

The Benefits of Physical Activity and Sport on Mental Health and Well-Being in School-Aged
Children

A Synthesis of the Research Literature

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Abstract

There is research that concludes that there are benefits of physical activity for young children. However, there is an area of research which is lacking the benefits that physical activity and sport have on mental health and well-being in school-aged children, specifically. Therefore, the purpose of this synthesis was to review the literature on the benefits of physical activity and sport on mental health and well-being in school-aged children. Results determined that there are significant benefits, and a correlation between physical activity participation and overall mental health in school-aged children.

Chapter 1: Introduction

In our nation, only one in three children are physically active every day. The Center for Disease Control and Prevention (CDC) stated that less than one-quarter (24%) of children ages six to 17 years old participate in 60 minutes of physical activity (PA) every day. They also concluded that higher physical activity and physical fitness levels are directly related with improved cognitive performance among students which includes concentration and memory. Physical activity and sport in school-aged children can provide critical development for not only physical health, but mentally, as well. While there is a significant lack of PA in children today, the United States Department of Health and Human Services concluded that 28.0% of Americans, or 80.2 million people, aged six and older are physically inactive. Huberty (2018) and the CDC added that American kids on average spend 1,500 hours viewing TV each year (CDC, 2003). The same children spend 900 hours per year in school with only 50% of schools providing PE classes for elementary school children. According to the Mental Health Foundation, poor physical health can generate higher risk of developing mental health problems, while poor mental health can also have a negative impact on physical health. This can eventually lead to an increased risk of some conditions.

Suicide is the second leading cause of death for ages 10-24 in the world. It is also the second leading cause of death for college-age youth and children ages 12-18 years old (CDC, 2017). Each day in our nation, there are an average of over 3,041 suicidal attempts by young people grades 9-12. The number would be significantly higher if the percentages were applied to grades seven and eight as well.

According to Medical News Today, almost one in five Americans experience mental health problems each year which is roughly 18.5%. The National Alliance on Mental Illness (NAMI, 2019) also stated that 16.5% of U.S. youth aged six to 17 experienced a mental health issue in 2016 (7.7 million people). The CDC reported that 9.4% of children aged two to 17 years have received an ADHD diagnosis (~ 6.1 million). 7.4% of children aged three to 17 years have a diagnosed behavior problem (~4.5 million) and 7.1% of children between these ages have diagnosed anxiety (~4.4 million). (CDC, 2019).

While adolescence is a vital period for mental, social and emotional well-being and development, teens are most vulnerable. The brain experiences critical development changes and behavior trends that last into adulthood. Furthermore, between 20% and 30% of children have one major depressive episode before they reach adulthood. There are many challenges that adolescents face which hinders healthy emotional and physical development. These include, but are not limited to: sexual and reproductive health, violence and unintentional injury, substance abuse, and nutrition and obesity. Due to their brains still evolving, children are particularly responsive to the positive influence of youth development strategies, social and emotional learning and behavioral modeling. This makes them more receptive to depression and more likely to engage in risky and thrill-seeking behaviors than either younger children or adults (NCCP, 2009).

Better Health Channel (2018) reported that physical activity carries several benefits including: reduced risk of heart attack, better management of body weight, lowered blood cholesterol levels, and lowered risk of type 2 diabetes and some cancers. Furthermore, critical benefits that physical activity have on mental health and well-being include quality of life, executive and cognitive function, improved self-esteem and lowered social anxiety, and the relief

of stress as well. For school-aged children, healthy development and growth is essential at a young age to gain discipline, values and accountability for the future. Project TEACH (2019) states that healthy development, ability to learn, interact with peers, reach full potential, achieve success in school, and understand and express emotions are all supporting reasons why good mental health is important for children.

While previously stated, the Mental Health Foundation concludes that poor physical health can lead to a higher risk of generating mental health problems. School physical education programs are an important and vital setting for addressing and preventing children's mental health problems. In a study published, Gu, Chang, & Solomon (2016) concluded that increasing activity participation has a direct correlation between PA and mental health on school-aged children.

In a study by Powell et. al (2019) there was conclusion that physical activity is associated with enhanced cognitive function and mental health across the life span, plus improved mental health and physical function. In the study, authors concluded that physical activity is associated with improved quality of life, improved sleep, reduced feelings of anxiety and depression in healthy people and in people with existing clinical syndromes. Powell also concluded that there was improved cognitive function across the life span in individuals.

Bailey et. al (2018) concluded that school-based PA can play a valuable role in protecting young people from mental illness and has the potential to save lives through helping to reduce feelings of hopelessness, suicide and self-harm. The study highlights the importance of social interactions, and resilience that could be supported through the provision of team sports at school and in clubs. Bailey also concluded that greater physiological difficulties are experienced by young people who drop out of sports and greater social and emotional problems are

experienced by those who do not participate in organized sport. Furthermore, Bailey stated that consideration should be given to the quality and implementation of physical education programs to ensure that they provide benefits to mental health. According to a study by Pluhar et. al (2019), prospective studies might further reveal both the immediate and long-term impacts of sport participation on mental health. Pluhar concluded that further research should also continue to investigate how children's motivation for participating in sport may relate, to or explain why, team sports mediate psychological problems more effectively than individual sports.

Statement of the Problem

While physical activity and sport can provide benefits that are both short and long term for children, research concluded that there is direct evidence of improved mental health and physical function with physical activity. Moreover, physical activity is good for mental health and can be of benefit to those with, and without, mental illnesses by creating active living habits, gaining social support and skills, and building resilience.

Research Questions

1. What are the benefits of physical activity and sport on mental health and well-being in children?
2. What psychological benefits are gained through sport for children?
3. What effect does physical activity have on cognitive function in children?
4. Does participating in sports at a young age lead to an active lifestyle as an adult?

Purpose Statement

The purpose of this synthesis project is to review the literature on the benefits of physical activity and sport on mental health and well-being in school-aged children.

Operational Definitions

These operational definitions are used for this synthesis:

1. **School-aged children:** Age six to 12 years old. (Icahn School of Medicine at Mount Sinai, 2019)
2. **Mental Health:** According to World Health Organization (2019), mental health is defined as a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community. Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.
3. **Physical activity (PA):** The World Health Organization (2019) defines physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure.

