Effective Strategies for Reducing Sedentary Lifestyles of Adolescent Youth

---

A Synthesis Project

Presented to the

Department of Kinesiology, Sport Studies, and Physical Education

SUNY Brockport

State University of New York

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Education

(Physical Education)

By

Jesse R. Fendryk

December 12, 2020

SUNY BROCKPORT

STATE UNIVERSITY OF NEW YORK

BROCKPORT, NEW YORK

Department of Kinesiology, Sport Studies, and Physical Education

Effective Strategies for Reducing Sedentary Lifestyles of Adolescent Youth

---

Dan Raimondo — 12/17/2020

Instructor Approval — Date

Accepted by the Department of Kinesiology, Sport Studies, and physical Education. SUNY Brockport, State University of New York, in partial fulfillment of the requirements for the degree Master of Science in Education (Physical Education.

Cathy Houston-Wilson — 12/17/20

Chairperson Approval — Date

Acknowledgements

This page is here specifically to acknowledge those in my life who have been my inspiration to complete this master's program. To my mother who has always pushed me to do my best, thank you so much for inspiring me. To my wife and children, you have been the motivation that has pushed me to do my best. Working through a graduate program with a three-year-old toddler and twin baby girls has not been easy, and you have been so supportive of my work. Thank you for being such an amazing and compassionate wife. A special thank you to my lovely daughter Kinsley, your smiles keep me going!

Table of Contents

Abstract

As society continues to evolve and adopt new ways of performing tasks, so have the people. In years past, children played outside with friends, entertained themselves, and walked to get where they were going. Children were physically active through play. Now more than ever, children are becoming complacent. They would prefer to play inside on a game console or computer rather than hangout with friends and play outside. It has been found that childhood obesity has a direct correlation with the overuse of electronic devices and children who live sedentary lifestyles (Granich et al., 2011). Barriers, such as a lack of parental involvement and unsupervised leisure time, have allowed adolescents the freedom to spend their time overly engaged in screen time activities and less involved in daily recommended physical activity (PA) (Abarca-Sos et al., 2016). The purpose of this synthesis was to review the literature of effective strategies for reducing sedentary lifestyles in adolescent youth.

Keywords: barriers, sedentary behavior, sedentary lifestyle, Adolescent Youth, MVPA

Chapter 1 - Introduction

Childhood obesity continues to be a growing epidemic around the world in adolescent youth today due to poor eating habits, a decline in physical activity, and advances in technology (Kudlacek & James, 2011; Ordonez et al., 2019). As sedentary lifestyle behaviors continue to become the norm, the decline in physical activity (PA) among youth puts their long-term health at risk (Fromel et al., 2012). It's no wonder why adolescents are packing on the pounds. A study in Scotland found that school aged children spent an estimated 3.8-5.6 hours per day engaged in sedentary behaviors (Martin-Smith et al., 2019), and teens in the United States average 4.25 hours a day engaged with an electronic device when the recommended daily usage is no more than two hours daily (Granich et al., 2011). It has been found that childhood obesity has a direct correlation with the overuse of electronic devices such as cell phones, computers, gaming systems and television (He et al., 2011). Children have a 63% greater chance of becoming overweight due to screen time usage greater than the recommended two hours or less per day (Granich et al., 2011).

Sedentary lifestyles are choices made by influential factors at home and in daily routines. It is not uncommon for children to get home from school, put their things down, and sit in front of a tablet or television instead of going outside to play. This is a result of parents letting these behaviors occur and not taking an active role in promoting healthier lifestyle choices for their children (He et al., 2011). Other factors, such as economic deprivation and social fragmentation, have also been proven to be barriers inhibiting adolescent youth from going outside to play (Pabayo et al., 2014). If community environments are a barrier preventing kids from playing outside, promoting forms of physical activity in all content areas in schools is just one intervention to increase physical activity and reduce time spent sedentary (Ordonez et al., 2010).

Recognizing perceived barriers and understanding why adolescents are engaging less in physical activity may lead to the development of interventions that can reduce sedentary behaviors and increase physical activity (Granich et al., 2011).

In each article discussed in this synthesis, the authors focus attention on the perceived barriers and why adolescent youth are complacent in their ways of living sedentary lifestyles. They go into detail to present potential solutions on how to change adolescent youth behavior to increase daily physical activity and to promote healthier lifestyles.

Statement of the Problem

With so much technology available in today's world, children have become complacent with the idea of being on an electronic device instead of being physically active. Physical activity is important to produce long-term health benefits such as reducing stress, improving muscular and cardiovascular strength and endurance, and reducing risks of chronic diseases. With the increased use of technology, many adolescent children are now spending more time engaged in screen time activity than in physical activity (Biddle et al., 2014). Sedentary behaviors have been linked to poor body composition, heightened risk of obesity, Type II Diabetes, poor self-esteem, and an overall decline in fitness levels (Biddle et al., 2014; Mayorga-Vega et al., 2018; McKenzie et al., 2008).

