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Universal Prevention Depression

Physical Activity and Exercise as a Universal Depression Prevention in Young People: A Narrative Review

Running title: Universal Prevention Depression

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This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: [10.1111/eip.12737](https://doi.org/10.1111/eip.12737)

Abstract

Aim: The aim of this narrative summary was to examine the efficacy of physical activity and exercise as a universal prevention for depression in young people.

Methods: We conducted a search of the literature in the open-access evidence database of controlled trials and systematic reviews in youth mental health, an initiative between Orygen, The National Centre of Excellence in Youth Mental Health and headspace, National Youth Mental Health Foundation. In April 2018, we searched for all papers published between 1980-2017 relating to “Depressive Disorder” under the “Universal Prevention” illness stage and classified as “Physical activity/Exercise” under the treatment/intervention classification. Systematic reviews, randomised control trials and controlled clinical trials were all included.

Results: A total of 11 papers were returned. Three of these studies were observational and eight studies were controlled trials. The reviewed studies indicate that exercise and physical activity might be an effective universal depression prevention intervention for young people. Three of the controlled studies had a passive control group or no control group and only one study had longer-term follow-up. No trial used a longitudinal design to determine if interventions prevent the onset of new cases of depression.

Conclusions: The studies reviewed in the current review demonstrate a bidirectional relationship between physical activity, exercise and adolescent mental health. The results of the current review suggest that physical activity and exercise programs designed to increase the level of activity in young people should be implemented to be attractive and achievable to young people that may have poor psychological health.

Key words: Adolescent, Depression, Mood, Movement, Well-being.

Introduction

Depression is a serious mental illness (Gore et al., 2011a) and is the leading cause of disability in adolescents and young adults worldwide (Gore et al., 2011b). Depression is highly prevalent in young people and is most likely to have its first onset in adolescence (Australian Bureau of Statistics, 2010). At present, at least one quarter of young people will experience an episode of depression before 19 years of age (Lewinsohn, Rohde, & Seeley, 1998). The associated adverse consequences of depression can be life-long and include increased risks of recurrence (Fergusson & Woodward, 2002),

poor social functioning, reduced academic achievement, and reduced employment security (Fergusson & Woodward, 2002), as well a greater risk of suicide and self-harm (Gould et al., 1998). Many young people do not recover from an episode of depression despite treatment with the best available evidence-based approaches, such as cognitive behavior therapy (Brent, 2006). Given the scope and impact of depression in young people, and the poor recovery rates, effective prevention methods are desperately needed and would have significant impact in public health.

An increasing body of evidence indicates that physical activity and exercise are effective for improving mood and preventing mood disorders, however few studies have examined physical activity and exercise specifically as a prevention for depression, rather than a treatment, in young people. Meta-analysis of observational data shows that in physical activity is associated with reduced risk of depression in young people (Schuch et al., 2018). Brown et al., (2013) (Brown, Pearson, Braithwaite, Brown, & Biddle, 2013) similarly conducted a systematic review and meta-analysis and reported that physical activity interventions resulted in a small but significant reduction in depression symptoms in children and adolescents. However, both clinical studies non-clinical studies were included in this meta-analysis. Only three of the included studies were universal prevention in that they included young people from the general population and were directed towards a particular population irrespective of their risk status (Natl. Res. Counc., 2009). The majority of the included studies could be considered to be targeted, selective interventions in that they were aimed toward a population considered to be at high risk for depression (National Research, Institute of Medicine Committee on the Prevention of Mental, Substance Abuse Among Children, Young Adults: Research, & Promising, 2009).

Carter et al., (2016) (Carter, Morres, Meade, & Callaghan, 2016) conducted a meta-analysis examining exercise for depressive symptoms in people aged 13-17 years. This review included trials of clinical samples, and therefore did not focus specifically on the impact of exercise and physical

activity as a prevention intervention for depression. Indeed, five of the eleven included trials recruited clinical samples. The authors concluded that exercise had a moderate overall effect on depressive symptoms, particularly in people with clinical depression.