Delimitations

These following delimitations are used for this synthesis:

1. Studies that examine school-aged children, ages six to 12, who participate in physical activity or sport.
2. Studies published between 2009-2019.
3. Peer-reviewed studies.
4. Studies that investigated the mental health benefits that physical activity and sport provide for children.

Chapter 2: Methods

The purpose of this chapter was to review the methods used to find literature on the benefits of physical activity and sport on mental health and well-being in school-aged children. The studies collected for this synthesis were located using the EBSCO host database from The College at Brockport's Drake Library. Within the EBSCO host database, the following databases were searched: SPORTDiscus and Academic Search Complete.

Within these databases, a total number of 10 articles met the criteria for inclusion as part of the critical mass within this literature review. In order for an article to meet the criteria for selection in this synthesis it must have been published between 2009-present, this will provide the synthesis with the most up to date and current information available. Other criteria for selection included scholarly and peer reviewed articles that were full-text. Having scholarly and peer reviewed articles provides more validity within the articles and better overall quality. Other articles or sources selected as part of this literature review provided context about the topic, background information and supplemental information to complete the review. All articles and sources are appropriately cited in the reference section of this paper.

In order to gather valuable articles for this synthesis certain keywords and phrases were used when searching the data-base. SPORTDiscus was used initially for the significant number of searches in this synthesis. The first keywords searched were "Physical Activity" and "Mental Health" that resulted in 1,008 hits. This was a broad search to determine how many articles were relative to this specific synthesis topic. The next search was directed more towards the desired population which included, "Physical Activity and Mental Health in Children". This search

resulted in a significantly lower number of hits with just 154. Going forward, searched next was, “Physical Activity Benefits” which resulted in 1,790 hits. To direct the search more focused on the topic, “Mental Health” and “Benefits” was search which provided 516 hits. The next keywords searched were “Mental Health” and “Sports” that resulted in 1,156 hits. The next search was “Physical activity” or “Sport” and “Mental health” and “children” which resulted in 226 hits. The next keywords searched were “physical activity” or sport” and “children” and “health” that resulted in 4,350 hits. “Exercise benefits” and “mental health” and “children” which resulted in 18 hits. Following this search, “fitness benefits” and “mental health” and “children” was searched which resulted in just eight hits. The keywords, “physical activity benefits” and “cognitive function” and “children or adolescents or youth or child or teenager” was finally search which resulted in 14 hits.

Articles that were selected for use in this synthesis were scholarly and peer reviewed articles that were full-text. Also, when selecting articles for use in this synthesis it was important that each article selected had valuable information related to the benefits of physical activity and sport on mental health and well-being in school-aged children.

Specific criteria were used in order to be a part of the literature review. All of the articles selected were based on the benefits of physical activity and sport on mental health and well-being in school-aged children. Participants in the studies reviewed were all physically active boys and girls within the ages of five and 18 years old.

For this synthesis, a total number of 10 articles were used to compile data on the topic of physical activity and sport benefits on mental health and well-being in school-aged children. Articles came from a variety of journals including; *International Journal of Physical Education*, *Journal of Physical Activity and Health*, *The Physical Educator*, *Journal of Sports Science and*

Medicine, Journal of Sport Rehab, Palaestra, Journal of Teaching Physical Education, Kinesiology Review, Trends in Sport Sciences, and Journal of Park and Recreation Administration.

The critical mass for this synthesis is comprised of 3,265 participants. Within the 10 articles used for the literature review there was a total of 1,487 boys and 1,778 girls.

Data were analyzed using the following methodologies for the studies under review. Rapid reviewing which is a shortened form of systematic reviewing was used within articles. Self-description questionnaire inventory was an additional method used to analyze data. Furthermore, cross-sectional studies with questionnaire, evaluation and interview were also methods used to look at data among specific articles.

Chapter 3: Review of Literature

The purpose of this synthesis project is to present a review of the literature on the benefits of physical activity and sport on mental health and well-being in school-aged children. There are three specific areas which physical activity positively impacts mental health including, overall quality of life, greater executive and cognitive function, and improved self-esteem along with lowered social anxiety among this population. Moreover, these aspects will be closely examined and supported by the ten scholarly articles which make up the critical mass for this synthesis.

Quality of Life (QoL)

In the study, “Physical Activity, Physical Fitness, and Health-Related Quality of Life in School-Aged Children”, Xiangli Gu and Mei Chang (2016) reported that the results back the conclusion in which enhancing children’s physical fitness can facilitate positive outcomes including improved health related quality of life (HRQoL). The study had two overall purposes and the first ultimately looks at the comparison between physical activity (PA), physical fitness and health related quality of life among school-aged children ages nine to ten years old. The aim of the second purpose was to examine whether physical fitness moderates the relationship between self-reported PA and HRQoL, as well as pedometer-based PA. There were 201 total participants, which included 91 boys and 110 girls who attended school in the Southern U.S. The results concluded that PA and four components of physical fitness were associated positively with physical and mental function.

The correlational research design was carried out throughout one academic year and was separated into fall and spring semesters to collect data. The participants would attend a 30-min

PE class each school-day and all classes consisted of roughly 20-25 students each. The research design was initiated with a questionnaire during the fall semester which measured participants PA (self-reported PA). Once this data was collected, specific days were scheduled to assess student's in-class PA, measured by pedometers during normal PE classes (pedometer-based PA). At the conclusion of the fall semester, a FITNESSGRAM test battery was administered by the PE teachers which the state mandates. These would allow researchers to observe participants and ensure that the procedures were carried out in a reliable and compliant way. Students were familiar with this product as it is a requirement by the state for the PE curriculum.

In the second semester of the academic year, participants were administered the self-reported HRQoL survey in questionnaire form. With the supervision of researchers and PE teacher's assistance, the survey was confidential and participants were encouraged to answer all questions truthfully. The survey measures included demographic variables, self-reported PA, pedometer-based PA, physical fitness, and HRQoL.

Cronbach's alpha coefficients (Gu, Chang, & Solomon, 2016) was the first action used to study the internal consistencies of the self-reported measures. Intraclass correlation focused on reliability of the respective measurements and bivariate correlation among the study variables was also ran. The coefficients showed all of the analyses' provided internal consistency and that both self-reported PA and pedometer-based PA were positively linked with physical and mental functioning of HRQoL. Furthermore, results showed that both physical fitness and PA were highly connected to physical and mental functioning of HRQoL and fitness may also assist school-aged children to reach desired health benefits and overall well-being.

