



Recovery-oriented Community-based Exercise for Young Adults with Severe Mental Illness



PhD Thesis

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Preface

This thesis is the result of an exciting and challenging journey, both professionally and personally. Throughout my PhD, I have been closely involved in the Vega trial, a national pragmatic randomized controlled trial, particularly as “the man in Jutland” responsible for managing the intervention in Aalborg and Aarhus. Additionally, I was primarily responsible for the training of exercise instructors. It was particularly inspiring to meet so many young people with great competence and a strong desire to support recovery-oriented exercise for people with mental illness. Also, working with young adults with mental illness has been an eye-opening experience. I have witnessed firsthand how movement can be more than just exercise - it can be a means of rediscovering oneself, forging new social connections, and regaining a sense of control. At the same time, I have gained a deeper appreciation for the many barriers participants face - not just in terms of motivation or physical fitness, but also regarding stigma, social uncertainty, and the challenges of mental illness.

My PhD project has been made possible through meaningful collaboration between the Department of Physiotherapy at the University College of Northern Denmark (UCN), the Centre for Applied Research in Mental Healthcare (CARMEN) at Mental Health Centre Glostrup and Mental Health Services in the Capital Region. This partnership has been invaluable, and I hope that my work can help inspire future collaborations between educational institutions and clinical research environments. As a lecturer in physiotherapy, I have always had a strong professional interest in movement and exercise. However, working with this specific population was new to me, and it has challenged my understanding of how physical activity functions in different people's lives. My inherently positive approach to exercise has been tested, nuanced, and put into perspective through the interactions and conversations I have had with participants, instructors, and various stakeholders involved in the project.

Ultimately, my hope is that this work can contribute to improving opportunities for people with mental illness to engage in meaningful, recovery-oriented exercise. Physical activity should not be a privilege reserved for those in a state of well-being but should be accessible and supported whether one is at the peak or in the depths of their mental health journey. Everyone deserves the chance to move, to connect, and to experience the benefits of physical activity - regardless of where they are in their recovery process.

Acknowledgment

First, I would like to thank my primary supervisor, Professor Julie Midtgaard. Julie was also my supervisor during my Master's degree, and even though I moved from Copenhagen to Aalborg, she did not hesitate when I reached out about a potential collaboration. You opened my eyes to the value of qualitative research - something I had not previously identified with before this PhD. You always believed in me and supported me in doing things "my way." Truly, you are the embodiment of *Excellence and Kindness in Research Training*, and for that, I am deeply grateful.

To Victor Sørensen and Bolette Skjødt Rafn. Thank you for being close collaborators and "partners in crime" in the Vega Exercise Community. Victor, you were like "me in Copenhagen," only more gifted and talented than I will ever be. Bolette, thank you for serving as a co-supervisor on my PhD and being somebody, I can always call whenever something is on my mind. It is inspiring to work with such talented people who continually motivate me to do my very best. Most importantly, thank you both for the fantastic friendship that has developed over the past four years, making my trips to Copenhagen full of meaningful work and joyful social moments. I could not have imagined such a valuable collaboration and friendship emerging from a research project and PhD program conducted at a distance. I would not trade it for anything.

To my other PhD supervisors, Bjørn Ebdrup and Allan Riis, thank you for your support - especially when I needed fresh eyes and feedback from someone not as deeply embedded in the Vega Exercise Community. Your kindness, availability, and constructive input have meant a lot.

To all my colleagues at CARMEN and at the Department of Physiotherapy, UCN. Thank you for your understanding and support whenever needed.

In memory of Dorte Drachmann, former Head of Education at the Department of Physiotherapy, who passed away earlier this year. Dorte believed in me and hired me while I was still completing my Master's degree in Copenhagen. Together with Julie Midtgaard, she made this PhD possible. Dorte was truly inspiring - a pioneer - and without her, I would not be where I am today.

I also want to acknowledge all the fantastic participants who generously shared their experiences and perspectives. Your openness made this research possible and has had a profound impact on me personally. Thank you.

Last but not least, I would like to thank my friends and family - especially my wife, Elisabeth, and my two boys, Johannes and Elias. Thank you for your love and support over these past years, and

for your understanding whenever I was not present - sometimes physically, sometimes mentally. You have helped me create a life filled not just with work, but with treasured memories: getting married, welcoming two wonderful boys, traveling, and restoring our future home. I dedicate this PhD to you, for making these the best years of my life.

English summary

Introduction

This thesis explores the role of community-based exercise in supporting personal recovery among young adults with severe mental illness. While exercise is widely recognized for its benefits on physical and mental health, its contribution to personal recovery - a process of rebuilding a meaningful and self-directed life – remains relatively underexplored. Many individuals with SMI face barriers to physical activity, including symptoms from the illness, low motivation, medication side effects, social stigma, and environmental constraints. Understanding how exercise interventions can align with personal recovery is essential for creating sustainable and accessible opportunities for physical activity.

The thesis is related to the pragmatic randomized controlled trial, the Vega trial, which aims to examine the effectiveness of a community-based exercise intervention. It includes two published papers and one manuscript draft reporting the findings from three qualitative studies which have contributed to the development, evaluation and implementation of the Vega intervention, i.e., the Vega Exercise Community.

- Study I examined expert perspectives on developing community-based exercise interventions for young adults with schizophrenia.
- Study II explored stakeholder views on training lay exercise instructors in charge of facilitating community-based exercise for young adults with schizophrenia.
- Study III investigated Vega participants' lived experiences of their recovery process in relation to community-based exercise.

Methods

A qualitative design was applied, using Qualitative Content Analysis in Study I and II, and Reflexive Thematic Analysis in Study III. Data were collected through expert interviews (Study I), stakeholder focus groups (Study II), and in-depth participant interviews (Study III).

The epistemological stance of this thesis is pragmatism, which prioritizes practical solutions and real-world applicability over rigid theoretical constraints. Pragmatism allows for methodological flexibility, enabling qualitative insights to be integrated into a broader intervention framework.

Results

Expert and Stakeholder Perspectives on Community-Based Exercise: Findings from Study I and II highlight the importance of embedding exercise in community settings rather than clinical environments to foster a sense of normalcy and social integration. Experts and stakeholders emphasized that exercise should be recovery-oriented rather than medicalized, encouraging autonomy and participation rather than reinforcing illness-related identities. A key challenge was balancing structured programming with flexibility to ensure that individuals could engage at their own pace while benefiting from routine and stability. Lay exercise instructors were identified as crucial to the intervention's success. While mental health professionals could provide support, instructors needed training in fostering inclusivity and understanding participants' unique needs. Social support was also seen as essential for sustaining participation. Stakeholders emphasized the role of family, peers, and mental health professionals in encouraging engagement. However, they also noted that while exercising with others could be motivating, social comparison and performance-oriented fitness culture could sometimes discourage participation.

Embodied Recovery: Lived Experiences of Exercise: Findings from Study III show that exercise is not just a physical activity but an embodied and social process that plays a significant role in personal recovery. Participants described how mental illness and medication side effects had disrupted their bodily identity, leading to feelings of detachment and loss of control. Exercise allowed them to reconnect with their bodies, either by rediscovering past physical abilities or forming a new sense of bodily self. Beyond bodily identity, exercise provided a means of emotional and physiological regulation, helping participants manage anxiety, stress, and fluctuating energy levels. Structured movement routines offered stability and predictability, but some participants struggled with balancing physical exertion and fatigue. While exercise was often experienced as a stabilizing force, frustration arose when the body did not respond as expected, highlighting the ongoing negotiation between effort, capability, and self-perception. The social environment also played a crucial role. While exercising alongside peers fostered a sense of belonging, social comparison sometimes triggered self-doubt. Participants had to navigate the tension between motivation and pressure, reflecting the dual role of social settings in shaping engagement in exercise.

Discussion and Conclusion

The discussion in this thesis is framed using the socio-ecological model, which accounts for the multiple interacting factors that shape personal recovery. Findings suggest that community-based exercise is not just a tool for improving physical health but a meaningful, embodied process that fosters identity, self-regulation, and social connection.

Key takeaways from this thesis include the need for flexibility to accommodate fluctuating symptoms and motivation, socially inclusive environments that balance support with autonomy, and training for exercise instructors to foster recovery-oriented engagement. Rather than viewing exercise solely as a physical intervention, this thesis highlights its role in shaping identity, resilience, and social connectedness, offering new insights into its potential as part of personal recovery for young adults with severe mental illness.

Dansk resume

Introduktion

Denne afhandling undersøger rollen af træningsfællesskaber i understøttelsen af personlig recovery blandt unge voksne med svær psykisk lidelse. Selvom træning er bredt anerkendt for sine positive effekter på fysisk og mental sundhed, er dens bidrag til personlig recovery – en proces med at genopbygge et meningsfuldt og selvstændigt liv – stadig relativt underbelyst. Mange personer med svær psykisk sygdom oplever barrierer for fysisk aktivitet, herunder symptomer fra psykisk sygdom, lav motivation, bivirkninger af medicin, social stigmatisering og miljømæssige begrænsninger. For at skabe bæredygtige og tilgængelige træningsmuligheder er det afgørende at forstå, hvordan træningsinterventioner kan understøtte personlig recovery.

Afhandlingen er relateret til det pragmatiske randomiserede kontrollerede forsøg, Vega, som undersøger effekten af en et træningsfællesskab forankret i civilsamfundet. Den består af to publicerede artikler og et manuskriptudkast, der rapporterer fund fra tre kvalitative studier, som har bidraget til udviklingen, evalueringen og implementeringen af Vega-interventionen, Vega Exercise Community.

- **Studie I** undersøgte ekspertperspektiver på udviklingen af fællesskabsbaserede træningsinterventioner for unge voksne med skizofreni
- **Studie II** udforskede interessenters syn på træning af ikke-professionelle træningsinstruktører, der faciliterer fællesskabsbaseret træning for unge voksne med skizofreni.
- **Studie III** undersøgte deltagernes levede erfaringer med deres recovery process i relation til træningsfællesskaber i civilsamfundet.

Metode

En kvalitativ forskningsdesign blev anvendt, hvor Kvalitativ Indholdsanalyse blev brugt i Studie I og II, og Refleksiv Tematisk Analyse i Studie III. Data blev indsamlet gennem ekspertinterviews (Studie I), fokusgrupper med interessenter (Studie II) og dybdegående interviews med deltagere (Studie III). Afhandlingens epistemologiske ståsted er pragmatisme, som prioriterer praktiske løsninger og anvendelighed frem for fastlåste teoretiske tilgange. Pragmatismen giver metodologisk fleksibilitet og muliggør integrationen af kvalitative indsigter i en bredere interventionsramme.

Resultater

Ekspert- og interessentperspektiver på fællesskabsbaseret træning i civilsamfundet: Studie I og II viste, at træning bør foregå i fællesskabsbaserede omgivelser i civilsamfundet fremfor kliniske rammer for at fremme en følelse af normalitet og social integration. Ekspertes og interessenter understregede, at træning bør være recovery-orienteret frem for medicinsk fokuseret, og at autonomi og deltagelse skal prioriteres frem for at forstærke sygdomsidentitet. En central udfordring var at balancere struktur og fleksibilitet, så deltagerne kunne engagere sig i deres eget tempo, men stadig drage fordel af stabilitet og rutiner. Træningsinstruktører blev identificeret som afgørende for interventionens succes. Selvom sundhedsprofessionelle kunne spille en understøttende rolle, var det essentielt, at instruktørerne blev uddannet i inkluderende praksis og forståelse af deltagernes behov. Social støtte blev også fremhævet som en væsentlig faktor for fastholdelse i træningen. Interessenter understregede betydningen af støtte fra familie, venner og psykiatrisk sundhedspersonale, men noterede sig også, at det at sammenligne sig med andre og fitnesskulturens præstationsfokus kunne udgøre barrierer.

Embodied recovery: Deltagernes oplevelser af træning: Studie III viste, at træning ikke blot er fysisk aktivitet, men en kropslig og social proces, der spiller en afgørende rolle i personlig recovery. Deltagerne beskrev, hvordan psykisk sygdom og bivirkninger fra medicin havde påvirket deres kropsopfattelse, hvilket skabte en følelse af afstand og tab af kontrol. Gennem træning genfandt de forbindelsen til deres krop, enten ved at genopdage tidligere fysiske evner eller udvikle en ny kropslig identitet. Udover identitet blev træning en måde at regulere følelser og fysiologiske tilstande på, hvilket hjalp deltagerne med at håndtere angst, stress og varierende energi. Mens træning ofte blev oplevet som stabiliserende, var der også frustration over, at kroppen ikke altid reagerede som forventet, hvilket tydeliggjorde en konstant forhandling mellem indsats, kapacitet og selvpfattelse. Den sociale kontekst var også afgørende. Selvom træning med andre skabte motivation og en følelse af fællesskab, oplevede nogle deltagere, at social sammenligning udløste tvivl og selvkritik. Deltagerne måtte navigere mellem motivation og pres, hvilket understregede den dobbelte rolle, som sociale omgivelser spiller når man engagerer sig i træning.

Diskussion og Konklusion

Afhandlingens diskussion er rammesat af den socioøkologiske model, som inddrager forskellige niveauer af indflydelse på personlig recovery. Resultaterne peger på, at fællesskabsbaseret træning

ikke kun forbedrer fysisk sundhed, men også understøtter identitet, selvregulering og sociale relationer.

Afhandlingens resultater fremhæver vigtigheden af fleksible træningsmuligheder, der kan tilpasses svingende motivation og symptomer, samt nødvendigheden af socialt inkluderende miljøer, der balancerer støtte og autonomi. Derudover understreges behovet for at uddanne instruktører til at facilitere recovery-orienteret træning. Ved at anskue træning som mere end blot en fysisk intervention bidrager afhandlingen med nye perspektiver på, hvordan træning kan fungere som et redskab til identitetsdannelse, følelsesmæssig robusthed og social integration for unge voksne med svær psykisk sygdom.

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List of papers

My PhD thesis comprises the following two published papers and one manuscript draft:

- I. Andersen MF, Roed K, Riis A, Rafn BS, Ebdrup BH, Midtgaard J, (2023) ‘Perspectives of professional experts in relation to the development of community-based exercise for young adults with schizophrenia: a qualitative study’, *BMJ Open Sport & Exercise Science*, 9(3) (1)
- II. Andersen MF, Roed K, Sørensen V, Riis A, Rafn BS, Ebdrup BH, Midtgaard J, (2024) ‘Required elements for an educational programme for lay exercise instructors in charge of community-based exercise targeting young adults with schizophrenia spectrum disorders – A stakeholder focus group study’ *BMC Psychiatry*, 24(1) (2)
- III. Andersen MF, Jørgensen R, Midtgaard J, ‘Bodily experienced as part of the personal recovery process in the context of community-based exercise in young adults with severe mental illness: an embedded qualitative study within a randomized controlled trial’, *In draft* (3)

Introduction

This introduction sets the scene for the current thesis, providing an overview of the research timeline and its progression. It aims to help readers follow the development of the studies included in the thesis and understand their broader context. The thesis is conducted in relation to the *Vega trail*, a multicenter pragmatic randomized controlled trial (RCT) investigating the efficacy of community-based exercise on personal recovery - a process of rebuilding a meaningful and self-directed life - in young adults with severe mental illness (SMI). A detailed trial design is described in the study protocol, published in 2023 (4) and attached, along with its Additional files, as Appendix to the current thesis.

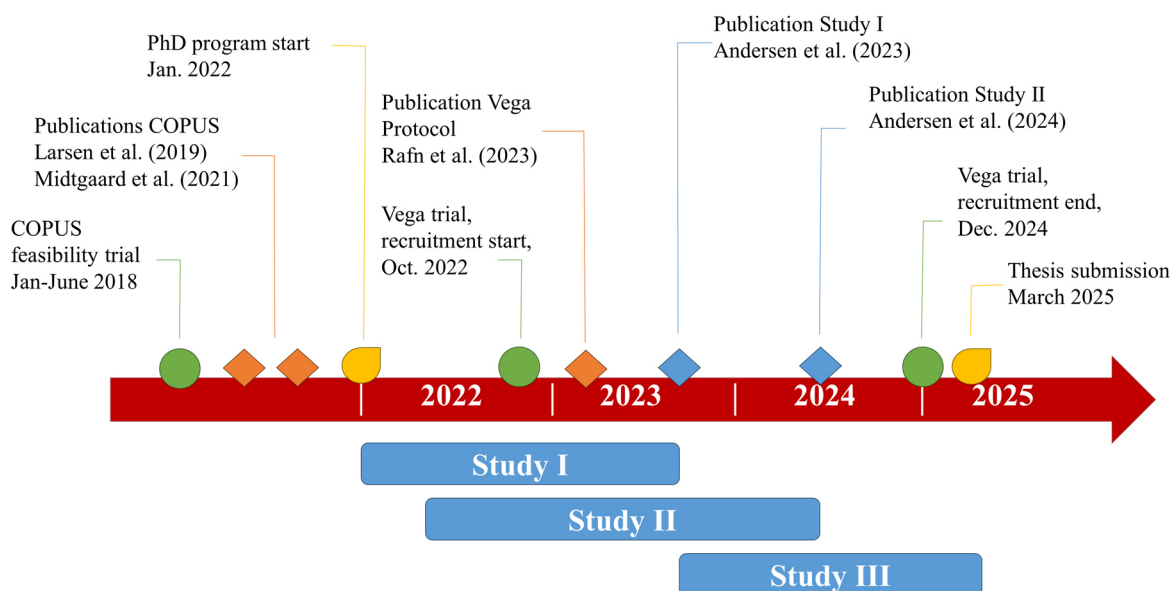


Figure 1: Timeline of the PhD program. Yellow indicates the time points from PhD program start to thesis submission. Green indicates trial conduction (COPUS and Vega). Orange indicates publications not included in the current thesis. Blue indicates publications included in the current thesis (Study III is available in a manuscript draft).

Figure 1 illustrates a timeline of the research progress and the positioning of the studies within the thesis. In 2018, the research group conducted a feasibility trial, COPUS, which examined the recruitment and retention of patients from an early psychosis unit (OPUS) in a gym-based exercise intervention delivered in a non-clinical setting. Findings from this trial, published in 2019 and 2021 (5,6), indicated that such a intervention was feasible. However, several aspects required further consideration, including recruitment strategies, intervention components, and approaches for long-

term sustainment before conducting a definitive trial. Consequently, the research group applied for and secured funding from Trygffonden for the Vega trial, which succeeded COPUS.

I began working in the developmental phase of the Vega trial in August 2021 and were enrolled at the University of Copenhagen in January 2022. Studies I and II in my thesis informed the development of the Vega intervention (from now on the *Vega Exercise Community*), engaged key stakeholders, defined a recruitment strategy, and refined the primary outcome of interest. The findings from these studies were published in 2023 and 2024 (1,2). Recruitment to the Vega trial began in October 2022 and primarily took place through outpatient services in the Capital Region, the North Denmark Region, and the Central Denmark Region, with the intervention delivered in Copenhagen, Aalborg, and Aarhus. At the end of December 2024, we ended the recruitment with a total of 226 participants enrolled in the RCT.

An important methodological note is that the inclusion criteria in the RCT changed during the recruitment period. Initially, the study included only individuals meeting specific medical criteria, e.g., regular daily dose of antipsychotic medication. However, this criterion was later removed, and the inclusion criteria were broadened to encompass a diagnosis of SMI, defined as schizophrenia spectrum disorders (SSD), bipolar disorder (BD), or major depressive disorder (MDD) (approved by local ethics committee on August 1st, 2024). As a result, readers will observe a shift in the study population throughout this thesis - from young adults with SSD (Studies I and II) to young adults with SMI (Study III). Study III is an embedded qualitative study conducted in 2024 during the final year of the Vega trial. This study aimed to explore the bodily experience bodily experiences in the process of personal recovery as it unfolds within the context of the Vega Exercise Community in participants enrolled in the Vega trial. Study III has not yet been published but is available as a manuscript draft (3).

I hope the preceding section has provided a short overview of the research timeline and positioned the studies included in the thesis. To provide a comprehensive foundation for the thesis, the following *Background* section will provide an in-depth account of the study population of individuals with SMI, physical activity (PA) and exercise interventions, community-based settings, and the intended outcome of supporting personal recovery.

Background

What is severe mental illness

The construct *Serious Mental Illness* or *Severe Mental Illness* (both using the abbreviation SMI), and sometimes *Severe and Persistent Mental Illness* (SPMI) refers to a subset of mental health conditions characterized by significant impairment in emotional, cognitive, and behavioral functioning, which substantially limits a person's ability to engage in daily life activities, maintain relationships, or participate in work or education (7). These conditions are often chronic, requiring long-term management and support, and are associated with heightened levels of distress and disability. Most prevalent, SMI includes SSD, bipolar BD, and MMD (8).

Schizophrenia spectrum disorders affects approximately 1% of the population (9). It is characterized by positive symptoms, including hallucinations, delusions, disorganized speech, and grossly disorganized behavior, as well as negative symptoms, such as reduced emotional expression, avolition, and cognitive impairment (10,11). Symptoms typically emerge in late adolescence or early adulthood (12), with a higher prevalence in men (10). The exact cause of SSD remains unclear, but it is believed to result from a complex interplay of genetic, environmental, and neurobiological factors (11). No single gene is responsible, but multiple genetic variations contribute to vulnerability (9,13). Environmental risk factors include prenatal complications, obstetric risks, psychosocial stressors, and cannabis use (9). Neurobiologically, the disorder is associated with dysregulation of dopamine and glutamate neurotransmitter systems, as well as structural brain abnormalities (9).

Bipolar disorder is characterized by recurrent episodes of mania or hypomania alternating with depression (14). It is often misdiagnosed, as symptoms overlap with other psychiatric disorders, and patients may lack insight, particularly into hypomanic episodes (14). The etiology of BD remains unclear but involves a complex interaction of genetic, neurobiological, and environmental factors. Genetic predisposition is well-established, with multiple genes implicated (15). Environmental factors, including childhood maltreatment, stress, and major life events, may contribute to the onset or exacerbation of symptoms (16). Neurobiologically, BD is associated with dysregulation of dopamine and serotonin systems (17), altered neuroplasticity, and structural brain changes, particularly in subcortical volumes, cortical thickness, and white matter integrity (18). Epidemiologically, BD affects approximately 2.4% of the population (19). Symptoms typically

emerge before the age of 25, with peaks in onset between 15-24 and 45-54 years (14,20). BD occurs equally across sexes, ethnic groups, and urban and rural areas (16).

Major depressive disorder was ranked as the third leading cause of disease burden worldwide in 2008, with projections placing it as the leading cause by 2030 (21). It is characterized by persistent low mood, anhedonia, feelings of guilt or worthlessness, fatigue, cognitive impairment, appetite changes, psychomotor disturbances, sleep irregularities, and suicidal ideation (22). The etiology of MDD is multifactorial, involving biological, genetic, environmental, and psychosocial factors. Earlier theories focused on neurotransmitter imbalances, particularly in serotonin, norepinephrine, and dopamine, as evidenced by the effectiveness of antidepressants targeting these pathways (22). More recent research highlights complex neuroregulatory and neural circuit dysfunctions, including glutamatergic and GABA dysregulation, neuroendocrine alterations, and structural brain changes (22). Adverse childhood experiences, trauma, and severe early-life stress have been linked to alterations in neuroendocrine function and cerebral structure, increasing the risk of developing MDD later in life (23). Genetic predisposition is strongly supported by family, adoption, and twin studies, with monozygotic twins showing a high concordance rate (24). MDD has a lifetime prevalence of approximately 5–17% and is twice as common in women as in men (25). Although the mean age of onset is around 40 years, recent trends indicate rising incidence in younger populations, likely linked to substance use and environmental stressors (22). MDD is more common in individuals with limited social support and those who are divorced, separated, or widowed (22).

Collectively, SMI often emerges during early adulthood, a critical period of identity formation, social development, and life transitions. The onset of SMI during this stage can disrupt education, employment, and relationships, creating long-term challenges in personal and social functioning. Individuals with SMI are at particular risk of occupational exclusion with low levels of employment both before and especially after the diagnosis of SMI (26). As a consequence, individuals with SMI experience reduced quality of life compared to healthy controls (27–29). This is often linked feelings of distress, lack of control of symptoms and daily life, a negative self-image, experiences of stigma and rejection, reduced activity, difficulties with daily functioning, and negative view on the future (30). From a neurobiological perspective, early adulthood is marked by an ongoing maturation of the prefrontal cortex and limbic system, regions in the brain associated with executive functioning, emotional regulation, and social cognition (31). This heightened neural plasticity renders individuals more susceptible to environmental stress while also presenting an opportunity for early intervention to mitigate long-term impairment (32).

Another critical consequence in relation to SMI, is what has been called a “Scandal in Premature Mortality”(33). A substantial body of evidence has demonstrated that individuals with SMI face a two- to threefold increased mortality risk compared to the general population (34,35). This mortality gap translates to a 13 to 30 year reduction in life expectancy and has continued to widen in recent decades, even in countries with well-developed healthcare systems. Notably, the leading cause of years of life lost in SMI is due to physical illnesses (35). Individuals with SMI experience a higher burden of physical health conditions, many of which are common in the general population but have a more severe impact in this group (34). According to the Lancet Psychiatry Commission and its blueprint for protecting physical health in people with mental illness, several factors constitute the increased prevalence and burden of physical health conditions in this population (35). Firstly, barriers to healthcare access, underdiagnosis, and inadequate medical treatment. Historically, somatic health in people with SMI has been neglected, and despite growing awareness, disparities in healthcare access, utilization, and quality persist (34). Secondly, side effects of psychotropic medications - including weight gain, metabolic syndrome, cardiovascular complications, and sedation - further exacerbate physical health risks. Antipsychotics, antidepressants, and mood stabilizers have been associated with increased cardiometabolic burden, leading to higher rates of obesity, diabetes, and cardiovascular disease in individuals with SMI. Lastly, modifiable lifestyle factors, such as smoking, poor diet, and physical inactivity, play a crucial role in worsening physical health outcomes.

Physical activity and exercise behavior in severe mental illness

Individuals with SMI face multiple health challenges, including higher smoking rates, increased nutritional deficits, and - particularly relevant to this thesis - lower levels of PA. On average, this population engages in only 38 minutes of moderate-to-vigorous PA daily while spending approximately 7.8 hours in sedentary behavior (36). Despite its well-documented health benefits, PA and exercise behavior are particularly difficult to modify due to several key characteristics (37,38):

1. PA is an adoption behavior, meaning that its absence is the opposite of the desired outcome, unlike behaviors such as smoking cessation.
2. It is not essential for survival, unlike eating, which limits natural opportunities for behavior modification.

3. It requires dedicated time, necessitating intentional scheduling.
4. Its physiological responses are adaptive and may be misinterpreted.
5. It demands frequent repetition, unlike one-time behaviors such as health screening.
6. It must be performed at an intensity above resting levels.

At an individual level, people with SMI encounter physiological, psychological, and socioeconomic barriers to PA participation (39). A systematic review by Firth et al. (2016) found that the most common motivators for engaging in PA were weight loss (83%), mood improvement (81%), and stress reduction (78%). However, low mood and stress were also among the most frequently cited barriers (61%), followed by lack of support (50%) (40). Additional barriers include medication side effects, co-existing physical health conditions (41), and factors such as high perceived fatigue, weight gain due to antipsychotic medication, negative symptoms, and absence of prior PA experience (40). Notably, compared with the general population, individuals with SMI are less likely to report time constraints or financial barriers as significant obstacles to PA participation (40).

Given these challenges, theory-based interventions have been explored as a means to promote PA among people with SMI. Social and behavioral theories such as the transtheoretical model (42), self-determination theory (43), self-efficacy theory (44), and the health action process approach (45) provide frameworks for understanding and facilitating PA engagement. A systematic review and meta-analysis by Romain et al. (2020) provides compelling evidence for the effectiveness of motivational theory-based interventions in increasing PA and improving health outcomes for individuals with SMI (46). Notably, interventions based on a single motivational theory demonstrated larger effect sizes, emphasizing the importance of structured, theory-driven approaches. Commonly integrated behavior change techniques include goal setting, self-monitoring, and social support, though their specific impact on PA outcomes remains unclear (46).

The transtheoretical model, in particular, categorizes individuals based on their readiness for change and incorporates constructs such as decisional balance, self-efficacy, and processes of change. Studies in SMI populations (47,48) have shown that behavioral processes of change, self-efficacy, and readiness to change predict PA engagement, underscoring their relevance in PA interventions. Additionally, self-determination theory highlights the role of autonomous regulation in sustaining PA behavior. Among individuals with SSD, those in the action and maintenance stages exhibit higher autonomous motivation and lower amotivation (49), while the satisfaction of psychological

needs - competence, autonomy, and relatedness - further enhances PA adherence and mental health-related quality of life (50). A systematic review by Farholm & Sørensen (2016) supports these findings, demonstrating that key motivational constructs - self-efficacy, autonomous motivation, and stages of change - positively correlate with PA behavior. Importantly, these associations are consistent with findings in the general population, suggesting that motivational mechanisms underlying PA engagement are not inherently different for individuals with SMI (51).

Physical activity and exercise as lifestyle intervention in severe mental illness

In 2018, the World Health Organization (WHO) guidelines on the management of physical health conditions in adults with SMI recommend lifestyle interventions as a first-line strategy for the prevention of cardiovascular disease in this population (52). Thus *Lifestyle Psychiatry* is an emerging field of interest as a valuable adjunctive treatment in mental healthcare (53,54). PA, including exercise interventions, is the most extensively researched lifestyle intervention in individuals with SMI, offering both preventative and therapeutic benefits for individuals with SMI (55,56).

Physical activity and exercise in the prevention of severe mental illness

The etiology of SMI is multifactorial and linked to several nonmodifiable and modifiable risk factors. PA and exercise may constitute a modifiable protective factor against the incidence of SMI (56).

Most promising is the protective relationship between PA and MDD. A recent umbrella review by Rahmati et al (2024) investigated the relationship between PA and the prevention of mental health complications. Their findings revealed a significant association between higher PA levels and reduced risk of depression (OR = 0.77, 95% CI [0.72 to 0.82]) (57). In their subgroup analysis of disease severity, they identified two meta-analyses reporting separately on MDD. The first one was Schuch et al (2018) who found that those with high levels of PA had lower odds of developing depression (adjusted odds ratio = 0.83, 95% CI [0.79 to 0.88]). Subgroup analysis also yields protective effects against MDD (adjusted odds ratio = 0.86, 95% CI [0.75 to 0.98]). The second one was Pearce et al. (2022), who observed an inverse curvilinear dose-response association between PA and depression, with steeper association gradients at lower activity volumes. Relative to no activity, accumulating half the recommended volume of PA (4.4 marginal metabolic equivalent task

hours per week [mMET-h/wk]) had 17% (RR=0.83, 95% CI [0.75 to 0.92]) lower risk of developing MDD. At volumes at 8.8 mMET hours per week, there were 25% (RR=0.75, 95% CI [0.64 to 0.87]) lower risk of MDD with diminishing potential benefit beyond that exposure level (58).

When it comes to the protective effects of PA in relation to SSD and BD, the evidence is more conflicting. A meta-analysis by Brokmeier et al. (2020) yielded that people reporting higher levels of PA had reduced odds of developing SSD or psychosis (OR = 0.73, 95% CI [0.532 to 0.995]). However, in sensitivity analysis adjusting for potential confounders, the significant protective effect disappeared (AOR = 0.59, 95% CI [0.253-1.383]) (59). A Mendelian randomization study by Sun et al. (2020) found no significant relationship between overall PA and SSD (OR = 1.133, 95% CI [0.636 to 2.020]) but in BD, PA was associated with lower risk (OR = 0.491, 95% CI [0.314 to 0.767]) (60). In contrast, one prospective study found that higher levels of PA were associated with a greater likelihood of incident BD at follow-up (61).

Physical activity and exercise in the management and treatment of severe mental illness

In a recent guidance on lifestyle interventions for adults with SMI, the European Psychiatry Association (EPA) they conducted a meta-review of the evidence (54). In relation to PA and exercise, they complemented an earlier EPA guidance paper from 2018 (55). The following section should be credited to these comprehensive works.

In SSD, the EPA provided the following recommendation:

“Physical activity should be offered to individuals with schizophrenia spectrum disorders as an adjunctive treatment to improve positive, negative and general psychopathology symptoms, cognition, and quality of life.”(54)

PA and exercise interventions have been shown to be effective in alleviating positive, general, and especially negative symptoms of SSD (54). A systematic review by Firth et al. (2015) found that 90 minutes of moderate-to-vigorous exercise per week reduced total symptoms (SMD = 0.72, 95% CI [-1.14 to -0.29]), positive symptoms (SMD = -0.54 95% CI [-0.95 to -0.13]), and negative symptoms (SMD = -0.44 95% CI [-0.75 to -0.09]) (62). Korman et al. (2023) evaluated the effect of exercise on functioning in individuals with SSD and found a moderate impact on global ($g = 0.40$, 95% CI [0.12 to 0.69]), social ($g = 0.54$ 95% CI [0.16 to 0.9]), and daily living functioning ($g =$

0.65, 95 %CI [0.07 to 1.22]) (63). Furthermore, aerobic exercise may be effective in improving the quality of life in SSD and other psychotic disorders (64). There is no consistent effect of PA and exercise on body weight and body mass index (BMI) (65,66), however, a systematic review by Vancampfort et al. (2015), found that exercise improves cardiovascular fitness in people with SSD ($g = 0.40$, 95% CI [0.16 to 0.64]) (67).

In MDD, the EPA provided the following recommendation:

“Physical activity should be offered as a treatment to improve depressive symptoms, cognitive functioning, and sleep quality in adults with major depressive disorder. Among meditative forms of physical activity, the strength of evidence is greatest for yoga.” (54)

Despite some null findings (68), aerobic and resistance exercise have been found to significantly reduce depressive symptoms in MDD, with larger effects when delivered at moderate intensity and supervised by exercise professionals (69), and the effect is consistent between different clinical and non-clinical settings (70). A recent network meta-analysis on a broad depression population (depression, MDD, and self-reported) found that walking and jogging had the largest effect on depressive symptoms ($g = -0.63$ 95% CI [-0.80 to -0.46]) and that resistant exercise appeared more effective when prescribed to a younger population (71). Furthermore, aerobic exercise is efficacious in improving overall cognitive function ($g = 0.21$, 95% CI [0.07 to 0.34]) and the sub-domains of memory ($g = 0.25$, 95% CI [0.06 to 0.44]) and executive function ($g = 0.12$, 95% CI [0.04 to 0.20]) in MDD (72). Different modalities of PA may improve sleep quality, with mind-body exercise (SMD = -0.46, 95% CI [-0.80 to -0.12]) and vigorous resistance exercise (SMD = -0.61; 95% CI [-1.12 to -0.10]) as the most promising (73). Currently, no conclusion can be drawn about the physical health benefits of PA and exercise interventions in MDD (68). However, there is a general consensus regarding the potential of exercise to reduce cardiovascular risk and mortality in MDD (74).

The EPA does not provide a recommendation for PA and exercise in BD (54,55) and the literature is sparse and inconsistent (41,56,75). One review by Melo et al. (2016), including observational studies and a few non-randomized interventional studies, found that higher exercise levels were associated with fewer depressive symptoms in individuals with BD, while the association with mania symptoms was inconsistent (76). There is some preliminary evidence suggesting that exercise can help individuals with BD manage their excess energy but may also exacerbate manic and hypomanic symptoms by triggering the behavioral activation system (77,78). Indeed, exercise has been reported as a *doubled-edged sword* by individuals with BD (79).

Community-based physical activity and exercise interventions

Community-based interventions are vital in promoting social inclusion, autonomy, and overall well-being among individuals with SMI by providing recovery-oriented support within their local communities rather than through hospital-based or residential psychiatric care (80). WHO advocates for integrated, community-based mental health services, highlighting their role in reducing stigma and fostering long-term functional recovery (81). PA and exercise intervention delivered in community-based settings may release the potential benefits on physical and mental health while providing a sense of purpose, achievement, and belonging (82). Moreover, it can provide structured opportunities to rebuild confidence and foster resilience in normalized social settings, counteracting social isolation and stigma (83). Lastly, community-based exercise produces life-skills like emotional regulation and goal setting that are relevant and transferable to other contexts, such as school, employment, and individual living (84).

Several PA and exercise interventions targeting individuals with mental illness have been integrated into community-based settings. In the following section, I will present some of these interventions that have been reported and evaluated in international peer-reviewed journals, along with local Danish initiatives.

The **IBEEP** (Investigating the Benefits of Exercise in Early Psychosis) study is a 10-week community-based exercise intervention designed for young adults (18–35 years) with first-episode psychosis (FEP). Participants attended twice-weekly supervised exercise sessions at local leisure centers, engaging in 45–60 minutes of aerobic and resistance training tailored to individual preferences. The program aimed to improve physical health, reduce psychiatric symptoms, and enhance cognitive and social functioning. Their non-randomized feasibility trial demonstrated high retention rates, symptom reduction, and cognitive benefits (85). At 6-month follow-up, long-term participation was associated with sustained benefits, however adherence to unsupervised exercise was low (86). In a qualitative evaluation, the participants highlighted how the program improved their mental health, confidence, and sense of achievement. Autonomy and social support were identified as critical for engagement in the program (87).

The **In SHAPE** (Self Health Action Plan for Empowerment) program is a community-based health promotion intervention developed to support individuals with SMI in adopting healthier lifestyle behaviors, focusing on exercise and nutrition. The program operates within mainstream community

settings, reflecting principles of social inclusion and community integration. In SHAPE collaborates with local organizations, such as the YMCA, to provide access to fitness facilities and promote PA and healthy eating among participants. Each participant is paired with a health mentor, a certified fitness trainer who provides individualized coaching and goal setting to develop a personalized fitness plan. The program includes regular weekly meetings with the health mentor, addressing fitness goals, dietary changes, and other health-related objectives. Mentors use motivational interviewing, problem-solving techniques, and positive reinforcement to encourage sustained participation and overcome barriers to engagement. The program includes free access to local fitness facilities, group-based fitness and nutritional education sessions, and a rewards system for meeting PA and dietary goals. Group celebrations held every six weeks further enhance motivation, providing social support, recognition, and educational activities. The In SHAPE program has been piloted (88) and evaluated in several times (89–91). In a qualitative investigation related to the pilot study found the most influential elements of the program was (i) individualized interventions promoting engagement in the program; (ii) relationships with health-promotion program employees and (iii) self-confidence resulting from program participation (92). Furthermore, in a longitudinal qualitative study, the participants identified the trainer's ability to contain their initial feelings of distress and form a working alliance as factors that contributed to their exercise persistence (93).

The **NEW-R** (Nutrition and Exercise for Wellness and Recovery) program is an 8-week intervention designed to support individuals with psychiatric disabilities in adopting healthier lifestyle habits, particularly for weight management. Developed for community mental health settings, it builds on the RENEW program, a 12-month weight-loss initiative. The program integrates self-determination theory, psychiatric rehabilitation, and the ecological model of obesity to provide a comprehensive, accessible solution to health challenges in this population. The program includes eight 90-minute sessions, each covering topics such as healthy eating, exercise, and weight management, featuring weigh-ins, goal setting, and 20 minutes of exercise. The final session focuses on reflecting on progress and creating a plan for continued weight management. The program emphasizes intentionality - encouraging participants to make mindful health choices - and provides social and instrumental support to help participants apply learned skills in everyday life. The program was piloted (94) and evaluated, resulting in significant improvements in perceived competencies for exercise and total HPLP (Health-Promoting Lifestyle Profile) (95).

The **FITMIND** program is a 12-week, community-based exercise intervention developed to support individuals with psychosis in adopting and maintaining regular PA. It aims to improve both

physical and mental health by integrating aerobic exercises and yoga into participants' routines. Delivered in weekly sessions, the program combines structured exercise, goal setting activities, and support from trained volunteers. FITMIND encourages participants to engage in vigorous-intensity PA, gradually building up fitness levels while improving mood and overall well-being. A pilot study demonstrated significant improvements in PA levels, mood regulation, and adherence to international PA guidelines (96).

