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Title: A Systematic Review of the Impact of Physical Activity Programmes on Social and Emotional Wellbeing in At-Risk Youth

Running title: Review of Physical Activity Programmes for At-Risk Youth

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Abstract

Background: Physical activity programmes have been identified as a potential strategy for improving social and emotional wellbeing in at-risk youth, who have a prevalence of depression and low self-esteem exceeding the general population. **Methods:** A systematic search of six electronic databases (EMBASE, OVID MEDLINE, PsychINFO, PubMed, Scopus, and SPORTDiscus) was conducted to identify physical activity programmes designed to improve social and emotional wellbeing in at-risk youth. **Results:** Our search identified 15 studies, which reported the effects of three types of physical activity interventions (i.e. outdoor adventure, sport and skill-based and physical fitness programmes) on social and emotional wellbeing. While many of the interventions resulted in significant positive effects, the risk of bias was high in all of the included studies. **Conclusion:** Due to the mixed findings and the high risk of bias, it is difficult to determine the efficacy of physical activity programmes for improving social and emotional well being in at-risk youth.

Key Practitioner Message:

- Physical activity programmes have the potential to improve social and emotional wellbeing in at-risk youth, but more rigorous trials are needed to evaluate their effectiveness.
- As none of the studies included long-term follow-ups (i.e. greater than 12-months), it remains untested whether the benefits associated with participation in physical activity programmes are sustained once youth return to their daily routines.
- The quality of existing studies is poor and has not improved since earlier reviews.
- Physiological and psychosocial factors may explain the beneficial effects of physical activity programmes on social and emotional wellbeing in at-risk youth.

- Clinicians working with at-risk youth are encouraged to consider specific physical activity programmes to support social and emotional wellbeing and general health in this group.

Key words: Activity level; health psychology; mental health; intervention; resilience

1 **Introduction**

2 There is strong evidence for the beneficial effects of physical activity on
3 musculoskeletal health, cardiovascular health, and adiposity in youth (Strong, et al., 2005). In
4 addition, an active lifestyle is associated with improved mental health in young people
5 (Ekeland, Heian, & Hagen, 2005; Parfitt & Eston, 2005). It is therefore not surprising that
6 physical activity programmes have been identified as a potential strategy for improving social
7 and emotional wellbeing in ‘at-risk’ youth (Collingwood, 1997; MacMahon, 1990; West &
8 Crompton, 2001), as these individuals are characterised by a number of conditions and
9 psychopathologies, with a prevalence of depression and low-self-esteem exceeding the
10 general population (Gendron, Royer, Bertrand, & Potvin, 2004; MacMahon, 1990).

11 ‘At-risk’ or ‘disaffected’ youth are children and adolescents who live in a negative
12 environment and/or do not possess the skills and values that assist them in becoming
13 responsible members of society (Collingwood, 1997). Disaffection is a complex and
14 multidimensional phenomenon that may manifest itself in different ways including
15 disengagement from mainstream activities, disruptive or antisocial behaviour and
16 involvement in criminal activity (Sandford, Armour, & Warmington, 2006). Disaffection may
17 lead to social isolation and partly explain the low levels of participation in structured physical
18 activity programmes observed among at-risk youth (Burton & Marshall, 2005; Duncan,
19 Duncan, Strycker, & Chaumeton, 2002).

20 Existing physical activity programmes for such at-risk youth can be broadly classified
21 into three groups: i) outdoor adventure programmes, ii) sport and skill-based programmes and
22 iii) physical fitness programmes. The mechanisms by which the three types of programmes
23 confer their benefits may differ and a description of their characteristics is necessary. Outdoor
24 recreation programmes generally involve experiential learning and are based on the belief
25 that learning and behaviour change can be achieved through direct experience (Gass, 1993;

West & Crompton, 2001). Programmes generally involve a range of physical activities such as rock climbing, orienteering and canoeing and may involve camping trips away from families. A previous review examining the impact of adventure programmes for at-risk youth found strong evidence for a positive effect on self-concept (West & Crompton, 2001), but noted that the methodological quality of the included studies was poor.

Organised sport programmes provide youth with an opportunity to participate in team and individual sport competitions and may result in positive outcomes through developmentally appropriate designs and positive child-adult (parent/coach) relationships (Fraser-Thomas, Cote, & Deakin, 2005). Skill-based programmes are generally targeted toward younger children and are focused on the development of motor skills, rather than participation in sport. Although there is debate as to what sport programmes actually achieve (Sandford, et al., 2006), they do provide youth with an opportunity to accrue health benefits through physical exertion, develop pro-social behaviours through positive interactions with others and achieve skill mastery (Robinson, Rudisill, & Goodway, 2009). Several reviews have espoused the potential benefits of sport and skill-based interventions for at-risk youth (Fraser-Thomas, et al., 2005; Martinek & Hellison, 1997; Sandford, et al., 2006), however, their conclusions have been based on limited evidence from empirical studies.

