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Effects of Physical Exercise Therapy on the Wellbeing and Functioning of Youth in a Secure Inpatient Mental Health Service: A Two Years Prospective Cohort Study

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ABSTRACT

The positive effect of physical activity (PA) on mental health has been widely documented, and interventions which increase physical activity levels have shown profound benefits in inpatient and outpatient populations. Despite the robust evidence base, participation in a tailored physical exercise programme is not prescribed as standard for Children and Young People's Mental Health Services (CYPMHS). Furthermore, individuals with mental health conditions continue to experience significant physical health inequalities compared with the general population, and admission to psychiatric hospitals is considered to exacerbate these inequalities.

The present study, conducted at an inpatient CYPMHS Low Secure Unit, collected 84 responses from service users who engaged in physical exercise sessions over a period 28 months. The Subjective Exercise Experience Scale, was completed pre and post-exercise therapy sessions, assessing three categories of subjective responses to exercise stimuli: positive wellbeing, psychological distress and fatigue.

The results demonstrated an increase in self-reported positive wellbeing, and a decrease in self-reported levels of psychological distress and in fatigue immediately after exercise, compared with immediately prior to engaging with physical exercise. The wider impact was an improvement in the young people's general functioning and increased levels of overall engagement with their care and treatment plans.

Understanding why this positive clinical response occurred, and the neuroscience behind it, is crucial for developing targeted physical activity interventions that improve holistic

wellbeing and encourage engagement in treatment plans. Our recommendation is to conduct further studies to explore the duration of these positive effects and within a larger sample size.
Keywords: Mental health; physical exercise therapy; adolescents; wellbeing; secure inpatient care

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Introduction

The positive effect of PA on mental health and overall wellbeing is widely documented and supported by a substantial body of research. The research encompasses a range of designs and provides a robust evidence base for recommending PA as part of a holistic recovery pathway for mental health disorders (Firth et al., 2019; Li et al., 2022; Liu et al., 2024; Vancampfort et al., 2017, 2025; Werneck et al., 2025). The European Psychiatric Association's guidance on PA as a treatment for severe mental illness – issued following a meta-review – also states the positive therapeutic impact of PA interventions. Physical activity can reduce depressive symptoms for those with major depressive disorder, and for those with schizophrenia-spectrum disorders, evidence indicates that aerobic PA can reduce psychiatric symptoms and improve cognition (Stubbs et al., 2018).

Beyond its immediate mental health benefits, physical activity plays a crucial role in promoting brain health across the lifespan. Evidence from longitudinal cohorts, such as the Framingham Heart Study (2025) suggests that higher levels of PA during adulthood is associated with significantly lower risk of dementia later in life (Marino et al., 2025). These findings support the assertion that the early introduction of, and sustained engagement in, physical activity may contribute to long-term brain resilience. This highlights adolescence as a critical window for intervention.

Despite the evidence base recording the multiple benefits of PA on mental health, PA is often not considered as part of the recovery pathway for individuals with mental health disorders (Yap et al., 2020), resulting in this cohort missing out on the benefits of PA, in particular relating to increased wellbeing and overall functioning. Vitally, research as consistently shown that, in comparison

to the general population, individuals with mental health conditions experience significant physical health inequalities. This cohort is at greater risk for cardiovascular disease (Correll et al., 2017) increased risk for metabolic syndrome (De Hert et al., 2009) and are affected by poor diet (Firth et al., 2019). Compounding this issue is the argument that secure psychiatric hospitals exacerbate this inequality due to factors including restricted living space and issues of service user risk and safety (Gorczynski et al., 2013; Rogers et al., 2021).