Finally, Larun et al., (2006) (Larun, Nordheim, Ekeland, Hagen, & Heian, 2006) assessed the effects of exercise as a depression and anxiety treatment and prevention intervention in a meta-analysis of randomised control trials (RCT) comprising of people aged up to 20 years. In five low quality studies, universal prevention intervention studies exercise reduced depression, compared to no-intervention. The authors concluded that exercise appears to reduce mean depression symptoms in the general population of young people. This interesting review was conducted over a decade ago and it would therefore be valuable to review studies exploring the impact of physical activity and exercise as a prevention for depression published since this time. Therefore, in the current narrative summary, we examine the efficacy of physical activity and exercise as a universal prevention for depression in young people.

Methods

Aims

The aim of this narrative summary was to examine the efficacy of physical activity and exercise as a universal prevention for depression in young people.

Searching

A single author conducted a search of the literature in the open-access “Evidence Finder” of controlled trials and systematic reviews in youth mental health, a shared initiative Australian between Orygen, The National Centre of Excellence in Youth Mental Health and headspace, National Youth Mental Health Foundation (<https://www.orygen.org.au/Skills-Knowledge/Resources-Training/Evidence-Finder>). The “Evidence Finder” provides a comprehensive summary of the extent and distribution of existing research through a rigorous process where intervention trials and systematic reviews published in the area of youth mental health are systematically searched for and compiled into a central resource. The “Evidence Finder” sources published studies from Embase, MEDLINE, PsycINFO and Cochrane Library databases (De Silva, Bailey, Parker, Montague, & Hetrick, 2018; Hetrick, Parker, Callahan, & Purcell, 2010). It includes research published from 1980-2017, with research added bi-annually.

The “Evidence Finder” contains prevention, treatment intervention and relapse-prevention studies with participants with a mean age between 6 and 25 years. It contains controlled clinical trials (including randomised controlled trials and quasi-randomised studies), systematic reviews and meta-analyses. It contains only studies published in English. Studies that recruit participants based on physiological or medical conditions are excluded.

Using the “Evidence Finder,” we searched for all papers relating to “Depressive Disorder” under the “Universal Prevention” illness stage and classified as “Physical activity/Exercise” under the treatment/intervention classification. Systematic reviews, randomised control trials and controlled

clinical trials were all included. Results were compiled independently by a single author by extracting relevant information from the primary study results into a custom master document designed for the conduct of the review. Only data for depressive symptoms outcomes was extracted.

PRISMA guidelines were followed where possible however given that the current research is a narrative review and we used the “Evidence Finder” to identify relevant studies, PRISMA guidelines were largely not applicable.

Inclusion criteria

Primary intervention studies, reviews and meta-analyses were included if they examined the efficacy and effectiveness of physical activity and exercise as a universal prevention for depression in young people. All interventions including an exercise or physical activity component were included in the review, regardless of the exercise or physical activity intensity, duration or frequency, this included interventions comprising of gentle activity such as yoga and more intensive activities such as aerobic exercise. All control conditions were included in the review, including wait list controls, usual care and active control groups, irrespective of the control condition type intensity or duration. To best capture the current state and quality of research in this field, studies were not excluded based on quality and thus all eligible articles were included. Quality assessment of included studies was not conducted. As this paper reviews the impact of exercise and physical activity as a depression prevention strategy, rather than a treatment strategy, included studies were not required to have conducted a formal assessment of clinical depression. We included any study where a measure of depressive symptomology had been collected and assessed, including self-report measures and when data had been collected by another person (i.e., a member of the research team, clinician). We limited

the mean age of included participants to a maximum of 25 years. English language studies only were included.

Results

A total of 11 papers were returned. This included eight controlled trials and three observational studies. Intervention duration ranged from a single session (Wood, Angus, Pretty, Sandercock, & Barton, 2013a) to fifteen weeks (Melnik et al., 2013), with the most common duration being eight weeks, which was used in three studies, as shown in Table 1.

Included studies in “Evidence Finder” are systematically extracted and coded in order to classify studies into meaningful categories. This includes mental health issue, illness stage study design and type of intervention. Therefore, all studies returned were relevant. Accordingly, we have not reported the number of studies screened, assessed for eligibility, and included in the review as per normal PRISMA guidelines.