In addition, a study by Bunc (2018) concluded the following: The greater the maximal performance in physiological components such as muscle strength, power and endurance, the

higher the reserve capacity is for the physical action of events of daily living. Also, the potential for quality life and the striving of independent life during increasing of age is additionally found to be greater.

The aim of this study was to gather the results of the application of appropriate physical activity (PA) based on walking on physical fitness and health in a non-trained Czech Republic population of various ages. Participants included children which consisted of 142 boys and 124 girls for the study, ages 10-14 years old. The method of the study consisted of aerobic walking or cycling at 50-70% VO₂max. The sessions varied in time ranging from 20-50 minutes and training was done three to five times a week. The study duration was carried out throughout five months. The main variables in which the researchers focused on were assessed through exercise treadmill by increased load and body composition, with assistance of whole body bioimpedance analysis, by using predicted equations that were gathered for the Czechia population.

Maintaining adequate physical performance is an essential element of a healthy and productive life among the nontrained population. Walking-based movement activities significantly affect the course of aging and may, in regular exercise, significantly affect the quality of life of individuals. Researchers concluded that children are able to reach a daily number of steps from 6,900 to 12,100 steps. However, the recommended daily volume of steps in children is 10,000 to 13,000 steps. Moreover, the number of steps in children is at a higher expected rate among all populations because of the need to learn new movement skills at a young age which requires more energy expenditure. Results showed that participants were monitored by weekly energy content of established PA in the range of 1686 kcal (7048 kJ) to 2570 kcal (10742 kJ) (mean was 2011 ± 471 kcal – 8406 ± 1969 kJ). The mean daily number of steps was 9441 ± 679 steps per day.

Similarly, Snyder (2010) formulated a study classified as, “Health-Related Quality of Life Differs Between Adolescent Athletes and Adolescent Nonathletes”. In the cross-sectional study design, participants among seven high schools consisted of 219 athletes (121 females, 98 males) and 106 nonathletes (61 females, 45 males) (325 total). The participants were aged 13-17 years old.

Therefore, the aim of the study ultimately examines the health-related quality of life (HRQoL) in adolescent athletes and nonathletes using two common test tools. The Medical Outcomes Short Form (SF-36) (36 questions) and the Pediatric Outcomes Data Collection Instrument (PODCI) are critical aspects used to measure data and carry out the study. The two measurements were completed in a counterbalanced procedure during the first session. Dependent variables from the SF-36 contributed of eight subscale scores including physical functioning, role limitations caused by physical health issues, bodily pain, general health perceptions, vitality, social functioning, role limitations caused by emotional problems, and mental health. There were also two composite scores used which included physical and mental. Each composite score measured different subscales in respective manner. Dependent variables from the PODCI consisted of five subscale scores including upper extremity and physical functioning, transfer and basic mobility, sports and physical functioning pain/comfort, and happiness and the PODCI global score as well. Summary scores were gathered as part of the data collection process and used for the physical and mental components of the scale. Each data measurement was classified as a demographic questionnaire for the participants and was completed in a single session during a class period. Counterbalance of data forms were used to administered the two tests allowing one to be taken before the other for subjects and vice versa. All forms were filled out independently and to the best of the participants abilities.

Nonparametric methods were used for the analysis of statistics along with SPSS software. SF-36 showed that athletes reported greater scores than nonathletes on the subscales for physical functioning, general health perceptions, social functioning, and mental health and mental composite score. However, athletes showed lower scores on the bodily pain subscale than nonathletes. PODCI showed that athletes reported greater scores on the subscales for sports and physical functioning and for happiness, and lower scores on the pain/comfort subscale than nonathletes. Overall, higher scores were reported for athletes in the subscales related to mental, emotional and physical well-being than nonathletes.

Executive and Cognitive Function

Powell et al. (2017) concluded that benefits of physical activity include enhanced cognitive function and mental health across the life span, plus improved mental health and physical function. The study, “In the Scientific Foundation for Physical Activity Guidelines for Americans, 2nd edition”, Powell also concluded that in children ages six to 17 years old there are fewer symptoms of depression, and improved quality of life following acute bouts of aerobic activity. The 2018 Physical Activity Guidelines Advisory Committee (PAGAC) used 38 questions and 104 sub questions as data collection for the study. The committee authorized nine subcommittees including, aging, brain health, cancer prevention of weight gain, exposure, individuals with chronic conditions, promoting regular physical activity, sedentary behavior, and youth as well as a pregnancy working group.

Furthermore, Park (2019) concluded that a single session of exercise has benefits for cognitive performance following exercise. While the majority of research has been carried out with young adults, very few studies to date have examined these effects in adolescents and school-aged children. Executive function (EF) flourishes through late adolescence and into

young adulthood. It is vital to gauge the extent to which acute exercise benefits EF in adolescents.

Therefore, the primary purpose of the study was to look at the effect of moderate-intensity acute exercise on ensuing EF performance. 22 healthy high school students (11 females, 11 males) ages 15-16 years old in South Korea volunteered to be participants for the study. The order of conditions was randomized and counterbalanced for the study using a within-subjects design. Subjects completed measures including the Stroop Test, the Symbol Digit Modalities Test, and the Tower of London Test, post control and exercise with sessions performed on various days.

Procedure for the study included two separate sessions for each participant. In the first session for sedentary control condition, subjects were asked to study for 20 minutes on their own material of choice. Cognitive tests were then administered immediately following this 20-minute period. The next session consisted of participants exercising for 20 minutes and the cognitive tests were administered ten minutes following. Heart rate (HR) and ratings of perceived exertion (RPE) were measured during this procedure as well. Statistical Analyses were carried out using repeated-measures analyses of variances (RM ANOVAs) and ultimately differentiated average HR between exercise and control conditions. To examine the effect of acute exercise on cognitive performance, two-way RM ANOVAs were used to compare performance between two conditions and two test orders. Furthermore, exercise performed prior to the cognitive tests determined vital benefits for Stroop Color, Stroop Color-Word tests, Symbolic Digit Modalities Test, Tower of London total moves, and Tower of London total excess moves. The results of the study supported a critical extension to the literature by validating that 20 minutes of moderate-intensity exercise positively aids EF performance in school-aged children.