The ***FEPP Fit*** program is a lifestyle intervention for young adults with psychosis, delivered over 11 weeks with weekly sessions. Each session lasts 60 minutes and consists of two central components: HIIT (High-Intensity Interval Training) group exercise and health education. The HIIT sessions, developed and delivered by a licensed trainer, include a warm-up, strength and aerobic intervals, and a cool-down with stretching. The health education curriculum, led by a registered dietitian or mental health professional, covers topics such as nutrition, goal setting, pedometer use, problem-solving skills, mindfulness, and positive psychology. In a pilot study, they found that the attendance rate to the program was 70% or higher for both the HIIT and the educational component (97).

The ***Psychiatric Alliance*** community sports initiative, designed to promote PA and social inclusion for individuals with mental health and substance use challenges. Offering a range of free sports activities in ordinary sports arenas, the initiative creates a low-threshold, inclusive environment that fosters participation and community engagement. A qualitative evaluation found participation in initiative enhances access to resources, providing structure, affordability, and opportunities for PA. It fosters recognition through responsibilities and roles, empowering participants by offering meaningful roles that strengthen their sense of agency and identity. Finally, it cultivates a sense of belonging through relationships, reducing isolation and creating a welcoming, stigma-free community (98).

There are also some notably Danish community-based exercise initiatives for people with mental illness.

“Idræt for Sindet” (*Sports for the Mind*) (99) is a nationwide initiative under the Danish Workers' Sports Federation (Dansk Arbejder Idrætsforbund, DAI) that has been working since 1996 to establish sports associations for individuals with mental health challenges. The aim is to promote PA and create social communities that support mental health and well-being. The initiative collaborates with municipalities to set up associations run by volunteers, offering regular training

sessions in various sports disciplines. Currently, approximately 38 municipalities have their own *Idræt for Sindet* association. Activities in these associations are diverse and can include sports such as badminton, floorball, gymnastics, walks, and mindfulness. They are designed to be inclusive, ensuring participation regardless of physical ability or prior sports experience. Emphasis is placed on creating a safe and welcoming environment where social interaction is central, both during and after activities.

“Idrætsforeningen Kæmperne af 1998” (IFK98) (100), commonly known as **“Kæmperne”** (*the Fighters*), is a sports association primarily catering to individuals aged 18 and above who face psychological and/or social challenges. The association offers a wide range of physical and social activities aimed at enhancing both physical and mental well-being. The association emphasizes creating a socially safe and stable environment through qualified training activities, tournaments, and other sports-related events. Social activities, such as club evenings, parties, chess and fishing clubs, as well as trips and events with other sports associations, are also integral to the community.

“MotionsCaféen” (*Movement Café*)(101) is an initiative under **“Håb i Psykiatrien”** (*Hope in Psychiatry*) that provides a free and supportive exercise community for individuals facing severe mental health challenges. The program focuses on promoting both physical and mental well-being through group-based PA and social interaction. The program offers a range of exercise sessions that are adaptable to all fitness levels, ensuring accessibility for all participants. In addition to PA, *MotionsCaféen* fosters a welcoming and inclusive social community, where participants encourage and motivate each other. After each session, a healthy lunch is provided, reinforcing a holistic approach to health. By bridging the gap between psychiatric treatment and everyday life, *MotionsCaféen* helps participants regain confidence and motivation in a safe, pressure-free environment. The initiative operates year-round, ensuring consistency and stability for participants and supporting sustained engagement in PA.

Community-based PA and exercise may present an untapped resource in recovery in SMI (83). However, recovery can be understood through different lenses, each emphasizing different aspects of the process (102).

Personal recovery

The concept of recovery in mental health has been the subject of extensive debate, leading to the development of various frameworks aimed at defining what it means to "get well." Broadly, recovery can be understood through two distinct approaches: clinical recovery and personal recovery (102,103). Clinical recovery - also referred to as recovery from, objective recovery, or recovery as an outcome - focuses on measurable improvements, such as symptom reduction and functional restoration, that align with diagnostic criteria for mental illnesses (103). This approach emphasizes quantifiable outcomes, including remission, which is defined as the reduction or absence of symptoms below diagnostic thresholds (104,105).

In contrast, personal recovery - also termed recovery in, subjective recovery, or recovery as a process - prioritizes the individual's subjective experience, emphasizing well-being and the ability to live a meaningful life even in the presence of ongoing symptoms (103). Unlike remission, personal recovery acknowledges that individuals can thrive and find fulfillment despite living with chronic symptoms. Personal recovery represents a paradigm shift in the understanding of mental health recovery, placing the focus on the subjective, individualized journey of reclaiming a satisfying and meaningful life (102,104,106). This approach challenges the traditional reliance on clinical measures alone, as reflected in William Anthony's widely cited definition: "*A deeply personal, unique process of changing one's attitudes, values, feelings, goals, skills, and/or roles. It is a way of living a satisfying, hopeful, and contributing life even with the limitations caused by illness*" (107).

Beyond clinical and personal recovery, two additional concepts – functional and social recovery – are crucial for understanding the broader implications of mental health rehabilitation. Functional recovery refers to an individual's ability to regain independence in daily activities, including self-care, work, and community participation (108). Social recovery, closely related to functional recovery, highlights the importance of reinterrogation into society and the ability to establish and maintain meaningful relationships (109).

While acknowledging the multifaceted nature of recovery in SMI, the present thesis primarily focus on personal recovery, emphasizing the subjective experience of well-being (103). One of the most widely recognized and influential models for understanding personal recovery in mental health is the CHIME framework (110). This framework identifies five key processes that are central to the recovery journey:

- ***Connectedness***: Emphasizes the importance of relationships and social support in recovery. Building connections with family, friends, peer support groups, or community networks fosters a sense of belonging and reduces isolation.
- ***Hope***: Serves as the foundation of recovery, fostering optimism and belief in the possibility of a better future. Hope is critical for motivating individuals to engage with recovery processes.
- ***Identity***: Involves reconstructing a positive sense of self, often through overcoming self-stigma and redefining oneself beyond the mental illness diagnosis.
- ***Meaning***: Highlights the importance of finding purpose and value in life, whether through work, relationships, hobbies, or spirituality.
- ***Empowerment***: Focuses on gaining control over one's life, making decisions aligned with personal values and goals, and fostering a sense of agency.

These domains are supported by complimentary literature that identifies similar aspects as promoters of recovery (102,111,112). The CHIME framework, originally developed based on the experiences of individuals with psychotic disorders, has since been increasingly recognized as transdiagnostic, supporting the idea that personal recovery processes transcend traditional diagnostic boundaries (113). While nuances may exist in how different populations experience and prioritize aspects of recovery, the overarching principles remain broadly applicable, reinforcing the need for recovery-oriented care that is person-centered rather than diagnosis-specific.

The CHIME framework has also been subject to critique. A systematic review of qualitative literature examining experiences of recovery argues that CHIME primarily emphasizes the positive aspects of personal recovery while overlooking the challenges and difficulties that many individuals with mental illness encounter throughout the recovery process (114). This critique highlights the need for a more comprehensive perspective that acknowledges both the empowering and the distressing aspects of recovery, including relapses, struggles with self-stigma, and systemic barriers that may hinder progress.

Aim and objectives

The aim of my thesis is:

To investigate the perspectives of experts, stakeholders, and participants in relation to the promotion of a recovery-oriented community-based exercise intervention for young adults with SMI.

The aim of my thesis is divided into the following three research objectives:

1. Explore the perspectives of professional experts in relation to the development of community-based exercise for young adults with SSD.
2. Explore the perspectives of various stakeholders on the role and training of lay exercise instructors delivering community-based exercise for young adults with SSD.
3. Explore the meaning of bodily experiences in relation to the process of personal recovery within the context of community-based exercise for young adults with SMI.

Collectively, the three studies informed the development, evaluation and implementation of a recovery-oriented community-based exercise intervention, i.e., the Vega Exercise Community, for young adults with SMI.

Definitions and clarifications

In the following section, I will provide definitions and clarifications of terms frequently used in the rest of the thesis.

Severe mental illness: As previously mentioned, SMI refers to a subset of mental health conditions characterized by significant impairment in emotional, cognitive, and behavioral functioning, which substantially limits a person's ability to engage in daily life activities, maintain relationships, or participate in work or education (7). There is still a lack of clarity and standardization regarding how SMI is operationally defined across contexts, including clinical settings and scientific research literature. Indeed, SMI is not an official diagnostic term according to ICD10 and DSM5 (115,116). As in most research literature, the current thesis uses only diagnostic criteria in the definition of SMI, which includes SSD (including other psychotic disorders), BD, and MDD.

As described in the *Introduction*, the population of interest in the Vega trial changed during my PhD program. Initially, the population was young adults (age 18 to 35) in antipsychotic treatment, and thus primarily individuals with SSD. On August 1st 2024, we changed the population young

adults with SMI following the definition above. Consequently, Study I and II focus exclusively on individuals with SSD, while Study III focus on individuals with SMI.

Community-based: The term *community-based* has a wide range of meanings, depending on the aim and construct employed by investigators of community-based projects. Community can be understood as a target, agent, resource, or setting of an intervention (117). Community-based interventions, as defined in this thesis, refer to initiatives implemented outside of traditional mental health services, specifically within the private and civil sectors, such as fitness centers, non-profit organizations, sports clubs, and other community-driven initiatives. In this context, the community primarily serves as the setting for interventions rather than as a structured mental health care system.

Physical activity and exercise: PA is defined as “*any bodily movement produced by the skeletal muscles,*” while exercise is considered “*a subset of physical activity that is planned, structured, and repetitive...*”(118). In this thesis, the term “exercise” will be used and primarily in the context of *community-based exercise*. At times, the term PA may be used when referring to activities that occur outside of the structured exercise setting, even if they could also be classified as exercise.

The Vega trial and the Vega Exercise Community: Throughout this thesis, I will refer to the Vega trial when discussing the pragmatic RCT and to the Vega Exercise Community when referring to the intervention being investigated within the Vega trial.

Methods

In the Methods section, I will first elaborate on the design and epistemological framework of my thesis, followed by a discussion of my preconception regarding the research subject. I will then outline how the Medical Research Council (MRC) framework for developing, evaluating, and implementing complex interventions (119) serves as a guiding structure for the Vega Exercise Community and the individual studies included in this thesis. Finally, I will provide a detailed account of the sampling strategy, data generation, and analytical procedures for Studies I, II, and III.

Design

This thesis employs a qualitative design, well-suited for exploring complex, context-dependent phenomena that cannot be fully captured through quantitative approaches (119,120). Prioritizing depth over breadth, qualitative research provides a nuanced understanding of individuals' lived experiences, perspectives, and interactions within their social and physical environments (121). By emphasizing subjective experiences and interpretative processes, this approach captures the richness and variability of human perspectives, particularly in contexts where personal narratives and social dynamics are central.

The three studies in this thesis share a qualitative foundation but employ distinct analytical approaches suited to their specific research questions and data characteristics (122). This flexibility ensures that each study effectively addresses its focus while maintaining coherence within the broader research framework. The rationale for data generation and analysis is detailed in their respective sections, supporting a rigorous yet adaptable examination of community-based exercise in the personal recovery process of young adults with SMI. By adopting this qualitative framework, the research remains attuned to the complexities of human experience while generating insights applicable to real-world settings (123).

Epistemological framework

An epistemological framework defines the nature of knowledge and how it can be acquired. My thesis draws on the epistemological framework of pragmatism, a philosophical approach that emphasizes the practical application of knowledge and its capacity to solve real-world problems (124). Pragmatism is particularly relevant to this research, as the Vega Exercise Community seeks

to support personal recovery in young adults with SMI through community-based exercise. By prioritizing actionable and contextually relevant knowledge, pragmatism provides a suitable framework for examining not only *whether* an intervention works but also *how* and *why* it may be effective in real-world settings.

Pragmatism occupies a middle ground between realist and idealist ontology, acknowledging that phenomena exist independently of human perception while also recognizing that we understand them through our ideas (124). Originating from the works of Dewey (125), Peirce (126), and James (127), pragmatism shifts focus away from abstract debates about the nature of truth, focusing instead on what is useful and relevant in practice. Rejecting rigid dichotomies - such as quantitative versus qualitative methods or objectivity versus subjectivity - pragmatism embraces methodological pluralism, integrating diverse approaches to effectively address complex research questions (122).

Within this framework, methodological choices are guided not by strict adherence to a specific epistemological tradition but by their utility in generating insights and producing solutions to the problem at hand (123). Pragmatism views knowledge as provisional and contingent, evaluating truth based on its practical consequences rather than as an absolute, universal concept. Knowledge is judged by its ability to achieve desired outcomes and improve practice. Additionally, pragmatism emphasizes the role of context, recognizing that knowledge and its application are shaped by specific conditions (128). This contextual sensitivity ensures adaptability, allowing interventions to be tailored to different populations and settings while maintaining their core purpose and function.

Author's preconception

Interpretation is central to qualitative research, where the researcher serves as the primary instrument for data collection and analysis. Knowledge is co-constructed and deeply embedded in context, making reflexivity essential for ensuring transparency and rigor (129). Given the inherently interpretative nature of qualitative inquiry, acknowledging the researcher's positionality helps to recognize and address potential biases rather than obscure them (121). My background and position as a researcher inevitably shape the research process, influencing what is investigated, how it is approached, and how findings are interpreted and communicated (121,129). Rather than being a limitation, subjectivity can serve as a resource, as researchers' backgrounds and experiences provide valuable perspectives that enrich data interpretation, leading to a deeper and more nuanced understanding of human experiences (130).

I have a professional background in physiotherapy and hold a Master of Science in Health Science. Prior to beginning my PhD program, I had no clinical experience working with individuals with SMI or in mental healthcare more broadly. Instead, my expertise lay in PA and exercise behavior within various clinical populations. I am currently employed as a lecturer at the Department of Physiotherapy, University College of Northern Denmark, where I teach physiotherapy students about PA and exercise in mental healthcare, among other topics. Additionally, I have a longstanding personal interest in community-based exercise, including participation in various sports associations, where I have been both an active participant and a volunteer throughout my life. Finally, I am one of the primary researchers in the Vega trial, which positions me as highly engaged in the context under investigation.

Recognizing that my background and positionality influence the research process, I have engaged in ongoing reflexivity to critically examine my assumptions and interpretations (121,129). Rather than viewing subjectivity as a limitation, I embrace it as a resource that enhances engagement with the data while ensuring analytical rigor and transparency (130). By maintaining a reflexive stance, I aim to balance insider knowledge with critical distance, strengthening the credibility and trustworthiness of my thesis.

Complex interventions

The MRC framework provides a structured approach for developing, evaluating, and implementing complex interventions in health care (119,131). The Vega Exercise Community qualifies as a complex intervention due to its multiple interacting components, contextual variability, multidimensional outcomes, and reliance on dynamic processes for delivery and implementation. Therefore, I use the framework as a guiding structure to map the interconnections between the three studies in this thesis - Studies I, II and III - as well as their relationship to other research activities related to the Vega Exercise Community and the Vega trial. The MRC framework outlines four key phases: i) develop/identify intervention, ii) feasibility, iii) evaluation, and iv) implementation. In the first edition, these phases were provided as a linear and sequential process drawing on epidemiological and clinical principles used for medical drug development (132). However, with the introduction of the second edition in 2008, the framework adopted a more iterative approach, reflecting a dynamic understanding of complex intervention (131). The latest version, published in 2021, further reinforces this iterative nature, positioning the four phases within a set of core

elements that apply regardless of the specific phase in which a study is conducted (119). This revised structure emphasizes the need for continuous consideration of these core elements throughout the research process, as illustrated in Figure 2.

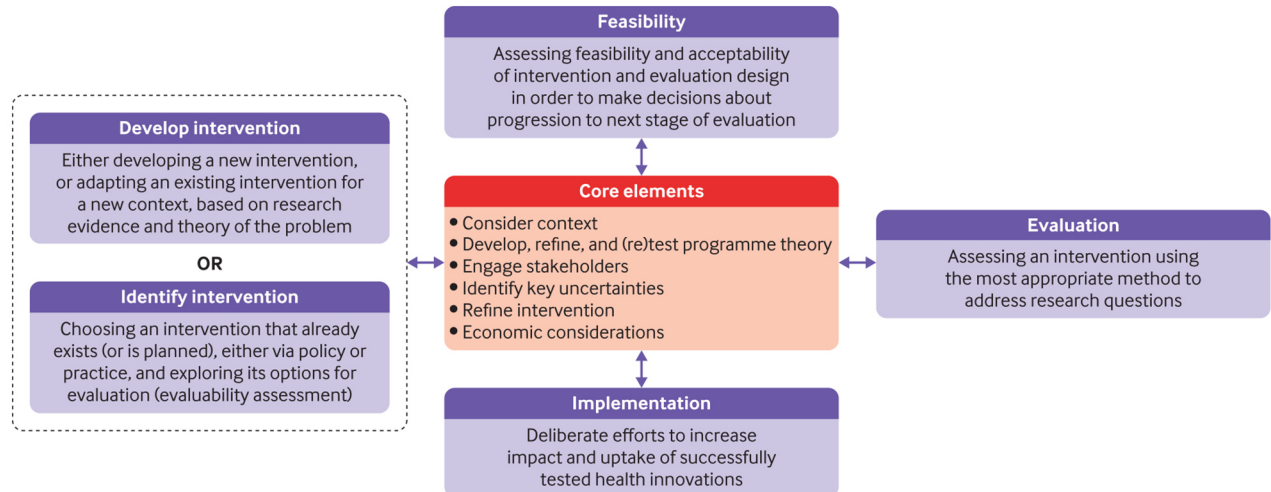


Figure 2: Medical Research Council (MRC) framework for developing, evaluating, and implementing complex interventions (119)

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Feasibility

The feasibility phase in the MRC framework assesses whether an intervention can be practically implemented before conducting a larger-scale evaluation. The Vega trial was preceded by the COPUS trial, a feasibility RCT investigating a supervised, group-based exercise intervention for individuals with first-episode psychosis delivered in a commercial fitness center. The primary objective was to assess feasibility in terms of recruitment, retention, adherence, and potential physiological benefits (6). Additionally, a qualitative sub-study explored motivational perspectives, social interactions, and potential positive and negative experiences associated with the intervention (5). The COPUS trial was conducted prior to the initiation of my PhD program. The key findings from the COPUS trial are outlined as follows:

Recruitment and retention challenges: Of the eligible patients, 35% consented to participate in the study. Retention rates were 76% at the end of the 8-week intervention but declined to 52% at the 16-week follow-up (6). Identified barriers to participation included limited engagement from

prescribing mental health professionals, symptom burden, and competing priorities among participants (6). Conversely, facilitators that supported engagement included the non-clinical setting (i.e., a fitness center), peer support, and goal-setting strategies, such as participation in an obstacle race at the conclusion of the intervention (5).

Adherence and engagement: Participants assigned to the intervention group attended an average of 43% of sessions (range: 9% to 96%). While some participants valued structured, high-intensity workouts, others found them overwhelming. A flexible and adaptive exercise approach, such as incorporating low-intensity options, was suggested to improve adherence (6).

Suggested modifications needed: To enhance recruitment, increased involvement of mental health professionals and peer ambassadors was recommended. Furthermore, offering more flexible exercise schedules and session formats could better accommodate fluctuations in mental health symptoms. Providing customizable intensity levels, including low-intensity alternatives, may further support adherence (6). Finally, the intervention should account for varying preferences regarding social engagement, as some participants found structured group interactions beneficial, whereas others preferred to exercise independently (5).

In conclusion, the COPUS trial highlighted both feasibility challenges and opportunities for a group-based exercise intervention for individuals with first-episode psychosis. The findings indicate that while the intervention was acceptable and potentially beneficial, adjustments were required to improve recruitment, retention, and adherence.

Intervention development

According to the MRC framework (119) and recommendations from the INDEX study (133), intervention development is a dynamic, iterative, and forward-thinking process. Based on findings from the COPUS trial, we identified the need for intervention refinement, leading to the development of the Vega Exercise Community (4). Studies I and II in the current thesis contributed to this process by addressing key components of complex interventions (center block in Figure 2). Study I informed the *refinement of the intervention* and the formulation of a preliminary program theory, while Study II addressed one of the *key uncertainties* by contributing to the development of an educational program for lay exercise instructors and *engaging key stakeholders*. These findings, alongside insights from the COPUS trial, existing evidence, and behavioral theories, informed the

development of a program theory, which structured the Vega Exercise Community and its expected mechanisms of change.

A program theory is essential for understanding how and why an intervention produces specific outcomes, helping to guide refinement and implementation. Within the MRC framework, it supports feasibility testing, identifies barriers and facilitators, and ensures that intervention components align with intended effects. However, while a program theory played a role in shaping the Vega Exercise Community, a detailed theoretical analysis lies outside the scope of this thesis. Instead, the present work focuses on the empirical contributions to intervention development, while the full program theory is documented in *Additional file 4* in the study protocol for the Vega trial (4).

To ensure transparency and replicability, the Vega Exercise Community was reported following the Template for Intervention Description and Replication (TiDIER) framework (134). TiDIER provides a structured approach for describing complex interventions, addressing the common issue of incomplete reporting in research studies. Similar to the program theory, the TiDIER checklist is included in *Additional file 3* in the study protocol for the Vega trial (4). However, to provide context for Study III, a brief description of the Vega Exercise Community is presented below.

The Vega Exercise Community is a supervised exercise intervention designed to foster social inclusion, PA engagement, and recovery in individuals with SMI. The intervention consists of three 60-minute group-based sessions per week, delivered in functional training gyms by trained lay exercise instructors.

Session structure: Each session follows a structured format, progressing through warm-up, resistance training, high-intensity functional training (HIFT), and cool-down. The warm-up (10–15 minutes) incorporates icebreakers and social exercises to enhance engagement. The resistance training (10–20 minutes) focuses on improving strength and movement efficiency through weightlifting and bodyweight exercises. The HIFT segment (10–20 minutes) includes varied, functional exercises performed at moderate to high intensity, utilizing formats such as Rounds for Quality (RFQ), As Many Rounds/Repetitions as Possible (AMRAP), and Every Minute on the Minute (EMOM). The session concludes with a cool-down (5–10 minutes), aimed at lowering arousal and enhancing mobility.

Setting and facilities: The intervention is implemented in functional gyms (sometimes known as CrossFit© centers) designed to provide an inclusive and non-clinical environment. Training areas

can be partially or fully secluded from other gym users, ensuring a safe and focused space for participants. The gyms are well-equipped for functional training, featuring rubber flooring, free weights, pull-up bars, rowing machines, and designated running routes. Additionally, each facility includes a social corner to facilitate interaction before and after sessions. To minimize logistical barriers, all intervention sites are easily accessible by public transportation.

Adaption and individualization: The intervention is designed to be flexible and adaptable to accommodate participants' individual abilities and experiences. Exercises can be adjusted in terms of load, movement complexity, and repetitions to suit different fitness levels. Instructors provide scaling options and encourage participants to modify their effort based on their physical and psychological state on any given day. Recognizing that mental health symptoms fluctuate, the intervention allows for flexible participation, enabling participants to modify workouts as needed. Psychosocial considerations are integrated into the intervention to ensure that participants can engage at their own pace without pressure. To support adherence, participants receive motivational text messages and have the option to bring a friend, relative, or peer to the exercise sessions.

Additional engagement opportunities: Beyond the structured sessions, participants are granted unrestricted access to the gym facilities, allowing them to exercise independently or join regular classes offered by the gym. Additionally, they have access to a private social media group, moderated by the research team, where they can connect with peers, share progress, and receive ongoing motivation and support.

Evaluation

The MRC framework emphasizes that evaluation extends beyond assessing an intervention's effectiveness. It also seeks to understand how the intervention works, in which contexts, and what broader impacts it generates (119). As described in our study protocol (4), we used a pragmatic RCT to evaluate the effectiveness of the Vega Exercise Community in real-world settings (135,136). Evaluating complex interventions presents the challenge of selecting appropriate outcome measures (119). A pragmatic approach prioritizes outcomes that are meaningful to individuals with SMI (135). With input from experts and stakeholders (Studies I and II) and in collaboration with patient representatives and a peer board of young adults with SMI, we identified personal recovery as the primary outcome, measured using the Questionnaire about the Process of Recovery (QPR) (137). However, personal recovery is complex, subjective, and non-linear, making

it difficult to fully capture through standard quantitative measures (110). Integrating qualitative research within RCTs is widely endorsed for evaluating complex interventions (138). Study III explores how and why the intervention works by identifying mechanisms that drive recovery. It also helps explain why some individuals benefit more than others, uncovering personal, social, and contextual factors that shape recovery trajectories. Finally, Study III enhances the interpretation of QPR's quantitative results, adding depth and nuance to ensure a holistic evaluation of personal recovery, rather than relying solely on predefined measures.

Implementation

According to the MRC framework, early consideration of implementation enhances the likelihood that an intervention will be widely adopted and sustained in real-world settings (119). Throughout the development, feasibility testing, and evaluation of the Vega Exercise Community, key implementation outcomes have been considered, including acceptability, adoption, feasibility, fidelity, sustainability, reach, and cost-effectiveness (139). While a comprehensive implementation evaluation is beyond the scope of this thesis, findings from Studies I, II, and III contribute with valuable insights for pragmatic implementation. The community-based nature of the Vega Exercise Community requires an understanding of how local resources, partnerships, and social environments shape intervention uptake and engagement. The pragmatic RCT design further supports implementation by testing the intervention under real-world conditions, allowing for variability in participation, delivery, and contextual adaptations that reflect routine practice. The three studies engage key stakeholders, including individuals with SMI, community exercise providers, lay exercise instructors, peer mentors, and mental health professionals, to explore factors influencing adoption and long-term sustainability. Such insights are important for ensuring that the intervention remains accessible, adaptable, and embedded within existing community infrastructures, supporting its scalability and real-world effectiveness.

Sampling and data generation

In the following section, I will describe the sampling strategy and the data generation from Studies I, II, and III.

Sampling and data generation Study I

I employed a purposeful sampling strategy to identify informants with expert knowledge, experience, or interest relevant to the development of community-based exercise for young adults with SSD. As I was new to the research field and had a limited academic network, I initially relied on colleagues within our research group to identify a small pool of potential informants. All these potential informants agreed to participate and were invited to suggest additional relevant experts. Consequently, I adopted a snowball sampling approach, leveraging their professional networks to access experts who might otherwise be difficult to reach (140). This flexible sampling strategy allowed me to adapt recruitment throughout the study, ensuring representation from diverse professional backgrounds to enhance information variation and richness (141).

In total, I conducted nine semi-structured interviews with 11 experts representing different fields such as clinical psychiatry, psychology, human physiology, physical therapy, occupational therapy, and exercise consultancy for individuals with mental illness. The semi-structured interview format ensured consistency across interviews while allowing flexibility to explore unique insights (142). For pragmatic reasons, three experts who were colleagues were interviewed in a group interview. I developed an interview guide consisting of a standard open-ended question, followed by thematically structured sub-questions aligned with each informant's area of expertise. The interview guide is provided in *Supplementary files 2* in Paper I (1). All key informants received written information materials detailing the study's purpose, procedures, and ethical considerations, including confidentiality and informed consent.

Each interview began with a brief introduction outlining the study aim and a broad definition of community-based exercise as:

“group exercise delivered by lay exercise instructors outside a hospital setting.”

The initial open-ended question encouraged a broad response, for example:

“As an expert, what should be considered when developing a community-based exercise intervention for young adults with schizophrenia?”

Probing and follow-up questions were used to deepen understanding and elicit concrete examples. Additionally, reflective techniques such as paraphrasing and mirroring were employed to enhance comprehension and encourage elaboration (142).

Interviews were conducted via Microsoft Teams video calls or face-to-face meetings, depending on the experts' locations. Given the geographical dispersion of informants, video calls were the preferred method, offering both flexibility and confidentiality, as the discussions focused on expert perspectives rather than sensitive personal experiences. Each interview lasted 45–60 minutes and was recorded using a Dictaphone (for face-to-face interviews) or Microsoft Teams (for video calls).

Following the interviews, I conducted a selective transcription, focusing exclusively on content relevant to the research question. A co-researcher validated the transcription, which was then returned to the expert for member checking (129). If necessary, transcripts were revised based on the experts' feedback.

Sampling and data generation Study II

To identify stakeholder groups with specific knowledge, experience, or interest in community-based exercise - particularly the training of lay exercise instructors - I first conducted a stakeholder analysis. Stakeholders were considered based on their involvement in or impact by the Vega Exercise Community and subsequently categorized according to their level of interest and engagement. Five stakeholder groups were identified as having high involvement, leading to the use of a purposeful sampling strategy to recruit representatives from these groups (141).

The stakeholder groups included:

- ***Clinical staff from outpatient mental health services***, as they served as the primary recruitment channel for young adults with SSD into the Vega trial.
- ***Physiotherapists working in mental health care***, due to their experience in facilitating exercise and adapted PA for young adults with SSD.
- ***Lay exercise instructors***, as they were responsible for facilitating the Vega Exercise Community. Both instructors with experience from the COPUS trial and instructors without experience from facilitating community-based exercise to young adults with SSD was recruited.
- ***Young adults with SSD***, as they represented the primary population of interest in the Vega trial.

- ***Relatives of young adults with SSD***, as they were considered key sources of physical and emotional support in initiating and sustaining participation to the Vega Exercise Community.

The recruitment process and participant characteristics from each stakeholder group are detailed in *Table 3*, Paper II (2).

I employed semi-structured homogeneous focus groups as the data generation method. This approach was chosen for its ability to generate rich, in-depth qualitative data through interactive discussions, enabling stakeholders to share and build on each other's perspectives (143,144). In total, I conducted six homogeneous focus groups - including a total of 30 individuals - each comprising stakeholders with shared backgrounds. This design fostered a safe and open discussion environment, minimizing potential power imbalances between participants (143).

The focus groups followed a semi-structured interview guide, balancing structure and flexibility. The guide included three core statements derived from Study I findings (elaborated in the *Findings* section), with tailored questions for each stakeholder group to ensure coverage of relevant topics while allowing for new insights (145). The three core statements were:

- *"It is important that instructors learn about the treatment of SSD and how these disorders affect people's life."*
- *"It is important that instructors learn about the concept of personal recovery and how exercise may support the process."*
- *"It is important that instructors learn about adapting exercise content so it is safe and relevant for people with SSD".*

I moderated all focus groups, with an observer present to take notes and pose follow-up questions as needed. Discussions lasted approximately 90 minutes and were audio-recorded for later transcription. The focus groups were conducted in natural settings (e.g., conference rooms) to foster a comfortable and open dialogue (142). To encourage group interaction and explore stakeholder priorities, participants were asked to rank and discuss the importance of the three core statements.

Sampling and data generation Study III

Informants for Study III were recruited among participants enrolled in the Vega trial. With a focus on maximal variation, I purposefully sampled according to three criteria: 1) The specific Vega

Exercise Community site they attended (Aalborg, Aarhus, or Copenhagen), 2) their attendance rate to the Vega Exercise Community sessions, based on a visual examination of different attendance trajectories, and 3) their personal recovery score at baseline, measured using QPR, categorized as high (total QPR score >50) vs. low (total QPR score <50). A visual representation of the sampling procedure is displayed in Figure 3.

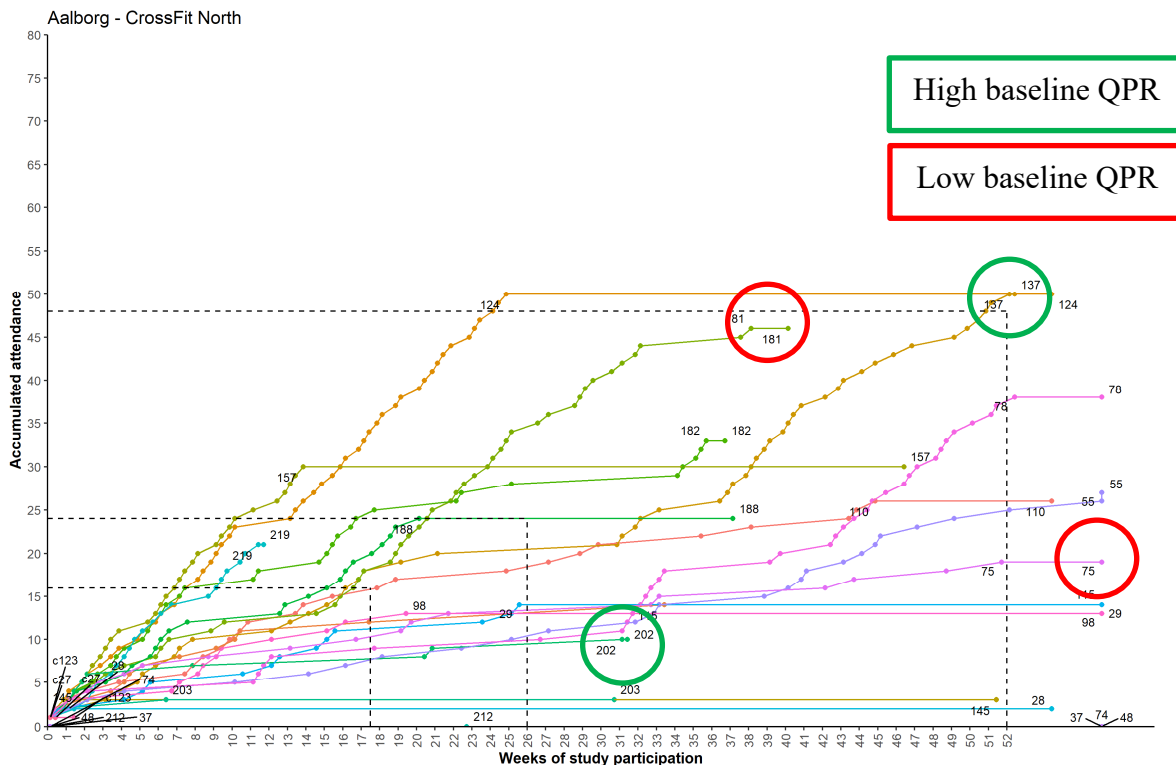


Figure 3: Graphic illustration of purposeful sampling strategy for one exercise site. The X-axis contains the number of weeks enrolled in the Vega trial, and the Y-axis contains the number of exercise sessions attended. The different colored lines represent individual participants' enrollment time and accumulated attendance. The green and red circles represent whether a participant had a high or low personal recovery score at baseline, respectively. Personal recovery was assessed using the Questionnaire about the Processes of Recovery (QPR), where a score >50 was interpreted as a high score (3).

and personal recovery. This approach provides a balance between structure and flexibility, allowing for the systematic exploration of key themes while enabling informants to elaborate on their unique experiences and perspectives (142). The structured elements ensured consistency across interviews, while open-ended questions fostered narrative depth, encouraging informants to share freely. This was particularly crucial, as multiple independent interviewers conducted the interviews. The flexibility of the semi-structured format allowed me to adapt my questioning techniques, incorporating metaphors, comparisons, and variations in tone to foster a supportive environment where informants felt comfortable sharing openly. This was especially important when discussing sensitive and abstract topics such as bodily experiences and personal recovery.

In total, 16 interviews were conducted in locations chosen by the participant, including outpatient settings, the exercise community, public spaces, or their homes. Allowing participants to select the location respected their autonomy and comfort, increasing the likelihood of candid and in-depth responses. All interviews were facilitated using a piloted, thematically structured interview guide based on the CHIME framework – Connectedness, Hope, Identity, Meaning, and Empowerment (110) with a particular focus on bodily experiences. Consistent with existing literature, an additional “Difficulties” domain was included to capture potential barriers to recovery (114). The interview guide is provided in *Supplementary file 3* in the manuscript draft to study III (3).

Each interview lasted 45 to 75 minutes and was audio-recorded and transcribed using an AI transcription program (Viceron ApS, Copenhagen), with all transcripts subsequently validated against audio recordings as part of the familiarization process.

Analytical procedures

In the following, I will shortly provide a general description of the method of analysis employed, followed by the analytical procedure for Studies I, II, and III.

Content analysis

In Studies I and II, I employed qualitative content analysis as described by Graneheim and Lundman (146). Although content analysis originates within the quantitative paradigm, its qualitative counterpart is grounded in the premise that reality is open to multiple interpretations, making understanding subjective and context-dependent (146). The method is flexible across epistemological positions and provides a systematic approach to analysing qualitative data at

varying levels of abstraction and interpretation (147). Additionally, content analysis accommodates different methodological approaches, including inductive (data-driven), deductive (concept-driven), and abductive (combined or complementary) strategies (148).

While content analysis can be structured in different ways, four core stages are commonly applied, regardless of the researcher's epistemological stance or methodological approach (146,149):

1. ***Decontextualization:*** The researcher familiarizes themselves with the data, then segments it into smaller meaning units, each labeled with a context-related code.
2. ***Recontextualization:*** The coded meaning units are compared against the original data to ensure all relevant information is represented.
3. ***Categorization:*** Depending on the level of abstraction and interpretation, the researcher identifies themes or categories. Graneheim and Lundman recommend using categories for more descriptive (manifest) analyses and themes for interpretative (latent) analyses (146).
4. ***Compilation:*** The final stage involves synthesizing and writing up the analysis.

I found qualitative content analysis well-suited for Studies I and II, as it is not tied to a specific scientific theory and thus aligns with the pragmatic research paradigm. Moreover, its structured yet adaptable approach facilitates the generation of actionable insights, making it particularly valuable for informing the development of a community-based exercise interventions for young adults with SSD and the educational program for lay exercise instructors responsible for delivering such interventions.

Analytical procedure Study I

The analytical procedure is presented in a narrative format, reflecting the iterative nature of the process, with ongoing movement between the stages described earlier.

Initially, a co-researcher and I independently read and reread all transcripts before jointly discussing them to gain an overall understanding of the data. This continuous process occurred throughout data collection and was also used to identify emerging perspectives and assess data saturation. All transcripts were weighted equally, regardless of the informant's professional background or expertise. The analysis then proceeded with the identification and extraction of meaning units. If a meaning unit was extensive, it was condensed while preserving its contextual meaning. Each meaning unit was assigned a descriptive code, which was then compared, abstracted, and grouped

into subcategories and categories. This categorization was conducted iteratively, involving constant movement between the whole and its parts through ongoing discussions with the co-researcher and my supervisor. To manage data efficiently, I used NVivo V.12 (QSR International, Melbourne, Australia) for extracting meaning units and coding. A matrix was then generated in NVivo and exported to Microsoft Excel, where the final categorization process was conducted. *Table 1* in Paper I provides an example of the analytical process from meaning unit to category (1).

Analytical procedure Study II

The analytical approach in Study II followed the same overall procedure as in Study I, but with key differences.

First, while a co-researcher and I independently read and reread all transcripts before discussing them, this process was conducted after the completion of all focus groups. This was partly due to pragmatic reasons, as the focus groups were held within a short time frame, but also to minimize the risk of premature conclusions influencing later discussions. Second, I adopted a more inductive approach, staying closely aligned with stakeholders' spoken words during coding. However, in contrast to Study I, a higher degree of interpretation was applied during the categorization phase, allowing me to derive curricular elements for the educational program. Lastly, through discussions with another researcher and my supervisor, we generated a single overarching theme with a higher level of abstraction: ***“Guardians of an Inclusive Culture”***. While this theme was not included in Paper II, it is available in a preprint and illustrates the core objective of the educational program - empowering instructors to foster an inclusive exercise culture (150).

Reflexive thematic analysis

In Study III, I analyzed data using reflexive thematic analysis as described by Braun and Clarke (151)(130). This qualitative analysis method focuses on identifying, analyzing, and interpreting patterns of meaning - or themes - within a dataset. Reflexive thematic analysis is theoretically flexible, making it applicable across various epistemological frameworks, and can be conducted inductively, deductively, or using a combination of both.