Physical fitness programmes involve exercise (e.g., resistance training, aerobics and circuit training) designed specifically to improve health-related fitness (i.e., cardio-respiratory fitness, muscular fitness, flexibility and body composition). Participation in physical exercise has been found to have both immediate and long-term beneficial psychological effects (Ekland, et al., 2005). For example, individuals often report feeling better after exercising and evidence from previous reviews suggest that exercise programmes may improve self-esteem and reduce depression in children and adolescents (Ekland, et al., 2005; MacMahon, 1990).

Previous reviews reporting the effects of outdoor education (West & Crompton, 2001) and physical fitness (MacMahon, 1990) programmes in at-risk youth were published over ten years ago. More recent reviews of the potential benefits of sport and skill-based interventions for at-risk youth have been descriptive in nature and not included risk of bias assessments (Fraser-Thomas, et al., 2005; Sandford, et al., 2006). Therefore this review provides both an update of the existing literature, and a critical review of the three different types of physical activity programmes (i.e. outdoor education, sport and physical fitness) for at-risk youth. As such, the primary aim of this review is to describe the effectiveness of physical activity interventions to improve social and emotional wellbeing in at-risk youth. Social and emotional well being is a broad term that includes feelings, behaviour, relationships, goals and personal strengths necessary for positive health and well being. It includes an individual's "ability to identify and understand one's feelings, accurately read and comprehend emotional states in others, manage strong emotions and their expression, regulate one's behaviour, develop empathy for others, and establish and sustain relationships" (Australian Institute of Health and Welfare, 2009, p. 60). A secondary aim is to evaluate the quality of existing studies and provide recommendations for future studies.

Identification of studies

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement (Moher, Liberati, Tetzlaff, & Altman, 2009) guided the conduct and reporting of this review. A systematic search of six electronic databases (EMBASE, OVID MEDLINE, PsychINFO, PubMed, Scopus, and SPORTDiscus) was conducted on the 21st December 2010. A professional librarian developed individualised search strategies for the different databases using combinations of the following key words: (child OR children OR adolescent OR youth OR young person OR juvenile OR teen OR teenager) AND (delinquent OR 'at risk' OR 'high risk' OR troubled OR antisocial OR disaffected OR depressed OR depression)

1 AND (physical activity OR exercise OR sport OR fitness OR recreation). Published articles
2 in peer reviewed journals were considered for the review. In the first stage of the literature
3 search, titles and abstracts of identified articles were checked for relevance and additional
4 articles known to the authors were assessed for possible inclusion. In the second stage, full-
5 text articles were retrieved and considered for inclusion. In the final stage, the reference lists
6 of retrieved full-text articles were searched.

7 *Criteria for inclusion/exclusion*

8 Two authors independently assessed the eligibility of the studies for inclusion using the
9 following criteria: (i) participants were aged 4 to 18 years, (ii) participants were disaffected or
10 “at risk” youth, including those experiencing behavioural difficulties, (iii) study involved the
11 implementation of an outdoor education, exercise, sport or sport skills intervention/programme
12 using a randomised controlled trial, quasi-experimental design or a single group pre-test post-
13 test design, (iv) included quantitative assessment of social and emotional wellbeing (e.g.,
14 depression, anxiety, self-concept, self-esteem, resilience), (v) published in English.

15 Participants with eating disorders and diagnosed psychiatric conditions were not included in the
16 review. Conference abstracts, dissertations, theses and articles published in non-peer reviewed
17 journals were not included in the review.

18 *Risk of bias assessment*

19 Studies were assessed for ‘risk of bias’ using criteria adapted from the Consolidated
20 Standards of Reporting Trials (CONSORT) statement by two authors independently (Moher, et
21 al., 2010). A ‘risk of bias’ score for each study was completed on a 6-point scale by assigning
22 a value of 0 (absent or inadequately described) or 1 (explicitly described and present) to each
23 of the following questions listed: (i) Were the groups comparable at baseline on key
24 characteristics (yes, if stratified baseline characteristics were reported and groups were similar;
25 no, if study did not include baseline information or a control/comparison group)? (ii) Did the

study include a control group and was the process of randomization clearly described and adequately carried out (e.g. envelope or algorithm)? (iii) Did the study report a power calculation and was the study adequately powered to detect intervention effects? (iv) Were the assessors blinded to treatment allocation at baseline and posttest? (v) Did the study report the numbers of participants who completed baseline and follow-up assessments and did at least 80% of participants complete follow-up assessments? (vi) Did the study account for potential differences at baseline in the analyses? Studies that scored 0-2 were regarded as having a high risk of bias, studies that scored 3-4 were classified as having a medium risk of bias and those that scored 5-6 were classified as having a low risk of bias.