Inset Table 1 about here

Review of the intervention studies

In a pilot RCT involving fifty-one sedentary university students and employees (mean age of 25 years), Taspina et al., (2014) (Taspinar, Aslan, Agbuga, & Taspinar, 2014) found that seven weeks of both hatha yoga and resistance exercise, three times a week, decreased depression symptoms, compared to a passive control group. Both hatha yoga and resistance exercise decreased fatigue, improved self-esteem, and quality of life, with the biggest improvements seen in the hatha yoga group. Hatha yoga and resistance exercise also improved body image, with the biggest improvements

seen in the exercise resistance group. A limitation of this study is that it assessed outcomes only in study completers, so while 80 participants initially consented, only 51 were included in the final analysis.

In a sample of 125 first year university students with a mean age of 20 years, Gallego et al., (2015) (Gallego, Aguilar-Parra, Cangas, Langer, & Manas, 2015) compared the effect of Mindfulness Based Cognitive Therapy (MBCT) which included yoga asana, to physical education classes consisting of stretching and sports games, and a passive control group. Sessions were one hour a week for eight weeks. Depressive symptoms, anxiety symptoms and stress levels were significantly decreased in the MBCT (including yoga) group at post-test compared to the control and exercise group, with no significant difference between the exercise and passive control group. No specific measures of mindfulness or acceptance were taken and therefore the mediational role of these variables on the findings are unknown.

In a study involving secondary school students aged 13-14 years, Wood et al., (2013) (Wood, Angus, Pretty, Sandercock, & Barton, 2013b) assessed whether a single 10 minute session of exercise affected self-esteem and mood, while participants were viewing natural or built scenes. Young people cycled on stationary bicycles at 50% of their maximum heart rate, while viewing images of either natural or built scenes, in a counterbalanced fashion. Young people reported improved self-esteem and mood from pre- to post-test, with no differences between viewing natural or built scenes. The small sample size of 25 students was a limitation in this study.

Costigan et al., (2016) evaluated two high-intensity interval training (HIIT) interventions (aerobic or resistance with aerobic, [8-10 min sessions, 3 times a week for 8 weeks]) compared to a control group who engaged with usual school-based physical exercise classes. The effect of the 3 intervention groups was assessed on well-being, distress, executive function and physical self-concept in 65 young

people with a mean age of 16 years. The authors did not find significant differences between groups from pre to post intervention, however effects sizes indicated small improvements in executive function and psychological well-being in the aerobic exercise group. In the resistance and aerobic group, effect sizes indicated small improvements in well-being and perceived appearance and moderate improvements in executive function. From pre- to post-workout, there was a significant improvement in feeling state scores in the aerobic exercise group, with no changes in the other studied variables (Costigan, Eather, Plotnikoff, Hillman, & Lubans, 2016).

Melnyk et al., (2013) (Melnyk et al., 2013) studied the effect of a 15 week cognitive-behavioral skills-building intervention including 20 minutes of physical activity, compared to a manualized program focusing on safety and common health topics/issues for adolescents. In participants with elevated depression scores at pre-intervention, the cognitive-behavioral skills-building intervention resulted in significantly lower depression scores at post-intervention, compared to the manualised safety program. At post-intervention, participants in the cognitive-behavioral skills-building group also had more steps per day, lower body mass index (BMI), less alcohol consumption, better social skills, and grades. At 6-months post intervention, BMI was still reduced in the cognitive-behavioral skills-building group. As this intervention incorporated both cognitive-behavioral skills-building and physical activity, the individual contribution of each of these on depression prevention is unknown. There were also some methodological limitations in this study as participants in the intervention group had higher body weight and TV viewing time at baseline, and approximately half of the classrooms teachers were observed to have poor fidelity to the intervention delivery.

