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The effectiveness of structured sport and exercise interventions in enhancing the mental health of adolescents with mild to moderate mental health problems: a systematic review

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ABSTRACT

Between 10% and 20% of adolescents globally have a diagnosed mental health disorder and a big proportion of individuals experience their first mental health problem during adolescence. However, limited research has investigated how an adult-led structured sport and exercise intervention can be used to support adolescents with mild to moderate mental health problems. A systematic review of the literature (five databases) was performed. Included studies (qualitative and quantitative) explored structured sport and exercise interventions aiming to help adolescents (aged 10–19 years) experiencing mild to moderate mental health problems. From 3506 studies screened, nine met the inclusion criteria (RCT=6 and non-RCT=3) following the PICOS, TIDieR frameworks and assessing quality of studies using the Mixed Methods Appraisal Tool. Activities included a group-based circuit training, high-intensity interval training, dance, group-based aerobic exercise, mindfulness-based Tai Chi Chuan and rugby. All included studies showed clinical improvements in adolescents' anxiety or depression (anxiety, $n = 5$ and depression, $n = 7$). There is evidence that structured sport and exercise interventions can support adolescents with mild to moderate mental health problems. However, more research is needed to understand the mechanisms of how these outcomes are achieved, specifically using well-designed interventions tailored to specific exercises/sports, populations, and mental health outcomes.

ARTICLE HISTORY

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KEYWORDS

Exercise; sport; interventions; adolescents; mental health outcomes

Background

Research shows that mental health problems are among the biggest global public health challenges (World Health Organisation, 2020). This is a particular concern for adolescents where mental health problems are highly prevalent (Carter et al., 2015). Approximately

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10-20% of adolescents worldwide have a diagnosed common mental health disorder (i.e. anxiety, depression, obsessive-compulsive disorder (OCD), post-traumatic stress disorder (PTSD) and panic disorder) (Pascoe et al., 2020; World Health Organisation, 2020). The National Health Service (NHS) in England (NHS Digital, 2021) conducted a survey on the mental health of children and young people in 2021 during the Coronavirus (COVID-19) pandemic and explored changes since 2017. Their findings show that rates of probable mental disorders had increased since 2017; in 6- to 16-year-olds from one in nine (11.6%) to one in six (17.4%), and in 17- to 19-year-olds from one in ten (10.1%) to one in six (17.4%). As there is an increasing number of adolescents needing support, it is vital that research seeks to understand the needs of adolescents so that they can receive appropriate and effective interventions to improve their mental health problems (Costigan et al., 2017). Identifying and developing such interventions for adolescents is particularly crucial as evidence indicates that half of all mental health problems begin by the age of 14 (Collins et al., 2013; World Health Organisation, 2017) and are likely to continue into adulthood (Ahmed et al., 2016). The majority of lifetime psychological disorders associated with educational, medical, and interpersonal challenges are established during adolescence (Vigo et al., 2016).

The two most common forms of treatment for adolescents' mental health problems, offered through the NHS, are talking therapies (e.g. cognitive behavioural therapy, counselling) and psychiatric medication (NHS, 2019). Most young people are likely to be offered cognitive behavioural therapy (CBT) which aims to identify connections between thoughts, feelings and behaviours to manage negative patterns that can cause difficulties for the individual (Mind, 2017). Evidence suggests that CBT can be an effective treatment. However, not all adolescents engage or adhere to such talking therapies. Talking about emotions and/or sharing feelings with someone that the adolescent is unfamiliar with can be challenging (Lederman et al., 2020; Schlimm et al., 2021). Evidence also suggests that more than one-third of adolescents with moderate to severe mental health problems do not show an adequate clinical response to medications (Mullen, 2018). Further, medication can have several adverse effects on adolescents (e.g. increased risk of behavioural disinhibition - restlessness, jitteriness, hyperactivity, hypomania or mania, decreased height/weight, and new-onset suicidal thoughts or behaviours; Addington et al., 2021). Therefore, there are justifications to explore alternative therapies to support the mental health of adolescents.

One way to engage adolescents with mental health support, which has shown promise in recent literature is through structured sport and exercise interventions (Mammen & Faulkner, 2013). Sport is part of the physical activity spectrum and corresponds to any institutionalised and organised practice, reined by specific rules (Thivel et al., 2018). Exercise, also a subcategory of physical activity, is planned, structured, repetitive physical activity, and favours physical fitness maintenance or development (Thivel et al., 2018). Sport and exercise interventions have few adverse effects, are much less expensive to run, and may be more accessible and acceptable than psychological talking therapies due to less stigma being attached to the activities (Addington et al., 2021). These interventions may also increase accessibility for populations often underrepresented in the therapeutic space (Grasser & Javanbakht, 2021). When compared to other forms of treatment, such as cognitive behavioural therapy (CBT), structured sport and exercise has been found to be equally effective in treating depression, anxiety, and other mental health problems

in adults and young people (Kristjánsdóttir et al., 2018; Williams et al., 2021). It has been suggested that exercise can improve perfusion, increase brain volume, reduce brain inflammation and, release growth factors and endorphins which all are important to improve mental health (Malm et al., 2019).

Current National Institute for Health and Care Excellence guidelines (NICE, 2019), recommend providing advice to children and young people, on the benefits of regular physical activity and exercise as part of treatment for mild to moderate depression. NICE guidelines also recommend for children and young people, with mild to moderate depression, to consider following a structured and supervised exercise or sport programme for over 10–14 weeks, either as a stand-alone therapy or as an adjunct to psychotherapy or medical treatment. Despite NICE (2019) guidelines recommending structured and supervised exercise programmes for adolescents, no structured and supervised sport and exercise interventions for adolescents with mild to moderate health problems, have been formally evaluated specifically using these guidelines. Therefore, it cannot be stated whether the recommendations above are the optimal treatment for adolescents' mental health problems supporting the need to gather more peer reviewed evidence from such interventions (Smith et al., 2022). This information is crucial so more adolescents from different backgrounds and circumstances can access support for their mental health problems. Interventions should be consistently evaluated to identify what works and what does not. More research and transparency is needed concerning the development of sport and exercise interventions for adolescents. Pascoe et al. (2020) conducted a scoping review to test intensity of exercise and sport interventions across mental health outcomes in young people with a mental health disorder. They found some evidence that light-to-moderate exercise intensity interventions decreased anxiety symptoms, particularly those delivered outdoors and in group formats. There was some evidence that light-intensity and moderate-to-vigorous-intensity interventions decreased depression, potentially through improvements in self-efficacy. However, although some research exists in this space, further research is required to understand which sport and exercise activities should be used and how, such as: settings, intensity, deliverers, environment, and potential barriers to consider in the implementation of a programme (Carter et al., 2015; Costigan et al., 2017; Pascoe et al., 2020).

To summarise, in recent years, there has been an increased, yet still limited, number of studies investigating structured adult-led sport and exercise interventions as treatment for adolescents with mild to moderate mental health problems. This review aimed to identify studies evidencing the role of structured adult-led sport and exercise interventions for adolescents aged 10–19 experiencing a range of mild to moderate common mental health problems (i.e. anxiety disorder, depression, obsessive-compulsive disorder, panic disorder and post-traumatic stress order). Existing systematic reviews have largely focused on one mental health problem, depression, highlighting a need to identify and synthesise other existing studies on structured sport and exercise interventions as treatment for other mental health problems. Further, existing systematic reviews have focused on ages 12–18 years and have included both supervised and unsupervised sport and exercise interventions. For example, Carter et al. (2016a) examined the treatment effect of physical exercise on depressive symptoms for adolescents aged 13–17 years and Radovic et al. (2017) determined whether exercise reduces depressive symptoms amongst adolescents with depression aged 12–18 years. NICE (2019) guidelines

recommend structured and supervised exercise interventions for adolescents and with evidence that half of all mental health problems begin by the age of 14 or younger (Collins et al., 2013; World Health Organisation, 2017), there is a need to identify structured and supervised sport and exercise interventions aimed at this population, and evaluate their efficacy.

Our main aim was to ascertain whether structured sport and exercise interventions for adolescents aged 10–19 years, experiencing mild to moderate mental health problems, can improve mental health outcomes. Our secondary aims were to identify (i) which mental health outcomes are commonly reported, (ii) which measurements are used to determine change, (iii) which types and intensities of sport and exercise interventions are reported, (iv) and the impact of deliverers.

Methods

Protocol registration

This review is reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (2020). A protocol for this review is registered with PROSPERO.