The approach is rooted in Big Q qualitative research, which prioritizes subjectivity and reflexivity. A core tenet of reflexive thematic analysis is that themes do not emerge from the data but are

actively constructed through the researcher's interpretative lens, shaped by theoretical, experiential, and cultural positioning (151,152). As Braun and Clarke emphasize, researchers should *own their perspective*, meaning they must be transparent about their interpretative stance and influence on the analytical process (152).

In Study III, I adopted a critical realist and contextualist positioning. Critical realism assumes that while an objective reality exists, our access to it is always mediated through social and cultural interpretations (130). Contextualism emphasizes that meaning is situated within specific contexts and shaped by individual lived experiences and broader social conditions (130). This combined framework allowed me to explore participants' bodily experiences of exercise and recovery, acknowledging both the material aspects (e.g., the physical body and its movements) and the interpretive dimensions (e.g., meaning-making and subjective understanding of bodily experiences).

Analytical procedure Study III

In the following section, I outline the analytical procedure for Study III, which follows the six-phase process of reflexive thematic analysis (153), involving familiarization with the data, generating codes, identifying and refining themes, and producing a final analytic narrative. The process is iterative, allowing for fluid movement between phases as I refine my interpretation. The analysis was conducted in ongoing collaboration with two experienced qualitative researchers - one with expertise in personal recovery research and another specializing in exercise behavior in clinical populations. The aim of this collaboration was to enhance reflexivity throughout the analytical process rather than to achieve consensus. To enhance transparency, I will share part of my reflective journal along with iterations made during the analytical process.

1. ***Familiarization:*** This phase involved becoming deeply immersed in the data.

Familiarization began during data collection, as I added summaries and short reflections to my reflexive journal between interviews. After completing all interviews, I engaged in repeated listening and reading of the transcripts, allowing for critical engagement with the data. Throughout this process, I took analytical notes to develop an overall impression of both individual interviews and the dataset as a whole. Emerging insights and interpretative reflections were recorded continuously in my journal, ensuring a structured yet flexible approach to data familiarization. Below, I share some of my meta reflection from critical

engagement with data as a part of the familiarization process, specifically a recurrent topic about energy levels.

August 18th, 2024, Toronto

A recurring topic in the interviews is the paradox of energy - wanting more energy through exercise but feeling too exhausted to start. It feels like a double bind: exercise is supposed to help, but it requires the very thing they are lacking. This makes me wonder if there's an underlying all-or-nothing mindset at play - either you have the energy to be active, or you don't, with little room for the in-between.

2. **Coding:** The coding process was organic and iterative, guided by an inductive approach that prioritized the meanings embedded in the data. Microsoft Excel was used to organize data extracts and codes, allowing for a structured yet flexible way to track emerging patterns. Initially, coding focused on the semantic level, capturing explicit, surface-level meanings in a descriptive manner. At this stage, the research question was still being refined, and coding served as a tool to systematically engage with the data while sharpening the analytical focus. As the analysis progressed, semantic codes were revisited alongside transcripts and audio recordings, enabling the development of latent codes that explored deeper, more conceptual meanings related to bodily experiences of exercise in relation to personal recovery. Here, I provide an example of the coding process from the interview with the informant referred to as *Grace*, who has experienced significant antipsychotic-induced weight gain.
-

Data extract: *"Well, when I am exercising, I can feel my muscles behind all the fat. It makes me feel strong when I am lifting something heavy, like a heavy back squat... Then I feel my muscles and not the fat. That is a nice feeling... It makes me feel like I am in contact with my old body."*

Semantic codes: *Heavy load makes one feel strong, forgetting the fat, remembering the body as it was before, exercise makes you feel the muscles, connecting bodily sensation with something good.*

Latent codes: *Rediscovering the body as part of the self, reconnecting with past bodily strength, sensory awareness of the body*

3. *Generating Initial Themes:* To facilitate the theme development process, I printed Excel sheets containing both semantic and latent codes, allowing for a more tangible, interactive engagement with the data. Tentative themes were developed by clustering related codes into patterns of shared meaning organized around a central concept. I initially identified five tentative themes, which were critically reflected upon and discussed with the collaborating researchers. These discussions helped refine the thematic structure, ensuring that themes remained grounded in the data while allowing for interpretative depth. Below, I provide an example of an initial theme from my reflective journal, including its title and my reflections on its meaning and relevance within the broader analysis

October 28th, 2024, Aalborg

Bodily Transformation and Enhanced Self-Perception

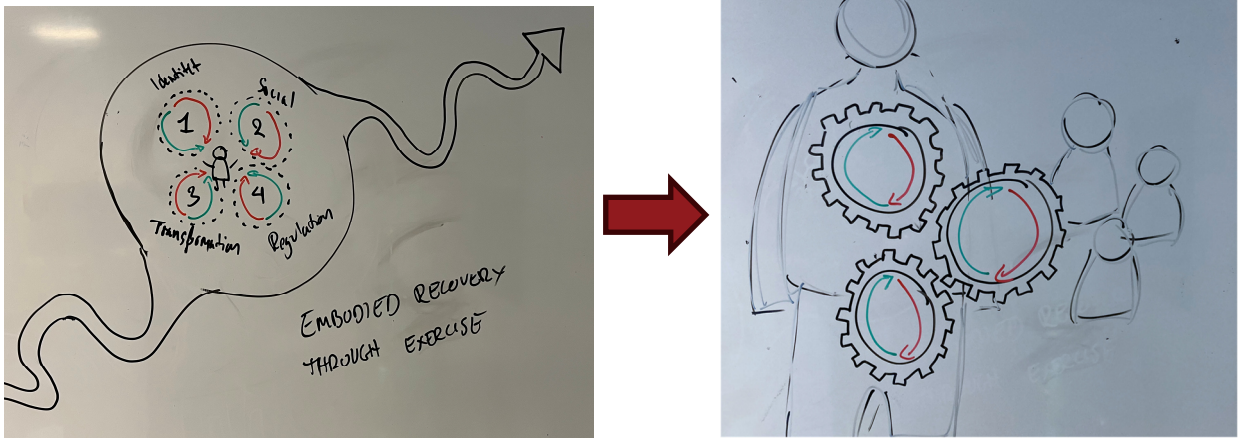
Physical progress appears to enhance both physical and psychological resilience. Participants describe how gaining strength and endurance makes daily activities easier, and some notice visual changes, such as weight loss or muscle definition, which positively impact their self-image. Reactions from others further reinforce this transformation, making them feel seen in a new way. For some, bodily changes translate into greater confidence and stability, with one participant describing feeling more grounded and another standing taller, pushing their chest forward with pride. However, frustration arises when expected changes - especially in weight - do not materialize, leading to self-doubt. This highlights the challenge of managing expectations and recognizing progress beyond visual or weight-related markers.

4. *Developing and Reviewing Themes:* In this de- and recontextualization phase, I moved backward, comparing my initial themes to the coded extract, the transcripts, and the audio files to ensure coherence and relevance.
5. *Refining, Defining, and Naming Themes:* Themes were further clarified and defined through a visual mapping technique in Microsoft Whiteboard. Audio recordings were prioritized over transcripts during this phase, as repeated audio playback triggered associations and reflexivity that enriched the interpretative process. Below you see a screen dump of my whiteboard with eight working themes.

November 11th, 2024



6. *Writing Up*: The final phase focused on refining the structure, interaction, and flow of the analysis. The themes were developed into a coherent narrative, ensuring they were both grounded in the data and shaped by interpretative reflections. Through this process, I gradually moved from five themes to four, and ultimately to three distinct yet interconnected themes, all nested under one overarching theme. Below are draft figures illustrating how these themes interconnect, capturing the dynamic relationships between them working with four and three themes respectively.



Findings

In the following section, I will present the findings from Studies I, II, and III.

Summary of findings Study I:

The analysis of the expert interviews resulted in four categories encapsulating their perspectives on the development of a community-based exercise intervention targeting young adults SSD (1). With this background, we proposed recommendations encompassing important structural and cultural factors, presented in Figure 4. In the following, I will present how the categories informed these recommendations.

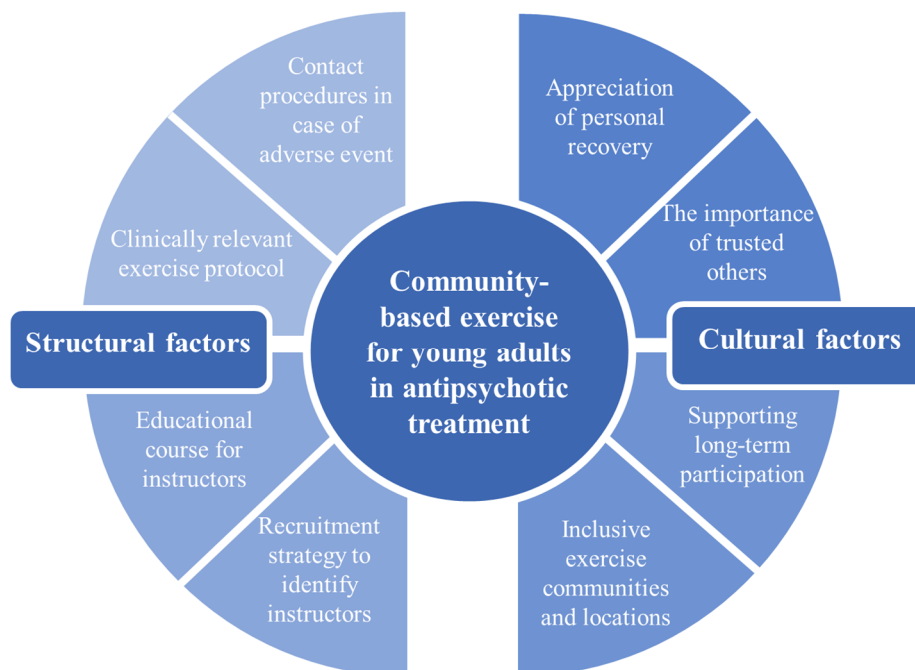


Figure 4: Structural and cultural factors of importance when developing community-based exercise targeting young adults with SSD (1).

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Recommendation 1: Balancing barriers and normalcy in exercise participation

Consider how to address various barriers to exercise participation in SSD while balancing the promotion of a normal exercise environment.

This recommendation was derived from the category ***Living a physical active life with SSD***. Key informants highlight that SSD is often associated with debilitating symptoms, such as detachment from the body and a lack of motivation, which can hinder participation in exercise. These barriers may manifest as difficulties in initiating or maintaining exercise routines or engaging in group activities. However, experts also emphasize that exercise has the potential to improve bodily integration and enhance participants' physical and mental well-being, making daily activities feel more manageable. Experts stress the importance of avoiding an excessive focus on the illness itself. While recognizing barriers is essential, they caution against allowing the disorder to dominate the exercise experience. Instead, fostering an inclusive and normal exercise environment helps participants feel empowered and capable. Additionally, they note that side effects of antipsychotic medication, such as weight gain, can cause psychosocial distress. Rather than prioritizing weight loss, the focus should be on promoting well-being and building physical strength, which are more achievable and beneficial goals of exercise.

Recommendation 2: Promoting personal and social recovery through exercise

Consider how exercise may promote the personal recovery process in community-based setting to support empowerment, social connectivity, and exercise identity.

This recommendation was derived from the category ***Exercise as a promoter of personal recovery***. Experts emphasized that community-based exercise may significantly support personal recovery by fostering a sense of belonging and psychological well-being. Being part of an exercise culture, where PA is integrated into daily life, helps participants rebuild their exercise identity and enhance self-worth. Experts stressed the importance of a safe, inclusive environment where all participation levels are valued. Group interaction was seen as essential for building social connections and mutual support, with activities like team exercises and post-session socializing helping reduce isolation. Interventions should promote empowerment by creating positive physical and mental experiences, such as feeling stronger, more energetic, and in control. While exercise alone may not always drive recovery, its surrounding social and environmental context plays a critical role. Finally, participants should be approached with respectful and supportive communication. Recognizing small achievements can counter self-stigma and build confidence. Experts emphasized that even showing up is an important accomplishment, and participants should be encouraged rather than judged for their level of attendance or performance.

Recommendation 3: Ensuring safe and relevant exercise

Ensure that safe and relevant exercise is prescribed by formulating a flexible exercise protocol and involving trusted individuals, such as relatives, friends, or mental health staff, to support participation and establish safety procedures.

This recommendation was derived from the category ***Prescribing safe and relevant exercise***. Experts highlighted the importance of safety and flexibility when developing exercise interventions for young adults with SSD. Safety protocols should address rare but possible adverse events, including psychotic or outgoing behavior, and outline clear steps for lay exercise instructors on whom to contact in such situations. Flexibility in the exercise protocol is equally critical, allowing for adjustments based on participants' physical, mental, and social capacities. Experts emphasized that a structured, yet adaptable approach helps instructors tailor exercises to individual needs while maintaining clinically relevant intensities to address the increased risk of metabolic diseases. The involvement of trusted individuals, such as relatives or mental health staff, can ease participants' transition into the intervention and serve as external motivators. Experts also stressed the need to manage participants' expectations about bodily sensations, such as muscle soreness or an elevated heartbeat, to prevent misinterpretation as harmful.

Recommendation 4: Ensuring instructors' qualification and training

Ensure instructors' qualifications and training by developing a strategy to identify and recruit experienced and passionate exercise instructors and establishing an educational course and professional network to provide insight into SSD and facilitate reflection on practical experiences.

This recommendation was derived from the category ***Instructors' qualification and formation***. Experts emphasized that the success of a community-based exercise intervention for young adults with SSD relies heavily on the qualifications and engagement of the instructors. Instructors should be experienced, reliable, and genuinely passionate about their role, as their ability to connect with participants and provide external motivation is vital. To support this, formal training is essential, combining theoretical knowledge about mental illness with practical experience. Experts recommended that such training should not be limited to a single session but include ongoing opportunities for reflection, feedback, and exchange of experiences. Establishing a professional

network would further enable instructors to share insights and continuously improve their skills, ensuring they are well-prepared to create an inclusive and effective exercise environment.

How Study I informed Study II

Findings from the expert interviews (Study I) comprised in the fourth recommendation - Ensuring instructors' qualification and training - strengthen the argument for developing an educational program for lay exercise instructors. The remaining recommendations were used to develop three core statements, which served as the foundation for focus group discussions in Study II. To foster group interaction and explore stakeholder priorities, they were asked to rank and discuss the significance of these statements. The core statements are displayed in the *Methods* section under *Sampling and data generation for Study II*.

Summary of findings Study II

The analysis of the stakeholder focus groups resulted in three categories and one overarching theme, demonstrating the role of lay exercise instructors and the required elements in an educational program supporting the delivery of community-based exercise for young adults with SSD (2). First, I will present the required elements derived from each of the three categories followed by the overarching theme.

Category 1: Awareness and understanding of mental illness

According to stakeholders, an educational program for instructors should provide foundational knowledge and practical tools to support individuals with SSD. Understanding the nature of SSD and its impact on daily life is crucial for dispelling myths and reducing stigma. Stakeholders emphasized that knowledge should clarify the distinction between symptoms and personality traits, but it must also avoid promoting an overly clinical or therapeutic focus.

The key elements of the educational program, as highlighted by stakeholders, include:

- ***Basic knowledge of core symptoms***: Stakeholders stressed the importance of equipping instructors with a thorough understanding of SSD symptoms, especially negative symptoms

like limited motivation, reduced interest, and emotional blunting, which are often misinterpreted.

- ***Understanding side effects of antipsychotic medication:*** Severe weight gain and other physical side effects of medication were identified as significant factors affecting participants' well-being.
- ***Case analysis:*** Stakeholders recommended incorporating real-life examples to demonstrate how SSD symptoms and medication side effects influence behavior, helping instructors to better understand participants' experiences and responses.
- ***Reflection on internalized stigma:*** Stakeholders emphasized the need for instructors to explore how self-stigma impacts participants, often leading to feelings of self-devaluation and shame.

Stakeholders also pointed out that symptoms may fluctuate, leaving participants vulnerable and prone to stress responses. During such times, instructors should show compassion by acknowledging even small victories and focusing on the effort rather than the outcome. This approach ensures that instructors act as external motivators, empowering participants and helping them build resilience on their recovery journey.

Theme 2: Protecting youth identity

According to stakeholders, an educational program for instructors should focus on key elements that support participants in maintaining their youth identity and integrating PA into daily life.

The core elements of the educational program identified by stakeholders include:

- ***Reflections on the concept of mental health versus mental illness:*** Instructors should understand the distinction between mental health and mental illness, ensuring they see participants as individuals rather than defining them solely by their diagnosis.
- ***Practice in respectful and inquisitive communication:*** Stakeholders emphasized the importance of engaging participants with curiosity and respect, addressing challenges openly while maintaining a balanced relationship. For example, if psychotic symptoms or negative symptoms hinder participation, instructors should address these issues constructively, treating participants as experts in their own experiences.
- ***Knowledge about social inclusion and personal recovery:*** Instructors must understand how social connection and recovery are interlinked. By fostering an inclusive exercise

community that embraces participants on both good and bad days, instructors can help them step out of the role of being a patient.

- ***Understanding the concept of the proximal zone of development:*** This concept emphasizes the importance of appropriately challenging participants without overwhelming them. Stakeholders recommended that instructors adapt exercise content to participants' physical, psychological, and social capacities while encouraging gradual progression.

By focusing on these core elements, an educational program can equip instructors to support participants in maintaining their identity, fostering social inclusion, and encouraging personal growth through exercise. This approach promotes a sense of normalcy and belonging, helping participants integrate exercise into their lives as a natural and empowering routine.

Theme 3: Promoting exercise as a shared activity

According to stakeholders, an educational program should focus on creating a shared exercise community where participants, peers, and instructors build relationships that foster personal growth. A shared exercise space should offer both predictability and flexibility, supporting participants in their recovery journey without focusing on solving their difficulties directly.

The key elements for an educational program identified by stakeholders include:

1. ***Guidelines and procedures for contacting appropriate parties:*** Instructors should be equipped with clear protocols for managing situations where participants display signs of distress, such as self-harm. While these occurrences may be rare, having procedures in place ensures the safety and well-being of participants and allows instructors to focus on their role in facilitating exercise.
2. ***Strategies for combining group facilitation with selective participation:*** Facilitating group dynamics is critical to fostering a positive and inclusive community. Stakeholders emphasized the importance of creating an environment where participants feel comfortable engaging at their own pace, balancing individual needs with collective goals.
3. ***Reflection on non-fitness related goals:*** Community-based exercise should go beyond physical fitness, aiming to provide participants with opportunities for social interaction, self-expression, and distraction from clinical symptoms. The overarching goal is to make exercise enjoyable and meaningful.

Stakeholders also highlighted that instructors should embrace that community-based exercise can serve as a steppingstone toward broader social inclusion, i.e., other sporting activities and communities not specifically tailored to individuals with mental health challenges.

Overarching theme: Guardians of an inclusive exercise culture

An overarching goal of the educational program is to equip instructors to take on the role of *guardians of an inclusive exercise culture*. This culture must adopt a clear anti-stigma approach, ensuring that exercise is achievable and accessible for all participants, regardless of their physical, social, or mental health challenges. The educational program should emphasize the importance of focusing on participants' personal resources rather than the limitations associated with their mental illness. Instructors must also be mindful of their own behavior and attitudes, as they serve as role models for participants, who may admire and draw inspiration from them. Their role should extend beyond facilitating exercise to creating a community where participants feel protected, valued, and actively involved. Finally, instructors must take responsibility for fostering a motivating and supportive exercise environment. This includes designing activities that help participants feel stronger and more capable, offering a pathway to rebuild their sense of identity through exercise.

Curriculum for the educational program

All the required elements identified and communicated in the findings from Study II were adapted and integrated into the *Vega Instructor Educational Program*, which is implemented in the Vega trial. The educational program encompasses:

- ***Instructor manual:*** This manual had two purposes. First, it included literature aligned with the learning objective of the educational program, serving as preparation for the course. Secondly, it included a standard operating procedure, outlining the instructors to deliver the intervention according to the protocol (4), as well as administrative tasks such as registering attendance. The table of contents of the instructor manual is available in *Supplementary Material 2* in Paper II (2).
- ***A one-day educational course.*** This was initially held as physical courses at the three Vega Exercise Community sites (Copenhagen, Aarhus, and Aalborg) and included a combination of lectures, group discussions, and practical exercises. The course was then adapted to a blended learning format, including e-learning material, 1:1 meeting, and follow-along in the

exercise sessions. This provided a flexible format for the ongoing education of new instructors during the Vega trial. In total, 28 instructors have been educated during the Vega trial. The agenda of the one-day course is available in *Supplementary Material 2* in Paper II (2). Figure 5 contains pictures from the education of the first Vega instructors.

- ***Continuous exchange of experience sessions.*** To bring all instructors together and facilitate the exchange of experiences across sites, we conducted these sessions online. This approach fostered mutual learning and provided a platform for instructors to share both positive and challenging experiences.



Figure 5: Pictures from the first educational courses held in Copenhagen, Aarhus, and Aalborg, April 2022.

Summary of findings Study III

Through the analysis of the interviews with young adults with SMI enrolled in the Vega trial, three interconnected themes regarding the bodily experience in the process of personal recovery in relation to community-based exercise emerged (3). These themes were entitled: *Bodily identity*, *Bodily regulation*, and *Bodily sociality*, all assembled under the overarching theme of *Embodied recovery*.

Theme 1: Bodily identity - Reclaiming a sense of self

Participants describe how mental illness, medication, and inactivity create a sense of estrangement from the body. Regaining bodily identity is not just about physical improvements but about reclaiming ownership of the body and integrating bodily changes into a renewed sense of self. Exercise plays a key role in this process, offering moments of reconnection where movement feels natural again. While some seek to return to a past version of themselves, others discover new physical capacities, reshaping their bodily identity in ways they had not experienced before. However, expectations around physical change - particularly regarding weight loss - can also lead to frustration and self-doubt, highlighting the importance of broadening definitions of progress.

“My body feels more like my body, and not just a thing I’ve been assigned. It’s like I’m getting it back again.” – Emma (3)

Theme 2: Bodily regulation - Finding balance

Participants used exercise as a tool to regulate their physical and emotional states, particularly in response to fluctuating energy levels and stress. For many, structured exercise creates stability, providing a sense of rhythm and control in an otherwise unpredictable recovery process. However, bodily regulation is not always straightforward - while exercise can provide grounding, it can also become a source of frustration when the body does not respond as expected. Some struggle with knowing when to stop, questioning whether pushing through discomfort is helpful or harmful. Others feel pressure to use exercise as a self-regulation tool, which, when ineffective, leads to disappointment and self-criticism. Learning to navigate these challenges requires flexibility, recognizing that recovery is not linear and that regulation is an ongoing process.

“Some days, I have to tell myself that it’s okay to stop. It’s not giving up; it’s listening to what my body needs right now.” – Lily (3)

Theme 3: Bodily sociality: Navigating connection and comparison

Exercising with others creates a dual experience of connection and comparison. Some participants find motivation and inspiration in seeing others move, using social settings to expand their sense of bodily possibilities. At the same time, comparison can also lead to self-doubt, making participants feel behind or inadequate. Social settings highlight how bodily awareness is not developed in isolation but shaped through interactions and external perceptions. While group exercise fosters a sense of belonging, it also introduces performance pressure, shifting attention from personal progress to external benchmarks. This tension requires participants to negotiate their engagement, balancing between self-driven motivation and external influences.

“When I see someone else doing an exercise I thought was impossible, I think maybe I can do it too.” – Jack (3)

Overarching theme: Embodied recovery

Embodied recovery frames personal recovery as a continuous negotiation - between loss and adaptation, stability and transformation, disconnection and reconnection. The three themes do not exist in isolation but interact dynamically, shaping how individuals experience their bodies, movement, and recovery over time.

As shown in Figure 6, the themes relate in the following ways:

- ***Bodily identity*** is shaped both by internal self-regulation and external social reflection.
- ***Bodily regulation*** depends on self-perception and social influences in managing bodily states.
- ***Bodily sociality*** influences how individuals experience and regulate their bodies based on external feedback and comparison.

These interactions are not linear but circular, reinforcing both positive and negative cycles in recovery. The green arrows in Figure 6 represent stability, confidence, and connection, while red

arrows indicate frustration, self-doubt, and instability. This highlights how recovery unfolds as a fluid, evolving process, rather than a fixed trajectory.

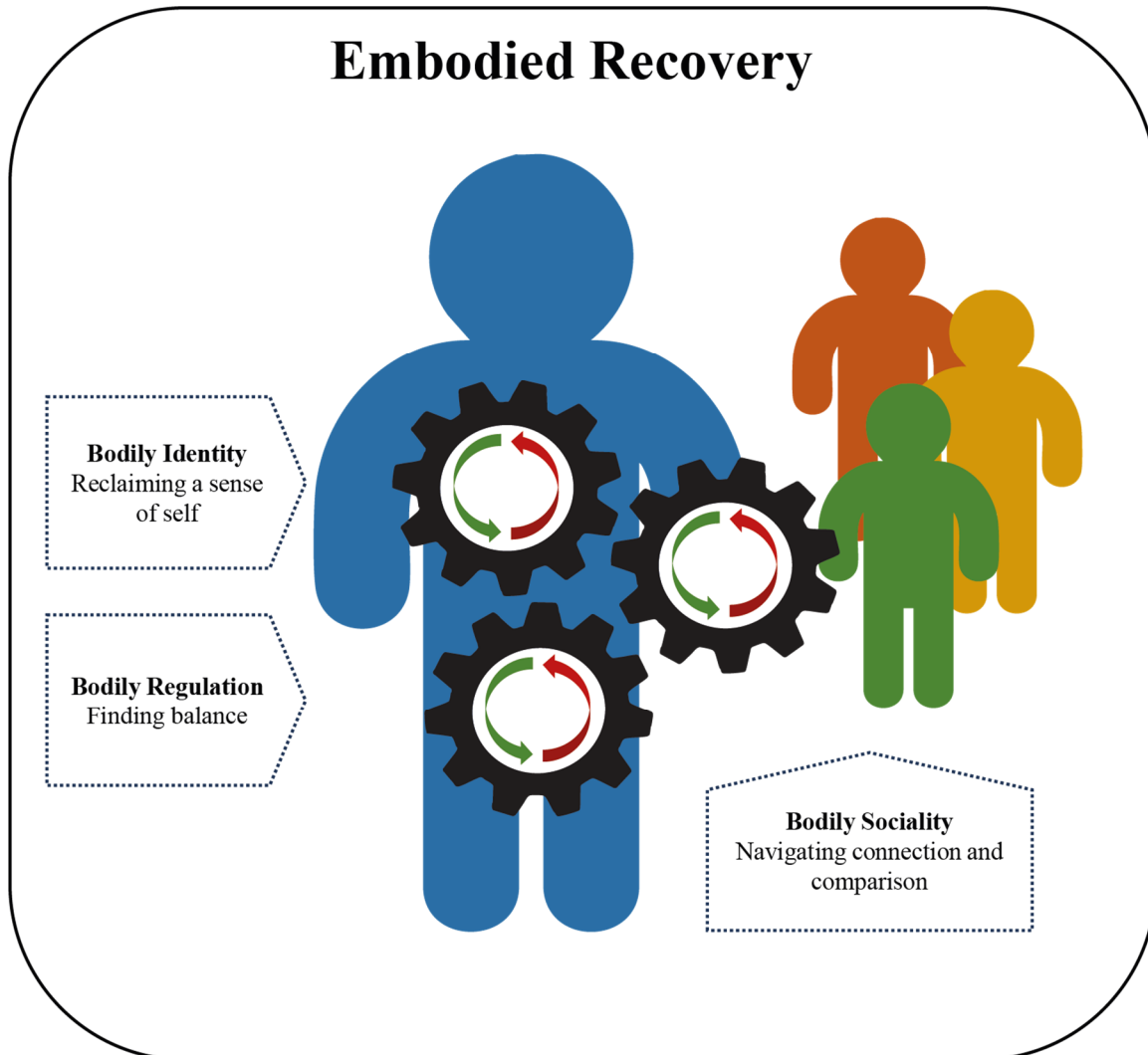


Figure 6: Embodied Recovery. The themes of *Bodily Identity* and *Bodily Regulation* are internal factors, while *Bodily Sociality* is an external factor, all shaping the embodied recovery. The green and red arrows illustrate positive and negative bodily experiences shaping a fluid and evolving *Embodied Recovery* process (3).

The findings of Study III suggest that the body is not a passive element in recovery but an active medium through which individuals navigate change. Exercise serves as both a mirror and a tool, reflecting the challenges of reclaiming bodily agency while offering opportunities for self-discovery, regulation, and connection.

Discussion

In the following section I will discuss the methods and key findings of the current thesis.

Methodological considerations

The aim of my thesis was to explore the perspectives of experts', stakeholders', and participants' perspective on the promotion of a community-based exercise intervention for young adults with SMI. I employed pragmatism as an epistemological approach, which is particularly well-suited to investigate complex interventions, i.e., the Vega Exercise Community. Pragmatism emphasizes flexibility, stakeholder engagement, and iterative refinement, aligning closely with the stages outlined in the MRC framework for complex interventions. The current thesis comprises three studies, wherein Study I and II were a part of the developmental stage, and Study III was a part of the evaluation stage. The three studies in this thesis employ qualitative designs, contributing to a broader understanding of the research topic.

The development of the Vega Exercise Community was informed by multiple sources, including findings from Study I and Study II, existing literature, theoretical frameworks (4), and evaluations from the preceding COPUS feasibility trial, which incorporated perspectives from various stakeholders (5,6). This comprehensive approach ensured that the intervention was grounded in both empirical evidence and practical insights. Additionally, Study III examined exercise as a core element of the intervention, providing deeper insight into how bodily experiences influence personal recovery. This helped uncover key mechanisms driving the intervention's potential effects.

In the following, I will discuss the methodological considerations regarding the three qualitative studies comprising the current thesis. The *trustworthiness* of qualitative research is often questioned by scholars trained within a positivistic research paradigm, as traditional concepts of validity and reliability cannot be directly applied to naturalistic studies. To address these concerns, researchers like Guba and Lincoln (1985) have proposed alternative criteria that align with the qualitative paradigm (154). They identify four key constructs:

- ***Credibility*** is parallel to internal validity and refers to the confidence in the truth and accuracy of the findings.
- ***Transferability*** is parallel to external validity or generalizability and refers to the extent to which the findings from my qualitative studies can be applied or transferred to other contexts, settings, or groups.

- ***Dependability*** is parallel to reliability and refers to the stability and consistency of the research process over time and across various conditions.
- ***Confirmability*** is parallel to objectivity and refers to the extent to which the findings are shaped by the data rather than the characteristics and preferences of the researcher.

These constructs aim to ensure the rigor of qualitative research without relying on positivist frameworks. Over time, these criteria have gained widespread acceptance, providing a robust foundation for evaluating the trustworthiness of qualitative inquiry. There are several strategies to ensure trustworthiness in qualitative research, and these strategies may be important in one or several of the four constructs. Some strategies are weighted differently depending on the analysis method, i.e., qualitative content analysis versus reflexive thematic analysis.

To enhance *credibility*, it is recommended that the researcher develop an early familiarity with the culture of the participating organization. In Studies I and II, this was a challenge due to the multiple organizations and cultures represented by the experts and the stakeholders. In this early phase of my PhD program, I was already familiar with community-based exercise through both professional and personal experiences. However, my familiarity with mental health care was limited, and I had no prior experience working as a clinician with individuals with SMI. Thus, I ensured collaborative work with co-researchers who were familiar with mental healthcare and the target population was critical to enhance credibility. Prior to Study III, I was highly familiar with the organization's culture, in this case, the Vega Exercise Community. I attended and observed several exercise sessions and regularly engaged in conversations with participants, instructors, and other potential stakeholders. Additionally, I gained firsthand insight into the target group by following clinical staff in their work with individuals with SMI, which enhanced my understanding and sensitivity toward the challenges faced by this population. This prolonged engagement not only enhances a contextual understanding but is also a way of establishing trust between the researcher and the participants, which makes it more likely for participants to provide rich and in-depth information about their bodily experiences of exercising. While I conducted the interviews with participants enrolled at two sites, Aalborg and Aarhus, my physical engagement was much more frequent at one of the sites, namely Aalborg. To compensate and build trust, I had longer conversations over the phone and physically prior to the interviews with participants from Aarhus. In Copenhagen, the co-researcher and research assistants who conducted the interviews had only a small familiarity with the culture in the Vega Exercise Community. Listening, reading transcripts, and analyzing these interviews did, however, not give me the impression that they had a lack of information richness and depth.

Another important thing to consider concerning *credibility* is the sampling of the individuals who served as informants. In all three studies, I used purposive sampling to ensure that informants had the necessary knowledge, experience, or characteristics to address the research questions effectively (155). Specifically, in the expert interviews (Study I), I employed snowball sampling, in addition to criteria sampling, to access a potential hard-to-reach population and leverage the expert's professional network, which may have increased the likelihood of participation (156). However, I cannot rule out that it has resulted in a form of convenience sampling, where the experts, despite having diverse professional backgrounds, shared a generally positive or enthusiastic view of exercise and its potential benefits in community-based settings. As a result, the information richness related to potential negative effects or challenges associated with community-based exercise may not have been fully represented in the expert sample. In the stakeholder focus groups (Study II), I initially made a stakeholder analysis to ensure the inclusion of all relevant perspectives by systematically categorizing stakeholders based on their level of involvement and impact on the study aim. This prevented omitting important voices and thereby contributed to a well-rounded and credible data set (157). During the interviews with the participants (Study III), I found that the use of metaphors and comparisons related to topics of personal interest - such as music and fantasy - was a valuable tool for discussing bodily experiences, particularly for participants who found it difficult to articulate these sensations in words. Recognizing this, I made a deliberate effort to refine and validate my emerging understanding throughout the interview process, ensuring honesty and depth in participants' responses through iterative questioning.

In the current thesis, I have paid careful attention to the contextual description, and provided a thick and detailed description of the Vega Exercise Community and placed my individual studies within the MRC framework (119). Furthermore, for each study, I have provided a detailed description of the research setting, informant characteristics, and data collection methods. These descriptions allow readers to assess the transferability of the findings to other contexts, an essential aspect of qualitative research (158). By offering rich descriptions and contextual details, this thesis supports readers in determining the relevance and applicability of its findings beyond the specific study settings (158). The degree of transferability may vary across the three studies. Study I and II focused specifically on intervention development, which is closely tied to young adults with SMI, potentially limiting their broader applicability. In contrast, Study III explores bodily experiences in relation to personal recovery, engaging with more universal themes, making its findings more transferable to other settings, populations, and exercise-based recovery interventions.

To enhance *confirmability and credibility*, I employed triangulation, using multiple data sources, i.e., expert interviews, focus groups, and in-depth interviews with participants, to gain a more comprehensive understanding of the thesis aim. I did not use triangulation of data sources within the individual studies. Studies I and II are connected and were conducted in prolongation of each other, as findings from expert interviews served as statements for discussion in the stakeholder focus groups.

The studies comprised in the current thesis were conducted in close collaboration with co-researchers and supervisors. Frequent debriefing sessions and peer scrutiny were used throughout the analytical process; however, the use of these sessions was different according to the analytical methods used. In the expert interviews (Study I), a co-researcher and I both had prolonged engagement with the data. As I was the only one coding and categorizing the data, we did not use inter-coder reliability. Still, due to the immersion of the data by multiple researchers, we felt confident that debriefing sessions were sufficient in enhancing the *credibility* of the codes and categories in alignment with content analysis (146,148). In contrast, in Study III, the co-researchers were not equally immersed in the data but represented research experience within the phenomenon of interest, i.e., community-based exercise and personal recovery. Thus, sessions did not aim to seek consensus or “validate” the analysis but to challenge and refine my interpretation with respect to my subjective lens. In agreement with reflexive thematic analysis, peer scrutiny was used as a tool for enhancing the reflexivity, coherence, and rigor of the analysis (151). Asking clarifying questions and suggesting alternative interpretations or highlighting potential blind spots, the co-researcher encouraged me to deeper reflexivity while still maintaining my analytical integrity. I made an effort to perceive divergent perspectives on the analysis as opportunities for deeper exploration rather than inconsistencies to be resolved.

To enhance both *dependability and confirmability*, I used an audit trail, ensuring that every step in the analytical process was thoroughly documented. In Study I and II I followed the stages recommended for qualitative content analysis (146), while the analytical procedure was described in detail. None of the analyses presented in the current thesis were linear but an iterative movement back and forth between the analytical phases. However, keeping a systematic audit trail was more difficult in Study III due to the reflexivity, which is a cornerstone of reflexive thematic analysis (151). Together with the audit trail, I kept a reflective journal, which allowed me to critically examine how my theoretical lens, experiences, and assumptions shaped the analysis. An important strategy to enhance both *confirmability and credibility* is to disclose my predispositions (129).

Braun and Clarke refer to this as *owning one's perspective*, both embracing subjectivity as a resource and the importance of articulating the researcher's theoretical, personal, and experiential lens throughout the research process (130). Even though I have disclosed my professional and personal preconception regarding the subject and context of the study, it is crucial for me to emphasize that my perspective is fluid and evolving throughout the research process. Therefore, at (pre)conception provides only a momentary insight, and thus, to provide transparency, I have shared parts of my reflective journal that hopefully illustrate an evolving interpretative lens.

Key findings

In the following section, I will discuss the key findings of the three studies comprising this thesis, integrating them based on their intersecting content and positioning them within the existing evidence base. This discussion will be framed using the four levels of the social-ecological model of health - individual, relational, community, and societal (159) - to provide a nuanced understanding of the complexities involved in promoting a personal recovery-oriented, community-based exercise interventions for young adults with SMI. The model is illustrated in Figure 7.

The social-ecological model was chosen as a framework because it accounts for multiple interacting factors that shape personal recovery, aligning with the MRC framework which underscores that the effects of an intervention cannot be reduced to a single mechanism but must be understood within a broader system of influences (119). Similarly, personal recovery is not a linear or isolated process but unfolds through interactions between the individual, their relationships, the community, and the broader societal context (102).

At the ***Individual*** level, I will discuss how community-based exercise may facilitate a process of identity reclamation, allowing participants to see themselves as more than just their mental illness.

At the ***Relational*** level, I will examine the importance of social support while also addressing the ambivalence of social comparison.

At the ***Community*** level, I will focus on the structure of the Vega Exercise Community and the role of instructors in fostering an inclusive and recovery-oriented environment.

Lastly, at the ***Societal*** level, I will discuss the impact of stigma and dominant fitness culture on PA participation and exercise behaviors among young adults with SMI.