An emerging body of research also considers the impact of different types of exercise on mental health and wellbeing. For example, Li & Liu's (2014) study on the benefits of PA at different intensities, concluded that PA created a dual effect on happiness. Firstly, PA has a direct impact of enhancing subjective wellbeing, and secondly PA has an indirect (psychological) effect whereby the subject experiences improved psychological variables such as greater self-efficacy and emotional regulation. The study also concluded that the higher the intensity of physical activity, the greater the subjective happiness. Similarly, a 12-month aerobic exercise intervention was associated with lower incidence of non-suicidal self-injury in school students with low baseline levels of physical activity (Werneck et al., 2025). Other studies have explored endurance exercise and high cardiorespiratory fitness (CRF) and their neuroprotective mechanisms. A recent review published in the Lancet highlighted the importance of CRF in promoting healthy brain aging by improving cerebral blood flow, reducing inflammation, and enhancing neuroplasticity (Tari et al., 2025).

In addition to preventing cognitive decline, exercise can also positively impact adolescent brain health and development. One study found that adolescents who participated in a 12-week aerobic exercise programme of moderate to high intensity levels, seemed to benefit from the positive effect on levels of serum brain derived neurotrophic factor whilst at rest, and created improvements in memory and cognitive functioning (Jeon et al., 2017). However, even with the growing body of evidence on the positive impact of PA for young people, clinicians remain uncertain about prescribing exercise in routine practice. Data from an anonymous online survey of NHS doctors, showed that clinicians recognise the value of physical activity in supporting young people's mental health, but a lack of protocol and guidance affects confidence and prevents routine prescription (Husain, 2025).

Although extensive evidence supports PA as a therapeutic intervention for mental health, there is limited research examining its effects in adolescent inpatient mental health settings, particularly regarding its impact on engagement in therapeutic treatment and overall functioning. Based on the evidence summarised above, we hypothesise that physical activity interventions could serve as alternative or adjunctive evidence-based approach to boost mental health, including cognitive function, psychological wellbeing, and reduction risk behaviours in children and adolescents with mental health disorders. We put forward that young people in inpatient services could yield wellbeing benefits and improvements in overall functioning from PA that would enable them to participate more fully in therapeutic treatments and the prescribed recovery pathway. This study was designed to investigate our hypothesis and potentially contribute to changes in clinical practice and treatment.

The aim of this study was to assess the effect of engaging in a programme of PA on the mood state and wellbeing of young people supported in a high-risk inpatient service (due to posing an immediate high risk to themselves and/or others). An additional objective was to observe participation in therapeutic interventions and the subsequent effect on young people's recovery pathways and overall functioning.

Method

Potters Bar Clinic offers a CYPMHS LSU inpatient service for young people aged 13-18 with a wide range of mental health disorders and complex needs. The 18-bed inpatient unit consists of two wards and provides tailored treatment programmes, led by a specialist multidisciplinary team (MDT).

To complete the study, Potters Bar Clinic collaborated with Psychesoma, a specialist physical exercise therapy provider, who delivered a person-centred programme focused on improving overall health, mood state and self-esteem. This tailored programme of group and individual physical exercise therapy sessions was delivered over 28 months (December 2022 – June 2025). The young people were admitted compulsorily and presented with a range of ICD diagnoses of a mental health disorder (mood disorder, anxiety/stress disorder, post-traumatic stress disorder, emotionally unstable personality disorder, autism spectrum disorder, attention deficit hyperactivity disorder and disordered eating).

Each participant was included in the design and implementation of their own physical exercise therapy programme by the Psychesoma team during the admission period. Trainers from Psychesoma also worked closely with the MDT to understand the individual needs of the young people and any challenges they were experiencing during treatment. The programme aimed to improve health and relieve stress and anxiety, to support improvement of overall functioning. It was posited that an increase in overall functioning would lead to increased participation in therapeutic treatment, support a recovery pathway, and lead to a reduction of hospital admission length.

The PA sessions, held either in the morning or afternoon, consisted of both conventional and non-conventional approaches to help boost engagement. Morning sessions were designed to improve alertness and processing speed. Morning sessions focused on lower-intensity activities such as yoga and Pilates, as well as less conventional 'reactionary games' such as red light/green light, passing the ball, and mirror mirror. The afternoon sessions adopted a more conventional approach to physical activity, with a circuit training style session with free weights and resistance bands, or other sport-based activities such as basketball, tennis or badminton.

