

Physical Activity and Adolescent Mental Health: Implications for Practice

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Abstract

Lack of physical activity (PA) in youth is becoming a growing concern. Although there is increasing evidence for the importance of physical activity, less than one-third of adolescents meet the CDC standards of at least 60 minutes of moderate-vigorous physical activity per day (Centers for Disease Control and Prevention [CDC], 2015; World Health Organization [WHO], 2011). Recent research suggests that this decline is due to increasingly sedentary lives among youth, both within and outside of school, as a result of technology, alternative means of transportation, and limited time spent in physical education classes and recess (Bucksch et al., 2016; Hillman et al., 2008; Stevens, To, Stevenson, & Lochbaum, 2008; WHO, 2011). In addition, this decrease in PA is disproportionately concentrated among older adolescents (ages 15-18) who are less likely to participate on sports teams than younger children (Johnson & Taliaferro, 2011; Mitchell et al., 2012). Given this rise in sedentary behavior, there is a burgeoning area of research exploring the link between children's physical and mental health, reflecting that the two are in fact intertwined. This review will explore the promising relationship emerging between adolescents' engagement in physical activity (i.e., moderate-vigorous exercise and/or sport participation) and their mental health. Implications for pediatricians working with youth at risk for mental health disorders will be discussed, as will physical activity interventions that promote healthier physical behavior.

Effects of Physical Activity on Physical Health

Exercise is especially vital for the physical health of children and adolescents and should be included in daily routines and activities for youth (Hills, Dengal, & Lubans, 2015). A healthy lifestyle that consists of regular physical activity (i.e. 60 minutes of daily moderate to vigorous physical activity) beginning early in life provides numerous health benefits. Youth who are more active reap the benefits of diminished risk of future chronic diseases, such as coronary heart disease, Type-2 diabetes, obesity, cancer, and arthritis (Carson et al., 2014; Iannotti, Kogan, Janssen, & Boyce, 2009). Further, physical activity plays a role in the growth and maintenance of a healthy musculoskeletal system, assists in sustaining an appropriate body structure through weight management and the decrease of body fat, and aids in the prevention and reduction of high blood pressure (Landry & Driscoll, 2012). Research has also shown an association between physical activity and improved cognition, including working memory and attention to task demands (Chaddock et al., 2012; Hillman, Khan, & Kao, 2015). Specifically, physical activity may increase blood flow to the brain, improve neurotransmitter functions, increase nutrient intake, and enhance arousal (Davis et al., 2011; Hillman et al., 2015; Segalowitz, 2016). These changes often result in increased energy, an improved ability to concentrate, and enhanced sleep quality (Chaddock et al., 2012; Hillman et al., 2015; Segalowitz, 2016).

In addition to children and adolescents attaining the physical and cognitive benefits of exercise, research is emerging that reflects an inverse relationship between physical activity and mental distress. Current research has demonstrated psychosocial benefits from physical

activity, including a reduction in the symptoms of depression, stress and anxiety, and improvements in self-esteem (Biddle & Asare, 2011; Segalowitz, 2016), making PA a potential protective factor that is simple, inexpensive and accessible to adolescents who may struggle with mental health (Gerber & Puhse, 2008; Gerber et al., 2012; Li, Xu, & Liu, 2014; Moljord, Moksnes, Espnes, & Eriksen, 2014).

Effects of Physical Activity on Children and Adolescents' Mental Health

Mental health is described as the way people think, feel, and act as they encounter personal challenges (Ortega, Ruiz, Castillo, & Sjostrom, 2008). Similar to adults, mental health problems are prevalent in children and adolescents (Merikangas, 2010; Perou, 2013). In fact, it has been estimated that more than 20% of children and adolescents, ages 9-17 years old, have a diagnosable mental health disorder, such as depression or anxiety, that causes some or major functional impairment (Merikanagas, 2010; Ortega et al, 2008). Suicide is the second leading cause of death for 15-24 year olds (American Association of Suicidology, 2013; Perou, 2013). Given this research, targeting effective and efficient treatment options for adolescents is a salient issue for practitioners who counsel adolescents and families in clinics.