Results

Overview of studies

The flow of studies through the review process is reported in Figure 1. Our search identified 15 studies that evaluated the effects of physical activity programmes on social and emotional wellbeing in at-risk children and adolescents (Table 1). Seven studies evaluated the effects of outdoor adventure programmes (Bloemhoff, 2006; Cross, 2002; Green, Kleiber, & Tarrant, 2000; Kaiser, Smith, Heleski, & Spence, 2006; Minor & Elrod, 1994; Pommier & Witt, 1995; Wu & Hsieh, 2006), seven studies evaluated the effects of sport and skill-based interventions (Basile, Motta, & Allison, 1995; Bonnette, McBride, & Tolson, 2001; Goodway & Rudisill, 1996; Maiano, Ninot, Morin, & Bilard, 2007; Palermo, et al., 2006; Robinson, et al., 2009; Tester, Watkins, & Rouse, 1999) and two studies reported the effects of physical fitness programmes (Basile, et al., 1995; Collingwood, Sunderlin, & Kohl, 1994). The majority of studies evaluated the effects of programmes among older children and adolescents, however, two studies (Goodway & Rudisill, 1996; Robinson, et al., 2009) reported the effects of motor skill interventions in at-risk preschool children.

**** Insert Figure 1 here****

1 did not improve social and emotional wellbeing (Kaiser, et al., 2006; Minor & Elrod, 1994).
2 The duration of the adventure programmes ranged from four hours (Bloemhoff, 2006) to
3 three months (Minor & Elrod, 1994). The adventure programmes included a range of
4 activities including rock climbing, ropes courses, horse riding, orienteering, sailing and
5 canoeing. Two of the courses included family training components to support positive family
6 relationships (Minor & Elrod, 1994; Pommier & Witt, 1995).

7 *Sport and skill-based programmes*

8 Both interventions targeting at-risk preschool children focusing on the development of
9 fundamental movement skills resulted in significant improvements in perceived physical
10 competence (Goodway & Rudisill, 1996; Robinson, et al., 2009). While Tester and
11 colleagues (1999) reported that the Singapore's Sports Challenge International Programme
12 improved self-esteem in at-risk children and adolescents, their failure to include a control
13 group makes it difficult to determine the true intervention effect. Additional benefits were
14 identified by Palermo and colleagues (2006) who found that a 10-month karate programme
15 helped to improve temperament in children with social cognitive and disruptive behaviours.
16 Two sport-based programmes targeting at-risk adolescent boys (Bonnette, et al., 2001) and
17 adolescent boys with conduct disorders (Maiano, et al., 2007) did not significantly improve
18 physical self-perceptions. Basile and colleagues (1995) compared the effects of a skill
19 mastery intervention to a fitness programme and a no treatment control and found that neither
20 programme significantly improved self-concept in children with behavioural disorders. The
21 skill mastery programme provided participants with an opportunity to achieve mastery on a
22 single motor task (i.e. basketball free throw) without substantial physical exertion.

23 *Physical fitness programmes*

24 Two studies reported the effects of physical fitness programmes for at-risk youth
25 (Basile, et al., 1995; Collingwood, et al., 1994). Collingwood and colleagues (1994) reported

significant improvements in self-concept in a large sample of at-risk adolescents following their participation in the First Choice Fitness leaders programme. However, their failure to include a control group and the high risk of bias in this study, make it difficult to interpret the intervention effects. Alternatively, the fitness programme evaluated by Basile et al (1995) did not improve self-concept in a group of children with behavioural disorders. The fitness programme consisted of jogging and walking around the school playground for 20 minutes. The programme also incorporated an obstacle course and additional activities to facilitate participant involvement and motivation.

Discussion

The primary aim of this review was to describe the effectiveness of physical activity interventions to improve social and emotional wellbeing in at-risk youth. While the majority of studies included in this review did not assess their impact on direct indicators of mental health, outcomes such as self-concept (Ali, Fang, & Rizzo, 2010), self-esteem (Bolognini, Plancherel, Bettschart, & Halfon, 1996), and resilience (Masten, 2007) are considered to be important protective factors against mental illness. For example, resilience is strongly associated with social competence, a sense of purpose, self awareness, a sense of belonging, problem solving, and critical thinking (Masten, 2007). These outcomes are of particular importance for at-risk youth, who tend to have low levels of resilience and lack the social-emotional skills necessary to recover from adverse circumstances (Collingwood, 1997).

There is some evidence to suggest that outdoor adventure, sport and physical fitness programmes have the potential to improve social and emotional wellbeing in at-risk youth. However, these findings should be treated with caution due to the high risk of bias in all of the studies reviewed. Clinicians working with at-risk youth are encouraged to consider specific physical activity programmes to support social and emotional wellbeing and general health in this group. They should be aware of the conditions under which these programme

are likely to be of benefit to young people and vigilant to the potential for an absence of clinically significant effects.

Outdoor adventure programmes

Despite considerable heterogeneity in the types of interventions and study populations, it appears that outdoor adventure programmes have the potential to improve resilience and self-concept in at-risk youth. Of the seven adventure programmes included in this review, five resulted in significant improvements in measures of social and emotional wellbeing. Our findings are consistent with a previous review of adventure programs for at-risk youth (West & Crompton, 2001), which found significant positive changes in self-concept in 14 of the 16 studies reviewed. The authors concluded that outdoor education programmes may contribute to reducing the negative behaviours typically demonstrated by at-risk youth. While their findings were generally positive, the authors noted the high risk of bias in many of the studies and questioned the generalizability of the interventions, as most of the participants were white male adolescents.

It is not entirely clear which aspects of the outdoor adventure programmes are responsible for inducing psychological benefits and studies have included family components in addition to the adventure activities (Minor & Elrod, 1994; Pommier & Witt, 1995).