Moreover, Schmidt (2015) investigated the effects of two qualitatively different chronic PA interventions on executive functions in primary school children in the study, “Cognitively Engaging Chronic Physical Activity, But Not Aerobic Exercise, Affects Executive Functions in Primary School Children: A Group-Randomized Controlled Trial”. 181 children ages ten to 12 years old were participants for the study and were assigned to either a six week PA program with a high level of physical exertion and high cognitive engagement (team games), a physical education program with high physical exertion, but low cognitive engagement (aerobic), or to a PE program with both low physical exertion and low cognitive engagement (control condition).

Executive functions were a portion of the cognitive assessment which included Inhibition and Shifting as well. Aerobic fitness was also determined pre and posttest of the respective condition, and was estimated using the Multistage 20-Meter Shuttle Run test. Collectively, 12 classes were assigned randomly to one of three experimental conditions. The interviews for the test were performed by the regular physical education teachers of their respective classes through the duration of two lessons per week, over a six-week period. Statistical analyses for the study used Outlier Analysis, Preliminary Analyses, and Main Analyses more specifically, as well. To analyze whether the cognitive engagement differed between the three experimental conditions, the three groups were correlated with regard to the rated involvement of updating, inhibition, and shifting.

Results for the study concluded that both interventions (team games and aerobic exercise) do in fact have a positive impact on children’s aerobic fitness (4-5% increase in estimated VO₂ max). In addition, involvement of cognitive engagement in PA seems to be the most encouraging type of chronic intervention to add to executive functions in children, while also facilitating deeper proof for the importance of the qualitative aspects of PA. Overall, the sequence of

physical exertion and cognitive engagement in the team games condition seems to have the greatest effect on EFs, considering the group introduced to the team games condition improved most in its shifting and performance. This was also from exposure between pre- and posttest related with the aerobic exercise and control condition.

Improved Self-Esteem /Lowered Social Anxiety

Kliziene (2018) concluded that schools are important settings for the promotion of children's physical activity. In the study, "Effects of an Eight-Month Exercise Intervention Program on Physical Activity and Decrease of Anxiety in Elementary School Children", the authors also expressed that this program led to statistically significant changes in the dependent variables including increased physical activity and decreased anxiety for the experimental group as well. The participants for the experimental group included 36 girls and 34 boys ages six to seven years old, where the control group consisted of only 35 girls and 33 boys. All participants were attendants of the same school.

The methodology of the study was based on a model which included dynamic exercise, intense motor skill repetition, differentiation, and physical activity distribution in the classroom. The Children's Physical Activity Questionnaire (Corder et al., 2009) was used as well, known as "The evaluation of physical activity". The basis of the study also used the Children's Leisure Activities Study Survey (CLASS) questionnaire and "The measurement of anxiety" – the methodology of Reynolds and Richmond (1994). Pre- and post-tests were used for the study and collection of data, which was chosen to avoid any complications with educational activities due, to the random selection of participants in the groups. The post-test of the experimental group boys was related to the girls to analyze differences among average physical activity. This was significantly higher in boys (1320.24 MET, min/week) to girls' statistics (840.60 MET,

min/week). The results were also higher statistically for average MET per boy in comparison with the female participants. The results of the somatic anxiety in EG were higher before the intervention than after, which concluded that there were lower levels of depression, seclusion, somatic complaints, aggression, and delinquent behavior.

The results indicated that the intervention program was effective and the mission of a positive youth development perspective is the promotion of healthy physical and psychosocial development in young children. School physical education represents a context that has the potential for promoting positive youth development, by helping students acquire life skills and psychosocial, as well as behavioral attributes, that can transfer to other important domains including school, family and work short and long term as well.

Alternatively, a cross-sectional study of child and adolescent athletes assessed at a sports injury prevention center was conducted by Pluhar (2019). The study aimed to determine two objectives including whether the proportion of athletes with mental health diagnoses and athlete motivations for playing differ between team sports and individual sports. 756 athletes between the ages of six and 18 years old, who had undergone a sports injury prevention evaluation (IPE), were participants for the study. Athletes were administered the questionnaire, which included extensive sports participation history, previous injuries, training regimen, dietary intake, and sleeping habits followed by anatomic measurements, performance measures, biomechanical evaluations, functional movement assessments, and physical fitness screening. Questionnaires for both individual and team sports were used for data collection and consisted of questions regarding goal-orientated reasons for playing and fun reasons for playing as well.

The results of the study were concluded by the authors. They determined that individual sport athletes were more likely than athletes in team sports to play their sports for goal-oriented

reasons, as opposed to for fun. Individual sport athletes are also more likely to report anxiety and depression than team sport athletes. The mental health benefits of participation in organized sports may fluctuate between individual sport athletes and those playing team sports.

Physical activity contributes to physical and emotional health through the combination of physical exertion and social contact. In a study by Mittleman (2018), the comparison between physical and social education has been highlighted with at-risk youth. The data collection of the study was composed of eight sessions of one hour and 15 minutes. Social value, personal growth, and communication were all aspects of the responses covered. 24 boys and 36 girls, among nine groups, made up this study of ages 15-17 years old. The interviews post intervention involved only 18 participants, however, and 15 questions that focused on four major issues including, social function, self-esteem, communication through passing the ball and the effects of holding the sessions away from the hospital. The great majority of the participants reported the group to be very meaningful socially and some also regarded it as a positive personal experience. This was in relation with the observations during the program. The following were among the reasons stated: it was fun and that they enjoyed learning how to play basketball and improve their skills fundamentally.

“Making After-School Physical Activity Programs A Success: Practical Lessons Learned”, is a study by Baghurst (2018) with a purpose of presenting the findings of three after-school programs that would be tested to improve physical and psychological outcomes. Participants included ten boys and 17 girls, in the first to fifth grades, from several schools in a small city in the Mid-South of the U.S. Measures used included the Self-Description Questionnaire Inventory (SDQI) which is designed for use with adolescents. Three programs were conducted, including one for running and two for indoor rowing as the subscales. Overall,

participants posttest scores were higher than their pretest scores on all subscale measures, including physical appearance, physical ability, peer relations, and general self.