The recommended amount of time for adolescent youth to be engaged in physical activity is at least 60 minutes per day of moderate to vigorous physical activity (MVPA). Unfortunately, approximately 81% of adolescents worldwide do not meet this daily recommendation (Mayorga-Vega et al., 2018; Morris et al., 2019). This target goal is seemingly difficult to attain when the average amount of time spent in screen time activity is 4.25 hours per day (Granich et al., 2011).

It is considered crucial to create more opportunities for adolescents to participate in physical activity to promote healthy living (Ordonez et al., 2019). Public school systems are a perfect environment to provide a significant amount of opportunity for children to engage in MVPA, however, not all students can participate in daily physical education classes. Due to scheduling, not all physical education classes are scheduled to offer an hour worth of daily physical activity (Mayorga-Vega et al., 2018). More so, research suggests that students at the secondary level participate in only 40.5% of a lesson engaged in MVPA (Martin-Smith et al., 2019). Opportunities to increase time spent engaged in physical activity could be achieved by lengthening physical education class time, increasing the number of classes per week for physical education, and by developing more efficient lessons dedicated to promoting more time engaged in MVPA (Martin-Smith et al., 2019). If this isn't feasible, time must be dedicated outside of school for play if adolescents are to meet the daily requirements to maintain a healthy lifestyle (Mayorga-Vega et al., 2018). Understanding why certain barriers hold back adolescents from engaging in physical activity is a start to changing sedentary lifestyle behaviors. By identifying barriers, intervention plans can be developed and put into practice to attempt to create change.

Socioeconomic environment, parents, and school systems play a large role on influencing students and their involvement in both activity and sedentary behaviors (He et al., 2011; Pabayo et al., 2014; Santos et al., 2018; Zhen et al., 2012). School officials**,** educators, and parents of children are key stakeholders in recognizing barriers and developing intervention plans to promote physical activity while simultaneously reducing sedentary lifestyle behaviors. Educators need to look at the amount of time students spend in school that is dedicated to physical activity (Mayorga-Vega et al., 2018) and recognize areas during the school day where students have free

time to allow for more engagement in physical activity. Parents need to be proactive in regulating their children's leisure time while at home and promoting more time to engage in physical activity. If adolescents continue to be more engaged in sedentary behaviors, and less engaged in physical activity, the risk of obesity and future health problems is inevitable.

Purpose of the Study

The purpose of this study was to review the literature on effective strategies for reducing sedentary lifestyles of adolescent youth.

Operational Definitions

1) Adolescent youth- People between the ages of 10-20 years old (WHO, 2020).
2) Barriers- Individual assessment of the obstacles to behavior change (Marriam-Webster, n.d.).
3) Moderate vigorous physical activity (MVPA)- Moderate to large amount of effort in physical activity noticeable by increased heart rate to rapid breathing and substantial increase in heart rate (WHO, 2020).
4) Physical Activity- Any bodily movement where energy is required (Kudlacek & James, 2011).
5) Sedentary lifestyle- Involving little to no physical activity. A person is often sitting, or laying down (Mayorga-Vega et al., 2018).

Research Questions

The research reviewed for this project focused on identifying effective strategies to reduce sedentary lifestyles of adolescent youth which are linked to potential health risks. The barriers associated with sedentary lifestyles were reviewed to identify possible solutions to

minimizing sedentary behaviors and lifestyles and to promote more time engaged in physical activity. The following questions will be addressed throughout this project:

1) What is the impact sedentary lifestyles have had on adolescent youths' physical fitness?
2) What are the barriers associated with the decline in physical activity in adolescent youth?
3) What are effective strategies to promote more involvement in physical activity?
4) How is physical activity being promoted inside/outside of school?

Delimitations

1) Articles used in this project were focused on children engaged in sedentary behaviors which led to a decrease in physical activity.
2) Participants in this review of literature consisted of both male and female students ages 10-20 years old.
3) The literature used in this synthesis project were full-text, peer reviewed quantitative, qualitative and review of research articles.
4) Articles used in this project were full text articles found through the Drake online library of SUNY Brockport.

Chapter 2 - Methods

Purpose

The purpose of this chapter is to identify effective strategies to reduce sedentary lifestyle behaviors of adolescent youth. This chapter will focus on the methods and procedures used to locate the literature necessary for this project.

To identify research that would be used in this project, a credible source was needed to obtain that information. The SUNY Brockport Drake Memorial online library, available through the SUNY Brockport school website, was utilized to search for peer-reviewed, full text documents. The studies collected for this synthesis project were located using the EBSCO Host database. Within the EBSCO database, the following databases were searched: SPORTDiscus and Academic Search Complete. Numerous articles were found based on specific keywords used. Fourteen articles were considered from the online resource because of their focus and relevance to the guidelines of this project.