Although outdoor adventure programmes are generally delivered in the wilderness, an unfamiliar environment is perhaps the most important aspect of the experience (Gass, 1993). Adventure programmes tend to include traditional therapy techniques, such as self-reflection, and journal writing to encourage participants to process their experiences (West & Crompton, 2001). Calculated risk taking, the mastery of challenging tasks and positive social support from instructors and peers may explain the improvements in outcomes observed among at-risk youth attending outdoor adventure programmes. Unfortunately, the unfamiliar settings necessary for many outdoor education programmes limits their availability for many youth,

1 who may not have access to such activities and locations. Furthermore, it remains untested
2 whether the changes induced through participation in these programmes are sustained once
3 youth return to their daily routines.

4 *Sport and skill-based interventions*

5 While there is a growing interest in using sport programmes to re-engage disaffected
6 youth (Sandford, et al., 2006), empirical evidence supporting the utility of such programmes
7 is limited. The current review identified only six sport-based programmes for at-risk youth,
8 all with a high risk of bias. The Singapore Sports Challenge programme reported 44% and
9 18% improvements in self-esteem in at-risk children and adolescents, respectively. However,
10 no details of a control group were reported and it is unclear how many of the young people
11 were retained in the programme over the study period. The Singapore Sports Challenge was
12 based on an Australian programme and involved four trained sporting mentors (two males
13 and two females) working with 50 identified at-risk students. Using sport as the medium
14 students were taught preparation for life skills, including realistic goal setting, strategies to
15 address conflict resolution with peers and family, strategies to ask for adult support, stress
16 management, and promoting positive social behaviours in the outdoor setting and in the
17 classroom. In addition to the student programme, parents and teachers were involved in
18 workshops to develop new skills and support the work completed by the mentors. A novel
19 aspect of the programme was that the students continued to interact with mentors via the
20 internet and the mentors returned to the schools for a minimum of three years. This level of
21 ongoing support is unique to the Singapore Sports Challenge and may explain the strong
22 positive results of the programme.

23 Palermo and colleagues (2006) evaluated a 10-month karate programme in a sample
24 of children with social cognitive and disruptive behaviours. They found significant beneficial
25 effects on domains of temperament and noted that the improvements were evident at home, in

1 the dojo and in school. The study participants were included in a larger karate class of
2 typically developing youth who were unaware that the targeted children were involved in an
3 intervention. While the programme included physical exertion and motor skill development,
4 it also taught participants self-regulation, executive skills, goal-directed attention and
5 concentration. This type of intervention has considerable potential for engaging disaffected
6 youth and the combination of activity to develop fitness and self-discipline may explain the
7 improvements in temperament observed in this group.

8 The early childhood years are considered to be the golden years of skill development
9 and motor skill proficiency in childhood and adolescence is associated with a range of health
10 benefits (Lubans, Morgan, Cliff, Barnett, & Okely, 2010). Two studies reported the positive
11 effects of motor skill interventions on physical self-perception in at-risk preschool children
12 (Goodway & Rudisill, 1996; Robinson, et al., 2009). The evidence suggests that interventions
13 to improve motor skills in young children will also improve physical self-perceptions and
14 may, in turn, influence general self-concept and self-esteem. The longer-term effects of motor
15 skill programmes on psychological outcomes in young children are unknown, yet the short-
16 term effects suggest that this type of intervention is clearly warranted.

17 *Physical fitness programmes*

18 Our review included only two physical fitness programmes for at-risk youth, but
19 additional evidence for the beneficial effects of physical fitness programmes were published
20 prior to our review cut-off date (i.e., 1990) (Hilyer, et al., 1982; MacMahon & Gross, 1988).
21 and included in an earlier review (MacMahon, 1990). MacMahon (1990) reviewed studies
22 which reported the effects of exercise programmes on psychological outcomes in delinquent
23 adolescents. Whilst acknowledging that delinquent adolescents are a heterogeneous group, he
24 concluded that intensive aerobic exercise programmes have the potential to induce clinically
25 important improvements in self-esteem and depression. MacMahon and Gross (1988)

1 evaluated the effects of aerobic exercise on self-concept, depression and physical fitness in
2 juvenile delinquents. Participation in the exercise program resulted in improved self-concept,
3 mood, and fitness. Interestingly, improvements in psychological variables were not
4 dependent on improved physical fitness. In another study involving youth offenders, Hilyer
5 and colleagues (1982) evaluated the effects of a 20-week physical fitness program delivered
6 by counsellors. Participants in the training programme reported significant improvements in
7 social and emotional wellbeing at the completion of the study.