In a RCT by Wipfli et al., (2011) undergraduate students with a mean age of 20 years were randomised to either 30 minutes of aerobic group-based exercise or group-based stretching, 3 times a week for 7 weeks. Individuals in the aerobic group were found to have lower levels of depression, compared to the stretching group. Students in the aerobic exercise group had a larger decrease

in serotonin, a monoamine neurotransmitter involved in the etiology of depressive disorder (Eison, 1990), than students in the stretching group. This decrease in serotonin was found to mediate the relationship between exercise and depressive symptoms (Wipfli, Landers, Nagoshi, & Ringenbach, 2011).

In a sample of 96 students 'at risk' of psychological distress, (mean age 15 years), those who completed an 8-week group based CrossFit™ intervention, delivered for 60 minutes, 2 times a week, had better self-esteem, perceived appearance, physical self-concept and less perceived body fat, compared to a passive control group. There were, however no intervention effects on the studied outcomes when the entire sample was included in analyses, rather than only those 'at risk' participants. Therefore, the authors preliminarily concluded that CrossFit™ may improve mental health in young people at risk of developing depression, but not in the general population (Eather, Morgan, & Lubans, 2016). It is also possible that the intervention duration of 8 weeks was insufficient to result in improvements in the studied outcomes and that a longer intervention period may be more beneficial. Previous meta-analysis investigating the impact of physical activity as a depression treatment in young people found that effective interventions commonly consisted of moderate or vigorous intensity activity for 60 minute sessions, multiple times a week, and occurred for at least 8-weeks (Bailey., Hetrick, Rosenbaum, Purcell, & Parker, 2018).

In a study by Balkin et al., (2007) (Balkin, Tietjen-Smith, Caldwell, & Shen, 2007) 110 undergraduate women with an average age of 21 years completed six weeks (duration and frequency of sessions not reported) of an aerobic exercise program, a weight-lifting program or no intervention. At post-intervention, women in the aerobic exercise group exhibited decreased depressive symptoms, as assessed using the Beck Depression Inventory-II, compared to the other two groups. The details of the physical activity programs used in this study were not reported, so the components of the aerobic and

weight lifting program are unknown. This study also did not specify if participants were randomly assigned to groups and if so, what method of randomisation was used (Balkin et al., 2007).

The above reviewed studies indicate that exercise and physical activity might be an effective universal depression prevention intervention for young people. However, the findings and implications are limited by the variable quality of the reviewed studies. Three of the studies had a passive control group or no control group (Eather et al., 2016; Taspinar et al., 2014; Wood et al., 2013a) and only one study had longer-term follow-up (Melnik et al., 2013). No study used a longitudinal design to determine if interventions prevent the onset of new cases of depression. Nevertheless, the above reviewed RCTs indicate that physical activity interventions can improve mood, decrease stress and increase self-esteem in the short-term.

Review of the non-randomised studies

In a survey of 32,860 upper-secondary schools Icelandic students, Baldursdottir et al., (2017), found that depressive symptoms increased while levels of physical activity decreased with age. Over half of the students were not engaging in recommended amounts of daily physical activity. Activity that was moderate to vigorous intensity was associated with fewer depression symptoms, while organized sports decreased depressive symptoms in girls (Baldursdottir, Valdimarsdottir, Krettek, Gylfason, & Sigfusdottir, 2017).

In a cross-sectional study of 1,810 Spanish adolescents (13–18 years) Gomez-Baya et al., (2017) reported that sport participation was associated with fewer depressive symptoms and, in boys, had a positive effect on body satisfaction. Body dissatisfaction was associated with more depressive symptoms in girls. Accordingly, the authors highlighted the need to implement gender-appropriate

programs to improve psychological adjustment in young people (Gomez-Baya, Mendoza, Matos, & Tomico, 2017).

In a longitudinal study of 4,023 Australian children (mean age 12 years), a bidirectional relationship was reported between the time spent playing sport and mental health, so that playing sport at age 12 was associated with better mental health two years later and those who reported poorer mental health at age 12 were less likely to be engaged in sporting activities at age 14. A bidirectional relationship was reported between the time spent playing sport and internalising social and emotional problems, so that playing sport at age 12 was associated with less internalising social and emotional problems two years later and those who reported less internalising social and emotional problems at age 12 were more likely to be engaged in sporting activities at age 14 (Vella, Swann, Allen, Schweickle, & Magee, 2017).