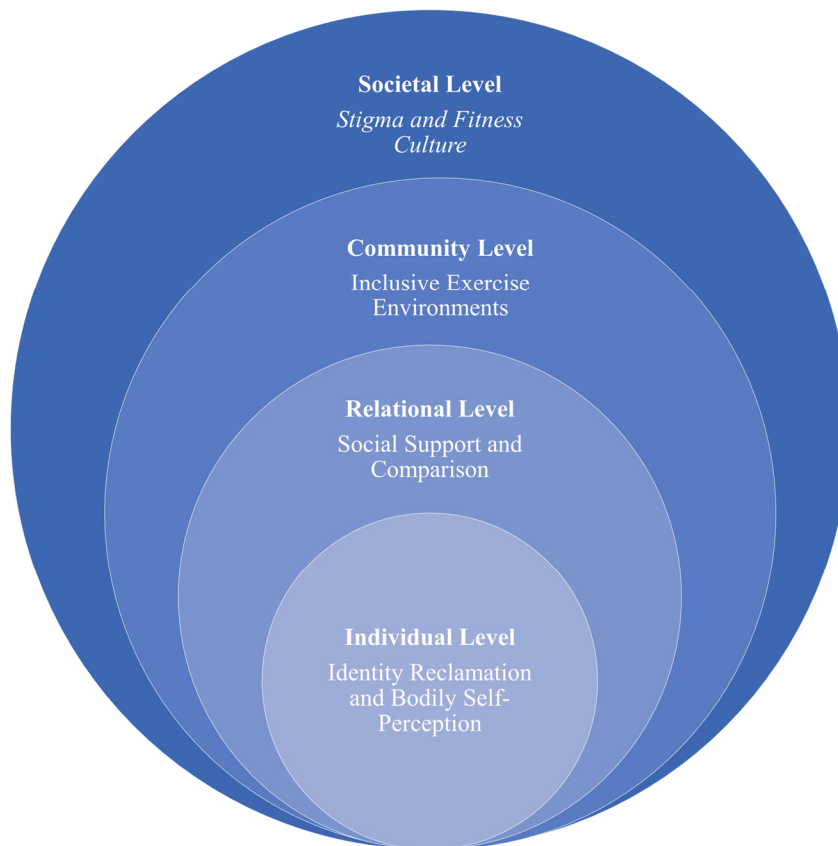


Figure 7: Socio-ecological model framing the discussion of the key finding in the current thesis

Individual level: Identity reclamation and bodily self-perception

The potential of community-based exercise in supporting personal recovery in SMI was highlighted by experts and stakeholders during the developmental phase of the Vega Exercise Community. Insights from the previous COPUS trial, alongside increasing political awareness of recovery-oriented practice, reinforced the relevance of personal recovery as the central phenomenon of interest in this thesis. While limited evidence directly supports the role of exercise in the overall concept of personal recovery, a focus on core recovery dimensions provides strong theoretical and empirical justification for the inclusion of exercise in recovery-oriented interventions. One core aspects known from the CHIME framework (110) and other literature on personal recovery is developing a positive identity (103,160).

In Study II, the stakeholders emphasized the importance of protecting youth identity by providing the participants the opportunity to step out of the role of being a patient and into the role of being a - as framed by individuals with SSD in Study II - “*normal young adult*” where exercise is a natural and integrated part of everyday life. This desire for normalcy is well-documented in qualitative

studies, where engaging in ordinary, everyday activities has been linked to the reconstruction of self in people with SMI (82,161–163). Both experts (Study I) and stakeholders (Study II) emphasized that this “*striving for normalcy*” must be balanced with the unique challenges of living with SMI, such as fluctuating symptoms and medication side effects. Findings from the COPUS trial align with this perspective, demonstrating that community-based exercise can simultaneously embrace a youth identity and a mental illness perspective, allowing participants to experience a sense of normalcy in a real-world setting (5). The duality of ill versus well self is further described in identity research, where overcoming or managing identity loss is crucial for recovery (164).

In Study III, participants expressed a (re)building process, where exercise played a role in reclaiming a lost identity. For some, exercise had previously been an important part of their identity but was gradually lost due to mental illness. Their engagement in the Vega Exercise Community provided an opportunity to restore and reconnect with this part of themselves, a theme also identified in prior research, where individuals describe exercise as a means to “*get back to their old self*” and rediscover lost experiences (162,165). In contrast, other participants had little or no prior exercise identity, and instead, their engagement in exercise became a process of exploration rather than reconnection. Participants in Study III also described a fluid and evolving identity, shaped by their bodily experiences over time. This aligns with Soundy et al.’s (2012) meta-ethnographic study, which conceptualizes an *evolving identity cycle* (163), showing that perceptions of self before, during, and after exercise are central

A key finding in Study III was that participants viewed exercise as a tool for shaping their embodied identity, allowing them to explore and refine their relationship with their bodies. This reconnection was not purely physical, but also represented emotional resilience, as illustrated by one participant who felt more secure and less vulnerable - both physically and psychologically - as a result of exercise. The concept of embodiment is central to phenomenological philosophy, and Lundh & Foster (2024) conceptualize it as a synthesis of having a body (the body as an object) and being a body (the body as felt from within), a synthesis that is fundamental to self-identity formation (166).

Both experts (Study I) and stakeholders (Study II) emphasize that initiating and maintaining community-based exercise is influenced by multiple individual factors in young adults with SMI. In Study III, participants expressed that symptoms and side effects of medical treatment often led to a loss of bodily control and an alienated relationship with their body, particularly due to fatigue and weight gain. Antipsychotic-induced weight gain is associated with serious metabolic side effects

and is considered one of the most distressing medication-related consequences (167,168). Weight management was described as both a barrier and a key motivator for engaging in community-based exercise, reflecting findings from Firth et al. (2016), who identified “*improving appearance*” and “*losing weight*” as highly endorsed reasons for exercise in people with SMI. (40). However, it is crucial to note that the contribution of exercise to weight loss is relatively modest, particularly without dietary modifications (54), and that the physical and mental health benefits of exercise are often independent of weight loss (169). Another factor that acted as both a motivating force and a barrier to exercise was energy and fatigue levels. Several participants in Study III described persistent struggles with low energy, which they linked to negative symptoms, medication side effects, or prolonged physical inactivity. This led to ongoing compromises in their ability to engage consistently in exercise. Energy is often reported as a motivational goal for initiating exercise, but also acts as a dominant barrier (40,41).

Relational level: Social support and comparison

One critique of newer definitions of personal recovery, such as Anthony’s widely cited formulation - “*a deeply personal, unique process...*” (107) - is that they emphasize individual agency while overlooking the social and interpersonal dimensions of recovery (109,170). In response to this critique, Topor et al. (2020) proposed an alternative definition, “*a deeply social, unique, and shared process,*” highlighting the importance of relational, cultural, material, and societal contexts in shaping recovery (171). In line with this perspective, the following section will discuss the role of relational and interpersonal factors in community-based exercise, particularly connectedness, as conceptualized in the CHIME framework (110). The discussion will begin with the supportive role of others in facilitating and sustaining engagement in exercise, which may help overcome individual barriers and directly contribute to personal recovery by fostering empowerment, hope, and optimism.

Across the three studies in this thesis, the importance of being with and being acknowledged by others emerged as a central theme. Experts (Study I) emphasized the critical role of social support from family, friends, and mental health professionals in promoting and sustaining community-based exercise engagement for individuals with SMI. The COPUS trial demonstrated that collaboration with mental health professionals in promoting and delivering exercise interventions was instrumental in helping participants initiate engagement (5). Existing literature further suggests that mental health staff should provide individualized and structured support, such as introducing

participants to instructors beforehand to create a sense of familiarity and safety (163). Mental health staff often function as gatekeepers, validating and facilitating access to community-based exercise (172). Quirk et al. (2020) described the initiation of community-based exercise for individuals with SMI as a “*journey*” that requires intensive social support from someone trusted and valued by the patient, including friends and family (168). The importance of bringing a friend or family member along to exercise sessions was highlighted by experts in Study I and subsequently incorporated as a supportive strategy in the Vega trial (4).

In Study II, stakeholders emphasized that facilitating group dynamics is crucial for engagement. Exercising with others who share similar experiences of mental illness can create an unspoken mutual understanding, fostering a sense of belonging. Soundy et al. (2015) identified group-based exercise as a mechanism for social connection, where peer support within the activity generates cohesion and motivation (82). Similarly, other qualitative studies suggest that group-based exercise can foster positive relationships, reinforcing social identity and connectedness, which in turn facilitates behavior change (173). However, group dynamics do not always have a positive impact on engagement or personal recovery. Brook et al. (2019) caution against an overly idealized perspective on exercise, emphasizing that it can also reinforce exclusion or exacerbate negative self-perceptions through social comparison (83).

This ambivalence was evident in Study III, where participants described both motivation and vulnerability within the social context of the Vega Exercise Community. While group settings provided inspiration and encouragement, they also triggered self-evaluative thoughts and self-critique. Social comparison theory posits that individuals have an innate drive to compare themselves to others to assess their own abilities and self-worth (174). The participants in Study III particularly struggled with upward social comparisons, where they evaluated themselves against peers perceived as superior. While upward comparison can motivate self-improvement, it can also lead to frustration, envy, anxiety, and reduced self-efficacy (175). In the fitness domain, research suggests that upward comparisons often result in negative self-evaluations of physical fitness, reduced motivation, and lower emotional well-being (176). For young adults with SMI, this ambivalence surrounding social comparison may exacerbate well-documented illness-related barriers, such as negative symptoms in SSD, social anxiety, and low self-esteem (41). Furthermore, it may contribute to the high dropout rates observed in exercise interventions for this population (177,178).

Community level: Inclusive exercise environment

In the following section, I will discuss the Vega Exercise Community and its local exercise context, specifically the functional gyms in which the intervention was delivered. A central theme throughout the developmental phase (Study I and II) was the importance of creating an inclusive exercise environment, which should aim to mitigate barriers to exercise commonly experienced by individuals with SMI while simultaneously supporting personal recovery.

Extending the previous discussion on the importance of social support, a key component of the Vega Exercise Community was the role of lay exercise instructors in facilitating sessions. In Study I, experts emphasized the necessity of ensuring that instructors possessed appropriate qualifications and training. Similarly, stakeholders in Study II stressed that instructors should act as guardians of an inclusive exercise environment, aligning with Richardson et al. (2005), who assert that:

“Enthusiastic, knowledgeable, and supportive exercise leaders are as important as the actual exercise prescription itself” (179). The importance of qualified exercise instructors is further reinforced by the European Psychiatric Association (EPA) in their meta-review and position statement on PA and exercise as a treatment for SMI. They highlight that exercise interventions supervised by qualified exercise professionals rather than mental health staff are associated with better outcomes and lower dropout rates (180). However, there remains a scarcity of exercise professionals, such as physiotherapists, within mental healthcare settings (181). Additionally, there is a need for replicable and scalable methods for delivering exercise interventions to large numbers of individuals with SMI (35). In the Vega Exercise Community, we employed experienced lay exercise professionals recruited in the local functional gyms and thus were not required to have any health professional background. Qualitative findings from the COPUS trial indicated that participants appreciated that the instructors were not mental health professionals, and it allowed the participants to feel *“normal”* and *“interact with the real world”* (5). Notably, many of the instructors who expressed interest in becoming Vega instructors were students or trainees in health-related professions such as physiotherapy, sports science, human physiology, nursing, psychology, and social work. This illustrates an existing health capacity within this sector and a willingness to contribute to mental health solutions.

Both experts and stakeholders emphasized the importance of balancing instructors' knowledge of mental illness. While instructors should not overemphasize participants' diagnoses, they should possess sufficient awareness to challenge misconceptions and reduce stigma. Findings from both the COPUS trial (5,6) and Study III suggest that participants felt a greater sense of safety when

instructors had a basic understanding of SMI. As part of the Vega Exercise Community educational program, instructors participated in exchange of experience sessions with instructors from across the different exercise sites. Interestingly, most instructors reported being positively surprised by how easily they connected with participants, despite initially perceiving the group as “*a bit quiet.*” One instructor, also a gym owner, noted that reflections on mental health versus mental illness would be valuable for all instructors in his gym, suggesting that mental health awareness has broader relevance beyond specialized SMI interventions and could help expand perceptions of normality within fitness environments.

Another key factor in creating an inclusive exercise environment - highlighted across all three studies - was the balance between structure, adaptability, and flexibility within the exercise interventions. Structure was considered essential for providing participants with a sense of predictability and stability, allowing them to engage confidently. In Study I, structured routines were identified as crucial for creating an organized and supportive environment. This is particularly relevant for young adults with SMI, who often struggle with structuring their daily lives due to symptoms of depression, SSD, and medication side effects (182), alongside higher rates of unemployment and disengagement from education (183). Research indicates that one of the primary perceived benefits of community-based exercise for individuals with SMI is having something to do and somewhere to go, reinforcing the need for structured opportunities for meaningful activity (168). Adaptability ensures that exercise interventions accommodate varying abilities and needs, preventing exclusion. Stakeholders in Study II emphasized that activities should be tailored to individual capacities while providing enough challenge to foster engagement and progress. Flexibility allows participants to adjust their engagement based on daily fluctuations in physical and emotional well-being. In Study III, participants described modifying their exercise intensity depending on fatigue or stress levels, underscoring the importance of a flexible approach that empowers individuals to engage at their own pace without feeling pressured.

In the Vega Exercise Community, functional gyms were chosen as exercise sites due to their capacity to provide a balance of structure, adaptability, and flexibility. Additionally, research suggests that functional gyms foster higher levels of social capital and community belonging compared to traditional gyms, making them a promising setting for recovery-oriented exercise interventions (184). However, other forms of exercise communities may also offer similar benefits in supporting personal recovery. Running clubs, for example, have been shown to enhance individual resilience and social connectedness, with group-based running interventions

demonstrating positive effects on mental well-being, emotion regulation, and social functioning (185,186). Similarly, team sports such as football or basketball create strong group cohesion and a sense of shared purpose, which can contribute to personal recovery through collective engagement and mutual support (83,187). Studies have highlighted the importance of team-based activities in fostering psychological resilience and identity reconstruction, particularly among individuals facing mental health challenges (188). Yoga communities may also provide valuable alternatives by integrating structured low-intensity PA with mindfulness and self-regulation practices, which have been linked to improved emotional regulation and stress management (189).

Societal level: Stigma and fitness culture

In our study protocol to the Vega trial (4), we provided a logic model that visually represented the intervention's input, activities, outputs, and expected outcomes. One of the expected outcomes was a reduction in stigma, both external and internal. Stigma emerged as a recurrent theme in Studies I and II, where experts and stakeholders emphasized the need for community-based initiatives to create opportunities for individuals with SMI to attain the highest level of health and participate in a society free of stigmatization and discrimination, a position supported by existing literature (80). In Study II, the stakeholders highlighted the importance of an educational program for instructors to dispel common myths about mental illness to reduce stigmatizing behavior and attitudes.

Interventions using contact and education are effective in reducing stigma towards people with SMI (190,191). Within the Vega trial, we hypothesized that embedding the intervention in existing functional gyms and recruiting instructors from these settings would support a gradual transition from the Vega Exercise Community to broader community participation. This approach aimed to foster social integration by increasing contact between participants and regular gym users. In Study I, one expert cautioned that community-based exercise interventions should not become isolated "*sanctuaries*" for people with SMI, as this could reinforce social disconnection. Therefore, while we sought to provide a "*normal*" exercise environment, we also aimed to challenge and expand perceptions of what constitutes an inclusive gym. Although only a few participants made this transition to regular exercise within the gyms, findings from Study III suggest that participation in the Vega Exercise Community may have facilitated a transition to PA and recreational sports. This aligns with what one stakeholder in Study II described as "*a steppingstone to something else*", indicating that the intervention may have played a role in encouraging long-term engagement in PA beyond the Vega Exercise Community.

In Study III, internalized stigma emerged as the most profound form of stigma, partly explained in the *Individual* and *Relational* level. This may be exacerbated by a dominant fitness culture in Western societies, where narrow and idealized body standards associate physical health and attractiveness with discipline, success, and self-worth. For young adults with SMI, who may experience weight gain, reduced physical capacity, or bodily discomfort, such cultural norms can intensify feelings of inadequacy and self-exclusion from exercise spaces (83). Indeed, some participants expressed concerns about not being “*fit enough for fitness*,” highlighting how these internalized perceptions act as a barrier to PA engagement.

This challenge is particularly relevant in Denmark, where sports and exercise are deeply embedded in the cultural fabric. Denmark has one of the highest participation rates in sports and PA globally (192), with more than 11,000 sports associations and approximately 2.7 million Danes - nearly half the population - registered as members (193). Among young adults, strength and fitness training are the most popular forms of exercise, with commercial fitness centres ranking as the most preferred exercise setting (193). This widespread engagement reinforces societal expectations around PA, making exercise participation appear not just beneficial, but normative. While this strong fitness culture provides many opportunities for engagement, it may also heighten self-stigmatization for those who struggle to participate, reinforcing feelings of exclusion from mainstream exercise environments.

Findings from Study III also suggest that mainstream fitness centers can present significant challenges for some individuals with SMI. Several participants described traditional fitness centers as uncomfortable or even distressing environments, emphasizing the omnipresence of mirrors, the performance-oriented atmosphere, and the sense of being observed or judged by others. This aligns with research showing that mainstream fitness environments can reinforce body surveillance and self-comparison, further discouraging participation among those who already experience bodily discomfort or low self-esteem (194). While some individuals may prefer the flexibility of a fitness center over the structured norms of sports clubs, for others, these settings may amplify existing insecurities and contribute to the avoidance of PA altogether.

Summary of the discussion

This discussion highlights the multi-level influences shaping personal recovery through community-based exercise, structured within a socio-ecological framework. At the individual level,

exercise supports identity reclamation, helping participants reconnect with their bodies and redefine their sense of self, though factors such as fatigue, medication side effects, and fluctuating motivation pose challenges. At the relational level, social support from peers, family, and healthcare professionals facilitates engagement, while social comparison can be both motivating and discouraging. The community level underscores the importance of inclusive exercise environments, where structured yet adaptable programs and well-trained instructors create a sense of safety and belonging. Lastly, at the societal level, dominant fitness culture and stigma can reinforce self-exclusion from mainstream exercise spaces.

These interconnected influences demonstrate that the promotion of recovery-oriented community based exercise is not an isolated process but shaped by interactions across multiple levels. The findings are summarized in Figure 8.

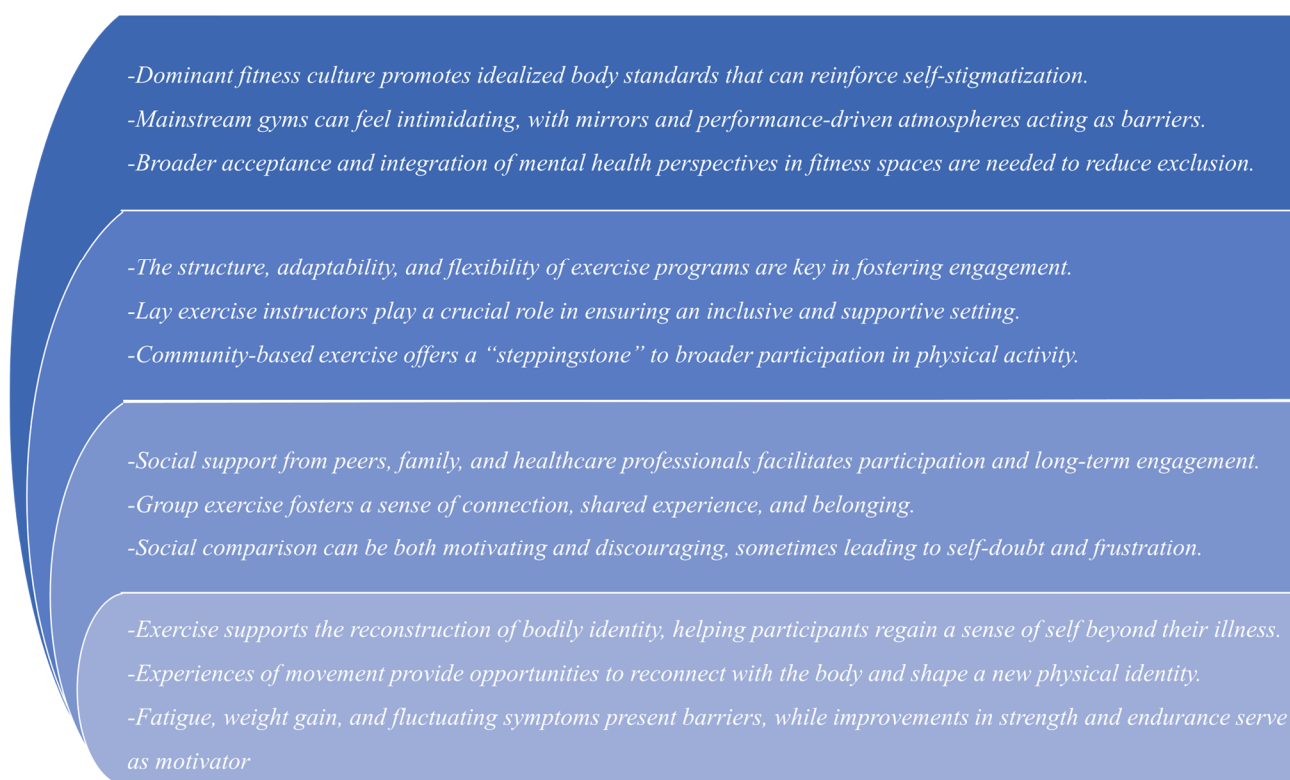


Figure 8: Socio-ecological model summarizing key discussion points at the individual, relational, community, and societal levels regarding community-based exercise for young adults with SMI.

Conclusion

This thesis aimed to investigate the perspectives of experts, stakeholders, and participants in relation to the promotion of a recovery-oriented community-based exercise intervention for young adults with SMI. Study I and Study II explored expert and stakeholder perspectives on designing a community-based exercise intervention and an educational program for lay exercise instructors. Study III examined the bodily experiences of participants engagement in exercise as part of their personal recovery journey.

For young adults with SMI, exercise can play a crucial role in reclaiming a sense of self, particularly after illness and medication side effects have disrupted bodily experiences. Exercise offers a way to reconnect with the body, rebuild confidence, and foster resilience. However, participation is shaped by fluctuating motivation, fatigue, and social influences, highlighting the need for a flexible and inclusive approach. This thesis also emphasizes the broader social and environmental factors that influence engagement. While support from peers, mental health professionals, and exercise instructors can facilitate participation, social comparison and performance-driven fitness culture may present additional challenges.

Overall, the findings demonstrate that exercise is not just about physical health - it is an embodied process that shape identity, self-regulation, and social connection. By acknowledging these complexities, community-based exercise can be designed in ways that align with the diverse needs and personal recovery experiences of young adults with SMI.

Implication for research

Future research should move beyond simply establishing the benefits of exercise and PA for individuals with SMI and instead address the implementation gap that hinders sustained participation. While documenting the effects of interventions like the Vega trial remains valuable, this knowledge is limited without a parallel focus on sustainability. Without understanding how interventions can be maintained and integrated into real-world settings, their long-term impact remains uncertain. Although strong evidence supports the positive effects of PA on physical and mental health, the key challenge lies in translating this knowledge into scalable, sustainable, and accessible interventions. To bridge this gap, research should prioritize implementation science approaches and models, such as the framework for Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) (195) and the Consolidated Framework for

Implementation Research (CFIR) (196). These frameworks can guide exploration into how exercise interventions can be effectively integrated into routine mental health care and community-based support systems. This includes identifying context-specific barriers and facilitators, understanding the roles and responsibilities of different stakeholders, and evaluating strategies to enhance interdisciplinary collaboration. Additionally, research should examine co-production models (197), ensuring that interventions are developed and adapted in partnership with people with lived experience with SMI to enhance engagement and reduce stigma (198).

Within the research field of personal recovery, a focus on how embodiment - both as having a body and being a body - interacts with recovery in SMI are warranted. SMI is often associated with severe weight gain (167), negative body image, and profound disruptions in bodily experiences (199), yet these embodied dimensions remain underexamined within recovery research. While there is a growing body of literature on the role of PA and exercise in recovery, most studies primarily address psychological, social, and narrative aspects, overlooking how direct bodily experiences shape the recovery process. Findings from Study III suggest that the body plays a significant role in recovery, as exercise transforms the body into both a site and a symbol of progress and setbacks. Future research should further explore how embodiment aligns with the conceptualization of personal recovery and how it can be integrated into existing frameworks such as CHIME (110). By addressing this gap, research can contribute to counteracting what has been described as "*Den kropsløse psykiatri*", ensuring that the bodily dimensions of recovery are recognized and incorporated into both theory and practice.

Implication for practice

Improving physical and mental health outcomes for people with SMI through PA on a large scale remains an elusive goal. Increasing PA and reducing sedentary behavior is a complex process as there are drivers of these behaviors on individual, social, community, and social levels. Such drivers affect opportunities and abilities for people with SMI to take part in PA initiatives, creating negative reinforcing loops of behavior and outcomes. Community-based exercise, such as the Vega Exercise Community, may provide a part of the solution. However, it is important to acknowledge that it may only be feasible for a given subgroup of the SMI population at a given continuum in their personal recovery process. Machaczek et al. (2022) published a position paper providing a rationale and recommendation for the utilization of a whole system approach to integrating PA to aid mental health recovery (39). They highlight four principles of system thinking in relation PA in SMI: 1)

multiple factors influence behavior, 2) practices are context-driven, 3) emergence, and 4) shared purpose. I find particularly the fourth principle of interest. A shared purpose, understanding, and appreciation are necessary to unite stakeholders representing different sectors and organizations to move in the same direction to maximize the potential. This way of thinking may help overcome the fragmentation inherent in care provision. Thus, initiatives like the Vega Exercise Community may act as integrated local solutions where, e.g., functional gyms provide relevant infrastructures (facilities and instructors), and mental healthcare clinics provide appropriately trained staff to support the initiation and sustained participation in community-based exercise.

Exercise and PA are suggested and recently recognized as a first-line adjunctive treatment for people with SMI (54). Acknowledging and appreciating the importance of PA in the process of “*getting well*,” even when people with SMI are at their worst, can help them get ready to be physically active in a nonclinical setting at a later point. PA spans a large continuum where one end focuses on reducing sedentary behavior, and the other end is structured exercise with high intensity (200). Still, it can be argued that the “*exercise is medicine*” paradigm has not gained momentum into routine mental health care. In mental health settings, nurses are the group of healthcare professionals with the strongest therapeutic relationship with the patients (201); however, they may lack specialized training in the design and delivery of adapted and customized PA and exercise (202). Prescribing PA is not straightforward and is not a one-size-fits-all intervention. Programs that are tailored to individual needs and supervised by health professionals with expertise in PA and exercise result in greater adherence (177,178) and better outcomes (180) compared to simply providing opportunities to exercise. As a representative of the Department of Physiotherapy, University College of Northern Denmark, educating upcoming physiotherapists, I must advocate for the potential of physiotherapists in implementing PA programs in clinical practice. This is supported by the International Organization of Physical Therapists in Mental Health (IOPTMH) (180); however, the role and organization of physiotherapists within mental health care appear to be up for discussion. At one end of the spectrum, physiotherapy may be positioned as a specialized treatment modality, requiring referral from another mental health professional. On the other end, physiotherapists may serve as an integral part of multidisciplinary mental health teams, directly facilitating movement-based interventions as part of routine care. Clarifying and strengthening this role is crucial for advancing the profession and ensuring that physiotherapists contribute effectively to the development and delivery of sustainable exercise and PA programs in mental health care.

In the community and voluntary sector in Denmark, there are several promising options for people with SMI to be physically active in a community setting. Some initiatives are specifically targeting people with mental illness, such as “*Kæmperne*”, “*Idræt for Sindet*” and the Vega Exercise Community, while general sports organizations have an increased focus on mental health, such as the collaboration between the University of Copenhagen and the sports association “*Dansk Gymnastik og Idræt (DGI)*” on the ABCs of Mental Health (203). As discussed earlier, the initiation of PA, exercise, and sports is challenging in people with SMI, and a supportive connection between the mental health care system and local communities is warranted. Social prescribing is a model for collaborative provision of care between the healthcare system and local community initiatives. It enables health professionals to refer people to a range of local, non-clinical services. (204). *Danish Regions* have an increased focus on social prescribing to mitigate social inequality in health, and the newly started national network “*Nationalt Netværk for Brobygning*” (NABRO) aims to strengthen the knowledge sharing and best practice about transitions between the healthcare sector and PA communities in civil society. There exist several models of social prescribing, but they often involve a link worker who supports the transition, engagement, and retention to the community activity (204). In the context of mental health care, peer workers may bear promising potential as link workers. Tweed et al. (2021) reviewed the literature that included peer support as a component of community-based PA programs for mental health service users. They found that these programs produced psychosocial benefits and positive behavior change but warranted a greater focus on implementing effective peer support into community programs (205).

Finally, this thesis argues that community-based exercise can serve as a valuable tool in recovery-oriented practice, supporting individuals with SMI in reclaiming agency, identity, and social connection. Moreover, recovery frameworks such as CHIME may provide a useful foundation for designing and implementing exercise and PA interventions tailored to this population. By shifting the focus toward how exercise supports and enhances the personal recovery process, interventions may foster sustainable engagement in PA, ultimately contributing to long-term metabolic health benefits. As people with SMI face a significantly reduced life expectancy, largely due to preventable physical health conditions, embedding PA within recovery-oriented care can be a critical part of the solution to counteract what has been called “*the scandal of premature mortality*” in this population (35).

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Paper I

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- Article
- Supplementary materials I+II

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Perspectives of professional experts in relation to the development of community-based exercise for young adults with schizophrenia: a qualitative study

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ABSTRACT

Physical activity is a key modifiable factor in protecting physical and mental health in people with severe mental illness including schizophrenia. Therefore, early promotion of physical activity is recommended and programmes supporting long-term maintenance of physically active behaviour are warranted. This study aimed to explore the perspectives of professional experts in relation to the development of a sustainable community-based exercise programme tailored to young adults with schizophrenia and intended to promote change and adoption of physical activity. We conducted 9 semistructured interviews with 11 clinical and professional experts. Qualitative content analysis, as described by Graneheim and Lundman, was applied to analyse data. We identified four categories: (1) living a physical active life with schizophrenia, (2) exercise as promotor of personal recovery, (3) prescribing safe and relevant exercise and (4) instructors' qualifications and formation. When developing sustainable community-based exercise programmes tailored to young adults with schizophrenia, developers should ensure instructors' qualifications and provide an exercise protocol. In addition, developers should consider providing an inclusive and recovery-oriented exercise environment.

BACKGROUND

Severe mental illness, including schizophrenia, is among the most burdensome and costly illnesses worldwide.¹ The clinical symptoms usually manifest in early adult life,² and a substantial proportion of patients with schizophrenia experience persistent physical, functional and cognitive impairments.³ Psychotic symptoms are often effectively treated with antipsychotic medication, however, treatment is commonly accompanied by metabolic side effects. Patients treated with antipsychotic medication have a 4-fold higher prevalence of metabolic syndrome,⁴ and a 2–3 fold higher risk of cardiovascular disease compared with

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Physical activity is a key modifiable factor in protecting physical and mental health in people with severe mental illness, including schizophrenia.
- ⇒ Sustainable community-based programmes to support adoption of physical activity for young adults with schizophrenia are warranted.

WHAT THIS STUDY ADDS

- ⇒ Developers of community-based exercise programmes for young adults with schizophrenia must ensure a strategy for identifying and training exercise instructors as well as providing a protocol for delivering safe and clinically relevant exercise.
- ⇒ Community-based exercise can promote personal recovery and considerations of how to balance overcoming potential barriers to participation with the goal of creating a non-clinical exercise environment are important.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ These findings could support and inform the development of community-based programmes promoting physical activity for people with schizophrenia and may be transferable or adaptable to other psychiatric populations in other countries.



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the general population,⁴ which contributes to a premature mortality rate of 15–20 years.⁵ Lifestyle factors, such as poor diet, smoking⁶ and physical inactivity,⁷ may contribute to the increased morbidity and mortality.

The Lancet Psychiatry Commission has pointed to physical activity as a key modifiable factor in protecting physical health in people with mental illness.⁸ Specifically, introducing exercise in the early stages of schizophrenia may be a sustainable solution in preventing or attenuating metabolic dysfunction associated with antipsychotic medication.^{8–9} Furthermore, exercise has been found efficacious in

improving clinical symptoms, quality of life, global functioning and cognitive deficits,^{10–12} and early improvements in these outcomes may reduce the likelihood of enduring symptoms and functional disability.¹³ Moreover, patients in the early stages of schizophrenia are more physically active than patients with long-term schizophrenia,¹⁴ and thus potentially easier to engage in exercise. However, long-term maintenance of physical active behaviour is challenging.¹⁵ Replicable and scalable methods of delivering physical activity to patients with schizophrenia in the early stages of their disease in a format that is accessible, engaging and effective for a large number are warranted.¹⁶ Indeed, the WHO's Mental Health Action Plan 2013–2030 calls for the provision of mental health services integrated in communities for service users and families.¹⁷ Accordingly, community-based group exercise may hold promise to support sustainable physical activity.¹⁸ Still, the initiation of community-based exercise in people with serious mental illness is not a simple step from intention to participation, but a non-linear slow phased transition with various challenges and setbacks at every phase.¹⁹

This study was conducted as a part of a project aiming to develop, evaluate and implement community-based exercise for young adults in antipsychotic treatment (ClinicalTrials.gov identifier: NCT05461885). Previously, we evaluated the impact and feasibility of a gym-based group exercise programme supervised by non-health professional exercise instructors for young adults in antipsychotic treatment (the COPUS trial).^{20 21} The results indicated that gym-based group exercise has the potential to support and promote personal recovery, which can be defined as 'changing values, feelings, goals, abilities and roles in order to achieve a satisfactory, hopeful and productive way of life, with the possible limitation of the illness'.²² However, feasibility was challenged due to a lack of incentives and infrastructure to ensure consecutive recruitment from outpatient clinics to gym-based exercise in communities. Consequently, it was concluded that refinements in both the intervention itself and in its the delivery were warranted before initiating a large-scale, definitive trial.²⁰ Also, community-based exercise programmes may be considered a complex intervention due to the properties of the intervention itself, that is, how the intervention produces change, and the interaction between the intervention and its context, that is, how the context affects implementation and outcomes. Hence, early considerations and continually revisiting core elements, that is, considering context, identifying key uncertainties, developing a programme theory and refining the intervention, are recommended throughout the research process when evaluating complex interventions.^{23 24} The current study aimed to explore the perspectives of various professional experts in relation to the development of community-based exercise for young adults with schizophrenia intended to promote long-term maintenance of physical activity.

METHODS

Design

We applied a descriptive qualitative design²⁵ using researcher triangulation and semi-structured interviews. This study follows the Consolidated Criteria for Reporting Qualitative Research checklist²⁶ (online supplemental material 1).

Sampling

We used a purposeful sampling strategy to support information richness.²⁷ Specifically, we used snowball sampling to reach unique key informants with expert knowledge, experience or interest concerning the study's aims.²⁸ Key informants were thus recruited among professional experts within exercise as health promotion and/or treatment of psychosis, for example, psychiatry, physiology, exercise psychology. All key informants who were contacted agreed to participate. The final sample was defined by theoretical saturation, that is, different expertise and perspectives represented, and by inductive thematic saturation during the analysis focusing on emerging new perspectives.²⁹

Data collection

KR (female investigator, registered nurse, full-time PhD student) or MFA (male investigator, certified physiotherapist, full-time PhD student) carried out the semistructured individual interviews, which lasted 45–60 min, using video calls on Microsoft Teams or physical face-to-face meetings. Only the interviewer and the key informants were present during interviews. Both KR and MFA have previous experience in conducting qualitative interviews and had no personal knowledge of the key informants beforehand. All key informants were provided with written or oral information regarding the study aim prior to the interviews. Hence, it was explained that community-based exercise was defined as group exercise delivered by non-health professional exercise instructors outside a hospital setting (eg, commercial gyms or sporting clubs). The interview guide comprised a standard open-ended question.

According to you, as an expert, what should be considered when developing a community-based exercise programme for young adults with schizophrenia?

In addition, each key informant was then asked specified questions thematically related to their area of expertise (online supplemental material 2). The face-to-face interviews were audiorecorded, and the online video calls were video recorded. The interviewer (KR or MFA) who had conducted a specific interview wrote selective transcriptions, that is, focusing exclusively on content relevant to the research question,³⁰ which was then validated by the other researcher (KR or MFA) while focusing on and discussing the emergence of new perspectives to determine data saturation.²⁹ To enhance trustworthiness, the key informants received the transcript within 1 week after the interview for member checking.³¹ Selective

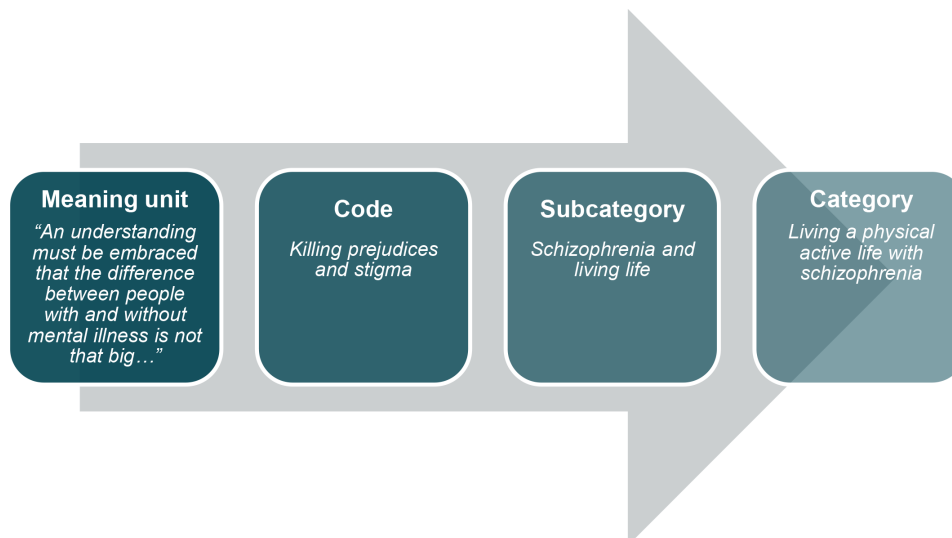


Figure 1 Example of the analytical process from meaning unit to category: living a physical active life with schizophrenia.

transcripts were adjusted according to comments from member checking when needed. Additional methodological considerations are available in online supplemental material 2.

Data analysis

The interviews were analysed using inductive qualitative content analysis, as described by Graneheim and Lundman.³² NVivo V.12 (QRS International, Melbourne, Australia) and Microsoft Excel were used to assist in data management.

MFA and KR initially read and reread the transcripts separately before jointly discussing them to obtain a sense of the complete data material. Subsequently, MFA identified and extracted meaning units and labelled them with descriptive codes. Next, MFA compared, abstracted and sorted codes into subcategories and categories, which were discussed with KR and JM (female psychologist, full-time researcher and principal investigator). Codes, subcategories and categories were continuously compared with original condensed summaries in an iterative process. Figure 1 provides an example of the condensation-abstraction process.

RESULTS

Characteristics of informants

Nine semistructured interviews were conducted with 11 key informants (3 key informants were interviewed simultaneously) representing different professional backgrounds, that is, clinical psychiatry (n=1), psychology (n=4), human physiology (n=1), consultants with expertise in exercise for people with mental illness (n=2) and physiotherapy (n=2) and occupational therapy (n=1) within mental healthcare. All key informants had more than 10 years of experience working with people diagnosed with schizophrenia, exercise physiology and/or exercise psychology.

Analysis of findings

Four main categories, 11 subcategories and 34 codes were identified (table 1). In the following presentation of the results young adults with schizophrenia will be addressed only as participants and non-health professional exercise instructors only as instructors as these were the terms used most frequently by the key informants.

Category 1: living a physical active life with schizophrenia

Schizophrenia is often associated with debilitating symptoms which have a major impact on daily life and therefore also on the ability to engage in physical activities. The key informants emphasise that taking these potential barriers into consideration when developing a community-based exercise programme is vital along with

Table 1 Results of the analysis

Categories	Subcategories
Living a physical active life with schizophrenia	Schizophrenia and living life
	How schizophrenia affects physical activity
Exercise as a promotor of personal recovery	Being part of an exercise culture
	Meeting at eye level
	Striving for commonness
	Feeling empowered
Prescribing safe and relevant exercise	Flexible exercise protocol
	Contact to trusted others
	Do no harm
Instructors' qualifications and formation	Experienced and passionate
	Learning through acting and reflection

ensuring that the exercise is supervised by instructors, who recognise these barriers.