8 Not surprisingly, the fitness programme evaluated by Basile and colleagues (1995)
9 did not have a beneficial effect on self-concept in a group of children with behavioural
10 disorders. This intervention required the participants to jog and walk around a field for 20
11 minutes four times per week for four weeks. This type of exercise is unlikely to engage
12 children and may result in children developing negative attitudes toward physical activity.
13 Ideally physical fitness programmes should provide meaningful experiences for participants
14 and provide opportunities for youth develop physical activity behavioural skills, such as self-
15 monitoring, self-assessment and goal setting. Alternatively, Collingwood et al (1994)
16 reported beneficial intervention effects on self-concept in their large physical fitness leaders
17 programme for at-risk youth. The objective of the First Choice programme was to provide
18 alternative activities for at-risk youth that directly teach self-esteem, self-discipline and self-
19 responsibility through physical activity (Collingwood, et al., 1994). The programme included
20 three major components- youth fitness skills training programme, parent training module and
21 peer fitness leader's training. Although the study findings are compromised by
22 methodological weaknesses, the strategy of using at-risk youth as physical fitness leaders has
23 considerable promise. Unlike the First Choice programme which found that changes in
24 fitness were associated with changes in psychosocial outcomes, MacMahon and colleagues
25 (1988) found that improvements in psychological variables were not dependent on

improvements in physical fitness in an aerobic training programme for delinquent males. These findings suggest that there are multiple mechanisms responsible for improvements in social and emotional wellbeing in physical fitness programmes. Physiological hypotheses suggest that improvements in social and emotional wellbeing following exercise are due to changes in neurotransmitters such as noradrenalin or serotonin (MacMahon, 1990). Elevated endorphin levels induced by exercise bouts have been linked to several psychological and physiological changes, including changes in mood and exercise-induced euphoria (Harber & Sutton, 1984). Alternatively, psychological theories propose that physical fitness programmes provide individuals with a sense of achievement and mastery of body function which is associated improved wellbeing and self-esteem (MacMahon, 1990; Soenstroem & Morgan, 1989).

Risk of bias assessment

The risk of bias was high in all of the physical activity programmes reviewed. The quality of studies has not improved since earlier reviews of exercise (Ekeland, et al., 2005) and adventure programmes (West & Crompton, 2001), both of which, identified the methodological weaknesses of the included studies. Five of the 15 studies were randomised controlled trials and only one of these studies adequately described the process of randomisation. It was of additional concern that none of the studies included a power calculation to determine if their study was adequately powered to determine the hypothesized effects. Statistical significance is largely dependent upon sample size and future studies are encouraged to provide this information along with standardised intervention effect sizes using Cohen's *d*. The retention of study participants was rarely described and this has important implications for determining the efficacy of the evaluated programmes. For example, if a large percentage of participants withdraw from the intervention and the data are not analysed

1 using intention-to-treat principles, researchers may conclude that the intervention worked
2 even though many participants were dissatisfied with the programme.

3 *Potential mechanisms of physical activity on psychological wellbeing*

4 Knowledge regarding the mechanisms responsible for the effects of physical activity
5 programmes on psychological wellbeing is limited (Cerin, 2010). Physiological mechanisms,
6 such as alterations in fitness, neurotransmitters and endorphin levels (MacMahon, 1990),
7 along with improvements in self-control, self-mastery and positive social support may be the
8 possible mechanisms explaining the beneficial effects of physical activity programmes on
9 social and emotional wellbeing in at-risk youth. Unfortunately we were not able to determine
10 the different intervention components (e.g. additional therapy) necessary for inducing
11 improvements in psychological outcomes. We encourage researchers working in this area to
12 consider the different intervention components and test the potential mechanisms using
13 mediation analysis.

14 *Strengths and limitations*

15 To the authors' knowledge this is the first study to systematically review the impact of
16 physical activity programmes on social and emotional wellbeing in at-risk youth. Due to the
17 small number of studies and large heterogeneity in terms of study length, sample size,
18 assessment of outcomes and participants, it was not possible, or desirable to conduct a meta-
19 analysis of the included studies. The review was guided by the PRISMA statement and
20 studies were assessed for risk of bias using criteria adapted from the CONSORT statement.
21 Despite these strengths, there are some limitations that should be noted. First, our review did
22 not include studies published before 1990, thus decreasing the pool of eligible studies.
23 Studies published before this time, were not included because their results had been reported
24 in previous reviews and their methodological weaknesses would potentially compromise the
25 validity of our findings. Second, there is possible bias in the selection of studies because we

1 did not include abstracts, theses or studies published in non peer-reviewed journals. Third,
2 there was considerable heterogeneity in the types of participants included in the review. Our
3 predetermined definition of ‘at-risk’ was deliberately broad to include a wide range of studies
4 and participants, including children and adolescents. Consequently, our review included
5 programmes that targeted youth with clinical behavioural problems along with individuals
6 classified as at-risk due to a variety factors (e.g. single-headed household, poverty, parental
7 unemployment, low parental education, lack of stable home environment, parental drug
8 exposure, incarceration of a parent and loss of parent/sibling). Finally, our criteria used to
9 assess risk of bias were not extensive, the inclusion of additional items such as length of
10 follow-up assessment and treatment of missing data should be considered for inclusion in
11 future reviews.