Data Collection

During the study data was collected across four main areas. Firstly, participation rates which were measured on an attended or declined basis. Secondly, the participants engagement level was recorded across four categories, 0 being no engagement, 1 being conversed (engage in conversation), 2 being light engagement (less than 10 minutes) and 3 being full engagement (10+ minutes). Thirdly, mood state responses were collected, dictated by a prompt from the trainer, such as 'How do you feel after that?' or 'Did you enjoy the session?' giving a score of -1, 0 or +1. Measures of engagement and mood state were pragmatic, session-based indicators developed for clinical monitoring rather than standardised, validated instruments.

Each participant also completed the Subjective Exercise Experience Scale (SEES) (McAuley & Courneya, 1994), a standardised measure of global psychological responses to exercise stimuli. The SEES assesses three general categories of subjective responses to exercise stimuli: positive wellbeing, psychological distress, and fatigue. Each sub-scale includes 4 emotion

statements, with 12 statements in total. Young people are required to rate the degree to which they feel each emotion in the present moment on a Likert type scale (1; 'Not at all' – 7; 'Very much so').

This measure was completed pre-session and post-sessions by the participants with the support of the Psychesoma trainers. The measure was completed 84 times in total by 19 young people and analysed by Potters Bar psychology team using T-tests to compare the mean difference between pre-session and post-session scores along the three subscales. T-tests were the most suitable choice because they allow for the comparison of mean differences between groups in which the independent variable was categorical with two levels (pre and post) and the dependent variable was continuous scale scores.

In addition, the MDT completed The Children's Global Assessment Scale (CGAS) pre-engagement and at the time of completion of the programme, to rate general functioning in YP participating in PA sessions. The CGAS, adapted from the Global Assessment Scale for adults (Endicott et al., 1976), is a rating of general functioning for children and young people aged 4-16 years old. The clinician assesses a range of aspects of psychological and social functioning and gives the child or young person a single score between 1 and 100, based on their lowest level of functioning. The score puts them in one of ten categories that range from "needs constant supervision" (1-10) to "superior functioning" (91-100). The measure can be used by clinicians as well as researchers to complement other scales measuring more specific symptoms (Shaffer et al., 1983).

Results

Participation

The average level of participation across the programme was 65.1%. Due to the nature of the high risk LSU inpatient wards for youth, and the complexity and variety of medical needs across the participation cohort, a significant degree of variation is to be expected. This is mainly due to the varied number of service users being able to engage in sessions from visit to visit.

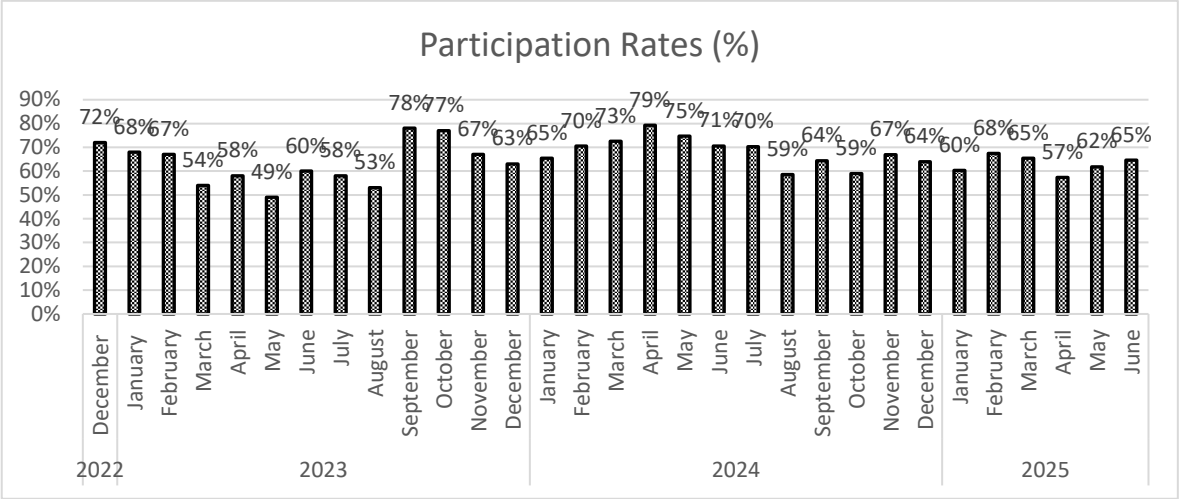


Figure 1. Participation Rates (%)

