



# Physical activity and depressive symptoms in youth

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Comment on: Recchia F, Bernal JDK, Fong DY, *et al.* Physical Activity Interventions to Alleviate Depressive Symptoms in Children and Adolescents: A Systematic Review and Meta-analysis. *JAMA Pediatr* 2023;177:132-40.

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Regular engagement in physical activity results in a lower risk of obesity during childhood (1) and reduced risk for cardiovascular disease across the lifespan (2). The effect of physical activity on mental health is emerging, with a systematic review indicating that adults who are regularly physically active experience improvements in depression, anxiety, and psychological distress (3). A recent systematic review and meta-analysis by Recchia and colleagues, published in *JAMA Pediatrics*, indicates children and adolescents also experience these protective mental health effects when engaging in regular physical activity. The purpose of this editorial commentary is to review the strengths and weaknesses of Recchia *et al.* [2023] and provide recommendations for future research (4).

Recchia *et al.* [2023] included 21 trials in their review and concluded that physical activity interventions reduced depressive symptoms in children and adolescents compared to control conditions (4). Participants older than 13 years and diagnosed with a mental illness and/or depression experienced an even greater reduction in depressive symptoms following the physical activity intervention (4). Surprisingly, the treatment effect was not altered by total physical activity volume, participants' physical health status, whether the allocation and/or assessments were concealed, or whether the study was a randomized controlled trial or not. Physical activity interventions that provided three sessions each week and were shorter than 12 weeks in duration induced a greater reduction in depressive symptoms than other

frequencies and durations (4).

Recchia *et al.* [2023] identified a timely topic. Mental health is a growing concern, as it is estimated that globally 1 in 7 adolescents aged 10–19 years experience a mental health condition (5). Current clinical guidelines advise the use of psychotherapy, pharmacotherapy, or a combination of these to mitigate childhood and adolescent depressive symptoms (6). Unfortunately, due to barriers such as lack of time, fear of stigmatization, and parental mistrust of mental health providers (7), as well as adverse side effects, nearly 80% of children needing mental health treatment do not receive appropriate care (7). In addition to this concerning trend, the coronavirus disease 2019 (COVID-19) pandemic and subsequent lockdowns exacerbate depression and anxiety symptoms in this age group (5). Recchia and colleagues found greater reductions in depressive symptoms for participants with pre-existing mental illness or depression, and greater reductions for adolescents compared to children (4). These findings, in tandem with evidence that adolescents with less time spent participating in sedentary behaviors at baseline have lower depressive symptomology at follow-up (8), emphasize the importance of regular physical activity for this age group for overall health. Unfortunately, current evidence suggests adolescence is marked by a rise in depression (9) accompanied by dramatic declines in physical activity participation (10). Designing and implementing engaging, sustainable, low-cost physical activity interventions for this age group is an urgent need to

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make impactful changes to adolescents' overall health.

Recchia and colleagues (4) conducted a rigorous systematic review and meta-analysis of the evidence of physical activity interventions to alleviate depressive symptoms in youth. The review aligns with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards and includes more studies than prior systematic reviews. Additionally, the authors included manuscripts published in languages other than English, i.e. Chinese and Italian, and participants with somatic or psychiatric disorders. In doing so, the systematic review has wider generalizability of the results. Furthermore, Recchia *et al.* [2023] assessed the risk of bias, performed a sensitivity analysis by recalculating the effect size after excluding potential outliers, and examined four a priori moderators (total physical activity volume, participants' health status, whether the allocation and/or assessments were concealed, and whether the study was a randomized controlled trial or not) as well as secondary moderators (intervention and participant characteristics).

A note of caution when interpreting the findings of the Recchia *et al.* [2023] review is that most of the studies included in the systematic review (4) are better categorized as exercise interventions than physical activity. Physical activity is defined as any bodily movement produced by skeletal muscle that increases energy expenditure above resting levels (11). Meanwhile, exercise is a subcategory of physical activity marked by a planned, structured, repetitive, and purposeful activity to improve physical fitness (11). For children or adolescents, this means that the findings of this review best align with programs that are structured and repetitive, such as a routinized sports practice, an aerobic activity (i.e., running or jogging) at a prescribed intensity, or circuit training in a gym. Often, these types of programs prescribe intensities, so the participant exercises at a moderate to vigorous level. These findings do not examine programs promoting spontaneous, unstructured free play or lifestyle activities children engage in on a playground, field, or backyard. Additionally, the studies do not include light physical activity, which research is beginning to acknowledge is beneficial for inactive populations (12). This is a gap in the evidence, given the prominent role of unstructured physical activity in children's lives, particularly among youth who do not have access to or financial resources to engage in exercise programs.