12 *Conclusions*

13 While there have not been sufficient studies conducted to determine which types of
14 programmes are most suitable for the various subgroups, there is evidence that adventure,
15 sport and fitness programmes all have the potential to confer psychological benefits for at-
16 risk youth. While individual preference may determine which type of programme is the most
17 suitable for at-risk youth, it is recommended that clinicians recommend motor skill programs
18 for younger children. Motor skills are ideally learnt in early childhood (Gallahue & Ozmun,
19 2006) and both actual and perceived competency are predictive of physical activity among
20 children and adolescents (Lubans, et al., 2010; Wrotniak, Epstein, Dorn, Jones, & Kondilis,
21 2006). Young children considered at-risk may benefit from interventions to develop their
22 motor skills, which may contribute to improved self-esteem in the physical domain. Sports
23 programmes have many potential benefits for older children and adolescents (Fraser-Thomas,
24 et al., 2005; Martinek & Hellison, 1997; Sandford, et al., 2006), yet the true effects of sport-

1 based programmes may not be easily captured in experimental studies, due to the difficulty of
2 recruiting and retaining at-risk youth in programmes.

3 Finally, individuals working in child mental health practice are encouraged to
4 recommend physical fitness programmes for older adolescents who may be at-risk. There is
5 strong to support the benefits of physical activity on physiological health in youth (Strong, et
6 al., 2005) and some evidence to suggest that structured physical activity programmes
7 contribute to social and emotional wellbeing in at-risk youth. Physical fitness programmes
8 that provide meaningful challenges for individuals and an opportunity to improve fitness and
9 apply behavioural skills (e.g. goal setting, self-monitoring and self-assessment) have
10 demonstrated promise in promoting physical activity in the short-term (Lubans, Morgan,
11 Callister, & Collins, 2009; Schneider-Jamner, Spruijt-Metz, Bassin, & Cooper, 2004).
12 Individuals who develop a routine of participating in lifetime activities (e.g. weight training,
13 aerobics, circuit training etc.) that can be easily carried into adulthood are more likely to
14 become active adults (Corbin, 2002) and participation in such programmes may act as a
15 protective factor against mental illness in both the short and long-term.

16 Considering the high prevalence of depression and low-self-esteem in at-risk youth
17 (Gendron, et al., 2004; MacMahon, 1990), their low rates of participation in structured
18 physical activity programmes (Burton & Marshall, 2005; Duncan, et al., 2002) and the
19 potential of such programmes to improve social and emotional wellbeing, encouraging at-risk
20 youth to engage in physical activity programmes is justified. However, it remains untested
21 whether the improvements in social and emotional wellbeing associated with participation in
22 physical activity programmes are sustained once youth return to their daily routines. Until
23 there is evidence for the long-term benefits of physical activity programmes, clinicians
24 working with at-risk youth are encouraged to recommend physical activity programmes that
25 promote sustainable physical activity behaviour change.

1 *Acknowledgements*

2 The authors would like to thank Sarah Costigan for her assistance in the preparation of this
3 research paper.

4 *Key points*

- A physically active lifestyle is associated with improved mental health in young people.
- ‘At-risk’ or disaffected youth are characterised by a number of conditions and psychopathologies, with a prevalence of depression and low self-esteem exceeding the general population.
- Physical activity programmes have the potential to improve social and emotional wellbeing in at-risk youth, but more rigorous trials are needed to evaluate their effectiveness.
- Knowledge regarding the mechanisms responsible for the effects of physical activity programmes on psychological wellbeing is limited and should be explored in future trials.
- As the long-term effects of existing programmes have not been tested, clinicians working with at-risk youth are encouraged to recommend physical activity programmes that promote sustainable physical activity behaviour change.

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Table 1: Physical activity programmes for ‘at-risk’ youth

Study	Sample	Design	Outcomes	Description of intervention and groups	Analysis	Results
<i>Adventure education programmes</i>						
Minor and Elrod (1995)	45 adolescent offenders Age range 12-17 years	RCT	Self-concept (Self-Concept Scale) and locus of control (Locus of Control Scale).	3-month programme that included four job preparation workshops, an intensive 3-day outdoor adventure and seven family skill-building workshops. Individuals in the CON group were assigned to usual care.	ANCOVA	No significant intervention effects ($p > 0.05$).
Pommier and Witt (1995)	107 adolescent status offenders Age range 13-17 years	RCT	Self-perceptions and global self-worth (Self-Perception Profile for Adolescents).	Outward Bound School programme that included a family training component. The programme consists of a 14 day intake period followed by 6 programme phases: orientation, expedition, reunion, reinforcement and facilitation phases. Individuals in the CON group continued with their normal school, community and family participation routines.	ANCOVA	Significant improvements in self-perceptions ($p < 0.01$) and global self-worth ($p < 0.01$) at 4-week post-test. Some differences were not sustained at 4-month post-test.
Green et al (2000)	Treatment group were 25 at-risk adolescents Mean age 11.6 years Comparison group were 95 African-American adolescents Mean age 12.9 years Control group were 57 adolescents Mean age 12.6 years	QEXP	Resilience (subscales-neighbourhood resources, interested adults, sense of acceptance, levels of control of deviant behaviour, models of conventional behaviour, positive attitudes to the future, values attached to achievements, ability to work with others, ability to work out conflicts and enjoyment of activity) (Protective Factors Scale).	Adventure-based ropes course with an educational processing component. Including high elements (e.g. climbing poles), low elements (e.g. balance beams) and various skill building and games. Adolescents participated in the ropes-course activity for four hours, one day a week for 4- to 6-weeks. COMP group was a random sample of African American adolescents drawn from the larger summer program population. A	ANCOVA	Most of the resilience subscale scores improved significantly over study period compared to the COMP group (all scores, $p < 0.001$) and the non-treatment CON group (scores ranged, $p < 0.01$ to $p = 0.421$).