The graph shows the average monthly participation rate across the whole patient cohort, displayed as a percentage.

Engagement

The physical activity session proved popular with participants and 82.6% of the sessions offered recorded full engagement.

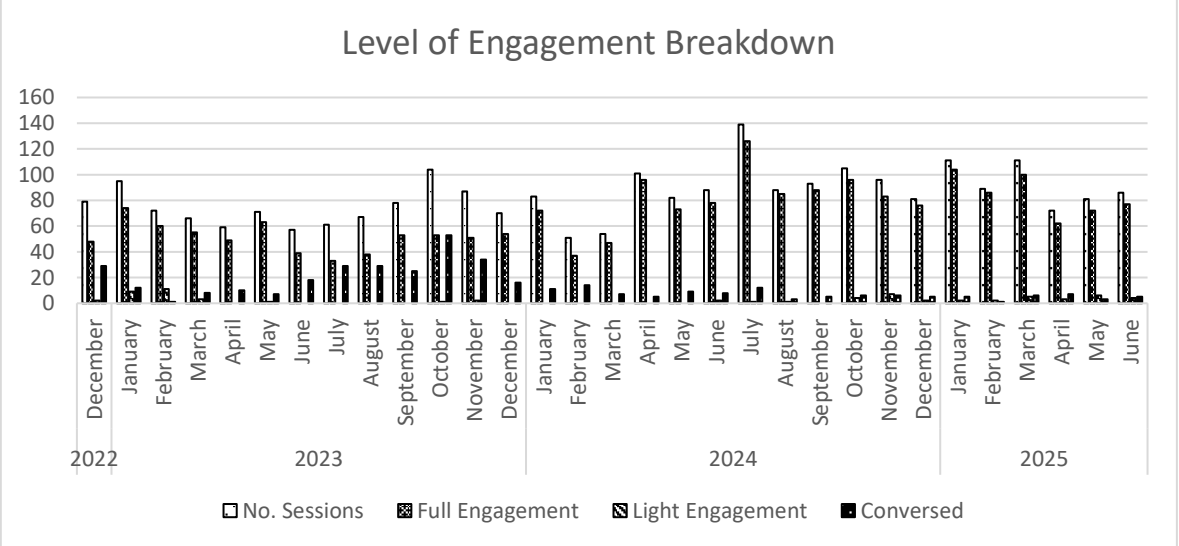


Figure 2. Level of Engagement Breakdown

The graph above shows the total number of sessions delivered each month, with additional bars to represent each level of engagement. Any non-participation was discounted from the data set.

The average level of engagement during the period December 2022 and June 2025 was 2.6.