Summary

The purpose of this chapter was to review the literature on the benefits of physical activity and sport on mental health and well-being on school-aged children. The first aspect reviewed the benefits, and overall impact of physical activity, on quality life as a whole. Not only does PA provide short term benefits, but long-term as well. Next, physical activity and sport provide benefits to executive and cognitive function, which is critical in adolescents and school-aged children. These aspects are essential for growth, development and decision making in young children. Lastly, the review of articles, and critical mass, supported the benefits of physical activity on improving self-esteem and lowering social anxiety in school-aged children as well. Collectively, after reviewing the research on these three main aspects, it can be concluded that physical activity and sport does benefit mental health and well-being in school-aged children.

Chapter 4: Review and Recommendations

The purpose of this chapter is to discuss and review the literature that was used throughout the synthesis and provide any recommendations for future research. Pluhar (2019) concludes that researchers should continue to investigate how children's motivation for participating in sports may relate to, or explain, why team sports mediate psychological problems more effectively than individual sports. It is possible that the social opportunities linked with team sports promote fun and stress relief, while training for individual sports on the other hand, is lonelier. This can also lead to less healthy goal setting and internal attribution after failure.

Similarly, Nixdorf et al., (2016) adds that individual athletes could be more likely to suffer from mental health problems, in part, because they may feel more pressure to perform. Exerting all of their energy to succeeding in a single athletic pursuit may lead to overly focused outcomes and they may experience greater internal attribution post failure. Moreover, team sport athletes can depend on the support of their teammates, whereas individual sport athletes rely on only their own preparation and skill level to achieve success. Competing alone, individual sport athletes can not only experience loneliness and isolation, but also, if they do not succeed in accomplishing their goals, may experience the weight of failure alone.

Interpretations

As part of this literature review, there were four questions that were posed. The first research question examined the benefits of physical activity on mental health and well-being in school aged children. The results of the research concluded that overall the quality of life is one supporting significant benefit of physical activity. Another research question for this synthesis investigated the psychological benefits that are gained by children through sport. The results of

this review of literature revealed that improved self-esteem and lowered social anxiety were significant results. The next question that was implored was, what effect does physical activity have on cognitive function in children? The results concluded that executive and cognitive function are, in fact, benefits of physical activity that ultimately effect children's processes, such as learning, attention, memory, intellectual development and decision making. The final question that was posed was whether or not sport participation at a young age leads to an active lifestyle in an adult as well. The results concluded that further examination should be taken for future research to test this theory.

Implications

This review of literature will be of value for physical educators, administrators, coaches, and parents. Schools are important settings for the promotion of children's physical activity (Kliziene, 2018). Healthy physical and psychosocial development in young people should be the goal of a positive youth development promotion. School physical education defines a context that has the potential for promoting positive youth development by helping students acquire life and psychosocial skills. It also carries behavioral attributes that can transfer to other important domains such as school, family, and work currently and over the life span. It is important for administrators and PE teachers to understand this vital potential and consider this critical contribution that it holds for children overall.

Children not only need enough PA, but also high-quality PA, which integrates games and activities requiring cognitive engagement (Schmidt, 2015). Providing time for physical education during the school day has been demonstrated to improve cognitive performance by this age group as well. School administrators should be aware of this and understand that 20 minutes of exercise during the school day is expected to benefit information processing, attention control,

inhibition, and planning and these affects have the potential to improves students' academic performance as well (Park, 2019).

There is significant importance of mental health awareness in schools, which is often overlooked by coaches and administrators. It is vital to support and promote children's mental health in physical education and interscholastic sport settings. The practical implications of this synthesis can raise awareness of mental health in school-aged children, and all administrators can be more mindful and considerate of the benefits associated with physical activity on children's mental health. These benefits go beyond the physical capabilities and talent of sport, but also carries the emotional and social health benefits that ensure a child's healthy development and overall well-being.

The conclusions of this synthesis agree with the authors of the articles of the critical mass in regards to physical activity providing several benefits to the mental health of school-aged children. Powell et. al (2019) and Park (2019) also added that school-aged children benefit from physical activity and sport in more ways than one, and it can assist in the social, emotional, physical and cognitive development during adolescent years.

My findings are significantly different from other studies. While this synthesis is primarily aimed to look at the benefits of physical activity and sport on mental health in school-aged children alone, which is more focused versus most studies. Studies by Bunc (2018) and Pluhar et. al (2019) sought to test other variables and factors associated with mental health issues, such as depression and anxiety in children and how physical activity could be a possible solution to reduce stigma. Further purposes of the studies included active lifestyles and the aging of adults and seniors as well, along with children which was a delimitation of this synthesis. Bunc (2018) and Pluhar (2019) also looked at the benefits socially, emotionally and

psychologically, unlike this synthesis which was limited to the benefits that physical activity can provide to mental health. No mental illness data was involved or used as a delimiting variable. Ultimately, this synthesis was to examine the direct benefits that physical activity provides to youth on their mental health and how they can grow socially, all mental illnesses aside. The findings of this synthesis are fundamentally within the articles of the critical mass, but limit mental illnesses, and only seek positive benefits to the overall well-being of school-aged children.

The results do confirm existing theories where many benefits can be gained. However, results were concluded to decrease mental illness issues, where this synthesis used factors to conclude that they can also be just as beneficial to overall mental, emotional and physical well-being. Furthermore, this includes physical and social functioning and mental health and happiness, even if the individuals are already mentally stable (Pluhar, 2019).

The results of this synthesis did meet my own expectations because I have personally been mentally and emotionally invested in sport my entire life. It is evident that sport and physical activity can provide benefits to mental health and the articles that made up this critical mass provided strong support of the topic. All the respective articles provided statistics in which physical activity benefited the studies purpose, which was also relevant and applicable to this synthesis. There was a clear indication that mental health benefited, to a certain level, from physical activity. I believed the results answered my own questions for this synthesis and there was significant validation throughout the entire review of literature.

In this manner, administrators, teachers, coaches, graduate students, student-athletes and parents will find value from this research. They may also be able to provide greater knowledge and understanding of the benefits that sport has on mental health in children. There is direct

implication to school-aged PE classes and interscholastic sports as well. We can raise awareness of the importance of mental health and how PA impacts it at a high level.