Eligibility criteria

Eligible studies were published since 2007 (Mental Health Act, 2007) until the date of systematic search on 21.02.2022 and included qualitative and quantitative intervention studies. A secondary systematic search was conducted on 19.09.2023 covering 21.02.2022–19.09.2023 to ensure all eligible studies are included. Due to fundamental changes made in 2007 to the 1983 Mental Health Act informing the decisions about mental health care, studies conducted prior to 2007 were not included. Key fundamental changes to the act that are relevant to this systematic review include; involvement of patients in planning, developing and delivering care and treatment appropriate to them; views of carers and other interested parties are considered; focus on effectiveness of treatment. Additionally, definition and application of medical treatment was altered in 2007. Therefore, we deemed studies conducted prior to 2007 to have utilised different clinical practice and used different guidelines. Studies were restricted to those written in the English language. Study characteristics were assessed and defined using PICOS (Participants, Intervention, Comparator, Outcome, Study design) to identify relevant sources.

Eligibility

P – Participants

World Health Organization (WHO) defines an adolescent as any person between ages 10 and 19 years. Therefore, studies were included if intervention participants were aged between this range. There were no limits on study participants in terms of sex, gender or ethnicity. NICE (2011) categorises mental health problems using three levels: Level 1 - A mild mental health problem where a person has a small number of symptoms that

have a limited effect on their daily life. Level 2 - A moderate mental health problem where a person has further symptoms that can make their daily life much more difficult than usual. Level 3 – A severe mental health problem where a person has many symptoms that can make their daily life extremely difficult. Participant samples presenting mild to moderate mental health problems based on these definitions were eligible for inclusion. Mild to moderate mental health problems were included due to limited research available looking specifically at adolescents with mild to moderate mental health problems and structured sport and exercise intervention. Any clinical diagnosis of mental health problems included in the studies also formed part of the quality assessment at full text extraction. Studies including people outside 10–19 years, and those with severe and major mental health problems were excluded.

I – Intervention

Studies were included if interventions used adult led structured sport or exercise as the main component with the aim to improve the mental health of adolescents with mild to moderate mental health problems. Included interventions were not restricted to a certain length of time e.g. three weeks, 12 weeks, on-going programme. All intervention settings were eligible for inclusion e.g. school, youth centre, sports stadium, leisure centre. Excluded studies were those that solely focused on non-sport/exercise groups.

C – Comparator or Control

Studies included at least one of the following comparison conditions: no treatment, waiting list, CBT, medication, treatment as usual (however defined), a psychosocial intervention, and an educational intervention. As there was no limit in the inclusion to RCTs, control group was not possible.

O – Outcome Measures

The primary outcome was the effectiveness of the intervention on the improvement of the mental health problem (through a range of measures using both quantitative and qualitative methods). According to NICE (2011), mild to moderate mental health disorders include generalised anxiety disorder, depression, obsessive-compulsive disorder, panic disorder and post-traumatic stress disorder. Other mental health disorders outside of the NICE definition – such as gaming disorders and substance use disorders were included but not explicitly searched for.

S – Study Design

All studies using an intervention design were included. Cross-sectional and observational studies were not included.

Information sources

A systematic review search was performed on 21.02.2022 covering the period of 2007 to 21.02.2022. A secondary systematic review search was performed on 19.09.2023 covering the period of 21.02.2022 to 19.09.2023. Both searches employed a multi-step process. Initially, the Cochrane Library and PROSPERO were searched for relevant reviews to

avoid duplication. A comprehensive search of the following electronic databases was then performed: Web of Science, PsycINFO, PubMed, SPORTDiscus, Scopus. Once all appropriate articles were identified, cited references were hand searched for further appropriate articles.

Search strategy

A combination of terms from medical subject headings and keyword variants were used to identify records. See Table 1 for search terms, organised by PICOS that were used and adapted to each database search.

Study selection

Records were imported into Mendeley (Mendeley, 2023) software and duplicates were removed by BK. All titles and abstracts were screened according to inclusion/exclusion criteria followed by full text screening for eligibility independently by BK and FK. Any discrepancies in decision making were discussed and resolved with CS or AMC.

Data collection process

Two reviewers (BK, FK) independently extracted and inserted data from the included articles into Excel (Microsoft Excel 2016), using a predefined data extraction form guided by PICOS and Template for Intervention Development and Replication (TIDieR) framework (Hoffmann et al., 2014). The PICOS form included general information about authors, publication year, study title, journal, type of publication, source, country of origin and study design. Participant characteristics included sample size, age range, sex, ethnicity, and mental health problem. Intervention characteristics included type of sport or exercise, duration, number of people or groups, provider, setting, mental health measures and follow-up. Interventions were described using the TIDieR framework, where relevant information such as intervention fidelity, tailoring, adaptations, provider, number of sessions, procedure, delivery, materials, type, and length of the intervention were recorded. It was noted if a control or comparison group was used. Outcome data recorded aim, main outcome, mental health problems measured, and measures used.

Table 1. Eligibility criteria based on PICOS study characteristics and search terms.

Concept	Search terms
Participants	'young people' OR 'young person' OR adolescen* OR youth OR teen* OR studen*. NOT adult OR 'older people' OR elderly
Intervention	physical activity' OR sport OR exercise AND intervention OR 'therapeutic intervention' OR treatment OR therapy OR program OR programme OR provision
Comparator	None specified
Outcome	'mental illness' OR 'mental health problems' OR anxiety OR depression OR 'generalized anxiety disorder' OR 'obsessive-compulsive disorder' OR OCD OR 'panic disorder' OR 'post-traumatic stress disorder' OR PTSD OR 'social anxiety disorder'. NOT severe mental health problems' OR 'major mental health problems' OR 'severe mental illness' OR 'major mental illness' OR severe OR major)
Study design	None specified

Synthesis of results

The effectiveness of structured sport and exercise interventions with any available measurement of the primary mental health problem was reported based on PICOS eligibility. A meta-analysis was not possible due to the variety of outcomes and study designs; therefore, a narrative synthesis was performed. This involved collating study findings into a coherent textual narrative, with descriptions of differences in characteristics of the studies including context and validity. Narrative synthesis is a method commonly used in systematic reviews where it may not be appropriate, or possible, to meta-analyse estimates of intervention effects (Campbell et al., 2018). Mental health as a concept is broad and there are no consistent tools within the literature. Therefore, it was not possible to calculate and include a single effect size for this review.

Risk of bias and certainty assessment in individual studies

Two reviewers (BK, FK) independently assessed the quality of the eligible studies using the critical appraisal tool relevant to mixed studies reviews, the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018). The tool permits an appraisal of the methodological quality of five categories of studies: qualitative research, randomised controlled trials, non-randomised studies, quantitative descriptive studies, and mixed methods studies. First, the MMAT was used to respond to the two screening questions: 'Are there clear research questions?' and 'Do the collected data allow to address the research questions?' If the study was appropriate for further appraisal, the quality of each study was ranked from 25% – 100% by answering 'yes', 'no' or 'can't tell' to a series of questions. All questions from the tool were used to assess the quality of the eligible studies. Examples include, (i) Are there clear qualitative and quantitative research questions or objectives, or a clear mixed methods question or objective?, (ii) Are the sources of qualitative and quantitative data relevant to address the research question or objective?, (iii) participant randomisation (are participants recruited in a way that minimises selection bias?), (iv) appropriate measures are measurements appropriate (clear origin, or validity known, or standard instrument?), (v) response rate (is there an acceptable response rate (60% or above?), (vi) comparison groups and (vii) complete outcome data is there complete outcome data (80% or above). The quality of the eligible studies using the MMAT are detailed further in the results section. In line with other published systematic literature reviews (e.g., Williams et al., 2021) and recommended ways to present the study quality using the MMAT (Hong et al., 2018), total scores for the critical appraisal have been reported.