Recently, physical activity has shown promise as a viable treatment option for adolescents' mental health. Budding research across cultures suggests that physical activity plausibly improves mental health in children and adolescents (Asare & Danquah, 2015; Li et al., 2014; Moljord et al., 2014). Additional studies have extended the relationship between PA and adolescent mental health. For example, Strohle and colleagues (2007) expanded findings by examining psychosocial and behavioral changes in 14-24 year olds ($n=2,548$). A decline in anxiety disorders (i.e., agoraphobia, specific phobia and PTSD), somatoform disorders, substance use disorders and dysthymia was found for youth who engaged in physical activity. The study found that for those youth who engaged in regular, daily, or more often occurring sports incurred a substantial protective effect from mental health disorders (Strohle et al., 2007). These findings complement literature that reflected a decrease (i.e., approximately 8%) in the odds of depressive symptoms for each added hour of exercise ranging from 0 to 7 or more hours adolescents participated in each week (Rothon et al., 2010). Yet, in addition to the benefits of more physical activity for adolescents with mental health issues, research also suggests that the maintenance of a physically active lifestyle over a long period of time has cumulative, positive psychological effects as well (Wiles et al., 2008). In other words, children who are consistently more active throughout their lives tend to have significantly fewer emotional problems than those children who exhibit sedentary lifestyle patterns of behavior.

In addition to the evidence suggesting a relationship between physical activity and correlates of mental health, an association of physical activity with other psychosocial factors and behaviors, such as improved academic performance and parental relationships, decreased anger, reduced drug use, and increased quality of life/perceived life satisfaction have surfaced (Booth et al., 2014; Ortega et al., 2008; Valois, Umstattd, Zullig, & Paxton, 2008). The results from these studies are consistent with the literature in this area, proposing that physical activity is inversely associated with not only depression and anxiety, but also social problems, delinquent behavior, and academic achievement in adolescents.

Physical Activity and Internalizing Disorders

Research consistently demonstrates a relationship between physical activity in children and adolescents and decreased anxiety, depression and increased self-esteem (Crews, Lochbaum, Landers, 2004; DeBate, Gabriel, Zwald, Huberty, & Zhang, 2009; Kirkcaldy, Shephard, & Siefen, 2002; Parfitt, Pavey, Rowlands, 2009; Wang & Veugelers, 2008). Carter and colleagues (2016) recently conducted a clinical, randomized study with 87 adolescents (ages 14-17) in England that demonstrated physical activity was negatively

associated with symptoms of depression at six-month follow up, while another relevant randomized study found a significant increase in self-esteem and self-efficacy for 122 Australian girls (ages 10-16) using the 10-week program, Girls on the Go! (Tirlea, Truby, & Haines, 2015). Kantomaa and colleagues (2008) explored the relationship between level of physical activity and emotional and behavioral problems through the examination of 7,002 adolescents, ages 15-16 years old in North Finland. It was found that physical inactivity in adolescents was correlated with an increased likelihood of emotional problems, which included anxious/depressed symptoms in boys, withdrawn/depressed symptoms in boys and girls, somatic complaints in girls, and thought problems in boys (Kantomaa et al., 2008). Mirroring these independent study findings, Biddle and Asare's (2011) meta-analysis of quantitative reviews reflected a negative relationship between depression, anxiety, and self-esteem and physical activity, with the strongest effect for improving self-esteem. When examining internalizing problems, a moderating effect of intensity has been found for gender in several studies. Activity benefits for girls occur after moderate exercise is incorporated into routines (Jerstad et al., 2010; Kantoma, 2008), whereas for boys, frequent, vigorous exercise is needed to reap benefits for internalizing problems, which include thoughts of hopelessness and suicidality (Kantoma, 2008; Taliaferro, Rienzo, Miller, Pigg, & Dodd, 2012). Overall, across studies examining internalizing outcomes among youth, physical activity appears to alleviate symptoms for adolescents.