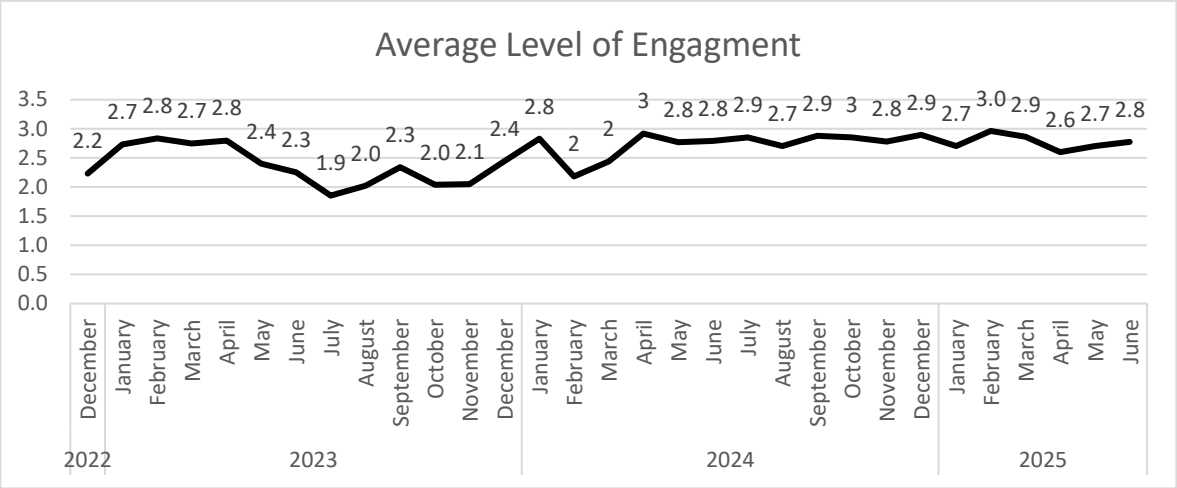


Figure 3. Average Level of Engagement

The graph above shows the average level of engagement trend between December 2022 and June 2025. Any non-participation was discounted from the data set.

Mood State Response

The number of positive mood state responses within this period was 79.2%. The mood state responses were both observed and/or reported. Self-reported responses were following a prompt from the trainer.

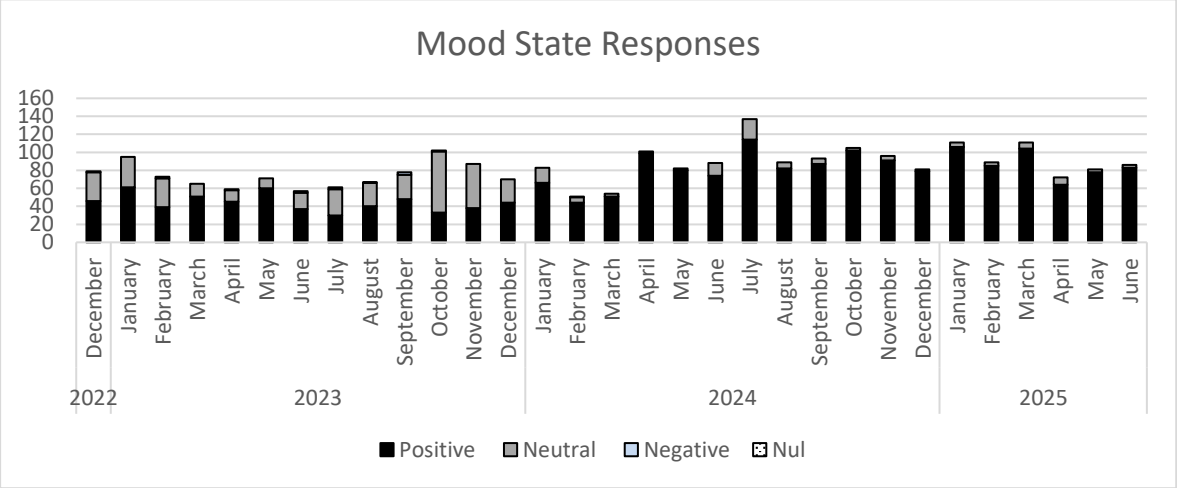


Figure 4. Mood State Responses

The graph above shows the breakdown of mood state responses to delivered sessions.

SEES Positive Wellbeing

The results indicate a significant increase (t(83)=12.255, p=<.001) between pre-session (M=11.11, SD=5.16) and post-session (M=16.10, SD=5.38) Positive Wellbeing scores. This represents an increase of 44.9%.