Cross (2002)	34 at-risk adolescents Age range 12-19 years	QEXP	Perceptions of alienation (Dean Alienation Scale) and personal control (New Multidimensional Measure of Children's Perception's of Control).	non-treatment CON group from one middle school was also included. CON group condition was not described. 5-day intensive rock climbing programme. Physically and psychologically demanding course designed to promote interpersonal and intrapersonal growth. Intervention included group and individual reflection sessions. CON group consisted of individuals from the same study school. COMP group condition was not described.	Independent t-test and ANOVA	Significant reductions in alienation ($p < 0.01$) and improvements in self-control ($p < 0.01$) observed in the intervention group.
Bloemhoff (2006)	106 at-risk adolescent boys from educational youth care centres Mean age 16 and 15.4 years	QEXP	Resilience (subscales- neighbourhood resources, interested adults, sense of acceptance, levels of control of deviant behaviour, models of conventional behaviour, positive attitudes to the future, values attached to achievements, ability to work with others, ability to work out conflicts and enjoyment of activity) (Shortened Protective Factors Scale).	4-hour adventure-based recreation programme. The ropes-based programme three elements- the balance beam, the two-line bridge and the multi-vine. COMP group condition was not described.	ANCOVA	Significant intervention effects for neighbourhood resources ($p = 0.003$), sense of acceptance ($p = 0.000$), models of conventional behaviour ($p = 0.008$), positive attitudes ($p = 0.000$), value attached to achievement ($p = 0.045$), ability to work with others ($p = 0.000$), ability to work out conflicts ($p = 0.002$) and enjoyment of activity ($p = 0.000$), but not for interested adults ($p = 0.076$) and levels of control of deviant behaviour ($p = 0.119$).
Kaiser et al (2006)	17 at-risk children Mean age 13.6 years	PRE-POST	Anger (Children's Inventory of Anger), anxiety (State-Trait Anxiety Inventory for Children)	Therapeutic riding programme consisting of a 1-hour riding session once/week for 8-weeks.	Paired t-test	No significant intervention effects for any of the outcomes ($p > 0.05$).

			and perceived self-competence (Self-Perception Profile for Children).			
Wu and Hsieh (2006)	12 at-risk adolescents Age range 11-17 years	PRE-POST	Self-concept (Tennessee Self-Concept Scale) and life effectiveness (including the following subscales: time management, social competence, achievement motivation, intellectual flexibility, task leadership, emotional control, active initiative, self-confidence and locus of control) (Life Effectiveness Questionnaire).	28-day outdoor education programme. Including rock climbing, ropes courses, horse riding, beach volleyball, sailing, canoeing, river-trekking, hiking, backpacking, first aid training and mountain climbing.	Paired samples t-test	Significant improvement in physical self-concept ($p = 0.01$). Significant improvements in most of the life effectiveness domains ($p < 0.05$).
<i>Sport and skill-based programmes</i>						
Goodway et al (1996)	59 at-risk children Age 4 years	RCT	Perceived competence and social acceptance (Pictorial Scale of Perceived Competence and Social Acceptance).	12-week motor skill intervention. Sessions last 45 minutes and included sustained activity, skill instruction and closure. Children in the CON group received their usual prekindergarten programme, which consisted of free play with motor skill equipment.	Repeated measures ANOVA	Improvements in perceived physical competence ($p = 0.01$). Perceived social acceptance increased in both INT and CON groups ($p = 0.03$).
Tester et al (1999)	445 at-risk children and 546 at-risk adolescents Age range 6-11 years and 12-16 years	PRE-POST	Self-esteem (self and school, self and others, self-worth, self and home and overall) (Song and Hattie Self-Concept Scale).	Duration of the programme varied from two 40 minute sessions for 14 weeks to three 90 minute sessions for 4-weeks. Through the medium of basketball and other sports at-risk youth are taught preparation for life-skills, such as realistic goal setting, strategies to address conflict,	No details provided.	Authors report a 44% and 18% improvements in overall self-esteem in children and adolescents, respectively (no statistics were reported).