Results

Study selection

A total of 2518 titles and abstracts were initially identified from the search criteria on 21.02.2022. Of these, 514 duplicates were removed, leaving 2004 records to be screened. Of these, 1991 titles and abstracts were excluded, leaving 13 articles for full text review. A total of nine of these articles met the inclusion criteria and were included in data extraction which are shown in [Figure 1](#). A total of 988 titles and abstracts were identified from the secondary search on 19.09.2023. Of these, 277 duplicates were removed, leaving 711

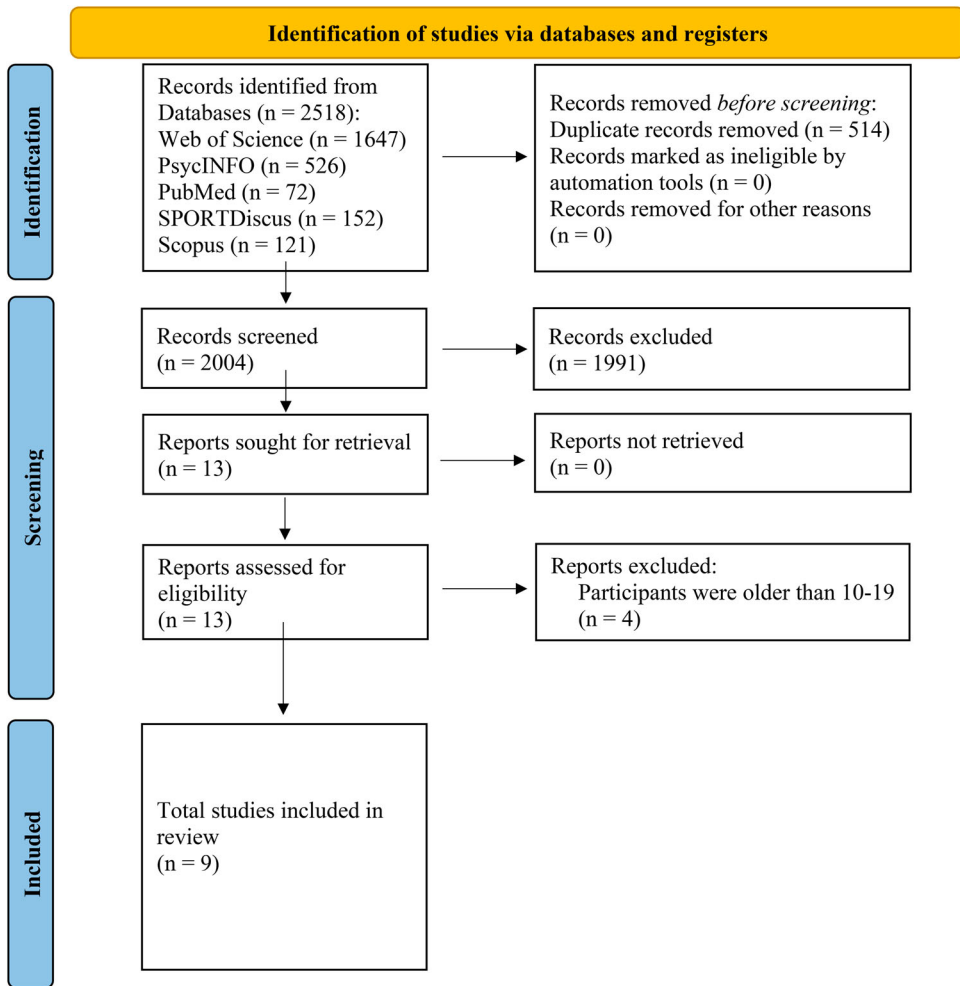


Figure 1. PRISMA (2020) data chart for article selection process February 2022.

records to be screened. Of these, 706 titles and abstracts were excluded, leaving five articles for full text review. A total of zero of these articles met the inclusion criteria which are shown in [Figure 2](#). From 3506 studies screened, a total of nine articles met the inclusion criteria and were included in data extraction.

Study characteristics

Of the nine included articles, one study was qualitative and used semi-structured interviews (Carter et al., 2015), the remaining eight were quantitative. Of the eight quantitative studies, six were Randomized Control Trials (RCT) (Carter et al., 2016b; Costigan et al., 2017; Duberg et al., 2020; Khademi & Rahimi, 2012; Meng et al., 2018; Turner et al., 2017), one was a longitudinal study (Dowell et al., 2021) and one was a preliminary small-scale study (Addington et al., 2021).

The eligible articles were from six different countries, the majority in the United Kingdom (n = 3) (Carter et al., 2015; Carter et al., 2016b; Turner et al., 2017), followed

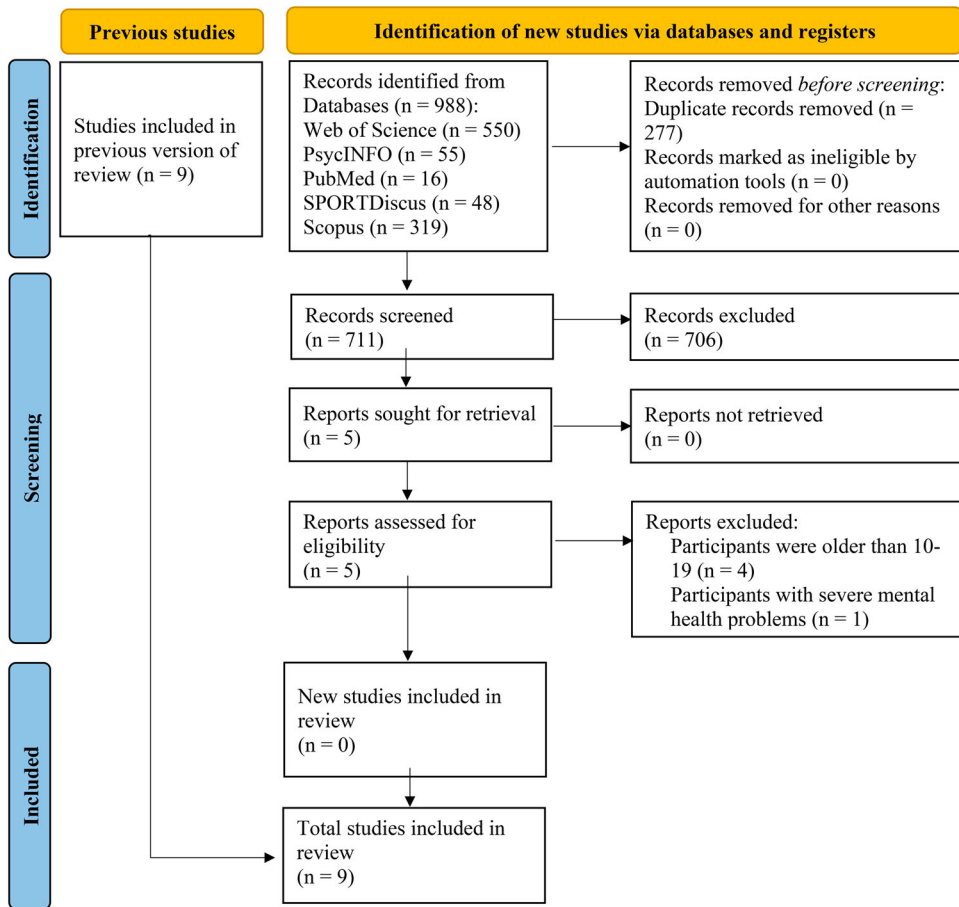


Figure 2. PRISMA (2020) data chart for article selection process September 2023.

by Australia (n = 2) (Costigan et al., 2017; Dowell et al., 2021), Canada (n = 1) (Addington et al., 2021), China (n = 1) (Meng et al., 2018), Iran (n = 1) (Khademi & Rahimi, 2012) and Sweden (n = 1) (Duberg et al., 2020). An overview of the study characteristics and findings can be found in Table 3.

Participant characteristics

A total of 645 individuals were included across the nine articles, with an age range of 12–18 years. Studies included 114 males and 428 females; the sex of 103 individuals was not specified. Only four studies detailed ethnicities and five different ethnicities were reported from those four, White-British, White European Australians, Australia's First People, Maori, Black and Caucasian (Addington et al., 2021; Carter et al., 2016b; Dowell et al., 2021; Turner et al., 2017).

Risk of bias and certainty assessment in individual studies

The MMAT (Hong et al., 2018) was used to assess study quality as shown in Table 2. In line with other published systematic literature reviews (e.g., Williams et al., 2021) and

Table 2. Mixed Methods Appraisal Tool (MMAT) scores.

Author (year)	MMAT Score				
	0%	25%	50%	75%	100%
1. Addington et al. (2021)				x	
2. Carter et al. (2015)					x
3. Carter et al. (2016b)				x	
4. Costigan et al. (2017)				x	
5. Dowell et al. (2021)				x	
6. Duberg et al. (2020)				x	
7. Khademi and Rahimi (2012)				x	
8. Meng et al. (2018)				x	
9. Turner et al. (2017)				x	

recommended ways to present the study quality using the MMAT (Hong et al., 2018), total scores for the critical appraisal have been reported. One study was rated 100% (Carter et al., 2015). Eight scored 75% (Addington et al., 2021; Carter et al., 2016b; Costigan et al., 2017; Dowell et al., 2021; Duberg et al., 2020; Khademi & Rahimi, 2012; Meng et al., 2018; Turner et al., 2017). The participants in Carter et al. (2015) were purposefully sampled for Carter et al. (2016b) study which means the principle of independence between these studies is violated. This had an impact on the MMAT score.