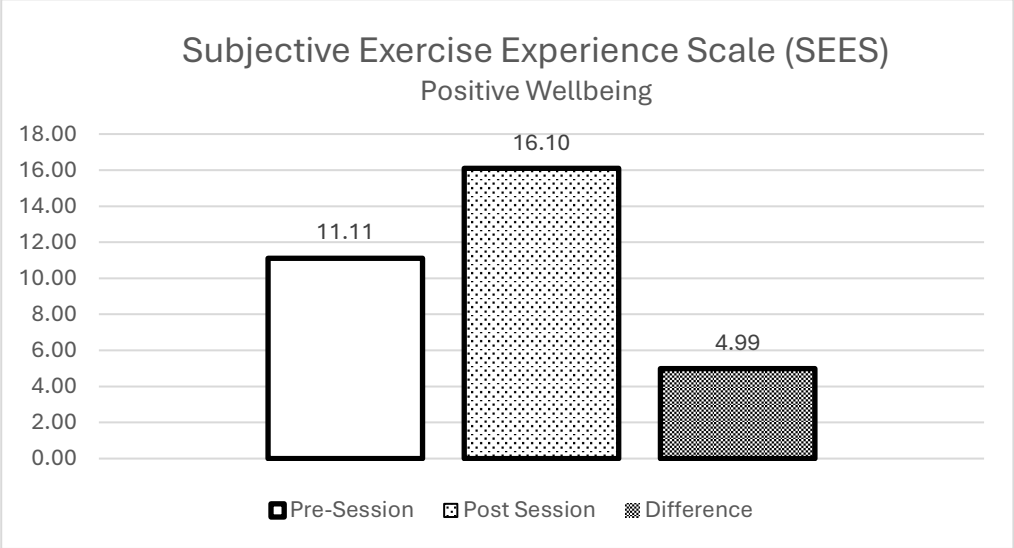


Figure 5. Subjective Exercise Experience Scale (SEES): Positive Wellbeing

The graph above shows that on the positive wellbeing SEES subscale, the cohort had a mean pre-session score of 11.11 and a mean post-session score of 16.10, representing a 4.99 point increase in self-reported positive wellbeing.

SEES Fatigue

The results indicate a significant decrease (t(83)=7.3015, p=<.001) between pre-session (M=15.46, SD=5.86) and post-session (M=11.19, SD=5.59) Fatigue scores.

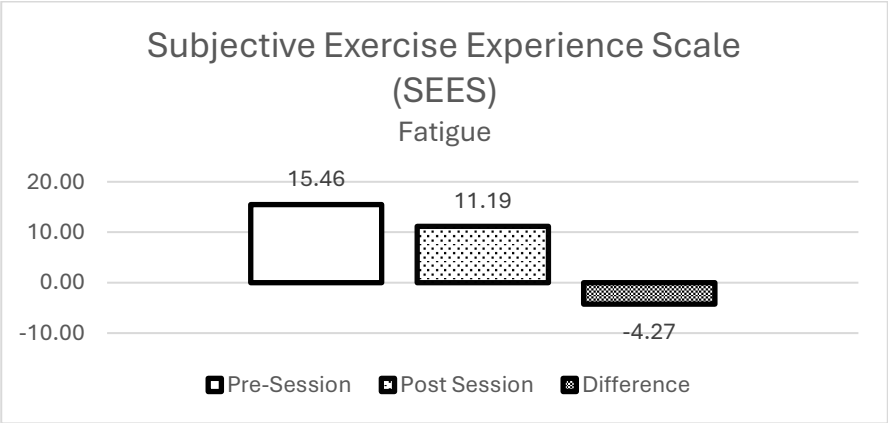


Figure 6. Subjective Exercise Experience Scale (SEES): Fatigue

The graph above shows that on the fatigue subscale, the cohort had a mean pre-session score of 15.46 and a mean post-session score of 11.19, representing a 4.27 point decrease in fatigue. This represents a decrease of 27.62%.

SEES Psychological Distress

Results indicate a significant decrease (t(83)=6.8684, p=<.001) between pre-session (M=10.29, SD=5.30) and post-session (M=7.90, SD=4.27) Psychological Distress scores.