Discussion

This review indicates that various forms of physical activity and exercise including yoga, resistance exercise, and aerobic exercise have beneficial effects on mental health in young adults. The results suggest that regular physical activity and exercise is a protective factor for mental health.

The findings of the current review is consistent with previous findings indicating that exercise and physical activity are an effective treatment for depression in young people. In a meta-analysis by Baily and colleagues (Bailey, Hetrick, Rosenbaum, Purcell, & Parker, 2017) physical activity was

found to effectively reduce depressive symptoms in sub-clinical samples and clinical samples of people aged 12-25 years. However the primary studies in this meta-analysis were often underpowered and often poor quality (Bailey et al., 2017). Our findings are also consistent with those of Carter and colleagues (Carter et al., 2016), who found in their meta-analysis that exercise was associated with a moderate effect size decrease in depressive symptoms in individuals aged 13-17 from general population, although this effect was not statistically significant. These authors also found that exercise was seen to result in a statically significant decrease in depression symptoms in clinical samples.

The results of the present review highlight the importance of maintaining and building physical activity and exercise programs in primary, secondary and tertiary education settings. Mendelson et al., (2017) recently highlighted that school based interventions have small but significant effects in terms of preventing the onset of depression in young people. While this previous review did not include studies of exercise or physical activity for those at-risk of or having identified mental health problems (Mendelson & Tandon, 2016), it highlights the importance of targeting school as an effective setting via which to deliver prevention interventions. In general, preventive interventions are not currently widely implemented in schools and communities (Ennett et al., 2003; Wandersman & Florin, 2003) despite providing access to a large number of young people, across a diverse range of backgrounds, during a formative developmental period (Sawyer et al., 2012). With the long-term consequences of depression including underachievement in education, under-employment, reduction in the quality of relationships, poorer physical health, and increased risk of suicide and self-harm (Fergusson & Woodward, 2002; Gould et al., 1998), prevention of the onset of depression is crucial. Even if modestly effective, the population level implementation of prevention interventions would help young people to develop healthy coping strategies that could protect them against the development of depression, which would confer significant health, economic and social benefits for large numbers of young people, their families and the community (Romano, 1992).

The particular stage during which exercise and physical activity prevention programs should be delivered to young people is an important area for future research. For example, Horowitz et al., (2006) reported that targeted programs for depression were more effective than universal programs (Horowitz & Garber, 2006) in a meta-analysis including 30 universal and prevention programs for young people and children. Conversely, Stockings et al., (2016) (Stockings et al., 2016) concluded in their meta-analysis that both universal (14 studies, n=7798) and selective prevention programs (9 studies, n=1234), were associated with a reduced risk of developing depressive disorder, when assessing psychological, educational and physical activity prevention programs, the majority of which were conducted in schools (n=113 of 146). Importantly, these effects were still present 6-9 months after the intervention completion, however none of the assessed studies used a physical activity intervention. Therefore, it is important to better understand the potential impact and benefits of implementing both universal and targeted prevention programs in the school settings.

It is also important to further explore what type of exercise or physical activity prevention programs might be most effective for young people. For example, in their meta-analysis of universal prevention programs, Larun et al., (2006) (Larun et al., 2006) concluded that vigorous and low intensity exercise interventions were equally effective in reducing depressive symptoms in people aged up to 20 years. However, only five low quality studies were included in this analysis indicating a need for high quality research studies in this area.

A limitation of the current narrative review is the inclusion on English language studies only. By excluding nine non-English publications this review may have decreased geographical representativeness. A further limitation is that in the current review we are unable to assess whether or not physical activity exercise interventions can reduce the risk or prevent the development of clinical depression. This would require appropriately designed and well-powered longitudinal studies. It also requires that appropriate identification and inclusion of young people who are at-risk for depression,

which is a challenge unable to be addressed by the current narrative review. Another limitation is that only one of the eleven studies included in the current narrative review include a follow-up period. Therefore the longevity of the observed effects is unknown.