Interventions' effectiveness

As there are no consistent tools within the literature, there was a high heterogeneity in study measures and most measures were only included once. Therefore, it was not possible to calculate and include a single effect size. Carter et al. (2015), through semi structured interviews, found that group based, self-selected intensity circuit training was beneficial for depression with participants emphasising the importance of self-selected intensity for enjoyment and commitment to the programme. These findings were supported by Carter et al. (2016b) and Turner et al. (2017) where no effect on depressive symptoms was found at post-intervention after six weeks, however, a statistically significant effect ($p = 0.03$) on depressive symptoms was found at six-month follow-up in favour of the self-selected intensity exercise intervention, compared to the non-exercise control/treatment as usual. No data was available against which type of control group the exercise group was most beneficial (e.g. talking therapy at CAMHS, CBT alone, medication etc.). The difference between exercise and non-exercise groups were also noted by Khademi and Rahimi (2012) who showed a significant decrease in cognitive anxiety ($p < 0.05$) after 8 weeks of sub-maximal group aerobic exercise and a significant decrease in cognitive and somatic anxiety ($p < 0.05$) after eight weeks maximal group aerobic exercise. No significant effect was seen in the control group who did not participate in any intervention. Similarly, Addington et al. (2021), reported significant clinical improvements in anxiety and depression (data not shown) for their group aerobic exercise intervention. Additionally, Costigan et al. (2017) highlight the positive impact of group HIIT interventions for adolescents' mental health where they found that mean feeling state scores improved from pre-workout to post-workout in both HIIT conditions, Aerobic Exercise Programme (AEP) and Resistance Aerobic Programme (RAP), with significant results for the AEP ($p = 0.001$). The positive impact of dance was mentioned in Duberg et al. (2020)'s reporting of their RCT where, at the first follow-up (eight months post

Table 3. Summary of data extraction to understand the effectiveness of structured sport and exercise interventions in enhancing the mental health of adolescents with mild to moderate mental health problems.

Authors (Year) Country	Title of Article	Study Type Methods Control or Comparator	Sample Size	Participant Details Age Range Sex	Mental Health Problem Measures Used	Setting Deliverers	Type of Structured Sport and Exercise Intervention Length of the intervention Other Co-Treatment or Medication Taken	Main Findings and Effect Sizes
Addington et al. (2021) Canada	Pilot Aerobic Exercise Intervention for Youth At-Risk for Serious Mental Illness	Quantitative Preliminary Small- Scale Study Sport and Exercise Intervention Group with mild mental health problems compared to group with moderate mental health problems	41	Ages 17.7 (3.4) Male (n = 12) Female (n = 29)	Anxiety and Depression Social Interaction Anxiety Scale. K-10 Distress Scale. Beck Depression Inventory-II	Fitness Facility Professional Fitness Coach, and a Research Assistant	A Group-Based Aerobic Exercise 16 weeks, 3 times per week No co- treatment or medication taken reported	Effect data not shown. Reported significant clinical improvements in anxiety and depression but not distress over time.
Carter et al. (2015) UK	Exercise for Adolescents with Depression: Valued Aspects and Perceived Change	Qualitative Study Semi-Structured Interviews No control group as qualitative study	26	Ages 14–17 Male (n = 5) Female (n = 21)	Depression Children's Depression Inventory 2nd Edition	Setting not stated Qualified Exercise Therapist and Two Additional Staff Members of The Project	A Group-Based Circuit Training 6 weeks, 2 times per week. Co- treatment or medication taken reported	Effect size data not available as qualitative study. Two categories were reported as findings: 1)Valued aspects of the intervention – The importance of choice; A sense of achievement; Being distracted; Feeling calm; Routine. 2)Perceived change – Physiological change; Emotional change; Psychological Change; Behavioural Change; A cycle of change

(Continued)

Table 3. Continued.

Authors (Year) Country	Title of Article	Study Type Methods Control or Comparator	Sample Size	Participant Details Age Range Sex	Mental Health Problem Measures Used	Setting Deliverers	Type of Structured Sport and Exercise Intervention Length of the intervention Other Co-Treatment or Medication Taken	Main Findings and Effect Sizes
Carter et al. (2016b) UK	Preferred Intensity Exercise for Adolescents Receiving Treatment for Depression: a Pragmatic Randomised Controlled Trial	Quantitative Pragmatic Randomised Controlled Trial Sport and Exercise Intervention A group-based circuit training group compared to non- exercise group/ treatment as usual	87	Ages 14–17 Male (n = 19) Female (n = 68)	Depression The Children’s depression inventory 2. The EuroQol group EQ- 5D-5 L and EQ-VAS.	Setting not stated Qualified Exercise Therapist and Two Additional Staff Members of the Project	A Group-Based Circuit training 6 weeks, 2 times per week. 6 months follow up Co- treatment or medication taken reported	No effect on depressive symptoms post- intervention. Significant effect ($p =$ 0.03) on depressive symptoms at six- month follow-up in favour of the self- selected intensity exercise intervention compared to non- exercise control
Costigan et al. (2017) Australia	High-Intensity Interval Training for Cognitive and Mental Health in Adolescents	Quantitative Randomised Controlled Trial Sport and Exercise Intervention Aerobic Exercise Programme (AEP), Resistance Aerobic Programme (RAP) and non-exercise control group	65	Ages 15.8 ± 0.6 Sex not stated	Anxiety and Depression The Kessler Psychological Distress Scale (K10). The Flourishing Scale. A one-item Feelings State questionnaire	School Research team	HIIT 8 weeks, 3 times per week. No co-treatment or medication taken reported	No significant effect but small improvements in executive function and psychological well- being in the AEP group; and moderate improvements in executive function and small improvements in well-being were observed for the RAP group. Feeling state scores improved from preworkout to postworkout in both HIIT conditions, Aerobic Exercise Programme (AEP) and Resistance Aerobic Programme (RAP), with

Dowell et al. (2021) Australia	Tackling Mental Health in Youth Sporting Programs: A Pilot Study of a Holistic Program	Quantitative Longitudinal Study Sport and Exercise Intervention No control group or comparator	74	Ages 12–15 Male (n = 36) 38 not specified	Anxiety and Depression The Revised Children's Anxiety and Depression Scale. The RCADS Depression Subscale (10 items)	Rugby clubs RISE Rugby League Staff together with University-Based Clinical and Developmental Mental Health Experts.	Rugby 5-months, 4 sessions each month No co-treatment or medication taken reported	significant effect for the AEP ($p = 0.001$) From pre – to post-program, boys' anxiety symptoms declined significantly ($p = 0.017$) with only a trend-level reduction in depression
Duberg et al. (2020) Sweden	The Effects of a Dance Intervention on Somatic Symptoms and Emotional Distress in Adolescent Girls: A Randomised Controlled Trial	Quantitative Randomised Controlled Trial Sport and Exercise Intervention Dance intervention compared to non-exercise control group	112	Ages 13–18 Female (n = 112)	Anxiety Questions from Swedish survey 'Life and Health – Young People' in line with the questions from 'Health Behavior in School-aged Children'	Dance studio Dance Teachers	Dance 8 months, 2 times per week No co-treatment or medication taken reported	No significant difference between the groups at 8 months follow up. Significant effect in reduction in somatic symptoms ($p = 0.021$) and emotional distress ($p = 0.023$) at the follow-up after 12 months within the dance intervention group compared to the non-exercise control group
Khademi and Rahimi (2012) Iran	Effects of 8-Week Maximal and Sub-Maximal Aerobic Exercises on High School Students' Anxiety	Quantitative Randomised Control Trial Sport and Exercise Intervention Sub-maximal aerobic exercise group 1, maximal aerobic exercise group 2 and non-exercise control group	90	Ages 14–18 Female (n = 90)	Anxiety Competitive State Anxiety Inventory-2	Setting not stated Deliverers not stated	Running 8 weeks, 3 times per week No co-treatment or medication taken reported	Group 1 after 8 weeks sub-maximal group aerobic exercise showed significant decrease in cognitive anxiety ($p < 0.05$) and group 2 after 8 weeks maximal group aerobic exercise showed significant decrease in cognitive and somatic anxiety ($p < 0.05$). No significant effect in non-exercise control group

Table 3. Continued.