Physical Activity and Externalizing Disorders

Research has also linked physical activity to reducing externalizing symptoms, including aggression, ADHD, delinquency and social problems in adolescents. As with internalizing disorders, it has also been proposed that the exercise needed to reap benefits for externalizing disorders should be frequent and vigorous for boys, though only moderate for girls (Kantomaa, 2008; Taliaferro, Rienzo, Miller, Pigg, & Dodd, 2012). Ahmed and Mohamed (2011) found a positive relationship in a 10-week aerobic exercise program on attention and classroom behavior for 84 students, ages 11-16, with ADHD. This research supports other studies that have found comparable results for disruptive behavior as well (Allen, 1980; Folino, Ducharme, Greenwald, 2014; Verret, Guay, Berthiaume, Gardnier, & Beliveau, 2012). Likewise, it was found that physical inactivity in adolescents was correlated with an increased probability of having several behavioral problems, which included rule-breaking behavior in girls, and social and attention problems in boys and girls (Kantomaa et al., 2008). Literature has also suggested that engaging in sports may dispel feelings of loneliness and bolster perceived social competence, as youth on sports teams build a social network of peers that share a commonality of physical activity (Haugen, Safvenbom, Ommundsen, 2013; Salvy, De La Haye, Bowker, & Hermans, 2012). In effect, through physical activity, adolescents plausibly reduce externalizing symptoms and gain social competence.

Physical Activity and Academic Achievement (cognitive/academic outcomes)

Research on the impact of physical activity and youth cognitive and academic outcomes is an area that has gained widespread attention in recent years (Donnelly & Lambourne, 2011; Esteban-Cornejo, Tejero-Gonzalez, Sallis, & Veiga, 2015; Fedewa & Ahn, 2011; Mura et al., 2015; So, 2012) with findings illuminating both short-term and long-term positive effects (Booth et al., 2014; Sardinha et al., 2016; So, 2012; Staiano, Abraham, & Calvert, 2012). For example, Ardoy and colleagues (2014) explored increasing the time and intensity of physical education classes through an intervention for 67 adolescents in Spain and found positive impacts on non-verbal and verbal ability, abstract reasoning, spatial ability, and numerical ability, as well as an increase in average school grades; while Booth (2014) using data from the Avon Longitudinal Study of Parents and Children, found a

positive, longitudinal relationship between moderate-vigorous physical activity and academic attainment in adolescents. Other literature has examined both short and long-term effects, suggesting positive findings for each. For example, in one study, a 10-week exergaming intervention (i.e., fitness video games) for 53 low-income African American adolescents (M age=16.46 years, 31 females), an increase in immediate executive functioning skills as well as weight loss and long-term improved executive functioning skills were found (Staiano et al., 2012). Thus, in addition to merely mental health benefits, physical activity may positively impact academic achievement and cognitive functioning as well, thereby allowing adolescents to have a better opportunity to successfully navigate the school day.

Physical Activity and Substance Abuse

Finally, studies have suggested an inverse relationship between physical activity and substance abuse (Audrain-McGovern & Rodriquez, 2015; Nelson & Gordon-Larsen, 2006). Kirkcaldy and colleagues found a strong correlation between physical activity and resistance to drug and alcohol addiction on 1000 German adolescents, ages 14-18, while a cross-sectional survey of American ($N=14,818$) and Canadian ($N=7,266$) adolescents in grades 6-10 reflected an inverse relationship with cigarette smoking and marijuana use and PA (Iannotti, Kogan, Janssen, & Boyce, 2009). Research has even explored addressing alcohol prevention within a sports and consultation framework (Werch et al., 2003). In effect, these findings further solidify trends forming that physical activity offers positive benefits for other psychosocial factors and behaviors, even outside of physical and mental health.