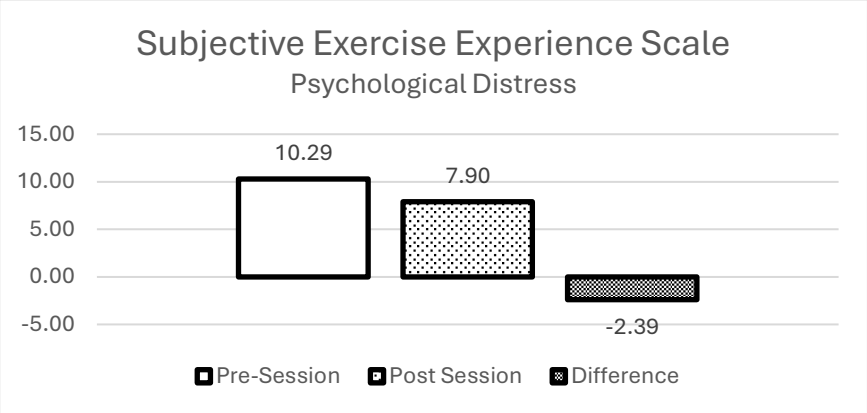


Figure 7. Subjective Exercise Experience Scale (SEES): Psychological Distress

The graph above shows that on the psychological distress subscale, the cohort had a mean pre-session score of 10.29 and a mean post-session score of 7.9, representing a 2.38 point decrease in psychological distress. This represents a decrease of 23.2%.

Upon examining overall functioning, the mean increase in CGAS scores from pre-treatment to post-treatment was 13.47 points (*SD* = 8.76). A one-tailed paired-samples *t*-test was conducted to examine this change. CGAS scores were significantly higher post-treatment (*M* = 48.47, *SD* = 7.76) compared to pre-treatment (*M* = 34.99, *SD* = 7.83). This difference was statistically significant, $t(18) = 6.70$, $p < .001$, indicating that engagement with the PA programme was associated with a significant improvement in overall functioning.

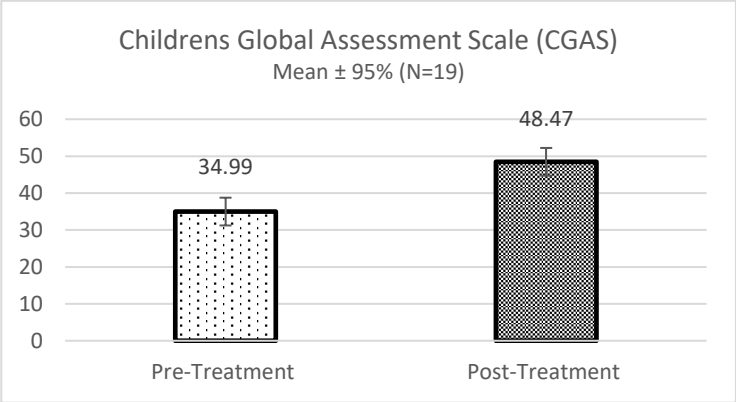


Figure 8. Children's Global Assessment Scale (CGAS): Mean ± 95% (N = 19)

Discussion

It is clear from the results that participants experienced an increase in positive wellbeing and a decrease in psychological distress and fatigue scores soon after participating in the PA session.

Understanding the reasons behind this positive clinical response, as well as the underlying neuroscience, is essential for designing targeted PA interventions that enhance holistic wellbeing and treatment engagement. PA can improve mental health in several ways. On a biological level, it boosts the release of neurotransmitters in the brain — such as serotonin, dopamine, and norepinephrine, which are involved in emotional regulation and pleasure. It also increases endorphins, which can reduce pain and create a sense of wellbeing. Exercise activates the body's endocannabinoid system as well, which helps reduce stress and anxiety. Another important effect is the rise in BDNF, a protein that supports brain growth, learning, and emotional balance. Aerobic exercise also interferes in the activity of the hypothalamic–pituitary–adrenal axis, reducing cortisol levels and promoting greater stress tolerance. On a social level, participating in aerobic activities in groups can increase a sense of belonging, provide support from others, and build confidence. These factors all help to build resilience.