The included studies in this review indicate that exercise and physical activity are promising in protecting against the development of depression symptoms, and demonstrate the bidirectional relationships between physical activity, exercise and adolescent mental health (Vella et al., 2017). Physical activity and exercise interventions may be particularly promising among young people as they are non-stigmatising interventions with few side effects (Chu, Buckworth, Kirby, & Emery, 2009). They are acceptable (Bailey. et al., 2018) and viewed as helpful in treating depression by young people in large-scale surveys (Jorm & Wright, 2007). The results of the current review suggest that physical activity and exercise programs are effective and can be of benefit to young people in terms of improving psychological health.

Acknowledgements

None

Conflict of interest statement

The authors declare not conflict of interest

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Table 1: Characteristics of Included Studies

Reference	Country	Study design	Participants	Intervention	Control	Time of assessment	Depression measurement tools	Follow up

Baldursdottir et al., (2017)	Iceland	Observational study	School students (age range=10-19 yrs)	NA	NA	NA	Symptom Check List (SCL-90)	NA
Balkin et al., (2007)	United States	Controlled trial (randomisation unknown)	University female students (M age=21 yrs)	Aerobic exercise program /or/ weight-lifting program (6 wks, duration, frequency unknown)	Passive control group	Post intervention	Beck Depression Inventory	None
Costigan et al., (2016)	Australia	RCT	School students (M age=16 yrs)	HIIT (aerobic /or/ resistance with aerobic [8-10m 3x wk/ 8 wks])	Usual school-based physical exercise classes	Post intervention	The Kessler Psychological Distress Scale (K10)	None
Eather et al., 2016	Australia	RCT	School students (M age=16 yrs)	CrossFit™ intervention (60m 2x wk/ 8 wks)	Sport lesson and health and physical education lessons (60m 2x wk/ 8 wks)	Post intervention	Physical Self-Description Questionnaire (PSDQ) (considered indicators of mental health)	None
Gallego et al., (2015)	Spain	RCT	University students (M age=20 yrs)	MBCT (included yoga asana) /or/ physical education classes (stretching, sports games) (1h wk/8 wks)	Passive control group	Post intervention	DASS-21	None
Gomez-Baya et al., (2017)	Spain	Observational study	School students (age range=13-18 yrs)	NA	NA	NA	Children's Depression Inventory	NA
Melnyk et al., (2013)	United States	Cluster RCT	School students (M age= 14 yrs)	Cognitive-behavioural skills-building (including physical activity [20m	Manualized program on safety and health topics/issues (1x wk (unknown duration)/	Post intervention	Beck Youth Inventory II©	6 months

				wk/ 15 wks))	15 wks)			
Taspina et al., (2014)	Turkey	Pilot RCT	Sedentary university students and employees (M age=25 yrs)	Hatha yoga /or/ resistance exercise (50m 3x wk/7 wks)	Passive control group	Post intervention	Beck Depression Inventory	None
Vella et al. (2017)	Australia	Observational study	Kindergarten students (age range=4-5yrs)	NA	NA	NA	The Strengths and Difficulties Questionnaire (SDQ)	NA
Wipfli et al., (2011)	United States	RCT	University students (M age=20 yrs)	Aerobic group-based exercise (30m 3x wk/ 7 wks)	Group-based stretching (30m 3x wk/ 7 wks)	Post intervention	Beck Depression Inventory	None
Wood et al., (2013)	United Kingdom	Crossover RCT	School students (M age=13-14 yrs)	Cycling while viewing natural scenes (10m single session)	Cycling while viewing built scenes (10 min single session)	Post intervention	Adolescent Profile of Mood States Questionnaire (POMS-A)	None

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Title:

Physical activity and exercise as a universal depression prevention in young people: A narrative review

Date:

2019-08-01

Citation:

Pascoe, M. C. & Parker, A. G. (2019). Physical activity and exercise as a universal depression prevention in young people: A narrative review. *EARLY INTERVENTION IN PSYCHIATRY*, 13 (4), pp.733-739. <https://doi.org/10.1111/eip.12737>.

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