Theoretical Underpinnings

Sparse research has prevented a clear explanation for the relationship between physical activity and mental health issues among youth to surface, although several hypotheses have been proposed. The first hypothesis is a neurological one, which suggests that physical activity improves our “feel good” neurotransmitters thus alleviating stress and improving mood (Ortega et al., 2008; Segalowitz, 2016; Voss, Vivar, Kramer & van Praag, 2013). In effect, greater physical activity increases blood flow to the brain and enhances neurochemicals such as epinephrine, norepinephrine, and serotonin. These neurotransmitters keep neurons healthy and thereby elevate an individual’s mood, reduce stress, and produce a state of tranquility within active individuals (Ortega et al., 2008; Segalowitz, 2016; Voss et al., 2013). A second hypothesis proposes that physical activity improves self-esteem, which in turn serves as a buffer for depression. In other words, children who are more physically active tend to have higher levels of self-esteem, which in turn minimizes their risk of developing depression (Cullen et al., 2014; Parfitt et al., 2009; Kristjansson, Sigfusdottir, & Allegrante, 2010).

It is also proposed that physical activity may improve youths’ emotional self-efficacy. Thus, physical activity allows adolescents to feel successful, thereby improving their self-esteem, social well-being, positive self-perception of body image and competence (Biddle & Asare, 2011; Valois et al., 2008). Because self-esteem is a major component of mental health and personality development (Wang & Veugelers, 2008), it is often used as an indicator of psychological well-being (DeBate et al., 2009; Wang & Veugelers, 2008). Children and adolescents with low self-esteem have social and cognitive development difficulties, negative attitudes, and fewer friends (Wang & Veugelers, 2008). As a result, adolescents are more likely to participate in self-destructive behaviors such as school absence, delinquency, smoking, drinking, and drug use, and have a greater chance of possessing psychological problems, such as anxiety, depression and suicidal behavior. However, when adolescents engage in physical activity, their lean body mass improves, leading to an enhanced body image and subsequently improved self-esteem (Ortega et al., 2008; Wood, Angus, Pretty, Sandercock & Barton, 2013). Researchers have also suggested that the very nature of physical activity for youth is social. Physical activity therefore provides the context of

facilitating social skills via increased interaction with other peers. Teamwork skills, tolerance, authentic challenges, goal setting, and self-assessment are all benefits of physical activity (Kantomaa et al., 2008; Li, Xu, & Liu, 2014; Lubans, Plotnikoff, & Lubans, 2014). Building social skills and thereby social networks among adolescents is also a buffer against depression, which may explain the relationship between higher rates of physical activity, higher levels of self-esteem, and lower levels of negative affect (Sagatun, Sogaard, Bjertness, Selmer, & Heyerdahl, 2007; Salvy et al., 2012).

Caveats

Whilst there is a positive relationship between exercise and overall health status, research does not yet provide convincing evidence to support the relationship between exercise/physical activities and the more subjective self-esteem and confidence levels. Most of the research are cross-sectional and or apply cross-sectional analytical methods. Therefore it is not possible to establish whether physical activities lead to commensurate high levels of self-esteem or confidence. In other words, it is possible that individuals in the sample had high levels of self-esteem before the commencement of the research or becoming physically active. If the average self-esteem levels were high before taking up physical activities then it is more likely that more confident people become physically active than those with lower levels of confidence which will have implications for strategy development. However, implications for health care services are discussed on assumption that physical activities do have positive effects of health and mental wellbeing.

Implications for the Primary Care Providers

Given the research regarding physical activity and adolescent mental health, the question arises of how pediatricians can best utilize this knowledge for their patients. In addressing both the family and the adolescent, several avenues are available for incorporating physical activity into an adolescent's daily routine.

First, when consulting with youth and their families on mental health concerns, providers should assess the occurrence of physical activity in the school and home settings (Floriani & Kennedy, 2008). How much physical activity does the child receive throughout a typical day? Is there a physical education class at school? If so, how often is that class? What does a typical day look like when the child returns home from school? Providers can strongly encourage participation in physical activity if it is less than the recommended 60 minutes of accumulated moderate to vigorous physical activity each day and educate the family on how it can be integrated into their daily routine. This includes discussing opportunities for physical activity both during and outside of school, as well as finding alternatives to sedentary behaviors, such as playing sports or engaging in extracurricular activities in lieu of television and videogames. Providers should encourage adolescents to work towards obtaining 1 hour of aerobic physical activity per day each week, acknowledging that this goal may be a gradual process (American Academy of Pediatrics, 2015). Activities could include briskly walking the dog, cycling, basketball, swimming, soccer, dancing or jogging. Any activity that continuously raises the heart rate and breathing, while maintaining the interest of the adolescent is recommended (American Academy of Pediatrics, 2015).