Today, sadly, kids are not attending high school PE classes and still managing to graduate middle and high school. Adolescents need PE exposure to gain developmental skills including decision making, teamwork, adversity, problem solving with different sports, resilience and passion. There is more to gain from sport and PA than winning, losing and breaking records. Sports and PE classes extend much further than a game and can teach school-aged children important lessons that can apply to life, relationships and success. Ultimately, learning how to become independent, overcoming adversity, working as a team and finding mental strength are benefits that can be gained. Mindfulness, communication, social functioning/interaction and strengthening self-esteem are also aspects of sport that can be achieved. Well-rounded student-athletes and interscholastic sports are great opportunities that can lead to future success for children.

In a generation that is struggling with staying physically active, being committed to a team, and using failure as an experience to grow, sport is ultimately a supplement for mental health which children can use for development and growth in life. Sport should provide educational lessons for school-aged children and allow them learn and apply strategies of a game to become mentally and emotionally stronger for bigger challenges in life. Physical health benefits from PA is well known to many, but it is the mental health benefits that is lacking awareness, understanding and treatment.

PE and interscholastic sport should be an extension of the classroom. Teaching before coaching is critical for any sport and it allows kids to learn and be coachable. Children simply do not gain practical skills from other outside activities that are essential for life and mental health

like they do with sport. While sport may not be for everyone, individuals should still seek physical activity to an extent and aspire to find mental and emotional benefits from it. Kids need structure, discipline and accountability which are critical aspects while being part of a team. Sport can provide overall quality of life, executive and cognitive function, and improved self-esteem and lowered social anxiety for school-aged children. If kids do not participate in sports due to the negative outcomes and barriers that may exist, they will never gain the positive experiences that are possible. It is likely that they will learn more about themselves and their teammates from defeat, more than they would from victory. Having a winning attitude, competing with peers, having fun and overcoming adversity are several others reasons children should look towards sport participation in school. Physical health and mental health go hand-in-hand and sport is a perfect example for school-aged children to gain the many benefits that physical activity can provide.

Recommendations

In reviewing the data base on physical activity and mental health in children, the following limitations were noted regarding the studies under review.

Based on these limitations and other insights related to the literature, the following recommendations for future research should be considered:

1. Researchers should continue to investigate how children's motivation for participating in sports may relate to or explain why team sports mediate psychological problems more effectively than individual sports. This is pivotal because many children may have feelings of hopelessness, suicide and self-harm while participating in individual sports, versus being part of a team. Isolation is common with this behavior. Team sports

provides opportunity in having social interactions with friends and peers to grow and participate. (Bailey et. al, 2018)

2. Depending on the purpose, and desired outcomes of an after-school PA program, researchers may want to evaluate improvements in technique and plan a follow-up with participants at a future time to examine continued interest in the particular activity. Children may find physical activity enjoyable for only a certain extent of time, which can lead to lack of motivation to participate in the respective activity.
3. Future research should consider the effects of gender, sport, and other nonathletic school activities on adolescent HRQoL, as well as the impact of sport-related injury on the overall health status of this vulnerable population. Many school-aged children experience judgement, failure and injury as reasons to stop playing a specific sport versus finding resilience and determination to keep going.
4. Physical activity has potentially beneficial effects for reduced depression and anxiety, but the evidence base is limited.
5. Further research might develop methods to infer the cognitive engagement inherent in qualitatively different forms of PA. Team and individual sports provide several different factors for children's participation and can alter their mental health dramatically.
6. Future research will be needed to expand the understanding of the mechanisms responsible for observed benefits in response to acute exercise. Small bouts of exercise such as low impact sports may not provide the same mental health benefits that other sports do.
7. There are a lack of studies and evidence directed at the long-term effects of PE and there is no proof to assume that PE produces an active lifestyle as an adult. For school-aged

children, active lives are critical during adolescent years and future research in the field can benefit, if a correlation between ages is made. (Bunc, 2018)

Summary

The purpose of this literature review was to determine the benefits of physical activity and sport on mental health and well-being in school-aged children. Delimiting variables were used to do an exhaustive data-based search which yielded ten articles. These articles were then systematically used determine the benefits of physical activity and sport on mental health and well-being in school-aged children. Research revealed that quality of life, improved self-esteem and lowered social anxiety, and executive and cognitive function were significant benefits of physical and sport. In a generation that is lacking an active lifestyle, children and adolescents need physical activity and sport that can provide essential benefits for mental health.

Furthermore, this plays a significant role in the vital stages of development, growth, and learning for children. Mental health is vital, especially in school-aged children, and it should never be overlooked. As a society, we should be providing children with the opportunity to gain as many benefits from a mental and emotional health standpoint through sport and physical activity that can affect them for the rest of their lives.

References

- Baghurst, T., & Fink, K. (2018). Making After-School Physical Activity Programs a Success: Practical Lessons Learned. *Physical Educator*, 75(3), 515–524.
- Bailey, R. P., Howells, K., & Glibo, I. (2018). Physical Activity and Mental Health of School-Aged Children and Adolescents: A rapid review. *International Journal of Physical Education*, 55(1), 2–15.
- Bunc, V. (2018). A Movement Intervention as a Tool of the Influence of Physical Fitness and Health. *Trends in Sport Sciences*, 25(4), 209–216.
- CDC - Learn About Mental Health - Mental Health. (2018, January 26). Retrieved December 10, 2019, from <https://www.cdc.gov/mentalhealth/learn/index.htm>.
- Gu, X., Chang, M., & Solmon, M. A. (2016). Physical Activity, Physical Fitness, and Health-Related Quality of Life in School-Aged Children. *Journal of Teaching in Physical Education*, 35(2), 117–126.
- Klizienė, I., Kimantienė, L., Čižauskas, G., Marcinkevičiūtė, G., & Treigyte, V. (2018). Effects of an Eight-Month Exercise Intervention Programme on Physical Activity and Decrease of Anxiety in Elementary School Children. *Baltic Journal of Sport & Health Sciences*, 111(4), 23–29.
- Mittleman, J., Iuchtman, A., & Yatzker, U. (2018). Basketball as Psycho-Social Therapy for Adolescents in Psychiatric Hospitalization. *Palaestra*, 32(3), 28–34.
- NAMI. (2019). Mental Health by The Numbers. Retrieved December 10, 2019, from <https://www.nami.org/learn-more/mental-health-by-the-numbers>.