Authors (Year) Country	Title of Article	Study Type Methods Control or Comparator	Sample Size	Participant Details Age Range Sex	Mental Health Problem Measures Used	Setting Deliverers	Type of Structured Sport and Exercise Intervention Length of the intervention Other Co-Treatment or Medication Taken	Main Findings and Effect Sizes
Meng et al. (2018) China	A Randomised Controlled Trial of Mindfulness-Based Tai Chi Chuan for Subthreshold Depression Adolescents	Quantitative Randomised Controlled Trial Sport and Exercise Intervention Mindfulness-based Tai Chi Chuan group compared to non-exercise group		Ages 16–19 Male (n = 23) Female (n = 41)	Depression Nine- item patient health questionnaire depression scale. The Chinese version of the Perceived Stress Scale	Gymnasium Qualified coach	Mindfulness-based Tai Chi Chuan (MTCC) 8 weeks, 2 times per week No co-treatment or medication taken reported	Significant decrease in depression ($p < 0.001$) and stress level ($p <$ 0.001) after 8-week MTCC when compared with non-exercise control group
Turner et al. (2017) UK	Cost-Effectiveness of a Preferred Intensity Exercise Programme for Young People with Depression Compared with Treatment as Usual: an Economic Evaluation Alongside a Clinical Trial in the UK	Quantitative Randomised Controlled Trial Sport and Exercise Intervention A group-based circuit training group compared to non- exercise group/ treatment as usual	86	Ages 14–17 Female (n = 67) Male (n = 19)	Depression The Children's depression inventory 2	Setting not stated Qualified Exercise Therapists and Two Additional Staff Members	A Group-Based Circuit training 6 weeks, 2 times per week. 6 months follow up Co- treatment or medication taken reported	No effect on depressive symptoms post- intervention. Significant effect ($p =$ 0.03) on depressive symptoms at six- month follow-up in favour of the self- selected intensity exercise intervention compared to non- exercise control

intervention), there was no significant difference between the groups, but a significantly greater reduction was found in somatic symptoms ($p = 0.021$) and emotional distress ($p = 0.023$) at 12 months post intervention compared to the control group. Dowell et al. (2021) longitudinal study of a rugby intervention showed that from pre- to post-program, males' anxiety symptoms declined significantly ($p = 0.017$). Additionally, the RCT on mindfulness-based Tai Chi Chuan (TTCC) for sub-threshold depression by Meng et al. (2018) showed a decrease in adolescents' depression ($p < 0.001$) after an eight-week intervention.

Mental health outcomes reported and measurements

Two mental health problems were reported as primary outcomes. Depression was most commonly measured as a primary outcome ($n = 7$ studies) (Addington et al., 2021; Carter et al., 2015; Carter et al., 2016b; Costigan et al., 2017; Dowell et al., 2021; Meng et al., 2018; Turner et al., 2017). The second mental health problem reported was anxiety as a primary outcome ($n = 5$) (Addington et al., 2021; Costigan et al., 2017; Duberg et al., 2020; Dowell et al., 2021; Khademi & Rahimi, 2012). No other mental health problem was included in any outcomes. Studies used 13 different questionnaires as measurement tools (See Table 3), there was a high heterogeneity in study measures and most measures were only used once. Only three studies reported whether adolescents required or were receiving other mental health support or were taking medication alongside the sport and exercise interventions sessions (Carter et al., 2015; Carter et al., 2016b; Turner et al., 2017).

Implementation of the studies

Six different modes of sport and exercise were mentioned: a group-based circuit training, High-Intensity Interval Training (HIIT), dance, group based aerobic exercise, mindfulness-based Tai Chi Chuan (MTCC) and rugby. Four studies did not indicate where the intervention took place, four studies took place in an indoor venue and one outdoor. No studies measured the impact of the intervention taking place indoor or outdoor. The intervention deliverers had a variety of roles and previous training (a professional fitness coach together with a research assistant; a qualified exercise therapist together with two additional staff members of the project research team; RISE Rugby League staff together with university-based clinical and developmental mental health experts; dance teachers and a qualified coach). No studies measured the impact of deliverers on mental health outcomes or engagement and/or adherence. Therefore, no conclusions can be made about the impact of deliverers. Six different lengths of interventions were implemented in the included studies (See Table 3). Six weeks, two sessions per week ($n = 3$ studies), eight weeks, three sessions per week ($n = 2$ studies), 16 weeks, three sessions per week ($n = 1$), five months, four sessions per month ($n = 1$), eight months, two sessions per week ($n = 1$), and eight weeks, two sessions per week ($n = 1$). No studies investigated the effect of the length of the sessions or how long the sport and exercise intervention took place. Only two studies investigated the exercise-intensity of the sessions (Carter et al., 2015; Carter et al., 2016b) and found that participants that used self-selected intensity sport and exercise, emphasised the importance of intensity choice on their enjoyment and commitment to the programme. Self-perceived physical exertion was measured

using the Borg Rating of Perceived Exertion (RPE) scale and participants' heart rate was monitored. A mean percentage of maximum heart rate of approximately 50% and a mean RPE value of approximately 10 suggest that the participants preferred to exercise, on average, at a low intensity. No other study investigated intensity or participants' choice of sport and exercise intervention.

Summary of studies

A synthesised narrative of the overall results provides evidence that structured sport and exercise interventions can support young people with mild to moderate mental health problems. One study found that a self-selected intensity sport and exercise intervention was beneficial for depression, and participants emphasised the importance of intensity choice on their enjoyment and commitment to the programme (Carter et al., 2015; Carter et al., 2016b; Turner et al., 2017). Carter et al. (2015) and Carter et al. (2016b) highlighted that the participants generally preferred to exercise at a low intensity. No other study investigated intensity or participants choice about sport and exercise interventions. All group-based sport and exercise interventions (group based preferred intensity circuit training, group based aerobic exercise, HIIT, rugby, Tai Chi Chuan, dance) showed some clinical improvements in either anxiety or depression (Addington et al., 2021; Carter et al., 2015; Carter et al., 2016b; Costigan et al., 2017; Dowell et al., 2021; Duberg et al., 2020; Khademi & Rahimi, 2012; Meng et al., 2018; Turner et al., 2017).

Discussion

The aim of this review was to ascertain whether structured sport and exercise interventions for adolescents experiencing mild to moderate mental health problems can improve mental health outcomes. Secondary aims were to identify (i) which mental health outcomes are commonly reported, (ii) which measurements are used to determine change, (iii) and which types and intensities of sport and exercise interventions are reported, (iv) and the impact of deliverers.

Effectiveness of sport and exercise interventions on adolescents' mild to moderate mental health problems

Our synthesis of nine studies that met the inclusion criteria demonstrated that structured sport and exercise interventions can be beneficial to support the treatment of depression and anxiety for adolescents. This supports research in adults (Patel et al., 2007; Vigo et al., 2016). Findings from this review can only be generalised to mild and moderate anxiety and depression in adolescents. No peer-reviewed studies measured other common mental health problems as a primary or secondary outcome, for example, obsessive-compulsive disorder, post-traumatic stress disorder, and panic disorder (NICE, 2011). Also, no studies measured other less common (in this age group) but increasing mental health disorders – such as gaming disorders, eating disorders or substance use disorders. Hegberg et al. (2019) highlighted the paucity of research on common and other mental health problems and suggested this may be due to the financial, logistical, and technical resources required to carry out research in these areas. This, along with the small number of studies

meeting the inclusion criteria included in this review, demonstrates that common and other mental health problems beyond depression and anxiety are under researched within structured sport and exercise interventions for adolescents. Further research should consider and include these conditions.

Mental health outcomes and measurements in sport and exercise interventions

Two mental health problems were reported as primary outcomes. Depression was most commonly measured as a primary outcome ($n = 7$ studies), followed by anxiety ($n = 5$). Thirteen different validated scales were used to measure mental health. The two most common measurements were the Children's Depression Inventory 2 ($n = 3$) (Carter et al., 2015; Carter et al., 2016b; Turner et al., 2017) and K-10 Distress Scale ($n = 2$) (Addington et al., 2021; Costigan et al., 2017). No studies used the same combination of questionnaires and some used questionnaires specific to the country where the research was being conducted. This did not allow an analysis on effectiveness. Future studies could elaborate on the rationale for the chosen measurement for their study above other measures. Aligned with recommendations made in a recent policy brief, a more standardised way of measuring and reporting these measures would be useful (Smith et al., 2022). This report calls for more high-quality research within sport and exercise interventions for the treatment and support of adolescents' mental health.