Educating parents is also a critical component in encouraging children to be more active. Parents are integral models in their children's lives, and if they consistently promote physical activity, then children are more likely to follow suit (Bauer, Laska, Fulkerson, & Neumark-Sztainer, 2011; Floriani & Kennedy, 2008). Parents therefore can be taught not only the cardiovascular benefits of physical activity, but the mental health advantages of physical activity as well. In addition, though research is currently limited on the topic, it may be worth sharing that girls benefit from moderate physical activity while boys benefit from

more vigorous, frequent exercise. In any case, parents should be explicitly encouraged to model physical activity and engage in physical activity with their children.

Yet, it is important to acknowledge that foregoing sedentary behavior is not easy for many families. Research shows that sedentary behaviors serve two main functions for parents, which make them reinforcing for both parents and children (Brindova et al., 2014; Floriani & Kennedy, 2008). Literature suggests that parents reinforce sedentary behaviors in their children by promoting television viewing and video game playing, as engaging children in these behaviors is a means of distraction that enables parents to fulfill their own responsibilities. Second, television viewing and video game playing is seen as a form of entertainment that promotes familial bonding (Floriani & Kennedy, 2008). Thus, families may view these activities as both meaningful and indispensable. It is therefore important for health practitioners to stress alternative activities that will both enable parents to have their free time while keeping their children physically active, as well as providing activities that engage the entire family and incorporate physical activity.

Another factor to consider is that parents often have minimal awareness of the consequences of sedentary behaviors and the interrelated link between mood, self-esteem, and other psychosocial factors that may be negatively impacting their children (Ahamed et al., 2007; Hillman et al., 2015; Myer et al., 2013). Accordingly, pediatricians are in a prime position to educate parents on the relationship between physical inactivity and psychological well-being. If parents can be made more aware of the knowledge that sedentary behaviors have a higher probability of leading to depressed, anxious, and delinquent behaviors; they will have the tools to promote physical activity in their homes and overall lifestyles. Specifically, parents can learn to create more restrictions and rules regarding time spent in sedentary behaviors and to provide more opportunities for physical activity at home (Floriani & Kennedy, 2008). Some guidelines that can be shared with parents include encouraging adolescents to walk the dog or to a friend's house, monitoring the amount of T.V. and computer time that is occurring and discussing with adolescents opportunities to join a sports team of interest (American Academy of Pediatrics, 2015).

Finally, physical activity may function as a fairly simple, low-risk, and cost-effective therapy for psychological issues (Kantomaa, 2008). Accordingly, providers should evaluate mental health issues in adolescents and educate youth on the positive impact physical activity may have on their problems (Floriani & Kennedy, 2008). Pediatric professionals should also attempt to increase their awareness of their abilities by promoting understanding of skills and physical fitness (Faigenbaum, Chu, Paterno, & Myer, 2013; Myer et al., 2013). Lastly, providers should strive to support adolescents' self-esteem and encourage an optimistic attitude towards physical activity in an enjoyable environment that does not emphasize exercise, but activity (DeBate et al., 2009). Finding activities that are inherently fun for youth and simultaneously enhance their physical fitness are optimal.

Pediatricians are often the first line of medical defense for youth and are desperately needed to advocate for the best interests of the whole child. As adolescents face a disproportionate amount of mental health disorders (Biddle & Asare, 2011; Taliaferro, 2012) and are also not meeting the recommended daily amount of physical activity (CDC, 2008), pediatric professionals are in an ideal position to educate youth and families on the interrelationship between physical health and mental health. By incorporating physical activity into the lives of more adolescents, the risk of anxiety, depression, low self-esteem and other negative psychosocial factors and behaviors can be reduced. In essence, through the positive effects of physical activity, adolescents will be given the opportunity to lead both physically and mentally healthy lives.

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