				stress management and strategies to develop positive relationships.		
Bonnette et al (2001)	80 at-risk adolescent boys Age range 10-13 years	QEXP	Global self-worth (Self-Perception Profile for Children).	Two 3-week sport and skill-based camps. Boys allocated to sports skills instruction (SSI) or sports skills instructions plus initiative (SSI+) groups. The programme was delivered at an outdoor summer camp five times/week for three weeks. Boys in the SSI group participated in skill-related drills to improve technique, modified and regulation games. Boys in the SSI+ group also participated in initiative games and sessions involved a student-centred approach.	ANOVA	No significant change in global self-worth ($p > 0.05$).
Palermo et al 2006	16 children with social cognitive and disruptive behaviours Age range 8-10 years	RCT	Domains of temperament- intensity, adaptability and mood regulation (Cary Temperament Scale).	10-month karate programme with a frequency of three lessons/week. Classes included no actual fighting but followed a framework including a warm-up, the practice of skills and mimicking of combat situations. CON group condition was not described.	Mann-Whitney t-test	Significant improvements in intensity ($p = 0.000$), adaptability ($p = 0.27$) and mood regulation ($p = 0.036$) in INT group.
Maiano et al (2007)	24 adolescent boys with conduct disorders Age range 11-13 years	QEXP	Physical self-concept (overall physical self-worth, physical condition, sport competence, physical attractiveness and physical strength) and global self-esteem (Physical Self-Inventory).	Boys allocated to three groups: inter-establishment basketball (IEBB), integrated scholastic basketball (ISBB) and adapted physical activity COMP group. Boys in the IEBB and ISBB groups participated in basketball competitions for 18-months. Boys in the COMP group participated in a traditional	Repeated measures ANOVA	No significant changes in overall physical self-worth ($p = 0.24$, ES = 0.12), physical condition ($p = 0.06$, ES = 0.18), sport competence ($p = 0.58$, ES = 0.07), physical attractiveness ($p = 0.87$, ES = 0.04), and physical strength ($p = 0.53$, ES = 0.08) or global self-esteem ($p =$

				adapted physical activity program combining various numerous activities, such as tennis, volleyball, wrestling, and basketball.		0.19, ES = 0.13).
Robinson et al (2009)	117 at-risk children Age 4 years	QEXP	Perceived physical competence (Pictorial Scale of Perceived Competence and Social Acceptance).	Children were allocated to one of two 9-week motor skill interventions or a COMP group. The low autonomy (LA) intervention used an instructor-centred approach to learning skills. The mastery motivational climate (MMC) group used a student-directed approach. Children in the COMP group participated in unstructured free play 2 days/ week for 9 weeks.	Repeated measures ANOVA	At posttest the MMC participants reported significantly higher physical self-perception scores ($p = 0.01$), with no changes in the LA and COMP groups.
<i>Physical fitness programmes</i>						
Collingwood et al (1994)	455 at-risk adolescents Mean age 16.2 years	PRE-POST	Self-concept (Bilis Index of Adjustment and Values scale) and wellbeing (General Wellbeing scale).	A fitness leadership programme designed to teach self-esteem, self-discipline and self-responsibility through physical activity. Programme delivered over an 8-16 week period and includes: 1) exercise classes, 2) educational modules, 3) discussion modules and 4) individual exercise programme maintenance.	Paired samples t-tests	Significant improvements in self-concept ($p < 0.001$). No change in wellbeing.
Basile et al (1995)	58 children with behavioural disorders Age range 7-13 years	RCT	Self-concept (behaviour, intellectual and school status, physical appearance, anxiety, popularity and happiness) (Piers-Harris Children's Self-Concept Scale).	Children randomized to three groups: exercise, mastery and CON group. The programmes were delivered 4 times a week for 4 weeks. The exercise group participated in 20 minutes of jogging and walking. The mastery group were	ANCOVA	Neither treatment group produced increases in self-concept relative to the control group ($p > 0.05$ for all subscales).

provided with opportunities to develop
proficiency in a range of unfamiliar motor
skills. CON group received no
intervention.

Abbreviations: RCT = randomised controlled trial, QEXP = quasi-experimental study design, PRE-POST = pre-test post-test design without a control group; CON = control, COMP = comparison; INT = intervention; ES = effect size.

Table 2: Risk of bias assessment

Studies	i) Were the groups comparable at baseline on key characteristics?	ii) Did the study include a control group and was the process of randomization clearly described and adequately carried out?	(iii) Did the study report a power calculation and was the study adequately powered to detect intervention effects?	(iv) Were the assessors blinded to treatment allocation at baseline and posttest?	(v) Did at least 80% of participants complete follow-up assessments?	(vi) Did the study account for potential differences at baseline in the analyses	Total
Minor and Elrod (1995)	0	0	0	0	1	1	2
Pommier and Witt (1995)	0	0	0	0	0	1	1
Green et al (2000)	0	0	0	0	1	1	2
Cross (2002)	1	0	0	1	0	0	2
Bloemhoff (2006)	0	0	0	0	1	1	2
Kaiser et al (2006)	0	0	0	0	1	0	1
Wu and Hsieh (2006)	0	0	0	0	1	1	2
Goodway et al (1996)	1	0	0	0	0	1	1
Tester et al (1999)	0	0	0	0	0	1	1
Bonnette et al (2001)	0	0	0	0	0	1	1
Palermo et al (2006)	1	0	0	0	0	0	1
Maiano et al (2007)	1	0	0	0	0	1	2
Robinson et al (2009)	0	0	0	0	1	1	2
Collingwood et al (1994)	0	0	0	0	0	1	1
Basile et al (1995)	0	1	0	0	0	1	2

Figure 1: Flow of studies through the phases of the systematic review