Implementation of sport and exercise interventions

All sport and exercise interventions included in this review were group based and showed some clinical improvements in either anxiety or depression. Group based sport and exercise interventions can provide an opportunity for adolescents to connect with others and get a break from distressing thoughts while having fun doing something they enjoy (Coakley, 2020). However, it is also noted that numerous adolescents drop out from or do not want to join sport and exercise groups because they are not having fun, are experiencing bullying or pressure from coaches and parents, causing negative outcomes on mental health (Dangi & Witt, 2018). Fitzgerald et al. (2012) explain that to avoid those negative experiences and negative outcomes on mental health, peer-support is becoming more important within sport and exercise interventions. All studies within this review were adult-led. It is therefore important to investigate the potential of peer-led interventions in future research. Additionally, no study discussed the impact of contextual factors, such as being indoors or outdoors in nature. Four studies did not indicate where the intervention took place, four studies took place in an indoor venue and one outdoor. Mnich et al. (2019) explain the beneficial effects of exercise in nature-based environments. Nigg et al. (2022) add that there is limited understanding of using outdoor exercise for treating mental health problems in adolescents. Such research may also be relevant to the discussion of specific guidelines for sport and exercise therapies to improve adolescents' mental health (Tost et al., 2019; Nigg et al., 2022). This further demonstrates the need to consider intervention development and delivery tailored for adolescents.

The mode or intensity of sport or exercise which might yield optimum mental health outcomes could not be determined through this review as there were six different modes

with a variety of intensities. The modes of sport and exercise could be sub-grouped into those linked with team sports (e.g. Rugby), exercises around relaxation and a focused mind (e.g. Tai Chi Chuan), group based aerobic exercises (e.g. circuit training, aerobic exercises, dance) or group based anaerobic exercises (e.g. HIIT). Further investigation is required to understand the affective responses to specific exercises, sports, and intensities. Grouping the modes of sport and exercise this way would allow for better understanding of the type and intensity of sport or exercise that may be the most beneficial to supporting the mental health of adolescents, and how social factors may influence any benefits. Pascoe et al. (2020) found, in their scoping review, that moderate to vigorous intensity exercise may be beneficial for reducing depression. However, they also found evidence to support other intervention intensities. It is important to consider the appropriate length of intervention. NICE (2019) states that structured and supervised exercise programmes for adolescents should typically consist of up to three sessions per week of moderate duration (45 min to 1 h) for between 10 and 14 weeks. However, no studies followed this recommendation per se. Therefore, it cannot be stated whether these recommendations are optimal for adolescents. Also, Carter et al. (2016b) and Turner et al. (2017) found no effect on depressive symptoms post-intervention after six weeks, however at six month follow up the effect was significant. Similarly, Duberg et al. (2020) found no significant effect at eight months follow up post intervention, but the effect was significant at 12 months follow up post intervention. This highlights the need for future studies to clearly specify descriptions of the exercise interventions detailing the type, intensity, frequency and duration for replication purposes, supported with appropriate quantifiable measures of the mental health problem, and measured at appropriate times.

As the intervention deliverers, within the studies, varied according to their roles and previous training, the impact of different deliverers could not be determined through this review. The deliverers' expertise and training will likely influence how the interventions are delivered. Qualified mental health therapists may have gone through extensive training to support adolescents' mental health depending on their level of focus on mental health support but have less training on sport and exercise coaching. Conversely, sport and fitness coaches may be qualified to coach their specific sport or exercise but have less specific mental health knowledge. As Costigan et al. (2017) explain, adolescents may feel more comfortable around sport or fitness coaches compared to therapists due to the stigma that surrounds accessing therapy for mental health (Williams et al., 2023). Therefore, future studies should investigate the role of the intervention deliverer and whether different deliverers, their training, and the context in which they deliver the session can influence the impact of sport and exercise programmes on adolescents' mental health.

Only three studies reported whether adolescents required or were receiving other mental health support or were taking medication alongside the sport and exercise interventions sessions (Carter et al., 2015; Carter et al., 2016b; Turner et al., 2017). Sport and exercise interventions alone may not be sufficient to support the mental health of adolescents (Smith et al., 2022). It is therefore important that individuals have access to, and consider, other therapies alongside sport and exercise (Johnston et al., 2021). This would allow researchers to explore the impact of delivering sport and exercise intervention together with other therapies such as talking therapies.

Limitations and future directions of research conducted

Due to heterogeneity in study designs, types of mental health problems encountered, sport and exercise interventions performed, and mental health outcomes reported, the synthesis of the data extracted from this review was limited to a narrative approach. Some studies did not use a control group when implementing a change in practice (Addington et al., 2021; Dowell et al., 2021) or did not state the setting where the intervention took place (Carter et al., 2015; Carter et al., 2016b; Khademi & Rahimi, 2012; Turner et al., 2017). Only a small number of studies were included in this systematic review and many of them had small sample sizes, and three studies used the same cohorts of participants or intervention (Carter et al., 2015; Carter et al., 2016b; Turner et al., 2017). Considering that in England (NHS Digital, 2021), findings show that rates of probable mental disorders have increased in 6- to 16-year-olds and in 17- to 19-year-olds to one in six (17.4%), it is important that future research draws from larger populations with better quality research methods, to provide a wider generalisation of results.

No study distinguished differences between adolescents' reactions, understanding or preference about structured sport and exercise interventions and other therapies. There are challenges with adolescents' engagement with traditional mental health interventions, including getting adolescents to attend sessions, children feeling that a small number of sessions is sufficient for their mental health and more are not needed, or difficulties within the family context that contribute towards drop out (O'Keeffe et al., 2019; Schlimm et al., 2021). These additional contextual issues may also impact the effectiveness of the traditional forms of mental health intervention (March et al., 2006; Romero, 2005). Structured sport and exercise interventions may be an effective alternative or adjunct to talking therapies or other therapies for that age group (Mammen & Faulkner, 2013). Therefore, future work should also explore and compare different treatment interventions for adolescents' mental health. Specifically, there is a large number of different treatment interventions taking place for adolescents which are not consistently and rigorously reported, and many of them are taking place without academic involvement which means evidence is not always reported (Smith et al., 2022).

By allowing broad search terms, this review was able to evaluate all types of structured sport and exercise interventions, common types of mental health problems (anxiety, depression, panic disorder, obsessive-compulsive disorder and post-traumatic stress disorder), ages 10–19 and all sexes. However, even with such a broad search, only nine studies met the inclusion criteria. We can conclude that structured sport and exercise interventions showed some clinical improvements in adolescents' anxiety or depression. However, the studies did not provide much information on the development and implementation of the sport and exercise intervention. Therefore, future research should look to understand important contextual factors to understand why and how interventions result in clinical improvements. More research is needed to identify which sport and exercise interventions are currently available within the sport, physical activity and mental health sector for adolescents who have mild to moderate mental health problem, how sport and exercise interventions need to be organised, which mental health outcomes are improved by which sport or exercise, and whether this differs by age, gender, mental health problem, and type of sport or exercise.

Strengths and limitations of the current review

This review is reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and a protocol for this review has been registered with PROSPERO. We aimed to achieve validity by providing details of the research process including study selection, data extraction and analysis, and ensuring the inclusion and exclusion criteria were applied to each study. Articles were also reviewed by two independent researchers. Interventions were described using the TIDieR framework (Hoffmann et al., 2014), where relevant information such as intervention fidelity, tailoring, adaptations, provider, number of sessions, procedure, delivery, materials, type, and length of the intervention were recorded. Nevertheless, the following limitations were identified for this systematic review. Firstly, the research question did not allow non structured or non-adult led interventions to be included, which may have excluded different types of physical activity interventions focusing on adolescents with mild to moderate mental health problems. Secondly, as the types of intervention deliverers within studies varied, it can be argued that delivery would differ between deliverers. This means the effectiveness may differ between deliverers, and future studies should further examine links between deliverers' attributes and characteristics and effectiveness.

Competing interests (include appropriate disclosures)

BK, FK, CS and AMC have no conflicts of interest to declare. No external funding to declare.

Availability of data and materials

Data is available from the corresponding author on reasonable request which will not conflict with the anonymity and confidentiality.

