    - establish the impact of activity on brain functioning
    - establish whether aerobic or resistance training is more effective for improving outcomes
- What are the current recommendations for minutes spent in moderate-to-vigorous activity per week for adults aged 19 to 64 in the UK according to the Chief Medical Officers' report?
    - at least 300 minutes of moderate activity or 150 minutes of vigorous activity
    - at least 75 minutes moderate-to-vigorous activity
    - up to 150 minutes of moderate-to-vigorous activity
    - **at least 150 minutes of moderate activity or 75 minutes of vigorous activity**

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**Author contributions**

Both authors made substantial contributions to the conception, drafting, revising, and final approval of the manuscript in accordance with ICMJE guidelines. The authors agree to be accountable for the integrity or accuracy of the work.

**Declaration of interest**

No authors have any conflicts of interest to declare.

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