The beneficial effects associated with physical activity participation are observed regardless of type (aerobic *vs.* anaerobic), intensity (high *vs.* low), physical environment (indoors *vs.* outdoors), and social context (individual *vs.*

group) (12,13). Recchia and colleagues only focused on aerobic exercise interventions, so it would be beneficial to further explore how specific types of physical activity, like muscle- and bone-strengthening activities, affect depressive symptoms in children. The World Health Organization recommends that children engage in at least 3 days/week of muscle and bone strengthening activities as part of their 60 minutes of daily moderate-to-vigorous physical activity (14). Some studies specifically examine muscle-strengthening activities and find a reduced risk of depression in adults (15) and youth (16). While this relationship is not fully understood, there is strong evidence suggesting that better muscular fitness is related to lower levels of central adiposity and higher levels of self-esteem (17). Psychological outcomes associated with obesity influence quality of life (18,19). Often, children with obesity face bullying from peers (18,19). It is possible that through muscle- and bone-strengthening activities, adolescents with obesity may improve their muscular fitness and self-esteem, leading to improvements in mental health. Despite being a part of the recommendations and providing physical and psychological benefits, muscle- and bone-strengthening activities are often neglected and not included in research studies. Some of the studies Recchia *et al.* [2023] include in their systematic review include these activities; however, Recchia and colleagues only focused on the aerobic effects. Stratifying results by these types of activities would provide more insight into the design of exercise programs and balance of activities to reduce depressive symptoms.

There are limitations in the body of literature that hinder the ability to determine effect sizes or conclude if there is a meaningful effect size. Further, many physical activity interventions are not grounded in behavioral theory, even though evidence suggests a theoretical foundation improves the effectiveness of a physical activity intervention (20). It is also unclear from the studies that Recchia *et al.* [2023] included in their review if the effect of exercise or physical activity on depressive symptoms is acute or long-term. Thus, a notable gap in the evidence is the failure to measure the sustainability of effects. Only four studies Recchia *et al.* included in the systematic review (4) assessed outcomes at a follow-up period. These studies did not detect any sustained changes in depressive symptoms after the exercise program ended. Temporary alleviation of depressive symptoms is helpful in improving quality of life; however, participants often return to baseline levels of physical activity once the exercise intervention concludes, and they are no longer

receiving support from the research team. Do the pre-existing depressive symptoms return as well? Additionally, most of the exercise interventions Recchia *et al.* included in the review were led and supervised by research staff or trained professionals, thus questioning the pragmatism and sustainability of these interventions.

While the physical activity interventions reviewed by Recchia *et al.* increased youths' physical activity levels, they were solely focused on the individual. There are multiple influences on youths' physical activity that remain underutilized. Throughout the week, physical education (PE) is a strategy to increase physical activity participation throughout the day (21). PE allows children to integrate movement into their typical day and learn the foundations of movement which can spur more physical activity throughout the day. For children and adolescents, adults are making the decisions that allow youths to have ample (or few) opportunities to participate in physical activity. Research indicates that through encouragement and behavior modeling, PE teachers have a positive effect on children and adolescents participating in physical activity (22). However, parents might have a bigger influence in adolescents' physical activity levels than PE teachers (22). Throughout a child or adolescent's life, parents have bountiful opportunities to model various health behaviors including physical activity participation. Furthermore, parents can provide encouragement and resources for a child to participate in after school physical activity opportunities such as sports. While adults are often the physical activity gatekeepers in a child's life and have a large influence on the child's physical activity levels, they are not the only influence to consider. Support and encouragement from friends impacts adolescents' physical activity levels (23). Overall, interpersonal relationships with parents, teachers, and friends impact a child's physical activity levels through modeling, encouragement, and enabling opportunities to be physically active. To create sustainable and scalable physical activity interventions, researchers should target multiple levels of the social ecological model (24). Furthermore, the facilitators (i.e., teachers, coaches, parents, researchers) should aim to provide physical activity opportunities that support the child's basic needs for autonomy, competence, and social connection (25). By doing so, children and adolescents can have multiple opportunities throughout their day to engage in physical activity and thereby experience benefits for mental health.

In summary, Recchia and colleagues conducted a timely

and rigorous systematic review and meta-analysis of the evidence-based on physical activity interventions to alleviate depressive symptoms in youth, particularly for adolescents and for those with pre-existing depressive symptoms. Despite these promising results, the studies included in this systematic review are best classified as exercise interventions not physical activity interventions. Thus, these findings stress the importance of regular exercise programming for adolescents' psychological health. When designing physical activity interventions, researchers should aim to measure the impact of intervention on both physical and mental health, with mental health as a primary outcome and not secondary or exploratory. In other words, studies should be sufficiently powered to detect changes in mental health outcomes. Additionally, interventions should be designed to examine not only acute effects but also long-term effects. Schools and other places that serve youth should prioritize physical activity opportunities, not only for physical health but also for mental well-being. As the prevalence of obesity, cardiovascular disease, diabetes, and mental health issues like depression continue to increase globally in youth, it is paramount that researchers, practitioners, and policymakers work in tandem. Making physical activity a daily part of children's lives is a critical strategy to reduce chronic disease and improve mental health.

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