Authors' contributions

BK, FK, CS and AMC wrote the protocol for this work. BK conducted the review. BK and FK screened titles and abstracts with CS settling any discrepancies. BK and FK extracted data from all eligible articles. BK and FK coded data for the TIDieR checklist, with CS and AMC checking content. BK prepared this manuscript with FK, CS and AMC providing detailed comments on drafts. All authors have read and approved the final manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

References

Addington, J., Corbett, S., Farris, M. S., & MacQueen, G. (2021). Pilot aerobic exercise intervention for youth at-risk for serious mental illness. *Early Intervention in Psychiatry*, 15(3), 547–553. <https://doi.org/10.1111/eip.12977>

- Ahmed, D., Ho, W., Lee J, Y., Niekerk, R, L, V., Zayed, K, N. (2016). The adolescent age transition and the impact of physical activity on perceptions of success, self-esteem and well-being. *Journal of Physical Education and Sport*, 2016(3), 776-784. <https://doi.org/10.7752/jpes.2016.03124>
- Cambridge Dictionary. (2021). APA 7th edition: Sport. <https://dictionary.cambridge.org/dictionary/english/sport>.
- Campbell, M., Katikireddi, S. V., Thomson, H., Sowden, A., & McKenzie, J. E. (2018). Improving Conduct and Reporting of Narrative Synthesis of Quantitative Data (ICONS-Quant): protocol for a mixed methods study to develop a reporting guideline. *BMJ Open*, 8(2), <https://doi.org/10.1136/bmjopen-2017-020064>
- Carter, T., Guo, B., Turner, D., Morres, I., Khalil, E., Brighton, E., Armstrong, M., & Callaghan, P. (2015). Preferred intensity exercise for adolescents receiving treatment for depression: a pragmatic randomised controlled trial. *BMC Psychiatry*, 15), <https://doi.org/10.1186/s12888-015-0638-z>
- Carter, T., Morres, I., Meade, O., & Callaghan, P. (2016a). The effect of exercise on depressive symptoms in adolescents: A systematic review and meta-analysis. *Journal of the American Academy of Child & Adolescent Psychiatry*, 55(7), 580–590. <https://doi.org/10.1016/j.jaac.2016.04.016>
- Carter, T., Morres, I., Repper, J., & Callaghan, P. (2016b). Exercise for adolescents with depression: valued aspects and perceived change. *Journal of Psychiatric and Mental Health Nursing*, 23(1), 37–44. <https://doi.org/10.1111/jpm.12261>
- Caspersen, C. J., Christenson, G. M., & Powell, K. E. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Reports*, 100(2), 126–131. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1424733/>.
- Coakley, J. (2020). *Sports in society: Issues and controversies* (13th ed.). McGraw Hill.
- Coalter, F. (2007). *A wider social role for sport: Who's keeping the score?* Taylor & Francis. <https://doi.org/10.4324/9780203014615>.
- Collins, P. Y., Insel, T. R., Chockalingam, A., Daar, A., & Maddox, Y. T. (2013). Grand challenges in global mental health: Integration in research, policy, and practice. *PLoS Medicine*, 10(4), e1001434. <https://doi.org/10.1371/journal.pmed.1001434>
- Costigan, S., Eather, N., Plotnikoff, R., Hillman, C., & Lubans, D. (2017). High intensity interval training on cognitive and mental health in adolescents. *Journal of Science and Medicine in Sport*, 20, e108–e109. <https://doi.org/10.1016/j.jsams.2017.01.182>
- Dangi, T. B., & Witt, P. A. (2018). Why children/youth drop Out of sports. *Journal of Park and Recreation Administration*, 36, 191–199. <https://doi.org/10.18666/JPRA-2018-V36-I3-8618>.
- Dore, I., O'Loughlin, J. L., Schnitzer, M. E., Datta, G. D., & Fournier, L. (2018). The longitudinal association between the context of physical activity and mental health in early adulthood. *Mental Health and Physical Activity*, 14, 121–130. <https://doi.org/10.1016/j.mhpa.2018.04.001>
- Dowell, T. L., Waters, A. M., Usher, W., Farrell, L. J., Donovan, C. L., Modecki, K. L., Zimmer-Gembeck, M. J., Castle, M., & Hinchey, J. (2021). Tackling mental health in youth sporting programs: A pilot study of a holistic program. *Child Psychiatry & Human Development*, 52(1), 15–29. <https://doi.org/10.1007/s10578-020-00984-9>
- Duberg, A., Jutengren, G., Hagberg, L., & Möller, M. (2020). The effects of a dance intervention on somatic symptoms and emotional distress in adolescent girls: A randomized controlled trial. *Journal of International Medical Research*, 48(2), Article 030006052090261. <https://doi.org/10.1177/0300060520902610>
- Fitzgerald, A., Fitzgerald, N., & Aherne, C. (2012). Do peers matter? A review of peer and/or friends' influence on physical activity among American adolescents. *Journal of Adolescence*, 35(4), 941–958. <https://doi.org/10.1016/j.adolescence.2012.01.002>
- Grasser, L. R., & Javanbakht, A. (2021). Virtual arts and movement therapies for youth in the Era of COVID-19. *Journal of the American Academy of Child & Adolescent Psychiatry*, 60(11), 1334–1336. <https://doi.org/10.1016/j.jaac.2021.06.017>
- Hegberg, N. J., Hayes, J. P., & Hayes, S. M. (2019). Exercise intervention in PTSD: A narrative review and rationale for implementation. *Frontiers in Psychiatry*, 10. <https://doi.org/10.3389/fpsy.2019.00133>
- Hoffmann, T. C., Glasziou, P. P., Boutron, I., Milne, R., Perera, R., Moher, D., Altman, D. G., Barbour, V., Macdonald, H., Johnston, M., Lamb, S. E., Dixon-Woods, M., McCulloch, P., Wyatt, J. C., Chan, A. W.,

- & Michie, S. (2014). Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *BMJ*, 348(mar07 3), gg1687. <https://doi.org/10.1136/bmj.g1687>
- Hong, Q. N., Gonzalez-Reyes, A., & Pluye, P. (2018). Improving the usefulness of a tool for appraising the quality of qualitative, quantitative and mixed methods studies, themixed methods appraisal tool(MMAT). *Journal of Evaluation in Clinical Practice*, 24. <https://doi.org/10.1111/jep.12884>
- Johnston, S. A., Roskowski, C., He, Z., Kong, L., & Chen, W. (2021). Effects of team sports on anxiety, depression, perceived stress, and sleep quality in college students. *Journal of American College Health*, 69(7), 791–797. <https://doi.org/10.1080/07448481.2019.1707836>
- Khademi, A. R., & Rahimi, G. (2012). Effects of 8-week maximal and Sub-maximal aerobic exercises on high school students' anxiety. *Advances in Environmental Biology*, 6(8), 2226–2231. <http://www.aensiweb.com/old/aeb/2012/2226-2231.pdf>.
- Kristjánisdóttir, H., Ólafsdóttir, K. B., & Saavedra, J. M. (2018). Effects of exercise on depression and anxiety. A comparison to transdiagnostic cognitive behavioral therapy. *Community Mental Health Journal*, 54(6), 855–859. <https://doi.org/10.1007/s10597-017-0213-9>
- Lederman, O., Ward, P. B., Rosenbaum, S., Maloney, C., Watkins, A., Teasdale, S., Morell, R., & Curtis, J. (2020). Stepping up early treatment for help-seeking youth with at-risk mental states: Feasibility and acceptability of a real-world exercise program. *Early Intervention in Psychiatry*, 14(4), 450–462. <https://doi.org/10.1111/eip.12871>
- Malm, C., Jakobsson, J., & Isaksson, A. (2019). Physical activity and sports—real health benefits: A review with insight into the public health of Sweden. *Sports*, 7(5), 127. <https://doi.org/10.3390/sports7050127>
- Mammen, G., & Faulkner, G. (2013). Physical activity and the prevention of depression. *American Journal of Preventive Medicine*, 45(5), 649–657.
- March, J., Silva, S., & Vitiello, B. (2006). The treatment for adolescents With depression study (TADS). *Journal of the American Academy of Child & Adolescent Psychiatry*, 45(12), 1393–1403. <https://doi.org/10.1097/01.chi.0000237709.35637.c0>
- Mendeley. (2023). Mendeley. <https://www.mendeley.com>
- Meng, L., Zhang, J., Qin, S., Zhou, Y., Su, H., & Zhao, S. (2018). [CDATA[A randomized controlled trial of mindfulness-based Tai Chi Chuan for subthreshold depression adolescents]]. [CDATA [Neuropsychiatric Disease and Treatment]], Volume 14, 2313–2321. <https://doi.org/10.2147/NDT.S173255>
- Mental Health Act. (2007). APA 7th edition: Mental Health Act 2007. https://www.legislation.gov.uk/ukpga/2007/12/pdfs/ukpga_20070012_en.pdf.
- Mind. (2017). APA 7th edition: Get Set to Go programme evaluation summary. <https://www.mind.org.uk/media-a/4785/get-set-to-go-research-summary-report.pdf>.
- Mind. (2017, October). APA 7th edition: Mental health problems – an introduction. <https://www.mind.org.uk/information-support/types-of-mental-health-problems/mental-health-problems-introduction/treatment-options/>.
- Mind. (2021). APA 7th edition: Physical activity and mental health. <https://www.mind.org.uk/about-us/our-policy-work/sport-physical-activity-and-mental-health/>.
- Mnich, C., Weyland, S., Jekauc, D., & Schipperijn, J. (2019). Psychosocial and physiological health outcomes of green exercise in children and adolescents—A systematic review. *International Journal of Environmental Research and Public Health*, 16(21), 4266. <https://doi.org/10.3390/ijerph16214266>
- Mullen, S. (2018). Major depressive disorder in children and adolescents. *Mental Health Clinician*, 8(6), 275–283. <https://doi.org/10.9740/mhc.2018.11.275>
- National Institute for Health and Care Excellence. (2011, May 25). APA 7th edition: *Common mental health problems: identification and pathways to care*. <https://www.nice.org.uk/guidance/cg123/ifp/chapter/common-mental-health-problems>.
- National institute for health and care excellence. (2019, June 25). APA 7th edition: *NICE guideline. depression in children and young people: identification and management*.<https://www.nice.org.uk/guidance/ng134/chapter/Recommendations>.
- NHS. (2018, Mar 2). APA 7th edition: *Exercise for depression*. <https://www.nhs.uk/conditions/stress-anxiety-depression/exercise-for-depression/>.