Schizophrenia and living life

Suffering from schizophrenia may be perceived as a life crisis that may dampen hopes and dreams of living a 'normal' life for the affected person. Community-based exercise may serve as a break from the disorder but may also constitute with yet another stressor:

Being struck by psychosis for a period in life can be exceedingly difficult... For some, physical exercise may be a ray of light that distracts them from the disease... But for others it may add to the list of things that have become unmanageable. (Expert in clinical psychiatry)

According to key informants with knowledge about mental illness, symptoms of schizophrenia may include a psychophysical split, implying that participants experience detachment from their own body. This may challenge participation in physical activity; however, exercise also has the potential to improve this phenomenon:

You can feel bodily disorganised and do not experience the body as one entity. There may also be the sensation that the body is levitating, and here physical exercising may be positive. (Expert in physiotherapy within mental healthcare)

How schizophrenia affects physical activity

The key informants acknowledge that community-based exercise should be delivered by instructors, who have received basic education about schizophrenia, so they understand the participants' potential reactions. Nonetheless, the education should not encourage an excessive focus on the disease:

Must NOT dominate! Knowledge about this [psychotic disorders] should enable instructors to have realistic and informed expectations... But they should also know that people with mental illness are not significantly different from other people. (Expert in psychology and recovery)

Especially, knowledge about psychotic and negative symptoms and how they may affect the participants' ability to engage in physical activity with others is important, as the general population often misinterprets these symptoms.

Negative symptoms play an important role in the disease and are experienced as the most debilitating aspect associated with a schizophrenia diagnosis, in contrast to the general perception that it must be the psychotic symptoms... The intentions are present, but the initiative is absent. (Expert in clinical psychiatry)

Furthermore, severe weight gain is a typical side effect of antipsychotic medication which is often accompanied by considerable psychosocial distress. Several key informants caution, however, against weight loss becoming

the most important goal as losing weight is difficult to achieve with physical activity alone. Instead, the experience of well-being and having a strong body should be promoted.

Category 2: exercise as a promotor of personal recovery

The key informants promoted the view that a community-based group exercise programme may have potential to facilitate participants' personal recovery process. However, to achieve this potential, the programme should create an inclusive exercise environment.

Being part of an exercise culture

Of importance, the key informants stated that the participants should ideally achieve a feeling of being a part of something bigger than just an exercise programme; thus, participants should enter an exercise culture where being physically active is part of a regular everyday routine. To succeed, the setting must feel like a safe space where participants know the instructors and vice versa and atmosphere should reflect that all levels of participation are acceptable.

It must be a cool experience. If that succeeds... then the potential for physical activity has a chance to unfold. (Expert in psychology and physical activity for recovery)

A safe atmosphere is created not only by the exercise instructor's facilitation but more importantly within the group of participants. As a result, group interaction should be equally, if not more highly, prioritised compared with the content of the exercise. Nurturing social relationships between the participants may be challenged because of, for example, negative symptoms or anxiety; hence the instructor should take charge of facilitating a feeling of being a part of a group before, during and after the exercise session. This may include having team exercise activities or encourage socialising after exercise sessions.

Meeting at eye level

The key informants expressed that it is important to have a caring communication without talking down to or being overprotective towards the participants. Participants may have experienced various disappointments and defeats regarding physical activity, potentially resulting in negative expectations and low self-confidence. Thus, self-stigma is considerable, and it must be acknowledged that even showing up may be a large accomplishment:

They [participants] will be tough enough on themselves if they only show up two out of three times. It's important to say, "So nice to see you" rather than "Where were you last time?" Small things make the difference. (Expert in psychology and schizophrenia)

Striving for commonness

One key informant underpins that the community-based exercise must not be a sanctuary for people with mental disorders disconnected from the rest of the world. Others state that being physically active where other young people are present and physically active might potentially be of great importance to the participants' self-worth and in the (re)building of an exercise identity:

For a young patient to tell other young people that: "in my spare time I go to the gym three times a week" can be of great importance. (Expert in physiotherapy within mental healthcare)

The participants should be met with the same demands and commitments as everyone else without violating their autonomy; it should be okay to withdraw for a moment if needed. There may be a general conception that people with schizophrenia are fragile and vulnerable, which may constitute a pitfall, and the exercise instructor may accidentally take on a therapeutic role:

Instructors should listen but abstain from being therapeutic and giving advice [on mental health] and be aware of their task—which is exercise. (Expert in physiotherapy within mental healthcare)

Feeling empowered

According to the key informants, a community-based exercise programme should seek to facilitate empowerment and draw attention to a positive sensation of being in control, being strong, having more energy and sleeping better; in other words, of connecting exercise with a feeling of well-being. One key informant, however, emphasised the importance of recognising that exercise alone may not function as the main driver for all participants, but that they may find the context surrounding the exercise, such as the people and the place, more important to their well-being.

It may not be exercise as such making the difference, but the meaningfulness placed within the exercise. (Expert in exercise for people with mental illness)

Category 3: prescribing safe and relevant exercise

Key informants agree that when developing a community-based exercise programme for young adults with schizophrenia, it is pivotal to ensure safety procedures in the case of physical and mental adverse events. Furthermore, the exercise protocol should have the flexibility to allow individual adjustments.

Flexible exercise protocol

Several key informants acknowledge that the exercise protocol should have a clear and recognisable structure. When the structure is known, varying the content and complexity of the exercise is easier for the instructors and more acceptable to the participants. It is important that

the exercise content can be adjusted to fit the individual's physical, mental and social capacity.

It's damn difficult because it's not only about making the exercise easier or harder, but also about what the patient is like in the room and how they interact with the others. Instructors must acknowledge the complexity of an exercise situation. (Expert in physiotherapy within mental healthcare)

The protocol must be flexible enough to accommodate individual goals of participants. However, even though individual goals may be mental or social, it is important that the instructors pursue clinically relevant exercise intensities given the considerably increased risk of metabolic diseases.

It's important to pay attention to every single patient's level of activity throughout the sessions, so each patient reaches a high level of activity over a longer period of time. (Expert in human physiology)

Contact to trusted others

The key informants highlight that the support of both relatives and healthcare professionals is essential since they serve as external motivators and improve the ability of participants to attend the exercise sessions. Furthermore, inviting a friend or next of kin may ease the initial process of joining the group exercise. Because participants may express psychotic, suicidal or aggressive behaviour during an exercise session, it is important that exercise instructors are provided safety procedures regarding what to do and who to contact. However, the key informants emphasise that such situations are very rare.

Do no harm

Some key informants express that elements of or being physically touched by others may be distressing for some participants. Furthermore, bodily discomfort such as delayed onset muscle soreness or an elevated heartbeat may be misinterpreted as dangerous and the normality of this needs to be addressed before, during and after exercise sessions.

What can be expected after exercise, such as muscle soreness, and what can be expected during exercise, such as sweating, elevated heartbeat, and shortness of breath. Some of it may be confused with symptoms of anxiety. (Expert in physiotherapy in mental healthcare)

Category 4: instructors' qualification and formation

When developing a community-based exercise programme for young adults with schizophrenia, identifying the right exercise instructors is crucial. The key informants highlight that they should be fully engaged in their role as exercise instructors and receive formal

training containing theory and the exchange of practical experience.

Experienced and passionate

According to the key informants, exercise instructors should be unpretentious and reliable to best support participants, who might be entering an unknown activity and culture. To do so, experience as an exercise instructor along with being passionate about this role is needed to focus on resonating with the participants. Furthermore, instructors should have relationship-building skills and be able to act as external motivation.

A motivational instructor is crucial for success.
Without that, a good programme is worth nothing.
(Expert in exercise psychology)

Learning through acting and reflection

The key informants recommend that exercise instructors must receive formal training combining theoretical sessions as well as reflection on their own experiences to facilitate exercise for people with mental illness. Since instructors may have sparse experience and knowledge about mental illness, facilitating an ongoing exchange of experience is essential.

They [instructors] should receive more than just one day of training, actually a whole course, with the possibility to try something out, exchange experiences, and receive qualified feedback. (Expert in physiotherapy within mental healthcare)

DISCUSSION

This qualitative study of the perspectives of clinical and professional experts offers a unique insight into core considerations when developing community-based exercise tailored to young adults with schizophrenia. It was widely acknowledged that mental health and social care initiatives in community-based settings are needed for people with severe mental illness to provide an opportunity to attain the highest level of health and participate in society free of stigmatisation and discrimination.³³ Thus, key informants acknowledge that community-based exercise programmes have the potential to promote long-term maintenance of physical and mental health for young adults with schizophrenia, and thereby achieve the proposed potential of exercise.^{8 10–12}

Notably, our findings show a belief among experts in the potential of community-based exercise as an important contributor to personal recovery. They highlight that exercise could facilitate the experience of empowerment, that is, of being strong and in control, which is an important factor in the recovery process according to one of the most accepted theoretical frameworks present to understand personal recovery, CHIME (Connectedness, Hope and optimism about the future, Identity, Meaning of life and Empowerment).³⁴ Furthermore, qualitative findings indicate that participating in sports contributes

to experiencing a sense of achievement³⁵ and may represent an untapped resource in personal recovery as it can serve as an arena that promotes physically active behaviour while providing an opportunity to build life skills and social connectivity.³⁶ Indeed, the key informants assert that group interaction should be prioritised at least as high as the content of the exercise. In addition, the community and the location should be a place that supports the participants in transitioning beyond their role as patients to help them (re)build an exercise identity. Qualitative findings from our recent COPUS trial found that group exercise delivered in a conventional fitness centre by non-health professional exercise instructors supported a feeling of being a normal young adult.²¹

The COPUS trial found that community-based exercise in a local gym was meaningful and safe for young adults with schizophrenia; however, it also reported that its feasibility was challenged due to limited recruitment and retention rates as the study setup did not provide the mental health staff with sufficient incitements and infrastructure to secure consecutive screening and promotion of the intervention.²⁰ The key informants in this study highlight that support from trusted individuals, such as the primary healthcare provider, has an immense influence on the ability of people with schizophrenia to participate. This aligns with a qualitative review suggesting that emotional and practical support from either health professionals and/or relatives plays an important role.¹⁹ Moreover, while the exercise protocol should allow all levels of participation, clinically relevant exercise doses and intensities should be striven for to improve metabolic conditions. Current evidence suggests that higher doses of aerobic exercise are not only recommended to improve cardiovascular health but also clinical and functional outcomes.³⁷

Another important finding is the need for carefully recruiting dedicated exercise instructors as their personal engagement and ability to resonate with participants is crucial for success. This is in line with other developmental research on community-based physical activity programmes for people with mental illness and other clinical populations. Here, relationship-building skills, including empathy and the ability to generate team spirit are described as important instructor qualifications.^{19 38 39} The key informants in our study stressed the importance of instructors having formal education and knowledge on how symptomatology and the potential side effects of medical treatment may affect participation to allow them to have realistic and informed expectations as also supported by an international consensus statement.⁴⁰ Especially negative symptoms, such as lack of energy, low self-esteem, depressive symptoms and apprehensive attitude to socialising, are the most frequently reported barriers towards exercise participation among people with schizophrenia.^{19 41} Furthermore, cognitive symptoms related to thinking about, planning and getting to an activity is also reported as a significant barrier.¹⁹ Knowledge about these symptoms may help instructors

understand the importance of creating a welcoming and safe environment.

Methodological considerations

This study has some strengths and limitations which should be taken into consideration. Despite our confidence in using purposeful sampling and snowball sampling aiming for variation in relation to the key informants' areas of expertise, we cannot rule out an element of recruitment bias implying that key informants may have been positive about incorporating physical activity in community mental healthcare. Due to the geographical distance between key informants and the interviewers, most interviews were conducted using video calls. We found that this format was flexible, served the intended objective and provided sufficient information power. For pragmatic reasons three informants who were colleagues were interviewed simultaneously. To avoid potential conformity and authority bias the interviewer continuously asked the respective expert to justify their answers and posed critical follow-up questions, for example, related to disadvantages or issues associated with a specific viewpoint. Furthermore, each expert received the transcript for additional comments which were not shared with the other informants. Selective transcripts were used as empirical data, a process in which some relevant content may have been lost. Thus, to enhance trustworthiness, the transcripts were validated by a second researcher and sent to the experts for member checking.

Clinical implications

Based on the perspectives of clinical and professional experts in the field, we propose the following recommendations encompassing structural and cultural factors in relation to promotion of long-term maintenance of physical activity in young adults with schizophrenia (figure 2).

- Consider how schizophrenia may produce various barriers toward exercise participation and how

paying special attention to them can be balanced with promoting a normal exercise environment.

- Consider how exercise may promote the personal and social recovery process, for example, the CHIME framework, in the development of gym-based exercise programmes to support the sensation of empowerment, social connectivity and exercise identity in participants.
- Ensure that safe and relevant exercise is prescribed, specifically by formulating a flexible exercise protocol and including other trusted individuals, for example, relatives, friends or mental health staff, to support participation and to agree on safety procedures.
- Ensure instructors' qualifications and training, specifically by drawing up a strategy to identify and recruit experienced and passionate exercise instructors and by establishing an educational course and professional network that allows instructors to gain insight into schizophrenia and share reflection on practical experiences.

The current study was carried out in Denmark where the mental healthcare system and the community sector are closely interconnected to provide comprehensive care to people with mental illness. Despite this context, we believe that the recommendations delivered from this study may be applied or adjusted for the development of programmes promoting physical activity among diverse psychiatric populations and in other countries.

CONCLUSION

This study provides key considerations when developing sustainable community-based exercise programmes tailored to young adults with schizophrenia intended to promote long-term maintenance of physical activity. Developers should focus on structural factors by ensuring instructors' qualifications and providing a flexible exercise protocol, and cultural factors such as facilitating an inclusive and recovery-oriented exercise environment. These findings may be transferable to the development of programmes promoting physical activity in other psychiatric populations.

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Contributors All authors participated in conceptualising the study. MFA, KR and JM planned the study design and methodology. MFA and KR were responsible for



Figure 2 Structural and cultural factors of importance when developing community-based exercise targeting young adults with schizophrenia.

the data collection and MFA was responsible for the initial data analysis. MFA, KR and JM contributed to the data analysis process. MFA generated the first draft, and all authors critically revisited the draft for important intellectual content. Lastly, the final version was sent to all authors for approval. All authors read and approved the final manuscript. MFA is the guarantor of the overall content of the study.

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Patient consent for publication Consent obtained directly from patient(s).

Ethics approval In addition to receiving written information about the nature of the study prior to participation, all key informants provided oral informed consent. All key informants were guaranteed anonymity and confidentiality. Thus, quotes presented in the results section are not linked with the informant ID. The study was conducted in accordance with the Declaration of Helsinki. The Regional Ethics Committee of Northern Denmark has confirmed that no formal ethical approval was required (2023000206) for the current study.

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Perspectives of professional experts in relation to the development of community-based exercise for young adults with schizophrenia – A qualitative study

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Supplemental Material 1 Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

Please note that the COREQ checklist originally operates with reporting items according to which page number they can be found on. The page numbers in this supplementary file refer to the original manuscript. An added row to the checklist provides information as to which section and heading of the article specific items are reported in.

Developed from:

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Heal Care*. 2007;19(6):349-357. doi:10.1093/INTQHC/MZM042

No. Item	Guide questions/description	Reported on Page #	Section and heading
Domain 1: Research team and reflexivity			
<i>Personal Characteristics</i>			
1. Inter viewer/facilitator	Which author/s conducted the inter view or focus group?	6	Methods under 'Data collection'
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	6	Methods under 'Data collection'
3. Occupation	What was their occupation at the time of the study?	6	Methods under 'Data collection'
4. Gender	Was the researcher male or female?	6	Methods under 'Data collection'
5. Experience and training	What experience or training did the researcher have?	6	Methods under 'Data collection'
<i>Relationship with participants</i>			
6. Relationship established	Was a relationship established prior to study commencement?	6	Methods under 'Data collection'
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	6	Methods under 'Data collection'
8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and	16	Discussion under 'Methodological considerations'

	interests in the research topic		
Domain 2: study design			
<i>Theoretical framework</i>			
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	7	Methods under 'Data analysis'
<i>Participant selection</i>			
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	6	Methods under 'Sampling'
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	6	Methods under 'Sampling'
12. Sample size	How many participants were in the study?	8	Results under 'Characteristics of informants'
13. Non-participation	How many people refused to participate or dropped out? Reasons?	6	Methods under 'sampling'
<i>Setting</i>			
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	6	Methods under 'Data collection'
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	6	Methods under 'Data collection'
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	8, Table 1	Results under 'Characteristics of informants'
<i>Data collection</i>			
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	6 Appendix 2	Methods under 'Data collection'
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	7	Methods under 'Data collection'
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	6	Methods under 'Data collection'
20. Field notes	Were field notes made during and/or after the interview or focus group?	7	Methods under 'Data collection'
21. Duration	What was the duration of the interviews or focus group?	6	Methods under 'Data collection'
22. Data saturation	Was data saturation discussed?	6, 7	Methods under 'Sampling' and 'Data collection'
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	6, 7	Methods under 'Data collection'
Domain 3: analysis and findings			
<i>Data analysis</i>			
24. Number of data coders	How many data coders coded the data?	7	Methods under 'Data analysis'
25. Description of the coding tree	Did authors provide a description of the coding tree?	8 Table 2	Results under 'Analysis of findings'
26. Derivation of themes	Were themes identified in advance or derived from the data?	7	Methods under 'Data analysis'
27. Software	What software, if applicable, was used to manage the data?	7	Methods under 'Data analysis'

28. Participant checking	Did participants provide feedback on the findings?	7	Methods under 'data collection'
Reporting			
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	8-14	Results under 'Analysis of findings'
30. Data and findings consistent	Was there consistency between the data presented and the findings?	8-14	Results under 'Analysis of findings'
31. Clarity of major themes	Were major themes clearly presented in the findings?	8-14	Results under 'Analysis of findings'
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	8-14	Results under 'Analysis of findings'

Perspectives of professional experts in relation to the development of community-based exercise for young adults with schizophrenia – A qualitative study

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Supplemental Material 2 Interview guide and additional methodological considerations

Standard opening and open-ended question:

According to you, as an expert, what should be considered when developing a community-based exercise programme for young adults with schizophrenia?

Expert specific question:

A:

- *With your practical experience in supervising exercise for people with schizophrenia, is there something you think non-health professional exercise instructors should pay close attention to? Motivation? Exercise content and structure?*

B:

- *With your knowledge of and experience in working with people with mental illness, what knowledge regarding pathophysiology should be shared with exercise instructors? Are there any contraindications that would inhibit people with psychotic disorders from participating in gym-based exercise? How should physical and mental complaints in relation to the exercise be handled?*

C:

- *With your knowledge of health psychology in relation to physical activity how would you create a motivating exercise environment outside the mental health system for people with mental illness? How do we avoid barriers towards change in physical active behavior?*

D:

- *With your practical experience in supervising exercise to people in antipsychotic treatment, is there something you think non-health professional exercise instructors should pay close attention to? Symptoms? Metabolic health?*

E:

- *With your experience in exercise programmes for people with mental illness, how would you create an inclusive and non-stigmatizing exercise environment? What should be considered in regard to the participants' social and personal recovery process?*

F:

- *With your knowledge of rehabilitation and recovery, what should be considered when delivering gym-based exercise to people in antipsychotic treatment in order to promote and support social and personal recovery? Are there any pitfalls that will work against recovery?*

G:

- *With your knowledge of and experience with physical activity in recovery processes, what would you consider when promoting exercise to people in antipsychotic treatment? Are there unique possibilities in using exercise instead of other social settings?*

H:

- *With your knowledge of exercise physiology, what should be considered to obtain clinically relevant exercise intensity and/or doses? How should the exercise content be organized? How should physical and mental complaints be handled during exercise?*

I, J, K:

- *With your knowledge of and clinical experience in working within early intervention outpatient clinics for people with schizophrenia spectrum disorders, how could an exercise community complement outpatient treatment?*

Additional methodological considerations

We chose online video interviews (Microsoft Teams) due to the geographical distance between experts and researchers, as well as due to the assumption that sharing professional expertise would not evoke strong emotions. Furthermore, data elicited via video calls have demonstrated substantial richness akin to that gained in a face-to-face interview (1).

We chose selective transcripts due to the fact that the analysis of the interviews was purely descriptive (not subject to in-depth analysis and interpretation). Moreover, the key informants were professional experts conveying professional knowledge and not personal experience, and we wished to concentrate on the specific aspects of the data that were most relevant to the research question rather than more latent content requiring more detailed transcripts.

No fieldnotes were made during or after the interview and interviews were not repeated.

No patients took part in planning, conduct or interpretation of the results of this study.

1. Keen S, Lomeli-Rodriguez M, Joffe H. *From Challenge to Opportunity: Virtual Qualitative Research During COVID-19 and Beyond. Int J Qual Methods [Internet]. 2022 May 1 [cited 2023 Jan 12];21:1–11. Available from: /pmc/articles/PMC9167989/*

Paper II

Andersen MF, Roed K, Sørensen V, Riis A, Rafn BS, Ebdrup BH, Midtgaard J, (2024) 'Required elements for an educational programme for lay exercise instructors in charge of community-based exercise targeting young adults with schizophrenia spectrum disorders – A stakeholder focus group study' *BMC Psychiatry*, 24(1). Available at: <https://doi.org/10.1186/S12888-024-05648-9>.

- Article
- Supplementary materials I+II

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RESEARCH

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Required elements for an educational programme for lay exercise instructors in charge of community-based exercise targeting young adults with schizophrenia spectrum disorders – A stakeholder focus group study

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Abstract

Background Exercise plays a crucial role in addressing the increased cardiometabolic morbidity and premature mortality in people with schizophrenia spectrum disorders. When delivered in community-based settings, exercise may also reduce loneliness, while promoting overall physical activity behaviours. Skilled instructors are essential to deliver effective community-based exercise; however, knowledge about their roles and required training is lacking. We aim to explore various stakeholders' perspectives regarding lay exercise instructors' roles, and the required elements in an educational programme supporting the delivery of community-based exercise for young adults with SSD.

Methods We used semi-structured homogeneous focus groups with representatives from different stakeholder groups (i.e., including representatives of clinical staff within mental health, physiotherapists, exercise instructors, young adults with schizophrenia spectrum disorders, and relatives of individuals with schizophrenia spectrum disorders) targeted or affected by a community-based exercise intervention. Data were analysed using qualitative content analysis.

Results We conducted six focus groups comprising a total of 30 individuals representing five different stakeholder groups. The analysis identified three categories: (i) *awareness and understanding of mental illness*, i.e., providing basic knowledge to dispel common myths and stigma regarding mental illness; (ii) *protecting youth identity*, i.e., supporting the feeling of being more than just a patient, and (iii) *promoting exercise as a shared activity*, i.e., a communal pursuit, fostering personal growth among participants, their peers and the instructors.

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Conclusions An educational programme for lay exercise instructors delivering community-based exercise targeting young adults with SSD should empower the instructors to assume the role of guardians of an inclusive exercise culture. Educational elements identified were adapted and integrated into an educational programme implemented and evaluated as a part of the Vega trial. Our results may be transferable to the education of lay workers in mental health care where the aim is to facilitate sustainable, recreational, community-based activities.

Keywords Exercise, Schizophrenia, Personal recovery, Community-based activities, Education, Focus group, Qualitative research

Background

People with schizophrenia spectrum disorders (SSD) face an elevated risk of developing cardiometabolic comorbidities, such as diabetes [1], metabolic syndrome, and cardiovascular disease [2], contributing to a premature mortality rate of 15–20 years [3–5]. This increased morbidity and mortality rate are partly attributed to the side effects of antipsychotic medication and unhealthy lifestyle choices, including physical inactivity and sedentary behaviour. The Lancet Psychiatry Commission [6] emphasizes that physical activity, encompassing exercise and sports, is a pivotal modifiable factor in protecting the physical health of individuals with mental illness. Moreover, increasing evidence suggests that community-based sports and exercise in groups can mitigate social isolation and reduce stigmatisation, while also enhancing the social identity of people with SSD [7–9]. Furthermore, community-based sports may offer an opportunity to deliver life skill training, improve social connectivity, and promote overall physically active behaviours within the same intervention [10]. Gym-based group exercise is both feasible [11] and popular among people with psychosis [12]. Still, people with SSD engage in less physical activity [13] and have more sedentary behaviour [14] compared to the general population. Early intervention is critical for the optimal treatment of SSD [15, 16], and the early stages of the illness may constitute a window of opportunity to establish sustainable physical activity habits when patients are younger, more active, and less affected by physical comorbidities [6, 17]. Consequently, building sustainable, easily accessible, and engaging community-based exercise and sporting activities targeting people with SSD has gained increased attention among clinicians, politicians, and stakeholders.

Qualitative studies have indicated that, for people with severe mental illness, unsupported transitioning from intention to participation is insufficient to ensure engagement in community-based exercise programs. Sustained involvement requires comprehensive practical and emotional support [9, 18], with a crucial role played by exercise instructors delivering and supervising community-based exercise programs [19]. Notably, exercise and lifestyle interventions supervised by physical educators, physiotherapists, and exercise physiologists, demonstrate greater efficacy than unsupervised interventions or those

supervised by other health professionals [20]. The mental health literature recognises the value of trained lay community health workers in transitional care [21]. This emphasizes the importance of lay exercise instructors with relevant training in basic mental health literacy for promoting long-term physical activity behaviour in individuals with SSD [22]. We recently investigated the perspectives of professional experts in relation to developing community-based exercise programs for people with SSD [23]. The results of this study emphasized the importance of ensuring safe and meaningful exercise content and that exercise instructors receive formal education prior to facilitating community-based exercise for people with SSD. However, the specific elements of the role and the required skills of exercise instructors have attracted little research attention, and accordingly, the content of an educational programme remains unexplored.

Thus, the current study aims to explore various stakeholders' perspectives regarding lay exercise instructors' roles, and the required elements in an educational programme supporting the delivery of community-based exercise for young adults with SSD.

Methods

Design and setting

The study was conducted as part of the development and design of the Vega trial which aims to evaluate the effectiveness of a gym-based exercise programme delivered by non-health professional exercise instructors for young adults receiving antipsychotic medication [24]. The current study applied a descriptive qualitative design using researcher triangulation and semi-structured focus groups. The study was reported according to the Consolidated Criteria for Reporting Qualitative Research checklist [25] (Appendix 1).

Sampling

We employed a purposeful sampling strategy to ensure information richness [26] by recruiting participants with specific knowledge, experience, and/or interest concerning the study aim. Specifically, we considered stakeholders targeted or affected by a community-based exercise intervention as relevant contributors possessing valuable knowledge about the required training of lay exercise instructors [27]. Thus, we recruited representatives

Table 1 Overall statements to facilitate discussion during focus groups

Overall statements
<i>It is important that instructors learn about the treatment of schizophrenia spectrum disorders and how the disorders affect people's lives.</i>
<i>It is important that instructors learn about the concept of recovery and how exercise can support personal recovery.</i>
<i>It is important that instructors learn about adapting the exercise content, so it is safe and relevant for people with schizophrenia spectrum disorders.</i>

from the following five main stakeholder groups: clinical staff from outpatient mental health services; physiotherapists working in mental health care; exercise instructors, both with and without previous experience with facilitating exercise for young adults with SSD; young adults with SSD; and relatives of individuals with SSD. Within the stakeholder groups, we recruited using convenience sampling through email invitations distributed by gatekeepers to the different stakeholder groups, e.g., the team leader of clinical staff, peer-board coordinator, or personal email directly to stakeholders such as exercise instructors. We aimed to conduct focus groups comprising four to seven stakeholders, as smaller groups might easier facilitate in-depth discussions [28], and used an over-recruitment strategy to account for last-minute cancellations. Considering the specific aim of the current study and examination of mutable perspectives (i.e., inclusion of various stakeholder groups and multiple representatives from each stakeholder group), we estimated that conducting a single focus group with each stakeholder group would be enough to achieve adequate information power.

Data collection

We used semi-structured homogeneous focus groups (all focus group participants representing the same stakeholder group) which were audio recorded and facilitated by MFA (male investigator, certified physiotherapist, and full-time PhD student), who has previous experience in facilitating focus groups. VS (male investigator, human physiologist, and full-time PhD student) assisted as an observer, took notes, and posed additional questions

when necessary, with a primary emphasis on evaluating density and information richness within each focus group [29]. Neither MFA nor VS had any relations with the stakeholders beforehand. The individual focus groups were held in conference rooms made available by either the stakeholders' gatekeeper or the researchers. To facilitate group discussions, stakeholders were given three overall statements (Table 1) and instructed to rank them from most to least important, providing explanation for their chosen order. This step was followed by specific questions for individual stakeholder groups to discuss (Table 2). The overall statements were developed based on findings from our previous qualitative study examining the perspectives of clinical and professional experts on the development of community-based exercise programmes for people SSD [23]. Only the stakeholders and the researchers (MFA and VS) were present during the focus groups. The focus groups lasted ~90 min and were not repeated. Stakeholders received a token of appreciation of EUR 25.

Data analysis

A research assistant transcribed the audio recorded material clean verbatim in accordance with conventions described with predefined transcription guideline. MFA validated the transcripts against the audio recordings. NVivo 12 (QRS International, Melbourne, Australia) and Microsoft Excel were employed to facilitate both data management and data analysis. All data and transcription guidelines (in Danish) can be provided upon reasonable request.

Inductive qualitative content analysis, as described by Graneheim and Lundman [30], was applied to analyse the focus group discussions. MFA and KR (female investigator, registered nurse, and full-time PhD student) initially read and reread the transcripts separately before jointly discussing them to obtain a sense of the complete data material. Subsequently, MFA de-contextualised the material, identifying and extracting meaning units before labelling them with descriptive codes (in NVivo). Next MFA compared, abstracted, and sorted codes into

Table 2 Specific questions tailored to stakeholders to facilitate discussion in focus groups

Examples of specific questions for stakeholder groups	
Clinical staff from outpatient mental health services	<i>What can exercise instructors do in order for community-based exercise to complement outpatient mental health services?</i>
Exercise instructors with/without experience in coaching people with SSD	<i>What concerns do you have about facilitating community-based exercise targeting young adults with schizophrenia?</i>
Physiotherapists working in mental health services.	<i>What is important to consider when working with community-based exercise targeting young adults with schizophrenia?</i>
Relatives of individuals with SSD	<i>What do exercise instructors need to be aware of to meet the needs of relatives in relation to community-based exercise targeting young adults with schizophrenia?</i>
Young adults with SSD	<i>What is important for supervised community-based exercise to facilitate long-term physical active behaviour?</i>

SSD=Schizophrenia spectrum disorders

categories and subcategories (in Excel), which were discussed with KR and JM (female investigator, psychologist, senior qualitative health researcher, and clinical professor). Categories and subcategories were continuously compared with the original transcripts in an iterative analytic process.

Results

Characteristics of informants

Six focus groups were conducted, involving a total of 30 individuals representing five different stakeholder groups in January and February 2022. A total of eight individuals (three young adults with SSD, two relatives of individuals with SSD, two physiotherapists, and one clinical staff at mental health outpatient clinic) who had initially agreed to participate in the focus groups had to cancel their participation due to a positive COVID-19 test. Two focus groups included clinical staff from mental health outpatient services, one of which served as a pilot test of the interview guide. Since the interview guide did not require any revision, the transcript from the pilot focus group was included in the analysis. Table 3 presents the selection criteria, recruitment method and stakeholders' characteristics.

Findings

Thirty-three unique codes, nine subcategories and three categories were developed. From these findings we derived required elements for an educational programme. Table 4 communicate these required elements and the categories: (i) *awareness and understanding of mental illness*, (ii) *protecting youth identity*, and (iii) *promoting exercise as a shared activity*, with corresponding subcategories and quotes. In the following presentation of the results, lay exercise instructors will be addressed only as *instructors*. Young adults with SSD who are expected to participate in community-based exercise will be addressed only as *participants*. Each subcategory name will be indicated in italics.

Category 1: Awareness and understanding of mental illness

According to the stakeholders, an educational programme should enable instructors to comprehend and acknowledge the nature of SSD and how the disorder may affect the life of the person suffering from them. Consequently, equipping instructors' knowledge and tools for continuous reflection, was considered beneficial in dispelling common myths and stigma associated with mental illness. Based on the assertion that *knowledge kills prejudice*, the stakeholders emphasized the importance of providing instructors with fundamental knowledge about SSD and common side effects of medical treatment, including severe weight gain. However, knowledge should not be provided with the aim of enabling instructors to

engage in therapeutic work. Several stakeholders pointed to the balance between knowing too little or too much, as both may lead to an inappropriate focus on the disease. The purpose of the knowledge taught should be to reduce stigma by clarifying that limited motivation, interest, and expression are well-known negative symptoms of SSD and potential side effects of medical treatment, not to be confused with personality traits. Symptoms often fluctuate may manifest as the feeling that life has a *lack of meaning*, leading to periods with self-devaluation and internalized shame among the participants. During these times, participants may be in a vulnerable state of mind, and stressful situations may trigger a fight or flight response. The stakeholders emphasized that instructors may need to show *extra compassion* by acknowledging even the smallest victories and focusing on the effort being made rather than the results being achieved. The instructors' role is to empower the participants and serve as an external motivator during periods when the participant's internal motivation might be low.

The required elements for an educational programme derived from this category includes (a) basic knowledge in core symptoms of SSD with particular focus on negative symptoms, (b) understanding the impact of antipsychotic medication side effects on the body, (c) analysis of cases demonstrating how symptoms and medical side effects can influence behaviour, and (d) reflection on internalized stigma among individuals with SSD.

Category 2: Protecting youth identity

The stakeholders emphasised that the instructors must meet participants with the same level of curiosity as they would meet anyone else at the gym. They must focus on exploring personal resources to support the protection of youth identity. Thus, an educational programme must inspire instructors to put the *person before the diagnosis* and acknowledge that even though participants may share the same diagnosis, they will all have different difficulties, strengths, preferences, and dreams in life. The stakeholders said that instructors must be encouraged to communicate with curiosity if they observe participants who are experiencing challenges due to their mental illness. Psychotic symptoms, such as hallucinations and delusions may inhibit participants from touching exercise equipment, while negative symptoms, such as apathy and withdrawal from social situations may hinder them from participating in a team workout. The stakeholders fear that instructors may refrain from addressing what is happening to avoid making the situation worse, but this may constitute a disservice to the participants. Instructors should embrace an attitude that shows that they are interested in learning from the participants as experts in their own lives and by building a balanced relationship. Sharing and laughing about everyday problems, thoughts,

Table 3 Selection, recruitment, and characteristics of stakeholders ($n = 30$)

Stakeholder group	Inclusion criteria	Recruitment	Setting	Participant characteristics
Clinical staff at mental health outpatient clinic	Professional experience from working with young adults with SSD	Personal email to team leader at two outpatient clinics who distributed the invitation all staff at the outpatient clinic.	Conference rooms, outpatient clinics	Two groups: ($N = 4$, $N = 5$) 3 men and 6 women Nurses ($n = 3$), social workers ($n = 4$), occupational therapists ($n = 2$) 2–30 years' experience working in mental health 1–16 years' experience working in an outpatient mental health clinic
Young adults with SSD	Lived experience of having a SSD diagnosis (F20–29)* Treated at an outpatient mental health clinic and diagnosed with SSD	Email invitation distributed by peer-board coordinator	Conference room, University of Copenhagen	One group: ($N = 4$) 2 men, 2 women Full-time ($n = 1$), between jobs ($n = 1$), student ($n = 2$) 2–17 years in diagnosed with SSD
Relatives of individuals with SSD	Lived experience of being a relative to an individual with SSD	Email invitation distributed by a manager of an outpatient clinic	Conference room, University College of Northern Denmark, Aalborg One relative participated via a Microsoft Teams due to COVID-19	One group: ($N = 4$) Mothers of individuals with SSD Work in healthcare (nurse, occupational therapist, healthcare worker, physician) Time since children's diagnosis 1.5–4 years
Physiotherapists working in mental health centres	Experience working with physical activity and exercise for people SSD	Personal invitation to team leader at a department of physiotherapy, who distributed the invitation to all physiotherapist at the department.	Conference room, mental health services, Capital Region of Denmark	One group: ($N = 4$) 4 Women Educated from 1993–2019, 1.5–25 years' experience working in the psychiatric field
Exercise instructors with/without experience in coaching people with SSD	At least two years' experience working as exercise instructor and/or experience with coaching people with SSD	Personal email to exercise instructors coaching people with SSD as part of previous feasibility study** Email invitation distributed by fitness chain	For geographical reasons Microsoft Teams was used	One group: ($N = 9$) 6 men, 3 women Previous experience coaching people with SSD ($n = 3$), no experience ($n = 6$), student ($n = 4$), full-time personal trainer ($n = 2$) 2–8 years' experience as an exercise instructor

*International Classification of Diseases–Version 10 [31], ** [32], SSD = schizophrenia spectrum disorders

and experiences may foster an atmosphere where engaging in physical activity with others becomes a natural and integrated part of daily life, serving as a means of *stepping out of the patient role*. To enable participants to be physically active despite potential barriers, stakeholders highlight that an exercise community should be able to embrace participants during *good and bad days*. An educational programme should ideally give instructors the ability to balance the demands of the exercise content with the physical, psychological, and social capacity of the participants. It is crucial to recognize when to take care of special needs and when to encourage participants to out of their comfort zones. However, the stakeholders recommended starting slowly to improve the chance of success, which is why they may benefit from discreetly making note of the energy level of the participants at the beginning of an exercise session.

The required elements for an educational programme derived from this category includes (a) reflections on the concept of mental health versus mental illness, (b) practice of respectful and inquisitive communication, (c) knowledge about social inclusion and personal recovery, and (d) understanding the concept of proximal zone of development.

Category 3: Promoting exercise as a shared activity

According to stakeholders, a shared exercise community may become a symbol of the relationship between the participants, their peers, and the instructors which may in turn produce personal growth for everybody involved. Nevertheless, the instructors are responsible for contextual factors that may be crucial to realising the potential of exercising together. As such, community-based exercise should represent a *safe space* for participants that ensures a recognisable and predictable structure and the presence of trusted others. The stakeholders also mentioned that instructors should be adequately prepared for their role as instructors for them to feel comfortable. Instructors will likely be affected if they see signs of self-harm, such as cutting marks and cigarette burns, but their focus should be to support participants in their recovery process and not to solve their difficulties. To facilitate empowerment and sustained engagement in physical activity, the stakeholders emphasized the importance of *making exercise meaningful* for everyone, even though this may be challenging when the exercise is delivered in groups. Aligning expectations may be beneficial in identifying individual goals, and instructors can help support minor improvements based on these goals. For some, this may involve assisting in establishing structure in everyday life; for others, it may involve providing an arena for participants to develop their social skills. Some participants may strive to be strong or fit, while others might seek a distraction from clinical symptoms.

However, the stakeholders believe that the overall goal of the exercise should be to make it enjoyable. Community-based exercise should create an environment for being both *alone and together* emphasizing both individual and collective goals. Facilitation of group dynamics is crucial since it fosters a positive, binding community capable of sustaining ongoing participation. Exercising with others, who may face similar challenges due to mental illness may produce an unspoken mutual understanding. As such, instructors should acknowledge community-based exercise as a shared space that participants utilize as a steppingstone towards social inclusion in civil life.

The required elements for an educational programme derived from this category includes (a) guidelines and procedures for contacting appropriate parties if needed, (b) strategies for combining group facilitation with selective participation, and (c) reflection on non-fitness related goals in community-based exercise.

Discussion

This study aimed to provide perspectives into the required elements of an educational programme for lay exercise instructors engaged in delivering community-based exercise tailored for young adults with SSD. Our objective was to meet the growing demand for sustainable, easily accessible, and engaging community-based initiatives in mental health care [33]. Overall, our findings suggest that educational programmes should allow instructors engage in the highly significant role as guardians of an inclusive culture that embrace an anti-stigma stance by: (a) being aware and understand the difficulties that mental illness may produce; (b) being a protector of youth identity; and (c) being a provider of exercise as a shared activity that symbolises the relationship between participants, their peers, and the instructors. A qualitative review of physical activity among people with enduring mental health difficulties found that exercise instructors were essential in providing a safe and supportive environment while bolstering their sense of competence and self-esteem [34]. Furthermore, our previous qualitative study on the experiences of participants and instructors investigating the feasibility of an exercise programme for people with first-episode psychosis, indicated that lay exercise instructors contributed considerably to a caring yet challenging environment [35]. Instructors may also play an important role in creating a feeling of partaking in normal physical activity with other young adults, helping to reverse the negative stigma associated with mental illness [10].