Due to these combined effects, regular physical activity has been shown to reduce depressive symptoms, anxiety, anger, fatigue, and stress. It can also improve self-esteem, positive mood, and emotional resilience in young people. These findings, along with their practical applicability, consolidate PA as a strong recommended intervention strategy for promoting psychological wellbeing during development.

Previous research has focused on the benefits of engaging in aerobic exercise. Within this study we identify that a combination of types of physical exercise activity (aerobic, strength, flexibility, balance and coordination, specific sport, and recreational activities developing the mind-body connection) showed a positive effect on young people's overall wellbeing. This study is among the first to evaluate the results of PA on young people with mental health disorders presenting with high risk toward themselves and/or others within an inpatient setting and combining different forms of physical activities. (Carcelén-Fraile et al., 2025; Carney et al., 2021; Rodriguez-Ayllon et al., 2019). As such, these findings may inform future efforts to incorporate PA as part of a holistic recovery pathway. Therefore, we recommend conducting further studies with larger sample sizes to examine the duration and sustainability of these effects. Further research using larger samples and robust designs—such as longitudinal studies and controlled trials—is needed to clarify the mechanisms, durability, and clinical relevance of physical activity interventions, and to determine how intervention type, intensity, and setting influence outcomes in young people with mental health disorders.

We noticed that those young people who did participate in PA sessions were more available to engage in therapeutic treatment offered to them (including psychology sessions, occupational therapy, family therapy and education). This increase in engagement in therapeutic work, led to an improvement in overall functioning and recovery pathway as shown in CGAS score improvement. Further studies are needed to validate our observations and hypothesis.

In addition, young people at high risk who receive treatment in hospital tend to receive psychotropic medication and remain in a hospital setting for an extensive period, leading to future risk of obesity and metabolic imbalance. PA would also be imperative as a protective factor to reduce future cardiovascular risks and deaths (Ekelund et al., 2026).

Limitations

Despite these promising findings, several limitations must be considered. First, the study is subject to selection bias, as only participants who were willing and available to complete the relevant outcome measure prior to, and following sessions were included. Observer bias may have influenced measures of engagement and mood, as trainers recorded these outcomes based on

observation and prompts. Social desirability bias may have affected immediate post-session responses, potentially inflating reports of positive wellbeing or engagement. Additionally, the analysis relied on 84 session-level measurements collected from 19 participants. As a result, it reflects outcomes per session rather than per individual, which limits generalisability.

Other methodological constraints include the absence of a control group, a small sample size, and lack of adjustment for repeated measures, all of which limit statistical power and generalisability. Several secondary variables (e.g., long-term functional outcomes, physiological markers) were not operationalised, restricting interpretation beyond immediate psychological responses and CGAS-measured functioning. Furthermore, the observational design means causality cannot be firmly established, though the temporal association between PA engagement and improvements in wellbeing and functioning is compelling.

These limitations highlight the need for future research using larger, controlled, and longitudinal study designs to assess the durability and clinical relevance of PA interventions in inpatient child and adolescent mental health services. Specifically, studies incorporating randomised controlled designs, repeated-measures analysis, and objective physiological and cognitive measures would provide stronger evidence of efficacy and inform best practices for integrating PA into holistic recovery pathways.

Ethical Approval and Informed Consent

This study was conducted as a service evaluation within a specialist inpatient Child and Young Person's Mental Health Service. The physical activity programme formed part of routine clinical care and did not involve any alteration to standard treatment pathways. Data were collected anonymously as part of routine outcome monitoring, and no identifiable patient information was recorded. Given the observational and non-interventional nature of the study, formal ethical approval was not required in accordance with local governance and NHS service evaluation guidance. All clinical activities were delivered in line with safeguarding policies, and parental or guardian consent procedures followed standard inpatient service protocols.

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