- NHS. ((2019, Apr 11). APA 7th edition: *Children and young people's mental health services (CYPMHS) - help for children and young people*. <https://www.nhs.uk/mental-health/nhs-voluntary-charity-services/nhs-services/children-young-people-mental-health-services-cypmhs-children-information/>.
- NHS. (2021, Aug 4). APA 7th edition: *Exercise*. <https://www.nhs.uk/live-well/exercise/>.
- NHS Digital. ((2020, Apr 17). APA 7th edition: *Clinical Classifications*. <https://digital.nhs.uk/services/terminology-and-classifications/clinical-classifications>.
- NHS Digital. (2020, Jan 20). APA 7th edition: *Lifestyles*. <https://digital.nhs.uk/data-and-information/areas-of-interest/public-health/lifestyles>.
- NHS Digital. (2021, Sept 30). APA 7th edition: *Mental Health of Children and Young People in England 2021 - wave 2 follow up to the 2017 survey*. <https://digital.nhs.uk/data-and-information/publications/statistical/mental-health-of-children-and-young-people-in-england/2021-follow-up-to-the-2017-survey>.
- Nigg, C., Schipperijn, J., Hennig, O., Petzold, M. B., Rulf, E., Meyer-Lindenberg, A., Tost, H., Ebner-Priemer, U. W., & Reichert, M. (2022). Time to go green? Nature-based physical activity as potential treatment for mental disorders. *Sports Psychiatry*. <https://doi.org/10.1024/2674-0052/a000018>.
- O'Keeffe, S., Martin, P., Target, M., & Midgley, N. (2019). 'I just stopped going': A mixed methods investigation into types of therapy dropout in adolescents With depression. *Frontiers in Psychology, 10*, <https://doi.org/10.3389/fpsyg.2019.00075>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ, 372*(71), <https://doi.org/10.1136/bmj.n71>
- Pascoe, M. C., Bailey, A. P., Craike, M., Carter, T., Patten, R., Stepto, N. K., & Parker, A. G. (2020). Exercise interventions for mental disorders in young people: a scoping review. *BMJ Open Sport & Exercise Medicine, 6*(1), e000678. <https://doi.org/10.1136/bmjsem-2019-000678>
- Patel, V., Flisher, A. J., Hetrick, S., & McGorry, P. (2007). Mental health of young people: a global public-health challenge. *The Lancet, 369*(9569), 1302–1313. [https://doi.org/10.1016/S0140-6736\(07\)60368-7](https://doi.org/10.1016/S0140-6736(07)60368-7)
- Radovic, S., Gordon, M. S., & Melvin, G. A. (2017). Should we recommend exercise to adolescents with depressive symptoms? A meta-analysis. *Journal of Paediatrics and Child Health, 53*(3), 207–321. <https://onlinelibrary.wiley.com/doi/10.1111/jpc.13426>.
- Romero, A. J. (2005). Low-income neighborhood barriers and resources for adolescents' physical activity. *Journal of Adolescent Health, 36*(3), 253–259. <https://doi.org/10.1016/j.jadohealth.2004.02.027>
- Schlimm, K., Loades, M., Hards, E., Reynolds, S., Parkinson, M., & Midgley, N. (2021). 'It's always difficult when it's family. . . whereas when you're talking to a therapist. . .': Parents' views of cognitive-behaviour therapy for depressed adolescents. *Clinical Child Psychology and Psychiatry, 26* (4), 1018–1034. <https://doi.org/10.1177/13591045211013846>
- Smith, A., Kinnafick, F., & Rogers, E. (2022). *Moving for mental health: How physical activity, sport and sport for development can transform lives after COVID-19*. Sport for Development Coalition/Mind.
- Smith, B., & McGannon, K. R. (2018). Developing rigor in qualitative research: problems and opportunities within sport and exercise psychology. *International Review of Sport and Exercise Psychology, 11*(1), 101–121. <https://doi.org/10.1080/1750984X.2017.1317357>
- Telford, R. M., Telford, R. D., Cochrane, T., Cunningham, R. B., Olive, L. S., & Davey, R. (2016). The influence of sport club participation on physical activity, fitness and body fat during childhood and adolescence: The LOOK Longitudinal Study. *Journal of Science and Medicine in Sport, 19*(5), 400–406. <https://doi.org/10.1016/j.jsams.2015.04.008>
- Thivel, D., Tremblay, A., Genin, P. M., Panahi, S., Rivière, D., & Duclos, M. (2018). Physical activity, inactivity, and sedentary behaviors: definitions and implications in occupational health. *Frontiers in Public Health, 6*, 288. <https://doi.org/10.3389/fpubh.2018.00288>
- Tost, H., Reichert, M., Braun, U., Reinhard, I., Peters, R., Lautenbach, S., Hoell, A., Schwarz, E., Ebner-Priemer, U., Zipf, A., & Meyer-Lindenberg, A. (2019). Neural correlates of individual differences in affective benefit of real-life urban green space exposure. *Nature Neuroscience, 22*(9), 1389–1393. <https://doi.org/10.1038/s41593-019-0451-y>

- Turner, D., Carter, T., Sach, T., Guo, B., & Callaghan, P. (2017). Cost-effectiveness of a preferred intensity exercise programme for young people with depression compared with treatment as usual: an economic evaluation alongside a clinical trial in the UK. *BMJ Open*, 7(11), e016211. <https://doi.org/10.1136/bmjopen-2017-016211>
- Vigo, D., Thornicroft, G., & Atun, R. (2016). Estimating the true global burden of mental illness. *The Lancet Psychiatry*, 3(2), 171–178. [https://doi.org/10.1016/S2215-0366\(15\)00505-2](https://doi.org/10.1016/S2215-0366(15)00505-2)
- Williams, J., Chater, A., Zakrewski-Fruer, M., Shorter, J., W, G., & Howlett, N. (2023). What roles does physical activity play following the death of a parent as a young person? A qualitative investigation. *BMC Public Health*, 23), <https://doi.org/10.1186/s12889-022-14542-6>
- Williams, J., Chater, A. M., Zakrewski-Fruer, J., Shorter, G. W., & Howlett, N. (2021). Can physical activity support grief outcomes in individuals Who have been bereaved? A systematic review. *Sports Medicine - Open*, 7(7), <https://doi.org/10.1186/s40798-021-00311-z>
- World Health Organisation. (2017). APA 7th edition: *Adolescents and mental health*. https://www.who.int/maternal_child_adolescent/topics/adolescence/mental_health/en/.
- World Health Organisation. (2020). APA 7th edition: *Adolescents health*. https://www.who.int/health-topics/adolescent-health/#tab=tab_1.
- World Health Organization. (2016). APA 7th edition: *Growing up unequal: gender and socioeconomic differences in young people's health and well-being*. https://www.euro.who.int/__data/assets/pdf_file/0003/303438/HSBC-No.7-Growing-up-unequal-Full-Report.pdf.
- World Health Organisation. (1993). APA 7th edition: *The ICD-10 classification of mental and behavioural disorders: diagnostic criteria for research*. <https://apps.who.int/iris/handle/10665/37108>.