The stakeholder groups agreed that lay exercise instructors should receive training in basic mental health literacy, which is supported by an international consensus statement [22]. Especially knowledge about negative symptoms as these may often be misinterpreted as

Table 4 Overview of analysis resulting in required educational elements derived from three categories and nine subcategories with corresponding illustrative quotes

Required educational elements	Categories	Subcategories	Illustrative quotes
a) Basic knowledge in core symptoms of SSD with particular focus on negative symptoms.	Awareness and understanding of mental illness	Knowledge kills prejudice	<i>It would be nice to know something about the illness [SSD] before you start as an instructor. ... it would be nice to confirm or deny some common myths and assumptions regarding schizophrenia. (Exercise instructor)</i>
b) Understanding the impact of antipsychotic medication side effects on the body.		Lack of meaning	<i>It makes me think about the shame... the feeling of: "Why is this so awkward? Why am I making it awkward? Why can't I figure out how to be in company with other people?" I have thought a lot about that. (Young adult with SSD)</i>
c) Analysis of cases demonstrating how symptoms and medical side effects can influence behaviour.		Extra compassion	<i>The process in getting better is long and thus it may be beneficial to focus on the small things, like "I see you look happier today" or "You could do 20 [repetition of an exercise] and now you can easily do 30". So, you look at what is small, good, or on the way. (Clinical staff at mental health outpatient clinic)</i>
d) Reflection on internalized stigma among individuals with SSD.		Person before the diagnosis	<i>Two people with the same diagnosis can have totally different symptoms and functional level... they are so much more than just a diagnosis. (Clinical staff at mental health outpatient clinic)</i>
a) Reflections on the concept of mental health versus mental illness.	Protecting youth identity	Stepping out of the patient role	<i>So, she [a young adult with SSD] can take a selfie for her friends and tag it with "going to the gym, smiley" helping her maintain an identity similar to her friends. (Relative of an individual with SSD)</i>
b) Practice of respectful and inquisitive communication.		Good and bad days	<i>Once, I heard on the radio that you can climb a hill in different ways. You can run, you can walk, and you can crawl... but we all need to get up there. (Young adult with SSD)</i>
c) Knowledge about social inclusion and personal recovery.			
d) Understanding the concept of proximal zone of development.			
a) Guidelines and procedures for contacting appropriate parties if needed.	Promoting exercise as shared activity	Safe space	<i>Trust that others [health professionals] have the responsibility to address this, not themselves [instructors]. They are just one part of the journey for the young person to feel better. No further demands should be imposed on the instructors besides doing the best they can and knowing that they are doing something good. (Relative of an individual with SSD)</i>
b) Strategies for combining group facilitation with selective participation.		Making exercise meaningful	<i>Having a playful part at the beginning [of an exercise class] really loosened up the atmosphere... playing around positively affected the dynamic... and ending the class well... having a good experience to go home with. (Exercise instructor)</i>
c) reflection on non-fitness related goals in community-based exercise.		Alone and together	<i>They can give each other so much. Somebody may contribute with more motivation. Sometimes, you may come up with your own goals, but you may also be inspired by others, and suddenly, you have a common goal. (Physiotherapists working in mental healthcare)</i>

inherent personal traits, contributing to stigma against people with mental illness among the general population. Additionally, negative symptoms are highly linked to social functioning and self-efficacy [36], significantly impacting participants' ability to participate in community-based exercise. Another notable finding across the stakeholders was the importance of the community and that an educational programme should provide the instructors with the skills to facilitate social connectivity among the participants, which is supported by current evidence [10]. Qualitative findings show that the main narratives related to participation in sports and exercise were that the experience of achievement was shared by, and could potentially be shared with, many others in everyday life [37]. Instructors must nevertheless be aware that social interaction is difficult for most people with SSD and may lead to self-isolation [38]. Gym-based group exercise may provide unique flexibility that allows participants to oscillate between socialising and exercising alone [35]. Hence, instructors should be able to tailor exercise content based on physical, social and mental parameters, ensuring that the exercise is meaningful for each participant in the exercise community. Indeed, the motivation for being physically active varies significantly among individuals with SSD. Motivational factors may span from physical outcomes such as weight control and fitness to more psychological and social outcomes like improving mood and meeting new people [12, 39].

The stakeholders pointed to the importance of striking a balance between having too much and too little knowledge. Similarly, the educational content should allow instructors to balance between promoting exercise in a non-patient environment while respecting the limitations and boundaries of SSD. Indeed, based on the assumption that knowledge should serve to promote anti-stigma, education appears to be effective in terms of improving knowledge and fostering positive attitudes, and thereby reducing stigma and discrimination related to mental illness [40]. Furthermore, an educational programme should facilitate ongoing reflections among the instructors to obtain practical knowledge. Qualitative evidence suggests the importance of exchanging experiences and ideas with health professionals and peer instructors when lay instructors supervise physical activity in clinical populations [41]. Also, of importance, exercise instructors may embrace an exercise evangelistic mindset, assuming that exercise participation will invariably contribute to positive personal growth and mental well-being. Therefore, education should clarify that, alongside the potential benefits of exercise and sports, there is also a risk of harm, such as social exclusion or unfavourable comparison to more successful peers [10]. This is especially important considering that initiating community-based exercise in this population may be associated with low

self-esteem and the feeling of powerlessness after previously unsuccessful attempts to engage physical activity [7, 9].

Stakeholders touched upon severe weight gain as a medical side effect, and the radical change in body composition that accompanies it may challenge the ability and motivation for physical activity. Interestingly, stakeholders demonstrated limited attention to physical health issues among people with SSD, not focusing on how these issues may serve as both a motivational goal and a potential barrier to physical activity. A systematic review indicates that, exercising to improve general physical health is reported as the most endorsed reason for engaging physical activity among individuals with severe mental illness, while one out of four are citing poor physical health as a barrier to exercise [39]. One explanation may be that stakeholders perceive that addressing physical health issues are within the pre-existing knowledge and competence of lay exercise instructors, making it a less prominent learning objective in an education programme. Nevertheless, it is crucial to ensure the accuracy of this assumption, particularly considering that many individuals with SSD experience lower health literacy (the ability to access, understand and utilise basic health information) compared to the general population [42].

Methodological considerations

Some limitations and strengths should be considered. A strength is that we recruited individuals from five different stakeholder groups, all highly relevant and with specific knowledge and experience relevant to the objective of the current study. However, due to the COVID-19 pandemic, numerous stakeholders cancelled at the last minute. Consequently, a possible limitation is that only four people from the focus group for young adults SSD and four from the focus group for relatives participated, and they may be characterized by having stronger resources compared to people who were not able or willing to participate. Another limitation of relevance to all groups is that the sampling strategy potentially led to the recruitment of stakeholders with a special interest in, and a predominantly positive attitude towards, exercise. In this regard, relatives were also only represented by mothers working in the healthcare sector, which may challenge the transferability of their perspectives to other relatives, such as fathers and relatives not working in the healthcare sector. During the analysis, the authors felt confident of having achieved or at least closely approached thematic saturation, signifying that additional data would not contribute further to the overall aim of the current study [29]. Using inductive content analysis allowed us to capture the study's intended objective, which has been underexplored by previous research. Our findings present educational elements derived from a comprehensive

interpretation of stakeholder perspectives; hence, we acknowledge the influence of our own preconceptions [43]. To enhance credibility, continuous reflections and discussions on preconceptions relating to the study objective were carried out throughout the entire research process [44].

Implication for practice

The educational elements identified and communicated in the Findings section were adapted and integrated into an educational programme for lay exercise instructors delivering community-based exercise targeting young adults. The educational programme is currently implemented and evaluated as a part of the Vega trial [24] and encompasses (1) a written exercise instructor manual; (2) a one-day educational course; and (3) continuous exchange of experiences between instructors. Appendix 2 provides an overview of the educational programme with headlines on the educational content. The full version of the educational programme in Danish can be provided upon reasonable request.

Exercise interventions within mental health care often aims to improve physical health concerns and clinical symptomatology, thereby prompting exercise instructors to concentrate primarily on prescribing exercise regimes in terms of dosage, intensity, and frequency address physical health exclusively. However, our findings provide learning activities designed to enable exercise instructors to deliver exercise content that fosters youth identity, empowerment and social connectivity, which are core elements in personal recovery [45]. As such, the educational material produced may hold applicability in the training of lay workers engaged in facilitating community-based activities aiming to support the personal recovery journeys of young adults with severe mental illness.

Conclusion

An educational programme for lay exercise instructors delivering community-based exercise targeting young adults with SSD should emphasize an understanding of the consequence of living with mental illness, strategies to protect youth identity, and methods to promote exercise as a shared activity fostering a sense of community. Indeed, the required elements of such an education programme should empower lay exercise instructors to assume the role as guardians of an inclusive exercise culture. Our results may be transferable to the education of lay workers in mental health care where the aim is to facilitate sustainable, recreational, community-based activities.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12888-024-05648-9>.

Supplementary Material 1

Supplementary Material 2

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Author contributions

All authors participated in conceptualizing the study. MFA, KR and JM planned the study design and methodology. MFA and VS were responsible for the data collection and MFA was responsible for the initial data analysis. MFA, KR and JM contributed to the data analysis process. MFA generated the first draft, and all authors critically revisited the draft for important intellectual content. Lastly, the final version was sent to all authors for approval. All authors read and approved the final manuscript.

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Data availability

Data and material can be provided upon reasonable request by the corresponding author.

Declarations

Ethical approval and consent to participate

In addition to receiving written and oral information about the nature of the study prior to participation, all participants provided written informed consent and were guaranteed anonymity and confidentiality. The study was conducted in accordance with the Declaration of Helsinki. The Regional Ethics Committee of Northern Denmark has confirmed that no formal ethical approval was required (Case No. 2023000206) for the current study.

Consent for publication

Not applicable.

Competing interests

BHE is part of the Advisory Board of Eli Lilly Denmark A/S, Janssen-Cilag, Lundbeck Pharma A/S, and Takeda Pharmaceutical Company Ltd; and has received lecture fees from Bristol-Myers Squibb, Boehringer Ingelheim, Otsuka Pharma Scandinavia AB, Eli Lilly Company, and Lundbeck Pharma A/S. MFA, KR, VS, AR, BSR and JM declare no competing interests.

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Required elements for an educational programme for lay exercise instructors in charge of community-based exercise targeting young adults with schizophrenia spectrum disorders – A stakeholder focus group study

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Appendix 1 Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

Please note that the COREQ checklist originally operates with reporting items according to which page number they can be found on. The page numbers in this supplementary file refer to the original manuscript. An added row to the checklist provides information as to which section and heading of the article specific items are reported in.

Developed from:

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Heal Care*. 2007;19(6):349-357. doi:10.1093/INTQHC/MZM042

No. Item	Guide questions/description	Reported on Page #	Section and heading
Domain 1: Research team and reflexivity			
<i>Personal Characteristics</i>			
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	5	Methods under 'Data collection'
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	5	Methods under 'Data collection'
3. Occupation	What was their occupation at the time of the study?	5	Methods under 'Data collection'
4. Gender	Was the researcher male or female?	5	Methods under 'Data collection'
5. Experience and training	What experience or training did the researcher have?	5	Methods under 'Data collection'
<i>Relationship with participants</i>			
6. Relationship established	Was a relationship established prior to study commencement?	6	Methods under 'Data collection'
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	20	Declarations under 'Ethical approval and consent to participate'

8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	19	Discussion under ‘Methodological considerations’
Domain 2: study design			
<i>Theoretical framework</i>			
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	7	Methods under ‘Data analysis’
<i>Participant selection</i>			
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	5	Methods under ‘Sampling’
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	5, Table 3	Methods under ‘Sampling’
12. Sample size	How many participants were in the study?	8	Results under ‘Characteristics of informants’
13. Non-participation	How many people refused to participate or dropped out? Reasons?	8	Results under ‘Characteristics of informants’
<i>Setting</i>			
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	6	Methods under ‘Data collection’
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	6	Methods under ‘Data collection’
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	8,9, Table 3	Results under ‘Characteristics of informants’
<i>Data collection</i>			
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	6,7, Table 1,2	Methods under ‘Data collection’
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	6	Methods under ‘Data collection’
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	5	Methods under ‘Data collection’
20. Field notes	Were field notes made during and/or after the interview or focus group?	5	Methods under ‘Data collection’
21. Duration	What was the duration of the interviews or focus group?	6	Methods under ‘Data collection’
22. Data saturation	Was data saturation discussed?	19	Discussion under ‘Methodological considerations’
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?		N/R
Domain 3: analysis and findings			
<i>Data analysis</i>			
24. Number of data coders	How many data coders coded the data?	7	Methods under ‘Data analysis’
25. Description of the coding tree	Did authors provide a description of the coding tree?	10 Table 4	Results under ‘Findings
26. Derivation of themes	Were themes identified in advance or derived from the data?	7	Methods under ‘Data analysis’

27. Software	What software, if applicable, was used to manage the data?	7	Methods under 'Data analysis'
28. Participant checking	Did participants provide feedback on the findings?		N/R
<i>Reporting</i>			
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Table 4	Results under 'Findings'
30. Data and findings consistent	Was there consistency between the data presented and the findings?	10-15	Results under 'Findings'
31. Clarity of major themes	Were major themes clearly presented in the findings?	10-15	Results under 'Findings'
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	10-15	Results under 'Findings'

Required elements for an educational programme for lay exercise instructors in charge of community-based exercise targeting young adults with schizophrenia spectrum disorders – A stakeholder focus group study

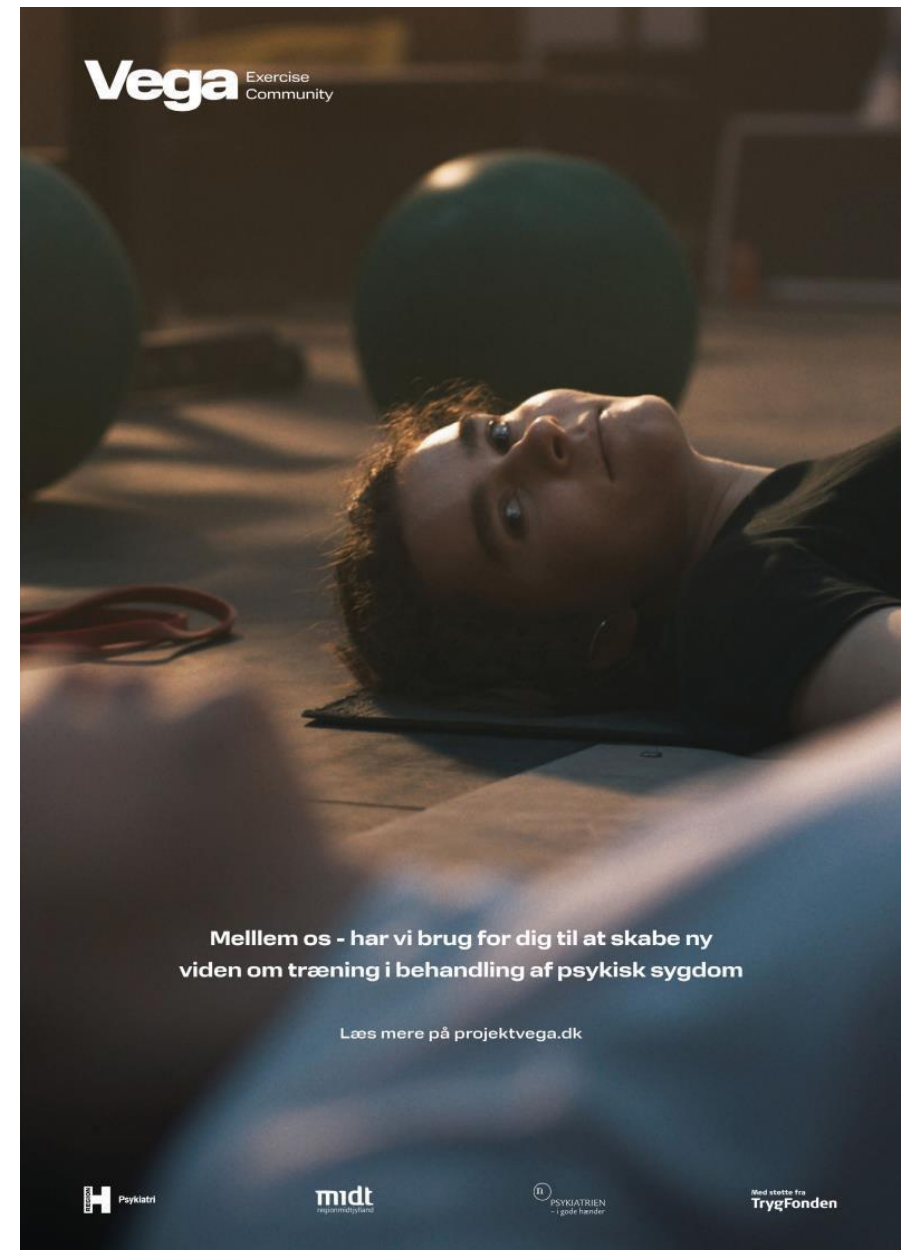
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Appendix 2 Overview of the educational programme with headlines on the education content (instructor manual and one-day educational course)



Vega Exercise Community

Mellem os - har vi brug for dig til at skabe ny viden om træning i behandling af psykisk sygdom

Læs mere på projektvega.dk

 Psykiatri

 midt
regionssjælland

 PSYKIATRIEN
i gode hænder

Med støtte fra
TrykFonden

Introduction	3
Project aim	3
Mental health and mental illness	4
Schizophrenia and other psychotic disorders	4
Symptoms	5
Treatment	5
Living with the illness	6
Myths and misunderstandings	6
Mental illness in everyday language	7
Being a Vega exercise instructor	7
Recovery	8
Special attention	10
In case of adverse events.....	11
Vega exercise protocol	13
General structure	13
Adjusting the Vega exercise	13
An exercise session (example)	14
Other working tasks in Vega	16
Exercise self-efficacy meeting	16
Extended support meeting.....	18
Administrative registration	18



9.00 – 9.30	Who are we and what is Vega Exercise Community?
9.30 – 10.10	What are schizophrenia and psychotic disorders w/ Professor and psychiatrist
10.10 – 10.50	Why is exercise relevant w/ Physiotherapist and PhD student
10.50 – 11.00	Break
11.00 – 11.40	How is the illness treated w/ Psychiatric nurse and teamleader
11.40 – 12.20	What is Recovery? w/ Psychiatric nurse and PhD student
12.20 – 12.30	Living with schizophrenia Patient case (video)

Vega Exercise Community



12.30-13.15	Lunch
13.15 – 14.00	Vega Exercise Community (the exercise protocol)
14.00 – 14.45	Practical testing of the exercise protocol w/ Physiotherapist and skilled exercise instructor
14.45 – 15.00	break
15.00 – 15.45	Administrative tasks in Vega (Holdsport.dk)
15.45 – 16.00	Q&A and evaluation

Vega Exercise Community

Manuscript draft (III)

Andersen MF, Jørgensen R, Midtgaard J, 'Bodily experienced as part of the personal recovery process in the context of community-based exercise in young adults with severe mental illness: an embedded qualitative study within a randomized controlled trial', *In draft* (Andersen, Jørgensen and Midtgaard, 2025)

- Draft
- Supplementary material I-III

Embodied Recovery - A qualitative investigation of personal recovery in young adults with severe mental illness in the context of community-based exercise

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Abstract

Introduction

Severe mental illness SMI profoundly affects bodily experiences, often leading to a sense of detachment, dysregulation, or heightened distress. While exercise is recognized as a valuable tool for supporting personal recovery, research has primarily focused on psychological and social dimensions, overlooking the role of embodied experiences. This study explores how bodily experiences shape the process of personal recovery within a community-based exercise intervention for young adults with severe mental illness.

Methods

This qualitative study was embedded within the Vega Exercise Community, a multicenter pragmatic randomized controlled trial conducted in functional gyms across three Danish cities. Using purposive sampling, 16 participants (aged 25–35) were identified based on study site, attendance patterns, and personal recovery scores. Semi-structured interviews captured participants' bodily experiences of exercise in relation to their personal recovery process. Data were analyzed using Reflexive Thematic Analysis.

Results

The analysis generated three interrelated themes under the overarching theme of *Embodied Recovery*.

1) *Bodily Identity* describes how movement helped participants reclaim a sense of self, either by reconnecting with past physical abilities or by discovering new capacities. Exercise played a central role in reshaping their perception of self, reinforcing agency, and instilling confidence in their bodies. 2) *Bodily Regulation* highlights how participants used exercise to manage energy levels, stress, and emotional states, though some struggled with bodily unpredictability, overexertion, and the pressure to regulate through movement. 3) *Bodily Sociality* illustrates how engaging in exercise alongside others provided motivation and a sense of belonging, but also introduced challenges related to social comparison and self-perception.

Conclusion

This study introduces *Embodied Recovery* as a framework for understanding the bodily dimensions of personal recovery in SMI. Findings highlight the role of exercise in shaping bodily identity, self-regulation, and social connection. Future research should further explore how these processes evolve and how exercise interventions can be optimized for accessibility and sustainability.

Introduction

Severe mental illness (SMI) significantly impacts both psychological, physical and relational dimensions of life (1), often resulting in profound disruptions in bodily experiences and self-regulatory processes (2). For individuals with psychosis, these disruptions may manifest as a sense of detachment or estrangement from the body, where the body feels dissociated from the self (2,3). In contrast, individuals with major depression often experience the body as a site of suffering, presenting symptoms such as pervasive fatigue, slowed motor activity, and somatic pain (2,4). Anxiety, frequently comorbid with SMI, is often accompanied by heightened bodily responses, including muscle tension, hyperarousal, and elevated heart rate (4). These symptoms underscore the intricate mind-body interplay in SMI and the need for integrated treatment approaches.

Treatment modalities such as body psychotherapy and psychomotor therapy have been developed to address these challenges. These therapies focus on enhancing body awareness, improving self-regulation, and fostering a sense of embodied presence, often yielding significant therapeutic benefits (5). However, access to these specialized treatments remains limited due to cost and the availability of trained professionals. In contrast, exercise programs offer accessible, sustainable and scalable alternatives (6), especially in community settings (7).

Exercise is increasingly recognized for its potential to protect and improve both physical and mental health among individuals with SMI (8,9). Specifically, research has highlighted how exercise-based programs can support personal recovery (i.e. an individual's sense of agency, meaning, and capacity to live a fulfilling life) (10,11). Personal recovery, as conceptualized within the CHIME framework, includes key processes such as connectedness (building relationships and shared experiences), hope and optimism for the future, identity development (regaining a sense of self beyond the illness), engaging in meaningful activities, and empowerment (exercising choice and agency) (12). Emerging evidence suggests that movement-based activities can promote a sense of agency over the body, reinforce bodily trust, and facilitate social interactions in shared exercise spaces, all of which align with these CHIME processes (10).

However, despite the growing body of research on exercise and its role in recovery, most studies of recovery encompass only the psychological, social, and narrative dimensions of recovery (13–15). Thus, the direct bodily experiences including the potential for improved body awareness, self-regulation, and sense of embodied presence, and their role in the recovery process remain largely underexplored. Addressing this gap is essential to fully understand how exercise can contribute to

personal recovery, particularly for individuals with SMI. Moreover, existing research predominantly relies on standardized quantitative measures, such as symptom reduction and functional improvements, which may not fully capture the lived, embodied experience of movement and its transformative potential. As a result, little is known about bodily experiences of individuals with SMI in relation to participation in exercise and what this means for their personal recovery. As such, the present study aimed to explore the nature of bodily experiences in the process of personal recovery as it unfolds within the context of community-based exercise for young adults with SMI.

Methods

Design

This study employs a qualitative method embedded within a multicenter pragmatic randomized controlled trial (RCT) aiming to examine the effectiveness of community-based exercise on personal recovery in young adults with SMI, i.e., the Vega trial (16). While the RCT provides quantitative evidence regarding the effectiveness of community-based exercise, the embedded qualitative component captures participants' lived experiences, offering insights into the embodied aspects of recovery that cannot be fully understood through standardized measures alone (17).

Study setting

The intervention in the Vega trial, i.e. the Vega Exercise Community, is implemented in three major cities in Denmark - Copenhagen, Aarhus, and Aalborg - and takes place in local functional gyms. The exercise program consists of multifaceted, moderate- to high-intensity functional training facilitated by experienced exercise instructors who have completed an educational course developed by the research team (18). Each training session lasts one hour and is offered three times per week (twice in the morning and once in the afternoon).

The study population in the Vega trial comprises young adults aged 18 to 35 diagnosed with SMI, defined as schizophrenia spectrum disorders, bipolar disorder, or major depressive disorder. Notably, the initial inclusion criteria required participants to be on a daily dose of antipsychotic medication, which naturally resulted in a predominance of individuals with schizophrenia spectrum disorders (16). However, this medical criterion was removed during the trial, though the study population has remained largely unchanged.

Sampling

We employed a purposeful sampling strategy with a focus on maximum variation (19) to ensure a diverse range of perspectives and experiences among participants in the Vega trial. This purposive sampling approach was chosen to capture variation across key characteristics including study site, attendance, and recovery to enhance the richness of the data and identify common patterns across diverse cases. Specifically, participants were sampled according to three criteria: 1) The specific site they attended (Aalborg, Aarhus, or Copenhagen), 2) their attendance rate to the exercise sessions, based on a visual examination of different attendance trajectories, and 3) their personal recovery score at baseline, measured using the Questionnaire about the Processes of Recovery (QPR), categorized as high (total QPR score >50) vs. low (total QPR score <50). A visual representation of the sampling procedure is displayed in Supplemental Material 1.

In determining the sample size for this study, we applied the concept of *information power*, which suggests that the more relevant information a sample holds for the research question, the fewer participants are required (20). Given the study's relatively narrow focus on bodily experiences in relation to personal recovery and the use of the CHIME framework (12) as a theoretical lens in the data generation process, we estimated that approximately 15 participants would be sufficient to generate a rich and nuanced understanding of the phenomenon under investigation. Thus, rather than aiming for traditional notions of saturation, we adopted a reflexive thematic analysis approach, where sufficiency is assessed based on the depth and quality of data in relation to the research aim (21). This approach prioritizes the richness of individual narratives over a fixed sample size, ensuring that the collected data provide meaningful insights into the embodied aspects of recovery within community-based exercise program.

Data generation

Data were generated through semi-structured individual interviews, a method chosen for its ability to capture the nuanced and subjective nature of bodily experiences in personal recovery. This approach allowed participants to describe their sensations, movements, and bodily changes in their own words while ensuring both depth and flexibility in exploring these lived experiences (22,23).

Participants determined the time and location of the interviews, selecting from outpatient settings, the exercise community site, public places, or their own homes. The majority of the interviews were conducted by the primary author (MFA), who has extensive experience in qualitative research interviewing. Additionally, MFA supervised two college students (one Masters student in psychology (AVF) and one BA student in Public Health), who, while less experienced, contributed to data

collection under guidance. Although MFA is involved in the Vega trial and has prior knowledge of some participants, none of the interviewers were otherwise involved in the participants' care or treatment for mental illness. All participants received written and oral information regarding the study aim and provided written informed consent (Supplemental Material 2) prior to the interviews.

The interviews were conducted interview guide, which was thematically structured around the domains of the CHIME framework - Connectedness, Hope, Identity, Meaning, and Empowerment (12). Consistent with existing literature, the interview guide also included an additional domain, "Difficulties" (24). All opening questions related to the CHIME domains were followed by questions regarding participants' bodily experiences. Although the present study was conducted in the context of their participation in the Vega Exercise Community, participants were encouraged to reflect on their bodily experiences of exercise beyond the intervention.

The interview guide was developed and piloted in collaboration between the primary author (MFA) and co-author (AVF), a former mental healthcare user who currently serves as an Expert by Experience. The interview guide is available in Supplemental Material 3.

All interviews were audio-recorded and transcribed using an AI transcription (Viceron ApS, Copenhagen). Subsequently, all transcripts were validated against the audio recordings by MFA as part of the familiarization process.

Analytical procedure

We employed Reflexive Thematic Analysis (RTA) as described by Braun and Clarke (25). This approach aligns with a "Big Q" qualitative mindset, characterized by organic and open coding and theme development procedures that center the researcher's interpretative engagement with the data (26). The analysis was conducted by the primary author in ongoing collaboration and discussion with two experienced senior qualitative researchers: one with expertise in personal recovery research (RJ) and the other with expertise in exercise behavior in clinical populations (JM). This collaboration aimed to enrich insight into the data and enhance reflexivity throughout the analysis process.

We undertook the six-phase process of Reflexive Thematic Analysis to identify and explore patterns across the dataset (27). The process was iterative allowing a fluid movement between phases.

1. *Familiarization*: Immersion and critical engagement with the data were achieved by repeatedly listening to and reading the interviews while taking notes to develop an overall impression of the dataset.

2. *Coding*: Coding was an organic and evolving process with an inductive orientation, emphasizing the meanings in the data. Microsoft Excel was used to organize data extracts and codes during this phase. Initially, coding focused on the semantic level, capturing surface-level meanings in a descriptive manner. As the analysis progressed, semantic codes were revisited against the transcripts and audio recordings to develop latent-level codes, exploring the deeper, conceptual meanings related to bodily experiences of physical activity in the context of personal recovery.
3. *Generating Initial Themes*: Tentative themes were developed by clustering both semantic and latent codes.
4. *Developing and Reviewing Themes*: This phase involved refining the initial themes by repeatedly comparing them to the coded extracts, transcripts, and audio recordings to ensure coherence and relevance.
5. *Refining, Defining, and Naming Themes*: Themes were further clarified and defined through a visual mapping technique in Microsoft Whiteboard. Audio recordings were prioritized over transcripts during this phase, as repeated audio playback triggered associations and reflexivity that enriched the interpretative process.
6. *Writing Up*: The final phase involved developing and refining the structure, interaction, and flow of the analysis. The themes were written up in a way that highlighted their relationships and presented a coherent narrative grounded in both the data and our interpretative reflections.

The recursive nature of RTA allowed us to move fluidly between phases, fostering deeper engagement with the data and supporting the development of themes that capture both semantic and latent patterns of meaning related to participants' bodily experiences and personal recovery process.

Preconception

Braun and Clarke encourage researchers using Reflexive Thematic Analysis (RTA) to “own their perspective”, recognizing it as an integral and important part of the analytical process (26). Reflexivity is a set of continuous, collaborative, and multifaceted practices through which researchers self-consciously critique, appraise, and evaluate how their subjectivity and context influence the research processes (28).

In the current study, we position ourselves within a critical realist and contextualist framework. Critical realism assumes that there is a reality independent of our perceptions; however, access to this reality is always mediated through social and cultural interpretations. Contextualism emphasizes that

meaning is situated within specific contexts and shaped by individuals' lived experiences and social conditions (29)(30). This combined positioning allows us to explore participants' bodily experiences of physical activity and recovery while acknowledging both the material aspects (e.g., the physical body and its movements) and the interpretive dimensions (e.g., the meaning-making and understanding of embodied experiences).

The primary author (MFA) has a background in physiotherapy and was instrumental in the development, implementation, and evaluation of the Vega Exercise Community. MFA works as a lecturer teaching physiotherapist students and have a longstanding professional and personal interest in community-based exercise for individuals with or without health conditions. However, MFA has no prior clinical experience working within a mental healthcare setting.

Recognizing that the researcher's background and positionality influence the research process, ongoing reflexivity has been employed to critically examine assumptions and interpretations (31,32). Rather than considering subjectivity a limitation, it is acknowledged as a resource that enhances engagement with the data while ensuring analytical rigor and transparency (30). By maintaining a reflexive stance, we seek to balance insider knowledge with critical distance, thereby strengthening the credibility and trustworthiness of the thesis.

Results

In the period of February to June 2024, we conducted 16 semi-structured interviews, whereas six was men and 11 was female. The mean age was 30 ranging from 25 to 35. Six of the interviews was conducted in Aalborg, four in Aarhus and six in Copenhagen. All interviews in Aalborg and Aarhus were conducted by MFA while the interviews in Copenhagen was conducted by AVF (three interviews) and a BA student (three interviews). The baseline QPR scores ranged from 44 to 57, whereas seven was interpreted as having a low baseline score (<50) and nine having a high baseline score (>50).

Analysis

In our analysis, we developed three themes, *i) Bodily Identity, ii) Bodily Regulation, and iii) Bodily Sociality*, which were assembled under the overarching theme of *Embodied Recovery*. The following sections explore the three underlying themes in depth, illustrating how embodied recovery is not a fixed state but a dynamic, evolving process.

i) **Bodily Identity: Reclaiming a Sense of Self**

Bodily identity refers to participants' recount of how they experience, interpret, and reconnect with their bodies in the context of the exercise. Rather than being a fixed state, bodily identity was described as fluid and evolving over time. For some, it involved rediscovering a past version of themselves—reclaiming former physical abilities or a lost sense of strength. For others, it was about constructing a new bodily identity, where movement fostered confidence in ways they had not experienced before.

Participants described feeling estranged from their bodies due to mental illness, medication side effects, weight gain, or long periods of inactivity. The experience of losing connection with the body was often gradual, though for some it occurred suddenly, triggered by illness or medical treatment. Regaining a sense of bodily identity was not solely about physical recovery; it was about reclaiming ownership of their bodies, acknowledging changes, and integrating these experiences into a renewed sense of self. Exercise played a crucial role in reshaping how they perceived themselves, providing a means to reconnect with their present selves and regain a sense of control. Emma captured this shift:

“My body feels more like my body, and not just a thing I’ve been assigned. It’s like I’m getting it back again.”

Exercise also provided tangible proof of change. Even small physical improvements - such as increased endurance or strength - became markers of progress and recovery. Olivia described how these subtle changes instilled a sense of hope:

“It’s not like I’m strong yet, but I can feel small changes. My legs don’t get as tired, and that makes me hopeful.”

This evolving sense of bodily identity was expressed both physically and symbolically. For some, it involved confronting the challenges and vulnerabilities of recovery, sometimes amplifying self-stigma. For others, reconnecting with their bodies was empowering, as they discovered new capacities and possibilities. Physical sensations and posture became embodied symbols of mental resilience. Some participants described how increased physical strength translated into greater self-confidence and psychological stability. Emma illustrated this connection, stating:

“I feel more grounded. Being physically stronger gives me confidence—I can stand my ground. If someone shoulder-checks me in the city, I don’t get pushed around anymore. It’s on them, not me.”

Ultimately, participants' journeys of reconnecting with their bodies were not solely about improving fitness or health; they were about developing a deeper understanding of themselves. Exercise became a space for exploring capabilities, pushing limits, and accepting boundaries, all while gradually reconstructing a sense of bodily identity.

ii) Bodily Regulation: Finding Balance

The second theme, *Bodily regulation*, refers to individuals' experiences of using exercise and awareness of their body to manage their physical and emotional states. Participants described struggling with fluctuating energy levels, heightened stress responses, and a sense of bodily unpredictability, making it difficult to feel in control. Engaging in exercise became a way to anchor themselves, offering moments of stability in an otherwise uncertain recovery process. Exercise provided a sense of rhythm and grounding, allowing participants to tune into their bodies, adjust to their capacities, and develop routines that fostered balance. Emma, who had returned to swimming after participating in the Vega Exercise Community, described how it helped her find a calming and soothing sense of stillness:

“When I’m underwater, everything becomes quiet. It’s like the world has a noise filter.”

For some, having a set exercise routine provided external stability when other aspects of life felt chaotic. Exercise became a consistent foundation, offering a reliable structure. Charlotte highlighted how incorporating exercise into her schedule gave her a sense of order and continuity:

“During my work placement, the training was part of my weekly structure. It gave my week something predictable and solid.”

However, bodily regulation was not always straightforward. While movement helped some participants regain stability, others described moments where exercise itself became a source of pressure. The expectation to use exercise as a regulatory tool could create frustration when it did not produce the desired effect or when the body refused to cooperate. Henry described this struggle:

“I want to move because I know it helps, but sometimes my body just won’t do what I want it to, and it frustrates me. It is like running the head against the wall.”

Some participants struggled with knowing when to stop, feeling unsure whether they needed rest or more exercise to regulate their emotions. At times, they pushed through discomfort, believing that exercise would help, only to find that overexertion worsened their symptoms. Rather than being a stabilizing force, exercise sometimes amplified fatigue, pain, or mental distress, forcing them to

reassess how they approached bodily regulation. Lily described how she had to reframe her understanding of success in relation to exercise:

“Some days, I have to tell myself that it’s okay to stop. It’s not giving up; it’s listening to what my body needs right now.”

At times, exercise also intensified negative emotions rather than alleviating them. When participants were unable to regulate their bodies as expected, it could lead to frustration, disappointment, or self-criticism. Finding balance, then, was not just about using exercise as a tool for regulation—it also required learning when to step back, adjusting expectations, and allowing flexibility.

As such, exercise was not just about creating stability - it was an ongoing process of anchoring themselves in the present, negotiating their limits and adapting to physical and emotional fluctuations.

Bodily Sociality: Navigating Connection and Comparison

The third and final theme, *Bodily Sociality*, relates to participants’ recounts of how comparison and shared exercise experiences shaped their awareness of their bodies. Engaging in exercise alongside others - whether in structured group settings or informal shared spaces - provided both motivation and moments of vulnerability. Some participants found that observing their peers helped them push their limits, expanding their sense of what was physically possible. Jack described how witnessing others’ capabilities encouraged him to challenge himself:

“When I see someone else doing an exercise I thought was impossible, I think maybe I can do it too.”

Beyond motivation, social settings also served as spaces for learning new movements. Participants described how observing others helped them refine their posture, coordination, and technique, highlighting that bodily awareness develops through social interaction rather than in isolation. These observations provided external reference points, enabling participants to adjust their own movements and become more attuned to their bodies.

However, social comparison also introduced challenges. While witnessing others’ progress could be inspiring, it could also heighten self-doubt and perceived inadequacy. Some participants became acutely aware of bodily limitations when measuring themselves against others, leading to frustration. Amelia described this experience:

“Sometimes I feel behind when I see others lifting heavier or moving faster. It’s hard not to think I’m not doing enough.”

For some, this external focus disrupted their personal experience of exercise. Rather than engaging with exercise on their own terms, they found themselves measuring their progress against external benchmarks, shifting the experience away from personal growth and toward performance. Lily captured this feeling:

“It’s like suddenly I’m not doing this for me anymore, I’m trying to keep up with everyone else.”

Despite these tensions, exercising in a social context also provided opportunities for connection and belonging. Some participants described group exercise as a collective experience, where synchronized movements fostered a sense of unity and shared purpose. James reflected on how these moments of togetherness deepened his experience of exercising:

“When we’re all moving together, it feels like we’re part of something bigger. It makes me feel connected to my body and to everyone else.”

Hence, while social settings could foster support and encouragement, they could also introduce pressure and self-evaluation, requiring participants to navigate how external perceptions shaped their bodily awareness. Exercising with others, therefore, served a dual role - reinforcing self-perception by reflecting internalized beliefs about the body while also fostering external validation and a sense of social connection.

Overarching Theme: Embodied Recovery

The overarching theme, *Embodied Recovery*, encapsulates the core of the three themes. i.e., the role of bodily experiences in personal recovery through exercise. It highlights a continuous negotiation between loss and adaptation, stability and transformation, and disconnection and reconnection. While often framed as a cognitive or emotional process, participants' experiences show that recovery is also deeply bodily. The three themes - *Bodily Identity*, *Bodily Regulation*, and *Bodily Sociality* - are not separate but constantly interact, making recovery a fluid and dynamic process rather than a linear progression.