- Park, S., & Etnier, J. L. (2019). Beneficial Effects of Acute Exercise on Executive Function in Adolescents. *Journal of Physical Activity & Health*, 16(6), 423–429.
- Pluhar, E., McCracken, C., Griffith, K. L., Christino, M. A., Sugimoto, D., & Meehan III, W. P. (2019). Team Sport Athletes May Be Less Likely to Suffer Anxiety or Depression than Individual Sport Athletes. *Journal of Sports Science & Medicine*, 18(3), 490–496.
- Powell, K. E., King, A. C., Buchner, D. M., Campbell, W. W., DiPietro, L., Erickson, K. I., ... Whitt-Glover, M. C. (2019). The Scientific Foundation for the Physical Activity Guidelines for Americans, 2nd Edition. *Journal of Physical Activity & Health*, 16(1), 1–11.
- Schmidt, M., Jäger, K., Egger, F., Roebbers, C. M., & Conzelmann, A. (2015). Cognitively Engaging Chronic Physical Activity, But Not Aerobic Exercise, Affects Executive Functions in Primary School Children: A Group-Randomized Controlled Trial. *Journal of Sport & Exercise Psychology*, 37(6), 575–591.
- Snyder, A. R., Martinez, J. C., Bay, R. C., Parsons, J. T., Sauers, E. L., & Valovich McLeod, T. C. (2010). Health-Related Quality of Life Differs Between Adolescent Athletes and Adolescent Nonathletes. *Journal of Sport Rehabilitation*, 19(3), 237–248
- World Health Organization. (2019, November 26). Mental Health. Retrieved December 10, 2019, from https://www.who.int/mental_health/en/.

Appendix A
Article Grid

Appendix A

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/ Recommendation Commonalities
Powell, Kenneth E. King, Abby C. Buchner, David M. Campbell, Wayne W. DiPietro, Loretta Erickson, Kirk I. (2019).	The Scientific Foundation for the Physical Activity Guidelines for Americans, 2nd Edition	<i>Journal of Physical Activity & Health</i>	Examine more broadly the wide-range benefits of physical activity to health, as well as the types, volumes, and intensities of physical activity that are associated with those benefits.	Through a series of discussions and ranking procedures, the committee identified 38 questions and 104 sub-questions to be addressed by the subcommittees. (9) Questions were selected for their public health relevance, potential to inform public policies and programs, maturity of the relevant science, and applicability to the general US population.	Using standard procedures, the consulting service staff prepared extractions, which included the citation, search dates for systematic reviews, the abstract, and information about the exposure and the outcome.	The public health impact of increasing population levels of regular physical activity and provide a firm foundation for the development of federal physical activity guidelines for the general US population.	Small increases in regular MVPA, especially if made by the least physically active individuals, would appreciably reduce the burden and cost of disease in the U.S. The list of health benefits attributable to greater amounts of physical activity continues to grow longer and applies to all of the US population.

Timothy Baghurst, Kevin Fink (2018).	Making After-School Physical Activity Programs a Success: Practical Lessons Learned	<i>The Physical Educator</i>	Not only to develop quality physical education as the foundation, but also to build PA programming for before, during, and after school that includes staff, family, and community.	Three after-school programs, one for running and two for indoor rowing. The running program (RUN) helped us to develop the indoor rowing program (ROW1), which was conducted 518 After-School Physical Activity Programs a second time (ROW2) using adjustments made from experiences acquired from ROW1.	Participants in all three programs were measured using the Self-Description Questionnaire Inventory (SDQI; Marsh et al., 1998), which is designed for use with adolescents. (e.g., I like the way I look), and (d) Peer Relations (e.g., I make friends easily)	Shows the influence external factors such as competition and audience effects, in addition to many other variables, can have on a performance. It is evident that participants did not put forth maximum effort in the posttest especially, and programmers need to find a motivator to ensure that they do.	Depending on the purpose and desired outcomes of an after-school PA program, researchers may want to evaluate improvements in technique and plan a follow-up with participants at a future time to examine continued interest in the particular activity. If interest has discontinued, researchers can probe to determine if environmental barriers or personal interest were factors. Therefore, working with community partners is essential to creating effective, enjoyable programs that are sustainable and provide equitable access to targeted community members.
Vaclav, Bunc (2018).	A movement intervention as a tool of the influence	<i>Trends in Sport Sciences</i>	The aim of the study is to summarize the results of the application of	In children (1842 boys and 1652 girls) we monitored the weekly energy content of imposed PA in the range	The functional variables were assessed on treadmill, body composition with help of bioimpedance analysis.	The greater the maximal performance in physiological components such as muscle strength,	Extensive research during the past 50 years strongly indicates that PF and changes in fitness are causally related to quality of life style and long-term health.

	of physical fitness and health		appropriate PA based on walking on PF and health in non-trained Czech population differing in age.	of 1686 kcal (7048 kJ) to 2570 kcal (10742 kJ) (mean was 2011 ± 471 kcal – 8406 ± 1969 kJ). The mean daily number of steps was 9441 ± 679 steps per day.		power and endurance, the greater is the reserve capacity for the physical performance of activities of daily living and the potential for quality life and the continuation of independent life during increasing of age.	
Emily Pluhar, Caitlin McCracken, Kelsey L. Griffith, Melissa A. Christino, Dai Sugimoto and William P.	Team Sport Athletes May Be Less Likely to Suffer Anxiety or Depression than Individual Sport Athletes	<i>Journal of Sports Sciences & Medicine</i>	The objective of the study was to determine whether 1) the proportion of athletes with mental health diagnoses and 2) athlete motivations for playing	Conducted a cross-sectional study of child and adolescent athletes assessed at a sports injury prevention center. We compared self-reported anxiety, depression, and reasons for participating in sports between athletes in	Pearson's Chi-square or Fisher's exact test was used to compare categorical variables. Any variable that differed between individual sport and team sport athletes on univariable	Among young athletes, anxiety and depression are more common in those who play individual sports than those who play team sports. In addition, adolescent individual sport athletes are more likely to	Researchers should continue to investigate how children's motivation for participating in sports may relate to or explain why team sports mediate psychological problems more effectively than individual sports. It is possible that the social opportunities associated with team sports promote fun and stress relief, while training for individual sports is lonelier