As shown in Figure 1, Bodily Identity and Bodily Regulation are internal processes, focusing on how individuals perceive, interpret, and manage their bodies, while Bodily Sociality is more external, shaped by social interactions, comparison, and relational influences.

- *Bodily Identity* is formed through both self-regulation (internal) and social reflection (external).

- *Bodily Regulation* depends on self-perception (identity) and external influences (sociality), shaping how individuals manage bodily states.
- *Bodily Sociality* affects how individuals experience and regulate their bodies in response to social feedback.

These processes are not linear but circular, continuously shaping and influencing one another. The circular arrows in green and red in Figure 1 highlight the dual nature of movement in recovery—green represents stability, connection, and confidence, while red reflects frustration, self-doubt, and instability.

Rather than following a set path, recovery unfolds through constant adaptation. The body is not passive but actively responds to both internal experiences and external influences. Embodied recovery is, therefore, best understood as dynamic and evolving, where exercise becomes both a mirror and medium for this process.

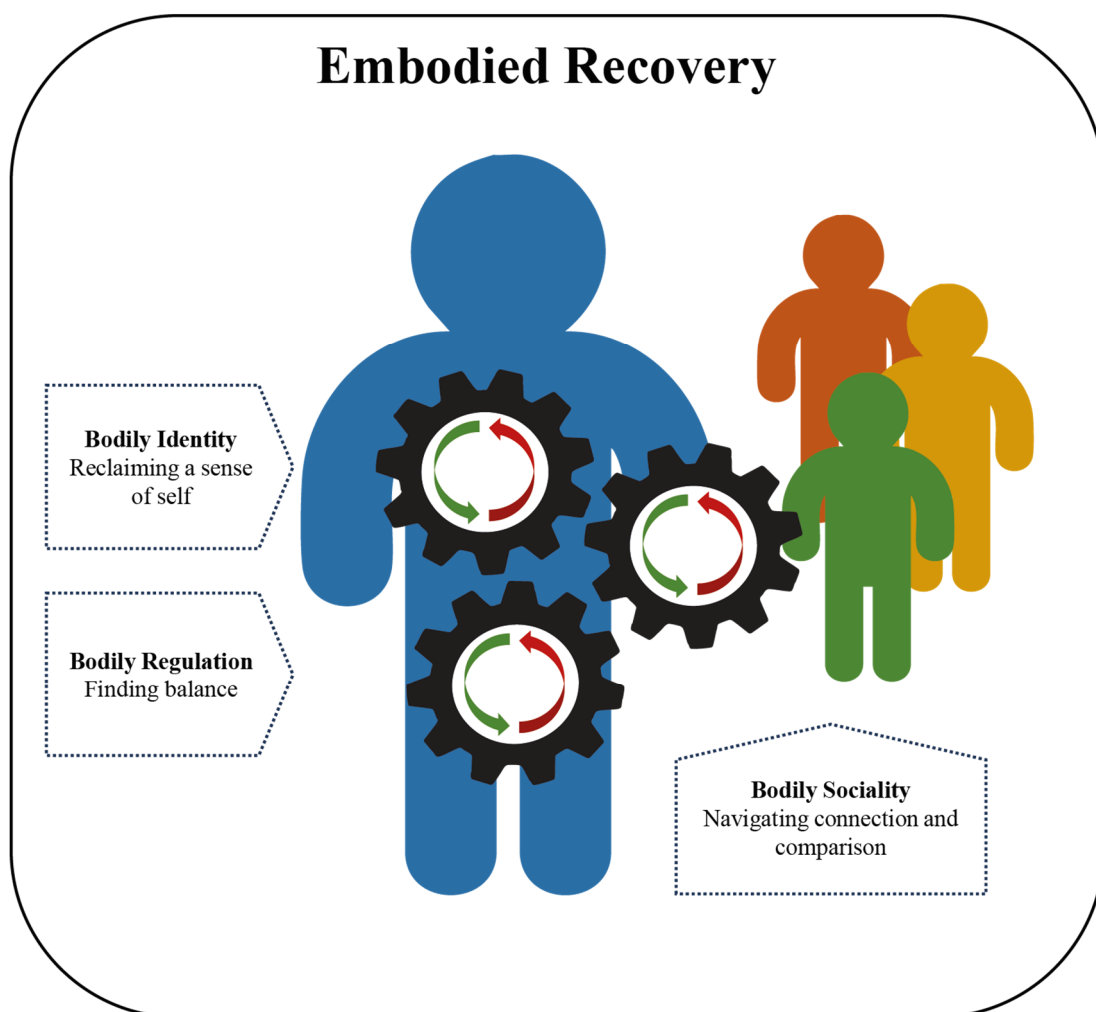


Figure 1: Embodied Recovery. The themes of *Bodily Identity* and *Bodily Regulation* are internal factors, while *Bodily Sociality* is an external factor, all shaping the embodied recovery. The green and red arrows illustrate positive and negative bodily experiences shaping a fluid and evolving *Embodied Recovery* process.

Discussion

This study initially aimed to explore the nature of bodily experiences in the process of personal recovery as it unfolds within the context of community-based exercise programs for young adults with SMI. Our findings illustrate that recovery in mental illness is not solely a cognitive or emotional process but also fundamentally embodied. We propose *embodied recovery* as a framework that acknowledges the critical role of bodily experiences in mental health recovery.

These findings are especially interesting bearing in mind that SMI profoundly impacts embodiment by altering how individuals experience, interpret, and interact with their bodies. Individuals with SMI often report feelings of disconnection or loss of control over their bodies, compounded by symptoms such as fatigue, medication side effects, and movement-related impairments (2,33). Our findings align with existing research suggesting that mental illness is not merely a psychological or cognitive condition but one deeply intertwined with bodily perception and experience (34). Also, the concept of *embodied recovery* resonates with Merleau-Ponty's (1962) phenomenology of embodiment, which posits that the body is not merely an object we inhabit but the medium through which we experience the world (35). From this perspective, bodily experience is always relational, shaped through interactions with the surrounding environment and social context. For individuals with SMI, disruptions in this embodied relationship - whether due to illness, medication, or inactivity - can lead to an altered sense of self. Notably, participants in this study did not perceive their bodies as passive entities affected by illness but as active agents in their recovery process. This aligns with Fuchs' (2005, 2014) work, which highlights the dynamic interplay between bodily sensations, emotions, and identity. He argues that subjectivity is inherently embodied, with the body acting as the primary mediator between self and world. In melancholia, this mediation collapses, rendering the body an obstacle, while in schizophrenia, a loss of agency results in a fragmented self-experience (36,37)

Specifically, the theme of *Bodily Identity* highlights how participants redefined their sense of self through movement and physical awareness. In this regard, Soundy et al. (2012) conceptualized an "evolving identity circle" in the context of exercise and sport for individuals with SMI, arguing that exercise facilitates a shift from passive to active engagement, with identity evolving through

overcoming barriers such as uncertainty, perceptual biases, and social challenges. Positive movement experiences reinforce confidence, self-reflection, and social belonging, which sustain recovery (38). Similarly, Lundh & Foster (2024) emphasize the role of bodily experiences in shaping self-perception, reinforcing the idea that embodiment is central to how individuals understand and position themselves in the world (39). Carless & Douglas (2004, 2008) also highlight how participation in sports fosters narrative identity reconstruction, allowing individuals with SMI to reframe their experiences in an empowering way (40,41). Thus, exercise may play an important role in identity development for individuals with SMI, facilitating a shift from passivity to active engagement.

In turn, the theme of *Bodily Regulation* underscores how participants struggled with the unpredictability of their physical condition, reinforcing the non-linear nature of recovery. This finding is especially relevant considering that SMI affects individuals' ability to regulate bodily states, particularly in relation to energy, fatigue, and movement patterns. Moreover, the notion of Bodily Regulation resonates with Csordas' (1993) concept of *somatic modes of attention*, which describes how individuals with chronic conditions learn to interpret, negotiate, and adapt to bodily fluctuations as part of daily life (42). This perspective aligns with Röhrich's (2015) work on the embodied experience of mental illness, emphasizing the role of bodily awareness in therapeutic processes (2). Our findings suggest that exercise served as a temporal anchor, providing routine and structure in everyday life, echoing previous research suggesting that engaging in regular exercise fosters predictability and continuity, offering individuals a sense of control over their lives (43). Also this highlights/contributes to further understanding of how and why exercise can stabilize mood and mental well-being, promoting sensory grounding, interoceptive awareness, and stress reduction (44), and how and why body-oriented psychotherapy approaches also can serve as a means of attuning to bodily signals, fostering self-regulation and resilience in individuals with SMI (2). In line with this, research on sport-based interventions further suggests that structured exercise can improve functional recovery and daily routine (11).

The theme of *Bodily Sociality* emphasizes the relational aspects of embodied recovery, echoing Bourdieu's (1986) concept of *habitus*, where bodily practices are shaped by social and cultural structures (45). In this regard, the current study emphasizes that recovery is not an isolated process but occurs through interactions with others - via comparison, encouragement, and shared experiences in exercise spaces. Fuchs (2014) further supports this perspective by introducing the concept of *embodied intersubjectivity*, emphasizing that individuals regain a sense of self through bodily engagement with others (36). Social interactions in movement settings act as a *felt mirror*, reinforcing bodily awareness and agency. Similarly, Topor et al.'s (2011, 2022) research on *social recovery* emphasizes that

recovery from SMI is inherently relational (15,46). A key finding was that participants frequently struggled with *upward social comparisons*, evaluating themselves against peers perceived as superior. While such comparisons can serve as motivation, they can also lead to frustration, envy, anxiety, and reduced self-efficacy (47). For young adults with SMI, this ambivalence surrounding social comparison can exacerbate well-documented illness-related barriers, such as negative symptoms in schizophrenia, social anxiety, and low self-esteem (Kandola & Osborn, 2022). This ambivalence was evident in participants' experiences within the Vega Exercise Community, where group settings provided both motivation and vulnerability. While these environments offered inspiration and encouragement, they also triggered self-evaluative thoughts and self-critique. Social comparison theory posits that individuals have an innate drive to compare themselves to others to assess their abilities and self-worth (48). In this study, participants particularly struggled with upward comparisons, which, while motivating for some, also contributed to feelings of frustration and anxiety (47). However, despite these challenges, exercise provided opportunities to renegotiate self-perception, cultivate supportive relationships, and integrate bodily and social recovery.

Methodological consideration

The primary author, MFA, had an essential instrumental role in with the Vega trial which provided a deep contextual understanding and helped establish trust with participants, facilitating richer discussions on bodily experiences. While interviews were conducted at multiple sites, variations in researcher familiarity were acknowledged and addressed through additional rapport-building efforts. Despite differences in prior engagement across locations, the interviews consistently yielded rich and in-depth data increasing information power. The use of metaphors and personal analogies (e.g., music and fantasy) emerged as a valuable strategy for helping participants articulate bodily sensations that were otherwise difficult to verbalize (23). This approach facilitated a deeper exploration of their embodied experiences, with iterative questioning ensuring both honesty and depth in their responses. In line with reflexive thematic analysis (25), peer scrutiny was employed not to validate findings but to challenge and refine interpretations. Co-researchers, with expertise in community-based exercise and personal recovery, contributed by posing clarifying questions and offering alternative perspectives, enhancing reflexivity, coherence, and analytical rigor. Furthermore, the interview guide was qualified and validated by a co-researcher who is an Expert by Experience as former user of mental healthcare services. Divergent viewpoints were seen as opportunities for deeper exploration rather than inconsistencies to be resolved.

Maintaining a systematic audit trail proved more complex due to the fluid nature of reflexivity. To enhance transparency and credibility, a reflective journal was kept to critically examine how theoretical perspectives, experiences, and assumptions shaped the analysis (32). In alignment with Braun and Clarke's emphasis on *owning one's perspective*, subjectivity was acknowledged as a resource rather than a limitation (30). Recognizing that perspectives evolve throughout the research process, excerpts from the reflective journal are provided to illustrate this ongoing interpretative engagement.

Conclusion

In conclusion, this study highlights that bodily experiences in community-based exercise play a crucial role in the personal recovery of young adults with SMI. We suggest the concept of *Embodied Recovery*, which is a dynamic and evolving process, where *bodily identity*, *regulation*, and *sociality* are not just interconnected but integral to fostering a renewed sense of self and well-being. Participants experienced exercise as a means of reclaiming bodily ownership, regulating physical and emotional states, and navigating social interactions. While exercise fostered self-awareness and connection, it also introduced challenges related to bodily unpredictability and social comparison. Ultimately, these findings highlight a fundamental role of bodily experiences in recovery, emphasizing the need for movement-based interventions that acknowledge both the psychological and embodied dimensions of mental health. Future research should further explore the complexities of *Embodied Recovery*, particularly how individual and contextual factors influence bodily identity, regulation, and sociality over time. Additionally, clinical applications should focus on mitigating challenges such as bodily unpredictability and social comparison while developing strategies to enhance the accessibility, inclusivity, and long-term sustainability of exercise-based interventions for young adults with SMI.

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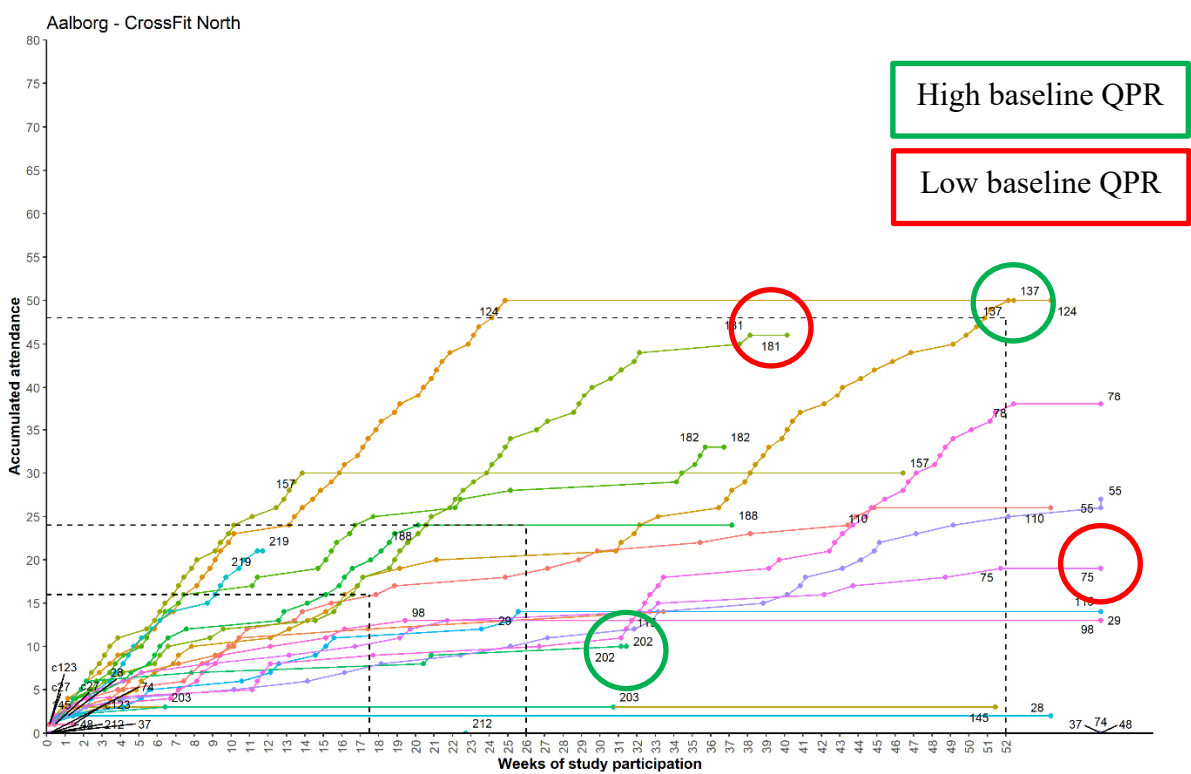
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Supplemental Material 1

Graphic illustration of purposeful sampling strategy for one exercise site. The X-axis contains the number of weeks enrolled in the Vega trial, and the Y-axis contains the number of exercise sessions attended. The different colored lines represent individual participants' enrollment time and accumulated attendance. The green and red circles represent whether a participant had a high or low personal recovery score at baseline, respectively. Personal recovery was assessed using the Questionnaire about the Processes of Recovery (QPR), where a score >50 was interpreted as a high score



Supplemental Material 2

Informed consent in Danish



CARMEN
Center for anvendt forskning
i mental sundhed

Samtykkeerklæring

Informeret samtykke til deltagelse i interview.

Interviewet gennemføres som en del af (kvalitativ) undersøgelse af erfaringer med personlig recovery i forbindelse med deltagelse i et træningsfælleskab for unge voksne (18-35 år) med svær psykisk sygdom.

Undersøgelsen er indlejret i et igangværende lodtrækningsforsøg, der skal afdække virkningen af træningsfælleskaber (Vega Exercise Community) for unge voksne med en skizofreni spektrum lidelse, bipolar lidelse, og/eller svær depressiv lidelse.

Erklæring fra den, der afgiver informationen:

Jeg erklærer, at nedenstående person har modtaget (mundtlig og) skriftlig information om projektet og interviewet.

Efter min overbevisning er der givet tilstrækkelig information til, at der kan træffes beslutning om deltagelse i interviewet.

Navn: _____

Dato: _____ Underskrift: _____

Erklæring fra den deltagende person:

Jeg har modtaget (mundtlig og) skriftlig information om interviewet, og jeg ved hvad det indebærer at deltage. Jeg er informeret om, at det er frivilligt at deltage. Jeg kan når som helst og uden begrundelse trække mig ud af undersøgelsen, uden at dette påvirker min nuværende eller fremtidige rettigheder.

Jeg giver samtykke til at deltage i undersøgelsen, og har fået en kopi af dette samtykkeark, samt en kopi af den skriftlige information om projektet til eget brug.

Deltagerens navn: _____

Dato: _____ Underskrift: _____

Supplemental Material 3

Interview guide translated from Danish

Interview Guide

Domain	Subdomain	Main Questions	Follow-up / Probing Questions
Opening Questions		When did you start in Vega? I would like to hear more about those months.	How have you been feeling since you started in Vega, i.e., in the past X months? What does it mean for you to feel good or bad? Are there specific experiences or situations that come to mind when you say good/bad? Can you describe one of these situations—what did you feel and think?
Meaningfulness		What has been important or meaningful to you during this period?	Is being active and moving meaningful to you? Can you describe a situation where you found physical activity meaningful? What were you thinking at that moment? How did it feel in your body? Has your perception of being active changed?
Connectedness		Do you prefer spending time alone or with others?	What do you enjoy doing with others? When was the last time you took the initiative to do something with someone? What kind of physical activity have you done with others? How would you describe your relationship with the people you engage with? Does being active with others feel different from being active alone? Can you describe a situation where you enjoyed being active with others? Has the way you interact with others changed?
Identity		If you were to describe yourself, what words would you use?	Why do you use these words? Are there any situations that make you think of these words? If I had asked you before Vega, would you have used the same words? How do you think others would describe you? How do you see yourself in relation to others? Who are you in a group? What is your relationship with your body? What do you think about your body? How do you experience your own body? Would you describe yourself as a physically active person?
Empowerment		In what situations do you feel capable and in control?	Why do you feel capable in these situations? To what extent do you feel you can influence your life in the direction you want? Have

Domain	Subdomain	Main Questions	Follow-up / Probing Questions
			there been situations where your sense of agency has changed since starting Vega? Do you feel in control of movement and physical activity?
Difficulties		What challenges have you faced? What obstacles have you encountered?	Can you describe what you experienced during these challenges? How do these challenges affect your ability to do what you really want? What do you think in situations where obstacles prevent you from doing what you intended?
Hope & Optimism		What do you think about the future? Do you have any goals or dreams you would like to pursue?	Have your goals and dreams changed? How confident are you that you can achieve your goals and fulfill your dreams? How does your body feel when you think about your dreams?
Bodily Experience		What do you think about your body?	Can you describe how it feels in your body? How do you experience the connection between your mind and body? What do you feel in your body before and after exercising? Has this experience changed over time? Can you point to or draw the sensation you feel in your body? What do you think about this bodily sensation? If you were to compare your body to a car (or something else that interests you), what kind would it be?
Concluding Questions (Vega-Specific)		How much have you participated in Vega training?	Is there anything about Vega that you found particularly meaningful? Can you give an example? Has anything in Vega challenged your recovery process? Please don't worry about being too critical—we are very interested in hearing about what hasn't worked or what has been negative for you.

Vega Trial Protocol

Rafn, B.S., Andersen, M.F., Sørensen, V. *et al.* Value of gym-based group exercise versus usual care for young adults receiving antipsychotic medication: study protocol for the multicenter randomized controlled Vega trial. *BMC Psychiatry* 23, 634 (2023). Available at: <https://doi.org/10.1186/s12888-023-05086-z>

- Article
- Supplementary materials I-IV

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STUDY PROTOCOL

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Value of gym-based group exercise versus usual care for young adults receiving antipsychotic medication: study protocol for the multicenter randomized controlled Vega trial

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Abstract

Background Exercise is recommended to protect physical health among people with severe mental illness and holds the potential to facilitate long-term recovery. An inclusive exercise community provides an opportunity for life skill training and social connectedness and may reduce the experience of loneliness and internalized stigmatization which together may improve personal recovery. Using a pragmatic randomized design, we aim to examine the effectiveness of a gym-based exercise intervention tailored to young adults in antipsychotic treatment (i.e., Vega Exercise Community) compared to usual care. It is hypothesized that the Vega Exercise Community will be superior to usual care for personal recovery at four months.

Methods The trial will be conducted at four sites in Denmark from which 400 participants, aged 18 to 35 years, who are in current treatment with antipsychotic medications for the management of schizophrenia spectrum or affective disorders, will be recruited. Participants will be randomized (2:1) to Vega Exercise Community or usual care. Vega Exercise Community includes three weekly group-based exercise sessions hosted in commercial functional training centers delivered by certified Vega instructors. After four months, participants in Vega Exercise Community will be randomized (1:1) to minimal versus extended support with regards to sustained physical activity. Data will be collected at baseline, four, six and 12 months. The primary outcome is personal recovery assessed by Questionnaire about the Process of Recovery at four months. Behavioral symptoms, health-related quality of life, metabolic health, and program costs will be evaluated to further determine the effectiveness and cost-effectiveness of the Vega Exercise Community. Finally, the quality of life and physical and mental health of the participants' primary relative will be evaluated.

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Discussion The results of this trial may have important implications for health, sustained physical activity, and recovery for individuals in treatment with antipsychotics. Given the pragmatic design, positive results may readily be implemented by mental health care professionals to promote exercise as an integrated part of treatment of severe mental illness.

Trial registration Clinical Trials.gov (NCT05461885, initial registration June 29th, 2022). WHO Universal Trial Number (UTN): U1111-1271-9928.

Keywords Physical activity, Severe mental illness, Recovery, High-intensity Functional Training, Antipsychotics, Community, Loneliness, Stigmatization

Background

Psychotic disorders are severe and enduring mental health conditions, which are often identified when people are in their young adulthood thus resulting in disruption to education, employment, and life prospects [1]. Specialized interventions that take place soon after the onset of the first episode of psychosis, and offered as an adjunct to treatment with antipsychotics, are associated with reduced symptoms and improved overall functioning [2–4]. Using exercise as part of early specialized interventions to treat negative and cognitive symptoms among young adults receiving antipsychotic medication holds the potential to facilitate long-term clinical recovery, as early improvements in these areas reduce the likelihood of enduring chronic symptoms and functional disability [1]. In addition to having beneficial effects on psychotic symptoms (i.e., clinical recovery) [5], negative and depressive symptoms, global functioning, and quality of life [6–9], exercise also improve multiple cardiometabolic outcomes [10, 11]. This is especially important bearing in mind the greatly increased risk for weight-gain and diabetes [12, 13] associated with antipsychotic treatment.

When building sustainable and engaging exercise routines, it is recommended to provide a combination of aerobic and strength training and a range of exercise options accommodating peoples' preferences and goals [11]. Specifically, previous research indicate that gym-based activities were substantially more popular among people with psychosis than other sporting activities [14]. As such, group-based exercise hosted in commercial functional training centers (i.e., CrossFit™ centers), which incorporates functional movements that increase strength and cardiorespiratory fitness, can be a possible novel clinical treatment strategy for people with psychosis [11, 15]. Further, an exercise community offers social inclusion and support in addition to training in social skills and thus has the potential to reduce loneliness and internalized stigmatization [16] which is of importance to peoples' personal recovery [17, 18]. Recovery is now among the most influential paradigms shaping mental health policy and practice [19, 20]. It poses an alternative to the biological view of mental illness which focus

on alleviating symptoms. In contrast, the notion of “personal recovery” entails living a meaningful, satisfying, empowered, and hopeful life even if the symptoms of the mental illness persists [17]. Personal recovery is related to clinical recovery and thus recommended as a clinical endpoint for research interventions [21].

Our pilot trial of supervised, group-based exercise delivered in a commercial fitness center for people with first episode psychosis [22, 23] and other trials [24–29] suggest that exercise is feasible and meaningful to people and associated with positive changes in personal [22, 23] and clinical recovery [24, 25], and increased levels of physical activity [27], weight loss [26], and reduced cardiovascular risk [28]. However, because of strict inclusion criteria, the external validity of existing studies, including transferability of interventions into real-world settings, is limited, and meta-review authors conclude that effectiveness studies are urgently needed [6, 11].

While the central actor in personal recovery always is the person with mental illness, the notion of “family recovery” has recently gained currency among both researchers and mental health practitioners [30, 31]. Indeed family members, friends and other persons close to the patient play decisive roles in the recovery process and in the long-term delivery of effective treatment [32]. Specifically, relatives often take significant responsibility in managing the patient's treatment appointments and medication [33]. However, caregiving of patients with severe mental illness imposes a substantial burden on the relatives [34, 35]. This burden include economic difficulties, negative effects on physical and mental health, impaired personal, social, and vocational capacity, family conflicts, separation, decreased quality of life, emotional distress, loss of self-esteem, and increased alcohol use [35]. Given the emphasis on family involvement in the recovery process of mental illness, it is important to understand what impact an exercise community designed to improve personal recovery for the patient may have on the relatives' physical and mental health.

This paper presents the protocol of the Vega trial based in Denmark. The aim is to examine the effectiveness of an exercise intervention tailored to young

adults in antipsychotic treatment delivered in a functional exercise environment (Vega Exercise Community) offered in addition to usual care and compared to usual care alone. We hypothesize that the Vega Exercise Community will be superior to usual care for personal recovery at four months.

Methods

Study design

The Vega trial will be a multi-center, pragmatic, randomized (2:1) trial comparing a four-month, supervised, gym-based group exercise program to usual care on changes in personal recovery. The pragmatic nature of the trial entails that it is designed to evaluate the effectiveness of intervention in real-life routine practice conditions [36, 37]. In order to explore different ways to support sustainment (i.e., post-intervention adoption of physical activity), and to guide strategies to facilitate adherence, we will do “a study within a trial” (SWAT) [38]. Hence participants randomized to the intervention at baseline, will be randomized (allocation ratio 1:1) after four months to minimal vs. extended support with regards to sustainment of physical activity. The protocol is reported according to the SPIRIT checklist (Supplementary file 1 and 2) [39].

Participants allocated to the usual care group will be offered free-of-charge access to the Vega Exercise Community for the remaining duration of the study after completing the 12 months end of study visit. This is to minimize attrition and ensure that all enrolled participants are offered access to the exercise community. Similarly, participants allocated to the intervention group will be offered free-of-charge access to the Vega Exercise Community for the duration of the study. Finally, the long-term use of mental health care resources will be collected from medical records at 24 months and 60 months. The trial will recruit participants from the North Denmark Region, the Central Denmark Region and Capital Region of Denmark during an anticipated 24 months. The trial design is outlined in Fig. 1.

Study aims

The primary aim is to examine the effectiveness of the Vega Exercise Community versus usual care for:

- i) Improving personal recovery measured by the Questionnaire about the Process of Recovery at four months.

The secondary aims are examination of the effectiveness of Vega Exercise Community on:

- ii) Mental health at four months (main secondary outcome measured by Short-Form-12 Mental Component Summary).
- iii) Other health outcomes (health-related quality of life, behavioral symptoms, metabolic health) at four, six and twelve months.

Tertiary aims include investigation of:

- iv) effect of prolongation of subsidized gym membership in addition to motivational text messages and individual meeting with instructor to set behavior goals (extended support) compared to subsidized gym membership alone (minimal support), and to treatment as usual in relation to post-intervention adoption of physical activity at six and twelve months;
- v) the impact of the Vega Exercise Community on the quality of life and physical and mental health of the participants' primary relative at four, six and twelve months;
- vi) the cost-effectiveness of the Vega Exercise Community expressed as the incremental cost-effectiveness ratio of the cost (education of instructors, delivery of the exercise sessions) and quality adjusted life years (QALY) from the EuroQol-5 Domain questionnaire (EQ-5D-5L) at four months; and
- vii) participants' long-term use of mental health care services at two and five years.

Participant eligibility

People aged 18–35 years who are currently treated with antipsychotic medication on a daily basis for at least the past one month (any dose and antipsychotic medication) for the management of a schizophrenia spectrum disorder (F20–F29) or an affective disorder (F30–F39), who read and speak Danish and are able to give informed consent will be eligible. Those who are advised against participating in exercise activities by their treating physician doctor (i.e., current injuries or instable somatic comorbidity) will be excluded. Women who are or become pregnant during the study period may participate but will not be assessed for body composition using bioimpedance due to manufacturer's contraindications. The Vega Exercise Community is intended as an adjunctive therapy to usual care. Ongoing pharmacological, lifestyle or other treatments during the intervention period is therefore not an exclusion criterion.

Recruitment

The primary recruitment strategy will be through the outpatient mental health services, OPUS (an intensive early-intervention program for people with first-episode

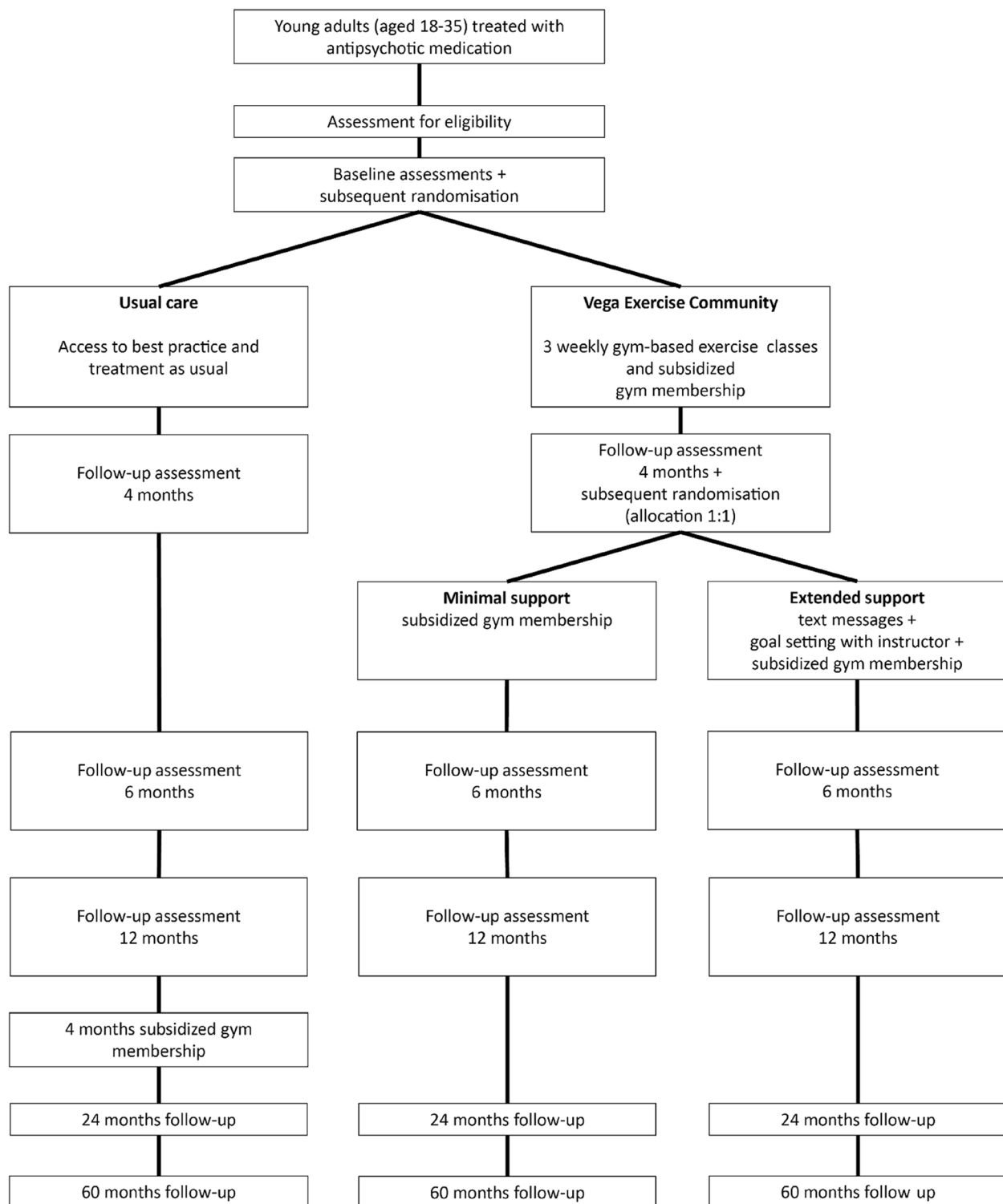


Fig. 1 Flow chart

psychosis) and flexible assertive community treatment (F-ACT) teams, in three regions in Denmark, namely the Capital Region, North Denmark Region, and Central

Denmark Region. The first information about the study will be given by health care professionals during outpatient treatment visits at the mental health centers. People

who are interested will be given written information for them to read at home. These people will then be contacted by telephone by the study team, who will explain the study in detail and confirm the person's eligibility and send them detailed written information. The person will be advised to identify their primary relative and bring them to the baseline visit if they wish to. Strategies to ensure adequate recruitment include a recruitment barometer with monthly updates to each site, newsletters, and acknowledgements (i.e., chocolate) to health care professionals when sub-goals are reached (i.e., $n = 30$ for a site).

Recruitment also occurs through community-based advertising such as posters and flyers displayed around mental health community hubs, media releases, newspaper articles, radio interviews, community talks, internet (www.projektvega.dk), and social media (@projekt_vega). Interested individuals undergo eligibility screening conducted over the phone with the study team. Eligible individuals are invited to enroll in the study.

Data collection

Baseline and four, six and 12-months assessments will take place in private rooms during an in-person visit at the treatment centers. Baseline measurements will be completed following written informed consent obtained by research assistants (RAs). RAs will administer questionnaires and measurements. If needed, RAs will assist participants in completion of questionnaires either by reading aloud the questions or by clarifying questions while the participant completes the questionnaire. All data will be collected through electronic data capture (REDCap®). During the visit, RAs will collect data on antipsychotic medications, and latest analyzed blood sample results from the medical records.

To promote data quality, two to three measurements of most metabolic outcomes are taken and the average recorded. A bioimpedance device is used to assess body composition (i.e., fat-free mass, fat mass, and skeletal muscle mass) based on the rate at which an electrical current travels through the body [40]. Cardiorespiratory fitness is measured with the revised Ekblom-Bak sub-maximal cycle ergometer test [41, 42]. RAs who will conduct the data collection will be thoroughly trained by the core research team (VS, MFA) and will be blinded to participants' group allocation. Therefore, participants will be reminded prior to each follow-up assessment not to reveal the group they have been assigned to retain blinded status of the RAs. To promote retention, participants will receive a gift card of DKK100 (€13.50) per visit. All outcome data will be collected for participants who deviate from intervention protocol (i.e., those who do not meet the per protocol criteria for exercise attendance)

while no outcome data will be collected for participants who discontinue the trial.

Finally, at 24 months and 60 months, use of inpatient and outpatient hospital mental health care services including contacts with mental health emergency departments will be obtained from the medical records to evaluate the long-term benefit of the program (i.e., reduced use of mental health care services).

Outcome measures

A summary of outcome measures is displayed in Table 1. Schedule of enrolment, intervention, and assessments is displayed in Table 2. Personal recovery assessed by the 15-item Questionnaire about the Process of Recovery (QPR) [43] will be the primary outcome of the study. QPR was developed to measure recovery among people with psychosis and has been suggested to be a psychometrically sound instrument for measuring personal recovery among people with severe mental illness [43]. It assesses the level of agreement with various statements that the respondent has experienced in the past 7 days on a 5-point Likert scale ranging from 0 (strongly disagree) to 4 (strongly agree). Scores range from 0 to 60.

The main secondary outcome is the Short-Form-12 Mental Component Summary, while other secondary outcome measures were chosen as they assess various relevant aspects of physical health and well-being including symptoms, sleep, depression, fitness, and health-related quality of life.

Safety

Procedural safety measures will be in place for participants exhibiting deterioration in mental health, such as signs of suicidality, an adverse event related to the exercise intervention, or elevation in positive and negative symptoms. As this is a non-drug trial, using interventions that are within recommended exercise guidelines, the risk of severe adverse events (SAEs) related to the exercise intervention is low. An adverse event (AE) can be any adverse or unintended reaction, every symptom no matter whether causality with the intervention is likely. The exercise intensity and complexity will be adjusted to individual needs to minimize the risk of AEs. Data on SAEs and AEs will be collected by the instructors.

In addition to collection of AE and SAE in relation to the delivery of the intervention, the research team will collect information from the medical record system when a participant, regardless of group, is admitted or has contact with the emergency room due to a mental health issue. Finally, participants complete a questionnaire on SAEs and AEs and the Modified Colorado Symptom Index (MCSI) at every study visit, which is overseen by the study coordinator and

Table 1 Summary of assessments

Endpoint	Domain	Measure	Instrument / Method	Data supplied by
Primary	Recovery	Personal recovery	15-item Questionnaire about the Process of Recovery (QPR) [44]	Participant (rating self) and participant's primary relative (rating participant)
Main Secondary	Mental health	Mental Component Summary (MCS)	12-item Short-Form-12 (SF-12) Health Survey [45]	Participant (rating self) and participant's primary relative (rating self)
Secondary	Health-related quality of life	Physical Component Summary (PCS)	12-item Short-Form-12 (SF-12) Health Survey [45]	Participant (rating self) and participant's primary relative (rating self)
	Behavioral symptoms	Physical role, bodily pain, general health, vitality, social functioning, emotional role		
		Affective symptoms	4-item Patient-Reported Outcomes Measurement Information System (PROMIS) Emotional distress (depression) [46]	Participant (rating self) and participant's primary relative (rating self)
		Physical activity	7-item International Physical Activity Questionnaire short form (IPAQ-SF) [47]	
		Sleep	5-item Pittsburgh Sleep Quality Index (PSQI) [48]	
	Metabolic health	Internalized Stigma of Mental Illness	9-item Internalized Stigma of Mental Illness Inventory (ISMI-9) [49]	Participant (rating self)
		Substance abuse	3-item Self-developed questionnaire	
		Positive and negative symptoms	14-item Modified Colorado Symptom Index (MCSI) [50]	
		Loneliness	Single-item measure	
		Abdominal and hip circumference, weight, height, BMI	Anthropometry	Blinded assessor (rating participant)
		Total and visceral fat mass and muscle mass	Non-invasive bioimpedance analysis	
		Cardiorespiratory fitness	Eklblom-Bak submaximal cycle ergometer test	
		Blood pressure and resting heart rate	Digital blood pressure monitor	
		Glycosylated haemoglobin (HbA1c)	Blood samples and biochemical analysis	Routine blood samples
		Blood lipids (total cholesterol, high density lipoproteins, triglycerides)		
Tertiary	Cost-effectiveness	Health care usage	Inpatient and outpatient hospital care	Medical records
		Quality of life	5-item Euroqol EQ-5D-5L [51, 52]	Participant (rating self)

medical personnel. MCSI consists of 14 items to measure positive and negative symptoms [53]. Reports on the MCSI of thoughts about self-harm, suicidal behavior or harm to others will initiate safety protocol procedures.

Vega exercise community

The Vega Exercise Community program has been developed by exercise physiologists, physical therapists,

and a consultant (NN) with expertise in developing functional exercise programs with the goal to support recovery for mental health [54, 55]. Vega Exercise Community will be hosted at commercial functional gyms and consists of one hour of supervised group exercise sessions offered three times per week for four months and will be offered in addition to usual care. In addition, participants will be offered free-of-charge membership to the gym from baseline to six months

Table 2 Schedule of enrolment, intervention, and assessments

TIMEPOINT	Pre-enrolment	Enrolment	Baseline	Month 4	Month 6	Month 12	Post-trial access to Vega
Eligibility screen	X						
Detailed information about the trial	X	X					
Informed consent			X				
Allocation			X				
INTERVENTIONS:							
Vega Exercise Community							
Usual care							X
ASSESSMENTS:							
Outcome measures							
Questionnaire about the Process of Recovery (QPR)			X	X	X	X	
Short-Form-12 (SF-12) Health Survey			X	X	X	X	
The Patient-Reported Outcomes Measurement Information System (PROMIS) Emotional distress			X	X	X	X	
International Physical Activity Questionnaire short form (IPAQ-SF)			X	X	X	X	
Pittsburgh Sleep Quality Index (PSQI)			X	X	X	X	
Internalized Stigma of Mental Illness Inventory (ISMI-9)			X	X	X	X	
Substance abuse			X	X	X	X	
Modified Colorado Symptom Index (MCSI)			X	X	X	X	
Loneliness			X	X	X	X	
EuroQoL-5 Domain (EQ-5D-5L)			X	X	X	X	
Abdominal and hip circumference, weight, height			X	X	X	X	
Fat mass and muscle mass			X	X	X	X	
Cardiorespiratory fitness			X	X	X	X	
Blood pressure and resting heart rate			X	X	X	X	
Glycosylated haemoglobin (HbA1c)			X	X	X	X	
Blood lipids			X	X	X	X	

follow-up and are invited to take part in exercise sessions and use fitness equipment provided by the gym to regular members. The supervised program will be tailored to meet the needs and requirements of this group of young adults and include moderate-to-high intensity and mobility exercises. Two experienced instructors recruited from the local functional gym will supervise all exercise sessions.

The exercise sessions will start with warm-up exercises, followed by 10–20 min resistance training (Part A), 10–20 min High Intensity Functional Training (HIFT) (Part B), and cool down. Instructors will be allowed to make adjustments as the delivery of the intervention is pragmatic [36, 37]. Of importance, participants will be allowed to either perform the exercise together as a group, in pairs or one-by-one depending on needs and preferences. Participants will be invited to bring a friend or relative as a “plus one” to participate in the exercise session free-of-charge. Also, peer mentors will be associated with each gym and invited to participate free-of-charge alongside participants allowing the possibility of have constructive dialogues with instructors about optimizing the exercise community and support for participants. A detailed description of the intervention according to the TIDieR template is provided in Supplementary file 3.

Strategies to increase exercise self-efficacy and adherence

In accordance with social cognitive theory [56], the intervention will offer exercise in groups allowing for the possibility of social modelling and/or vicarious experiences. Instructors and peer mentors will focus on means to aid participants' experience of mastery (e.g., emphasizing and promoting the value of a strong body rather than a slim body). To further support development of exercise self-efficacy, instructors will meet with each participant individually before initiation of the exercise program. During this meeting, the participant will complete a few exercise self-efficacy items to be used by the instructors to explore the participant's previous exercise experiences and preferences and how the participant will prefer to be coached and receive feedback. This meeting will furthermore include dialogue about development of individual behavioral goals. Instructors will send short text messages to participants prior to each exercise session encouraging them to show up. Strategies to support participants who repetitively miss sessions include additional support from peer mentors (i.e., identify the specific barriers and work with the participant to minimize those). Finally, participants will be encouraged to suggest exercises and music, and invited to socialize after each exercise session. The program theory is outlined in Supplementary file 4.

Intervention adherence and fidelity

Participants' attendance will be recorded by the instructors. Intervention fidelity will be measured by collecting data on intensity, duration, structure, and organization of the exercise sessions. Specifically, the duration, structure (i.e., warm up, resistance training, HIFT, and cooldown) and organization (i.e., presence of two instructors and peer mentor) will be reported by the instructors after each session. The exercise intensity will be monitored with heart rate monitors worn by the participants and self-reported using the Borg Scale of perceived exertion [57] in ten randomly selected sessions for each site.

Minimal versus extended support for post-intervention sustainment of physical activity

After completion of the four-month intervention period, participants will be randomized into one of two strategies supporting sustainment of physical activity. One group will be offered prolonged free-of-charge gym membership *and* invitation to meet the instructor individually once to discuss behavior goals for the coming two months *and* receive reminder short text messages prior to each exercise session (i.e., extended support) for a period of two months. In addition, the peer mentor will support this group in attending regular exercise sessions at the gym and in attending other physical activities if preferred. The other group will be offered prolonged free-of-charge subsidized gym membership only (i.e., minimal support), also for a period of two months.

Usual care

Participants allocated to the usual care group will receive treatment as usual and be informed of the official physical activity guidelines as part of the information on group allocation. Moreover, they are advised to continue their daily living, not guiding them to other interventions neither preventing them to do so. In addition, participants in the usual care group will be given a subsidized membership including access to the Vega Exercise Community program for four months after the 12 months follow-up.

Allocation and blinding

All people who meet the inclusion criteria and provide written informed consent will be randomized during the in-person visit after baseline assessments have been completed. Participants will be assigned to Vega Exercise Community or usual care using an allocation ratio of 2:1.

A block randomization list, stratified by center and diagnosis (F20/F30), with varying block sizes will be used. The list will be developed using the R-package “blockrand” [58] (R Core Team, 2022) with a unique matrix-generating number ensuring blinding of the

developer (VS) and implemented using the REDCap® system, which conceal the forthcoming allocation to all staff working on the trial.

After four months, participants allocated to the intervention group at baseline will be randomized, stratified to center and diagnosis (F20/F30), to either minimal or extended support, in a similar manner as the randomization at baseline.

Blinding of participants, relatives, or instructors will not be possible due to the nature of the trial. However, baseline and follow-up assessments will be undertaken by RAs blinded to allocation. Researchers who undertake data management and analysis will likewise be unaware of allocation.

Sample size

The sample size was chosen to yield sufficient power for detection of a difference of 5 points between the two groups on the primary outcome measuring change from baseline to four months in QPR. No previous studies have reported the SD on change scores, nor minimal clinically important difference, based on the 15-item version of QPR, but experience with similar questionnaires indicate that SD for raw scores and changes are comparable. We therefore used a standard deviation (SD) of 13.8 points which corresponds to an effect size of 0.36 based on a previous trial [59] comparing the effects of a recovery-oriented intervention versus traditional services on personal recovery in people with mental illness using the 22-item version of QPR (SD 16.2). Considering an allocation ratio of 2:1 in favor of the intervention group, a two-sided t-test with a significance level of 5% yields a power of 83% if 200 participants are included in the intervention group and 100 in the usual care group. We anticipate drop-out (i.e., participants are lost to four-month follow-up) of 20% and therefore a minimum of 375 participants is needed. However, given the limited research utilizing the QPR, we aim to recruit 400 participants. This sample size will allow the detection of a clinically relevant difference between groups on our main secondary outcome, the Short-Form-12 Mental Component Summary, of four points at four-months with a SD of 12 points. The SD is based on a previous trial [60] comparing the effects of first-generation antipsychotics versus second-generation antipsychotics on quality of life in people with schizophrenia. No interim analysis will be performed. If 400 participants have not been enrolled by December 2024, recruitment will end, and final analyses will be performed with the number of participants recruited at that point.

Because anchor-based estimations of minimal clinical important difference (MCID) on QPR are currently not available, we will supplement the data collection with

one question on perceived improvement as an external criterion (“anchor”), i.e. asking participants (on a Likert scale of 7 levels) how they perceive a change (improvement or worsening) from baseline or last follow-up (1, worse than ever; 2, much worsened; 3, slightly worsened; 4, unchanged; 5, slightly improved; 6, much improved; 7, completely improved) and calculate an empirical derived anchor-based MCID [51].

Data analysis

The main analysis will be based on the intention-to-treat principle where patients are analyzed according to the group to which they were randomly allocated. The primary outcome (personal recovery from QPR) and numerical secondary and tertiary outcomes will be analysed using a mixed effects model including relevant covariates (e.g., stratification variables) as well as main and interaction effects of assessment time and treatment as fixed effects. Random effects and appropriate correlation structures (depending on the number of assessment times to be modeled) will be included to capture the within subject dependence. Per protocol analyses will be performed to estimate the de jure effect of the intervention. The per protocol population is defined as intervention group participants who attended at least 16 (33%) of the exercise sessions during the four-month period. The per-protocol analyses will be adjusted with baseline covariates on disease and lifestyle characteristics to adjust for confounding variables that cannot be stratified for and that may arise when a sub-group (the per-protocol population) is analyzed [44]. Treatment effects will be quantified and interpreted using confidence intervals and significance tests on a 5% significance level. No formal adjustment of p-values will be applied, but the explorative nature and risk of false positive findings for secondary outcomes will be carefully addressed when results are presented. A subsequent within-trial health economic evaluation will be conducted from the service delivery perspective by including intervention costs (specifically cost of education course for instructors, salary to instructors and peer mentors, cost of exercise equipment etc. related to delivery of intervention), compared to quality-adjusted life years calculated from EuroQol-5 Domain (EQ-5D-5L) questionnaire [50, 52] combined with preference weights of the general Danish population [61].

Ethics and dissemination

Approval to conduct the study was received from The Ethics Committee for the Capital Region of Denmark (H-21079211) and the Danish Data Protection Agency (P-2022-78). The trial is registered at clinicaltrials.gov (NCT05461885). Important protocol modifications will

be documented in protocol amendments, which must be approved by the Ethics Committee for the Capital Region of Denmark and reported when the study is disseminated. The study will be conducted according to the Declaration of Helsinki (2008) and the International Conference on Harmonisation – Good Clinical Practice (ICH-GCP). As this is a non-drug trial, data monitoring and auditing is not warranted. However, the core research team (BSR, MFA, VS) monitor all aspects of the trial continuously including recruitment rate for each site, parameters related to the delivery of the intervention, attendance by participants to the intervention and assessments etc. Individual, electronic consent will occur prior to any testing procedures taking place. As the exercise intervention is designed to be an adjunctive therapy, all participants will be advised to continue usual care from their treating clinician while participating in the study. In accordance with the Declaration of Helsinki Dissemination Policy, research findings will be disseminated as widely as possible including an open access repository, conferences proceedings, presentations, and peer reviewed journals. To protect confidentiality of potential and enrolled participants, data access groups will be employed in REDCap® ensuring that RAs only access records for the particular site. The sponsor (JM), principal investigator (BSR), and core research team (VS, MFA) will have access to the final trial dataset, and statisticians (AT, RTW) will have access to pseudo-anonymized datasets. Findings will be reported using the Consolidated Standards of Reporting Trials (CONSORT) statement [62].

Discussion

The cornerstone for treating psychotic disorders is second-generation antipsychotics, and a substantial proportion of the prescriptions for continuous antipsychotic medication are commenced when people are in their late teens or early 20 s. While these medications can be effective for reducing psychotic symptoms, they also confer a myriad of metabolic side-effects [12, 13] for which exercise and other life style programs are demonstrated beneficial [26–29]. Despite clinical guideline recommendations that lifestyle-based approaches (particularly physical activity and exercise) should be a foundational component of mental health care [63] and first line approach for protecting physical and mental health [11], this is seldomly delivered as part of mainstream clinical practice. The Vega Exercise Community provides an opportunity for young adults to access an exercise environment that is equally challenging and caring and support the integration of being a young individual along with the experience of mental illness [23]. Further, the Vega trial is the first to examine

the effectiveness of an exercise intervention on personal recovery and also first to generate knowledge about and involve the primary relatives of the participants.

If the Vega Exercise Community program is superior to usual care in improving recovery and health, it has the potential not only to provide supplement care to individuals with mental illness but also enable mental health care professionals to promote exercise as an integrated part of treatment of severe mental illness. This trial will provide the first real-world data on the effectiveness and cost-effectiveness of exercise in commercial functional gym environments compared to usual care. It is anticipated that the intervention will produce dual mental and physical health benefits that may improve long-term health and result in cost-savings.

Abbreviations

AEs	Adverse events
CONSORT	Consolidated Standards of Reporting Trials
EQ-5D-5L	EuroQol-5 Domain questionnaire
HIFT	High Intensity Functional Training
ICH-GCP	International Conference on Harmonisation – Good Clinical Practice
IPAQ-SF	International Physical Activity Questionnaire short form
ISMI-9	Internalized Stigma of Mental Illness Inventory
MCID	Minimal clinical important difference
MCS	Mental Component Summary
MCSI	Modified Colorado Symptom Index
PCS	Physical Component Summary
PROMIS	Patient-Reported Outcomes Measurement Information System
PSQI	Pittsburgh Sleep Quality Index
QPR	Questionnaire about the Process of Recovery
RAs	Research assistants
REDCap	Electronic data capture
SD	Standard deviation
SAEs	Severe adverse events
SF-12	Short-Form-12 Health Survey

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12888-023-05086-z>.

Additional file 1: WHO Trial Registration Data Set.

Additional file 2: SPIRIT Checklist.

Additional file 3: The TIDieR (Template for Intervention Description and Replication) Checklist.

Additional file 4: Vega Program theory.

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Authors' contributions

Conceptualization: EDB, JM. Methodology: BSR, VS, MFA, EDB, JM. Analysis: AT, RTW. Writing (original draft preparation): BSR. Writing (review and editing): VS, MFA, EDB, BE, LB, DLV, OM, FKK, RTW, AT, JF, NN, STS, JM. Project administration: BSR, VS, MFA. Funding acquisition: JM, BE, LB, OM, FKK, RTW. All authors have read and agreed to the published version of the manuscript.

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Availability of data and materials

Data sharing is not applicable to this article as no datasets were generated or analysed yet in the current study.

Declarations

Ethics approval and consent to participate

The trial was approved by the Ethics Committee for the Capital Region of Denmark (H-21079211). All participants will provide written informed consent prior to enrolment. The study is being conducted in compliance with the principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

BHE has received lecture fees and/or is part of Advisory Boards of Bristol-Myers Squibb, Eli Lilly and Company, Janssen-Cilag, Otsuka Pharma Scandinavia AB, Takeda Pharmaceutical Company, Boehringer Ingelheim, and Lundbeck Pharma A/S. EDB is employed as clinical project lead at Novo Nordisk. DLV has received speaking fees from Lundbeck Pharma A/S and is the sub-investigator at the Aalborg site of the Boehringer Ingelheim Connex trial. RTW is employed as senior health economist at Bristol Myers Squibb. FKK has served on scientific advisory panels and/or been part of speaker's bureaus for, served as a consultant to and/or received research support from Amgen, AstraZeneca, Bayer, Boehringer Ingelheim, Carmot Therapeutics, Eli Lilly, Gubra, Lupin, Med-Immune, MSD/Merck, Mundipharma, Norgine, Novo Nordisk, Pharmacosmos, Sanofi, ShouTi, Zealand Pharma and Zucara; and is a minority shareholder in Antag Therapeutics and co-owner of the weight loss clinic *Medicinsk Vægt-tabsbehandling APS*. NN is employed at the commercial functional gym that hosts the Vega Exercise Community (Arca). All other authors declare that they have no competing interests.

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Supplementary file 1: WHO Trial Registration Data Set

1. **Trial registration:** ClinicalTrials.gov NCT05461885
2. **Registration date:** June 29th, 2022
3. **WHO Universal Trial Number (UTN):** U1111-1271-9928
4. **Funding:** TrygFonden (grant number 151603), Helsefonden (grant number 20-B-0328), and Toyota Foundation (grant number KJ/BG-10204 F).
5. **Sponsor:** Prof. Julie Midtgaard
6. **Secondary Sponsor(s):** None
7. **Contact for Public Queries:** Bolette Skjødt Rafn, PhD, Blegdamsvej 58, 2100 Copenhagen, +454015 6282, bolette.skjoedt.rafn@regionh.dk or Prof. Julie Midtgaard, Nordstjernevej 41, 2600 Glostrup, Julie.klausen.midtgaard@regionh.dk
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9. **Public title:** The Vega Trial
10. **Scientific title:** Evaluating the value of gym-based exercise versus usual care for young adults receiving antipsychotic medication: the Vega randomized controlled trial protocol
11. **Countries of recruitment:** Denmark
12. **Health conditions:** psychotic disorder or affective disorder
13. **Intervention(s)** Vega Exercise Community and Usual care.

Vega Exercise Community: Participants allocated to the Vega Exercise Community are offered one hour of tailored supervised, gym-based exercise training three times per week for a period of four months. In addition, participants are offered free-of-charge membership to the gym for six months and are invited to take part in training classes and use fitness equipment provided by the gym to regular members.

Usual care: Participants allocated to the usual care group will receive treatment as usual and be informed of the official physical activity guidelines as part of the information on group allocation. Moreover, they will be advised to continue their daily living, as they normally would do, not guiding them to other interventions neither preventing them to do so. In addition, participants in the usual care group will be given a subsidized membership

including access to the Vega Exercise Community for four months after the 12 months follow up.

14. Key Inclusion and Exclusion Criteria: Patients aged 18-35 years who are currently treated with antipsychotic medication on a daily basis for at least one month (any dose and formulation) for the management of a psychotic disorder (F20-F29) or an affective disorder (F30-F39), who read and speak Danish will be eligible. Those who are advised against participating in exercise activities by their treating physician doctor (i.e., current injuries or instable somatic comorbidity) will be excluded.

15. Study Type: This is a multicenter pragmatic randomized (2:1) controlled superiority trial comparing the outcomes of the Vega Exercise Community versus usual care on personal recovery at 4-months.

Blinding: The study staff who perform the assessments (baseline, four, six and 12 months), and the statistician will be blinded to group status. The instructors and participants will not be blinded to allocation due to the nature of the intervention.

Allocation: Participants will be assigned to exercise training or usual care using an allocation ratio of 2:1 ratio in favor of exercise. Randomization will take place during the in-person visit after informed consent and baseline assessments have been completed. A computer-generated random number randomization list, stratified to center and diagnosis (F2/F3), with varying block sizes will ensure random allocation.

16. Date of First Enrollment: 25.10.2022

17. Sample size: The sample size was chosen to yield sufficient power for detection of a difference in change between the two groups of 5 points on the Questionnaire about the Process of Recovery (QPR) at 4 months with a standard deviation of 13.8 points which corresponds to an effect size of 0.36. Considering an allocation ratio of 2:1 in favor of the intervention group, a two-sided t-test with a significance level of 5% yields a power of 83% if 200 participants are included in the intervention group and 100 in the usual care group. We anticipate drop-out (i.e., participants that are lost to 4-month follow-up) of 20% and therefore a minimum of 375 participants is needed. However, given the limited research utilizing the QPR, we will aim to recruit 400 patients. This sample size will allow the detection of a clinically relevant difference between groups on our main secondary

outcome, the Short-Form-12 Mental Component Summary (MCS), of 4 points at 4 months with a standard deviation of 12 points.

18. Recruitment Status: As of February 9th, 2023, 53 participants have been recruited.

- 1. Primary Outcome(s):** The 15-item Questionnaire about the Process of Recovery (QPR) is the primary outcome and is used to measure personal recovery.
- 2. Key Secondary Outcomes:** Secondary outcomes are related to health-related quality of life, behavioral symptoms, and metabolic health.
- 3. Ethics Review:** Approval to conduct the study was received from The Ethics Committee for the Capital Region of Denmark (H-21079211) and the Danish Data Protection Agency (P-2022-78). All patients are informed verbally and in writing about the study and the rights of research participants. The Helsinki Declaration is followed for all aspects of the study including for data handling and protection of participant rights.
- 4. Completion date:** Anticipated completion is Dec 2025.
- 5. Summary Results:** Trial is ongoing. Results will be provided later.
- 6. IPD sharing statement:**

Plan to share IPD: Individual participant data (IPD) will be available for meta-analysis. Proposals should be directed to the sponsor. To gain access, data requestors will need to sign a data access agreement. If requests are received from third world countries then the Data Protection Act, Chapter V, will be followed.

SPIRIT 2013 Checklist: Recommended items to address in a clinical trial protocol and related documents*

Section/item	ItemNo	Description	Page
Administrative information			
Title	1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	Title page
Trial registration	2a	Trial identifier and registry name. If not yet registered, name of intended registry	Title page
	2b	All items from the World Health Organization Trial Registration Data Set	Suppl. file 1
Protocol version	3	Date and version identifier	NA
Funding	4	Sources and types of financial, material, and other support	Suppl. file 1 + page 20
Roles and responsibilities	5a	Names, affiliations, and roles of protocol contributors	Title page + page 20
	5b	Name and contact information for the trial sponsor	Suppl. file 1
	5c	Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities	Suppl. file 1 + page 20

5d	Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint adjudication committee, data management team, and other individuals or groups overseeing the trial, if applicable (see Item 21a for data monitoring committee)	NA
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Introduction

Background and rationale	6a	Description of research question and justification for undertaking the trial, including summary of relevant studies (published and unpublished) examining benefits and harms for each intervention	Page 6 + 7
	6b	Explanation for choice of comparators	Page 6
Objectives	7	Specific objectives or hypotheses	Page 7 + 8
Trial design	8	Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group), allocation ratio, and framework (eg, superiority, equivalence, noninferiority, exploratory)	Page 7 + 8

Methods: Participants, interventions, and outcomes

Study setting	9	Description of study settings (eg, community clinic, academic hospital) and list of countries where data will be collected. Reference to where list of study sites can be obtained	Page 9 + 10
Eligibility criteria	10	Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and individuals who will perform the interventions (eg, surgeons, psychotherapists)	Page 9
Interventions	11a	Interventions for each group with sufficient detail to allow replication, including how and when they will be administered	Page 13-15 + suppl. file 3

	11b	Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose change in response to harms, participant request, or improving/worsening disease)	Page 12
	11c	Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence (eg, drug tablet return, laboratory tests)	Page 13 + 14
	11d	Relevant concomitant care and interventions that are permitted or prohibited during the trial	Page 18
Outcomes	12	Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended	Page 11 + Table 1
Participant timeline	13	Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see Figure)	Table 2
Sample size	14	Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations	Page 16
Recruitment	15	Strategies for achieving adequate participant enrolment to reach target sample size	Page 10

Methods: Assignment of interventions (for controlled trials)

Allocation:

Sequence generation	16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions	Page 15+16
Allocation concealment mechanism	16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned	Page 15
Implementation	16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions	Page 15
Blinding (masking)	17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how	Page 15+16
	17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial	NA

Methods: Data collection, management, and analysis

Data collection methods	18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol	Page 10+11
	18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols	Page 11

Data management	19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol	Page 10
Statistical methods	20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol	Page 17
	20b	Methods for any additional analyses (eg, subgroup and adjusted analyses)	Page 17
	20c	Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation)	Page 17
Methods: Monitoring			
Data monitoring	21a	Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed	18
	21b	Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial	Page 17
Harms	22	Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct	Page 12

Auditing	23	Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor	18
Ethics and dissemination			
Research ethics approval	24	Plans for seeking research ethics committee/institutional review board (REC/IRB) approval	Page 18
Protocol amendments	25	Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC/IRBs, trial participants, trial registries, journals, regulators)	Page 18
Consent or assent	26a	Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32)	Page 10
	26b	Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable	NA
Confidentiality	27	How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial	Page 18
Declaration of interests	28	Financial and other competing interests for principal investigators for the overall trial and each study site	Page 20
Access to data	29	Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators	Page 19
Ancillary and post-trial care	30	Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation	NA

Dissemination policy	31a	Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions	Page 18
	31b	Authorship eligibility guidelines and any intended use of professional writers	Page 21
	31c	Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code	Suppl. File 1

Appendices

Informed consent materials	32	Model consent form and other related documentation given to participants and authorised surrogates	Available in English upon request
Biological specimens	33	Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular analysis in the current trial and for future use in ancillary studies, if applicable	NA

*It is strongly recommended that this checklist be read in conjunction with the SPIRIT 2013 Explanation & Elaboration for important clarification on the items. Amendments to the protocol should be tracked and dated. The SPIRIT checklist is copyrighted by the SPIRIT Group under the Creative Commons "[Attribution-NonCommercial-NoDerivs 3.0 Unported](#)" license.

The TIDieR (Template for Intervention Description and Replication) Checklist*:

Information to include when describing an intervention and the location of the information

Item number	Item
1.	BRIEF NAME Provide the name or a phrase that describes the intervention. <i>Vega Exercise Community: 4 months of supervised group-based exercise 3 times a week in functional gyms</i>
2.	WHY Describe any rationale, theory, or goal of the elements essential to the intervention. <i>A gym-based exercise community offers social support and social inclusion in addition to training in social skills. Creation of an inclusive exercise community has the potential to reduce the symptoms (i.e., improve clinical recovery), and the experience of loneliness and internalized stigmatization which together may improve the participants' experience of personal recovery.</i>
3.	WHAT Materials: Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers. Provide information on where the materials can be accessed (e.g. online appendix, URL). <i>Instructors in charge of the VEGA exercise community (intervention providers) received prior to an educational programme (see point 5: WHO PROVIDED) written material including following headlines:</i> <i>• Introduction</i> <i>• Psychiatric diseases generally</i>

-
- *Schizophrenia*
 - *Symptoms*
 - *Treatment*
 - *Living with schizophrenia*
 - *Myths and misunderstandings*
 - *Being a VEGA instructor*
 - *Recovery*
 - *Points of attention*
 - *Procedures regarding adverse events*
 - *VEGA exercise protocol (see point 4: procedures)*
 - *Adjustment and adaption of exercise protocol (see point 9: TAILORING)*
 - *Examples of individual VEGA programmes (see point 4: procedures)*
 - *Administrative task in relation to VEGA*

4. Procedures: Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities.

A VEGA session will last 60 minutes, including a brief introduction of the daily program (which will be written on a whiteboard) and following headlines:

- *Class warm-up (10-15 minutes including introduction)*
- *Part A: Resistance training (10-20 minutes)*
- *Part B: High Intensity Functional Training (HIFT) (10-20 minutes)*
- *Cool down (5-10 minutes)*

Warm-up will primarily target the physical demands in the following content in part A and B and include an active icebreaker or social team exercise. Resistance training (part A) will focus on improving both strength and movement efficiency and have a combination of weightlifting and bodyweight exercises (see table below). HIFT (part B) will be provided as a “workout of the day” and incorporate all exercise modalities (see table below), with moderate to vigorous intensity. The combination of part A and B will strive to address all major muscle groups and the cardiovascular system in each VEGA session. Cool-down with focus on lowering arousal and conclude the session with low intensity mobility exercises.

Modality	Description	Example
Weightlifting	<i>Movements that involve lifting or moving of an external object like barbell, dumbbells or kettlebells.</i>	E.g., deadlifts, squats, press, push press, lunges.
Bodyweight	<i>Exercises that involve lifting or moving of a person's own bodyweight</i>	E.g., air-squats, push-ups, pull-ups, ring rows, burpees, sit-ups.
Mono-structural	<i>Traditional cardio exercises that are somewhat cyclical and allows for longer duration of performance.</i>	E.g., rowing, running, skipping.
Mobility	<i>Exercises targeting the ability to move a joint through its full range of motion with maximum levels of physical control.</i>	E.g. stretching, foam rolling, yoga positions.

All sections are completed together as a group and some sessions will include team-workouts, where participants work together to complete the exercises. Part A and B will be presented in different arrangements as well as different time domains and include movement instructions before initiating the exercises (see table below)

Type of workouts	Acronym	Description	Example
Rounds for quality	RFQ	<i>(Resistance training)</i> One or more movements are performed after each other with a focus on quality. Tempo is relatively low with sufficient rest between rounds in order to emphasize correct technique.	4 RFQ 8+8 Split squat with dumbbells 12 Ring rows
Rounds for time	RFT	<i>(HIFT)</i> Rounds of one or more exercises are performed as fast as possible. Exercises should be scaled so that participants move consistently well with correct technique even under higher stress. These types of workouts usually come with a timecap to give an idea of the intended stimulus.	3 RFT 21 Kettlebell swings 15 Box Jumps 9 Burpees Timecap: 12 minutes
As many rounds/repetitions as possible	AMRAP	<i>(HIFT)</i> One or more exercises are performed in a given window of time where the goal is to perform as many repetitions as possible. Exercises should be scaled so that participants move consistently well with correct technique even under higher stress.	AMRAP 15 200 Meters run 20 Dumbbells snatch 20 Push-ups 20 Ring rows
Every minute on the minute	EMOM	<i>(HIFT)</i> Interval-style training where a certain number of repetitions are performed within 1 minute. Exercises can switch each minute or stay the same.	EMOM 20 1. 8 Burpees 2. 10-15 Cal row 3. 50-70 Single/double under (skipping) 4. 10-15 Kettlebell goblet squat 5. Rest

Each VEGA session will be facilitated centrally developed exercise program including the content of the session. 6 months of unique programs will be developed, and these programs will cycle the VEGA intervention period. All programs are based on a 5-day cycle that ensures a certain amount of variation in each VEGA session. (see table below)

	Resistance training (part A)	HIFT (part B)	Example + coaches notes
Day 1	Lower body	Medium length (8-14 minutes)	A: 4 RFQ 8 Barbell deadlift B: AMRAP 10 10 Goblet squats 10 Push-ups 10 Ring rows Warm-up focus: Hips and posterior chain A: Spend at least 10 minutes on teaching the deadlift and building up to a comfortable weight before they start. Do one set every 2nd minute. Scale in weight or distance if technique is lacking. B: Make sure to provide scaling options for each movement. Goblet Squats can be scaled to air squats, pushups can be done on the knees or on a bench.
Day 2	Bodyweight	Longer duration (15-20 minutes)	A: 3 RFQ 20 Step-ups 20 Sit-ups B: EMOM 20 (:45 on/15: off) Min 1: Rowing machine Min 2: Jump rope Min 3: Burpees Min 4: Rest Warm-up focus: Heart rate

			A: This is meant to be done with bodyweight. On the sit-ups participants should scale to a number that they can do in one set. B: In this workout, participants work for 45 seconds followed by a 15 second transition on three different movements and then a minute rest. They go through this sequence five times, which in total concludes 20 minutes of work. Pace should be sustainable for the 45 seconds, scale accordingly.
Day 3	Upper body	Medium length (8-14 minutes)	A: 4 RFQ 10 Dumbbell bench press 10+10 One arm dumbbell rows B: 4 RFT 15 Kettlebell swings 15 Box Jumps Timecap: 10 minutes Warm-up focus: Upper body A: Team up two and two for a bench. dumbbell rows can be done standing at a box if there are not enough benches available. Each set should take about 3 minutes allowing for some at least 1 minute of rest between sets. B: Make sure to provide scaling options, especially for the box jumps where participants can either decrease the jumping distance or do step-ups instead. Fatigue will add up during the workout, so some might need to scale after the first round or two.
Day 4	Lower Body	Shorter intervals (2-7 minutes)	A: 4 RFQ 8 Barbell back squat B: 3 x AMRAP 3 / 1 min rest 1-2-3-4-5.... Push-ups Dumbbell snatch

			Warm-up focus: Squat positions A: Team up in groups of two/three per rack. Spend at least 8 minutes on teaching the squat so they are comfortable with this movement pattern. Do one set every 2nd minute. Scale in weight if technique is lacking. B: Help participants scale these movements, so that they can keep both high pace and good movement quality through each interval. Scaling can also be done as the workouts proceeds.
Day 5	Upper body	Longer duration (15-20 minutes)	A: 5 RFQ 10-10-8-8-6 Barbell shoulder Press B: AMRAP 15 200 meters run 20 Goblet lunges 20 Ring rows Warm-up focus: Shoulders A: Team up in groups of two/three per rack. Spend at least 8 minutes on instruction with an empty barbell before participants go for the working sets. Weight should start conservative and increase as the reps go down. B: The priority for this workout is to move at a steady pace for 15 minutes. Running can be scaled to rowing if participants are not comfortable with being outside. Difficulty on the lunges and rows should be a level where they can do at least 10 reps.

To support development of exercise self-efficacy, instructors and ideally also peer mentors will meet with each participant individually before initiation of the exercise program. During this meeting, the participant will complete an exercise self-efficacy questionnaire (developed for the study specifically), exploring previous exercise experience and preferences on how she/he is likely to prefer being coached and receive feedback. This

meeting will furthermore include discussion/development of individual goals. Furthermore, VEGA instructors are taught different methods of tailoring the workouts and exercises to all fitness levels (see 9, TAILORING) and focusing on success to promote exercise self-efficacy.

During the exercise period, short text messages will be sent by the instructor to all participants the day before each VEGA session (and/or in the morning in the case of classes scheduled in the afternoon), encouraging participants to show up. Participants will be invited to a group on social media administrated by a member of the research team and reserved for intervention group members and instructors.

Lastly all participants will be invited to participate in semi-annually Obstacle Course Racings which will facilitate as common goals between the participants.

WHO PROVIDED

- 5. For each category of intervention provider (e.g. psychologist, nursing assistant), describe their expertise, background and any specific training given.**

The instructors are expected to have experience as a fitness instructor, but no other formal qualifications are required. Instructors will be recruited through commercial functional gyms hosting the VEGA intervention. All instructors will be approved by the VEGA research team.

The instructors will be required to have completed an educational programme. The programme was conducted using a twostep qualitative process including interviews with key informants and focus groups with relevant stakeholders. A scientific paper regarding the development of the educational programme will be conducted (not yet published).

Prior to participating in the educational programme, VEGA instructors will receive written material (see point 3: materials).

The educational programme (1 day)

- *Presentation and rational regarding the VEGA trial*
- *Interview and e-learning by psychiatrist regarding schizophrenia*
- *Interview story from psychiatric nurse working in OPUS (outpatient clinic)*
- *E-learning with psychiatric nurse and recovery researcher regarding recovery*

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- *Interview story from former patient with schizophrenia*
 - *Delivering VEGA exercise community*
 - *Conducting start-up exercise self-efficacy meetings (see point 4: procedures)*
 - *Procedures regarding adverse events*
 - *Administrative VEGA work tasks*
 - *Evaluation, Q&A and rounding up*

HOW

6. **Describe the modes of delivery (e.g. face-to-face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group.**

The intervention will be delivered as face-to-face supervised group-based exercise facilitate by two instructors (see point 5: who provided) and ideally supplemented by a peer supporter. The peer-supporter will not attend all VEGA sessions but serve as equally member of the exercise community but with extended knowledge of living with a psychotic disorder and have completed a peer course provided by local psychiatric hospitals.

WHERE

7. **Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant features.**

The intervention will be delivered at following addresses.

<i>CrossFit North 579</i>	<i>ARCA, Værkstedet</i>	<i>ARCA Smedjen</i>	<i>ARCA, Fundamentet</i>
<i>Hjulmagervej 11</i>	<i>Kastanie Allé 20</i>	<i>Sigurdsgade 37</i>	<i>Helsingforsgade 23</i>
<i>9000 Aalborg</i>	<i>2720 København</i>	<i>2200 København</i>	<i>8200 Aarhus</i>
<i>Denmark</i>	<i>Denmark</i>	<i>Denmark</i>	<i>Denmark</i>

Public transportations are available within few hundreds meter from each intervention site.

The VEGA exercise community will take place in training facilities designed for functional training. Facilities have the possibility for privacy (can be secluded) and are equipped with rubber floors and pullup-bar for bodyweight movements, as well as barbells, dumbbells, kettlebells, medicine balls, rowing machines, etc. running routes of 200 and 400 meters are also provided. Dressing rooms, lockers and showers are also accessible. Lastly all facilities have a “social corner” where participants can hang out before and after the session. (see pictures below for example of facilities)



WHEN and HOW MUCH

- 8. Describe the number of times the intervention was delivered and over what period of time including the number of sessions, their schedule, and their duration, intensity or dose.**

Participants allocated to the Vega Exercise Community (i.e., intervention group) will be offered one hour of tailored supervised, gym-based exercise training three times per week for a period of four months. In addition, participants are offered free-of-charge membership to the gym for six months and are invited to take part in training classes and use fitness equipment provided by the gym to regular members.

Further information regarding the intervention see point 4: procedures.

TAILORING

- 9. If the intervention was planned to be personalised, titrated or adapted, then describe what, why, when, and how.**

To ensure both quality of movement and preservation of the intended stimuli of the workout, the instructor will provide scaling options for each exercise. This can be done by altering the load in either weightlifting or bodyweight movements, or by decreasing the range of motion with a given movement. Furthermore, there is an option of scaling the complexity of an exercise by changing it to another. The workout itself can also be altered by reducing the number of repetitions or rounds/sets. Scaling will be done on an individual basis according to the participants experience and abilities. The instructor will present these modifications to make the workout fit individual rather than a view of not being capable.

In addition, each exercise or activity can be adapted to the participants psychological and social capacities on the day, e.g., by reducing the social interaction in group-based exercises or altered exercise possibility if symptoms somehow prevent the participant from participating.

MODIFICATIONS

- 10. If the intervention was modified during the course of the study, describe the changes (what, why, when, and how).**

‡

Not applicable

HOW WELL

- 11. Planned: If intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them.**

Adherence will be monitored by VEGA instructors after each session using an app (Holdsport.dk). Further, the use of the subsidized membership (i.e., participation in other exercise classes) will be collected from the fitness centres' registration system.

Fidelity will be measured by collecting data on intensity, duration, structure, and organization of the session. Specifically, the duration, structure (i.e., warm-up, part A, part B and cooldown) and organization (i.e., presence of two instructors and peer-supporter) will be reported by the instructors in all sessions using an app (Holdsport.dk). The exercise intensity will be assessed using heart rate monitors worn by the participants and self-reported using the Borg Scale of perceived exertion in selected sessions.

Members of the research teams will occasionally overview the VEGA sessions to control the registration of adherence and compliance regarding fidelity from the instructors.

12. Actual: If intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned.

‡

Not applicable

**** Authors** - use N/A if an item is not applicable for the intervention being described. **Reviewers** – use ‘?’ if information about the element is not reported/not sufficiently reported.

† If the information is not provided in the primary paper, give details of where this information is available. This may include locations such as a published protocol or other published papers (provide citation details) or a website (provide the URL).

‡ If completing the TIDieR checklist for a protocol, these items are not relevant to the protocol and cannot be described until the study is complete.

* We strongly recommend using this checklist in conjunction with the TIDieR guide (see *BMJ* 2014;348:g1687) which contains an explanation and elaboration for each item.

* The focus of TIDieR is on reporting details of the intervention elements (and where relevant, comparison elements) of a study. Other elements and methodological features of studies are covered by other reporting statements and checklists and have not been duplicated as part of the TIDieR checklist. When a **randomised trial** is being reported, the TIDieR checklist should be used in conjunction with the CONSORT statement (see www.consort-statement.org) as an extension of **Item 5 of the CONSORT 2010 Statement**. When a **clinical trial protocol** is being reported, the TIDieR checklist should be used in conjunction with the SPIRIT statement as an extension of **Item 11 of the SPIRIT 2013 Statement** (see www.spirit-statement.org). For alternate study designs, TIDieR can be used in conjunction with the appropriate checklist for that study design (see www.equator-network.org).

Supplementary file 4: Program theory