Meehan III (2019).			differ between team sports and individual sports.	individual sports (e.g. gymnastics, running, diving) and team sports (e.g. soccer, football, hockey)	comparisons with a statistical significance of $p < 0.2$ was entered into a logistic regression model in order to determine the independent effect of each variable on our main outcomes. A p-value of < 0.05 or a 95% confidence interval that did not cross 1 were used to define statistical significance.	play their sport for goal-oriented reasons, instead of for fun when compared to their counterparts participating in team sports	and can lead to less healthy goal setting and internal attribution after failure.
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<p>Snyder, Alison R. Martinez, Jessica C. Bay, R. Curtis Parsons, John T Sauer, Eric L. Valovich McLeod, Tamara C (2010).</p>	<p>Health-Related Quality of Life Differs Between Adolescent Athletes and Adolescent Nonathletes.</p>	<p><i>Journal of Sport Rehabilitation</i></p>	<p>The purpose of the study was to compare HRQoL in adolescent athletes and nonathletes.</p>	<p>Cross-sectional study. 325 high school students (219 athletes, 121 female and 98 males) (106 nonathletes, 61 females and 45 males) 83 questions on the PODCI with 5 subscales. (PODCI)- Pediatric Outcomes Data Collection Instrument</p>	<p>Dep. Variables included 8 subscale and 2 composite scores of the SF-36 and the 5 subscale scores and 1 global score of the PODCI.</p>	<p>Athletes reported higher scores on phys. Function, general health, social functioning and mental health. On PODCI athletes scored higher than nonathletes.</p>	<p>Athletes reported higher scores on a number of SF-36 and PODCI subscales related to mental, emotional and phys. Well-being than nonathletes. Findings suggest that athletic involvement may be a benefit to the overall health status of adolescents and imply that athletes may be a distinct group requiring own normative values when using SF-36 and PODCI.</p>
<p>Se Yun Park, Jennifer L. Etnier (2019).</p>	<p>Beneficial Effects of Acute Exercise on Executive Function in Adolescents</p>	<p><i>Journal of Physical Activity and Health</i></p>	<p>The purpose of the study was to assess the effect of moderate-intensity acute exercise on subsequent EF performance in this population.</p>	<p>Healthy high school students (22) age 15-16 years old. Volunteered to participate. Stroop Test, The Symbol Digit Modalities Test, and the Tower of London Test following control and following exercise with sessions on diff. days.</p>	<p>To assess differences in HR, repeated-measures analyses of variances (RM ANOVAs) were used to compare average HR between exercise and control conditions.</p>	<p>Exercise resulted in significant benefits for Stroop Color, Stroop Color-Word tests, Symbol Digit Modalities Test, Tower of London total moves, and Tower of London total excess moves</p>	<p>The results provide an important extension to the literature by confirming that 20 minutes of moderate-intensity exercise benefits EF performance in high school students.</p>

<p>Xiangli Gu, and Mei Chang, Melinda A. Solomon (2016).</p>	<p>Physical Activity, Physical Fitness, a Health-Related Quality of Life in School-Aged Children</p>	<p><i>Journal of Teaching in Physical Education</i></p>	<p>Examined the association between PA physical fitness, and health-related quality of life (HRQoL) among school-aged children.</p>	<p>201 children (91 boys, 110 girls) Enrolled in one school in the Southern U.S. (Self-reported PA, pedometer-based PA) and physical fitness were assessed in fall. The PedsQL4.0 was used in spring to assess participants HRQoL.</p>	<p>Path analyses concludes physical fitness mediated the relationship between self-reported PA and HRQoL as well as between pedometer-based PA and HRQoL</p>	<p>PA and four components of physical fitness were positively associated with phys. And mental function.</p>	<p>Results support the conclusion that enhancing children’s physical fitness can facilitate positive outcomes including improved health related quality of life.</p>
<p>Irina Kliziene, Laura Kimantienė, Ginas Cizauskas, Giedre Marcinkeviciute, Viktorja Treigyte (2018).</p>	<p>Effects of an 8-Month Exer. Intervention program on physical activity and decrease of anxiety in children</p>	<p><i>Baltic Journal of Sport and Health Sciences</i></p>	<p>The purpose of this study was to establish the effects of a 8-month exercise intervention program on physical activity and decrease of anxiety for first grade students.</p>	<p>36 girls and 34 boys aged 6-7 yrs. old. Innovative PE classes was based on the DIDS model. Children’s Physical Activity Questionnaire was also used. CLASS questionnaire and the measurement of anxiety- the methodology of Reynolds and Richmond. (1994)</p>	<p>Significant difference was found between boys and girls during the analysis of MET. Boys (1390.45 MET, min/week) (girls 880.27) demonstrated lower levels of depression.</p>	<p>Program led to statistically significant changes in the dependent variables: increased physical activity and decreased anxiety for the experimental group</p>	<p>Physical activity has potential beneficial effects for reduced depression, but the evidence base is limited.</p>

<p>Mirko Schmidt, Katja Jager, Fabienne Egger, Claudia M. Roebbers, and Achim Conzelmann (2015).</p>	<p>Cognitively Engaging Chronic Physical Activity, But Not Aerobic Exercise, Affects Executive in Primary School-Children</p>	<p><i>Journal of Sport & Exercise Psychological</i></p>	<p>Aim of study was to investigate the effects of two qualitatively different chronic PA interventions on executive functions in primary school children.</p>	<p>181 children for study aged between 10 and 12. 6-week PE program with high and low physical exertion but low and high cognitive engagement. Team games, aerobic exercise, and control conditions</p>	<p>Means and standard deviations for accuracy and reaction times in the flanker task and pre- and posttest for the three experimental conditions.</p>	<p>Results revealed that both interventions (team games and aerobic exercise) have a positive impact on children's aerobic fitness (4-5% increase in est. VO2max)</p>	<p>Cognitive stimulation in that cognitively engaging PA leads to stronger improvement in EFs and PA without cognitive engagement. Chronic intervention to enhance executive function in children, providing further evidence for the importance of the qualitative aspects of PA.</p>
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