Data Collection Methods

The first step of this project was the development of the topic that would be studied. The topic was chosen in the interest of how to get students more engaged in daily physical activity. It was perceived that children are less active today than in years past. It was determined that this topic would focus on adolescent youth who engage in sedentary lifestyles and behaviors. The research was performed focusing on identifying perceived barriers linked between physical inactivity and sedentary lifestyle behaviors of children ages 10-20 years old, as well as effective strategies to reduce sedentary lifestyle behaviors. Criteria for article selection were as follows: articles published between the years 2010-2020 that were peer-reviewed, full text articles with participants for studies within the ages of 10-20.

The next step in the process was the development of keywords that were specific to this topic to search for relevant articles. These keywords were used across multiple databases to search for matching articles. The keywords helped to identify articles that included information such as subject matter, article names including keywords, specific age groups of children, and appropriate data. Articles were dismissed if there were not peer-reviewed or seemed questionable. The keywords used were physical activity, sedentary behaviors, time spent on social media, screen time, reducing sedentary lifestyles, physical inactivity, interventions, adolescent youth, and barriers.

Using the SPORTDiscus database, the keyword “physical activity” generated a total of 93,597 hits. To mitigate the number of articles, “physical activity and sedentary behavior” were used to produce 2,917 articles. To narrow the search again, keywords “physical activity, sedentary behavior” and “time spent on social media” produced six potential articles. Of those six articles, four contained keywords within their titles. Only articles that were full text, contained keywords within their title, and had participants within the age limits were considered for this project.

A second search of SPORTDiscus using the key words “reducing sedentary lifestyles” generated 155 potential articles. After setting parameters of peer-reviewed, full text articles published between the years 2010-2020, 64 articles were generated. Limiting the subject to health behavior, 14 articles met the criteria for this project. After review, four articles met the final criteria.

A third search using SPORTDiscus was performed beginning with the keyword “sedentary lifestyle” which produced 1,252 hits. Searching “sedentary lifestyle” and “intervention” together, the search was narrowed to 287 hits. A final search of “sedentary

lifestyle, interventions, and adolescent youth", produced nine articles for review. From that search, only four articles met the criteria for this project.

The next database searched was the Academic Search Complete database. The keywords "physical activity" produced 308,824 hits. "Physical activity and sedentary behavior" were used together to narrow the search to 6,426. The list was narrowed to 3,167 when limiters were set to full text, scholarly peer-reviewed journals, and academic journals. To further refine the search, the keywords "screen time" were added, narrowing the results to 346. Filters were applied once again to limit the subject matter. Based on titles containing the keywords "sedentary behaviors in children", this process narrowed the search results to 31 articles. Of those articles, only three contained information in their titles which met the criteria for this project.

For an article to be considered for this synthesis project there were specific criteria that had to be met. The participants of each study had to fall within a specific age range. The research had to focus on physical activity and its association with sedentary lifestyle/behaviors. It was important that the articles selected for this synthesis project were full-text articles which were peer reviewed. Articles that did not meet all criteria were excluded.

The research articles used in this synthesis project are a combination of qualitative, quantitative, and research reviews. There were 13 quantitative articles, five qualitative articles and two research review articles that met the specific criteria and were used for this project. Articles came from a variety of journals. These included the following: one article each came from *School of Sport, Exercise & Health Sciences, European Journal of Sport Sciences, Apuntz Educacio Fisicai Esports, German Journal of Sport Medicine, Journal of Sports Science, American Journal of Public Health, Journal of Exercise physiology Online, American Journal of Health Promotion, Research Quarterly for Exercise and Sport, British Journal of Sports*

Medicine, *Perceptual and Motor Skills*, and *Health Education Journal.* Two articles came from each of the following: *Acta Universitatis Palackianac* and *Pediatric Exercise Science*. Four articles came from the *Journal of Physical Activity and Health.* Data collection methods used in these articles included several methods such as surveys, questionnaires, focus groups, self-reporting, observation, interviews, records review, research reviews, and anthropometric measurements.

The critical mass for this synthesis comprised of 8,326 participants. The participants in the 10 studies were a combination of both male and female students. Grade levels for participants ranged from 7^{th} to 12^{th} grade. There were minimal requirements to participate in certain studies. Minimal requirements included students having to be enrolled in regular physical education classes as well as enrolled in a grade level before the start of the study. Age requirements were not considered, as most students fell within the range of 10-20 years old.

Data collection methods used in these articles included several methods such as surveys, questionnaires, checklists, focus groups, self-reporting, observation, interviews, records review, research reviews, accelerometer statistics, and anthropometric measurements. Most data was self-reported, therefore daily physical activity data was collected through surveys, questionnaires, and accelerometers. Other studies required pre and post anthropometric measurements, heights, weight, and BMI, to determine the effectiveness of training programs that were being studied. Questionnaires were utilized to measure participant activity and inactivity when self-reporting.

Chapter 3 – Review of Literature

The purpose of this chapter is to present a review of literature on effective strategies for reducing sedentary lifestyles of adolescent youth. Throughout this chapter the following topics will be reviewed: barriers and solutions to physical inactivity, benefits of participation in physical activity and intervention programs. This review will identify perceived barriers and explain why adolescent youth are at high risk due to sedentary lifestyles, as well as discuss the potential interventions that may reduce sedentary lifestyle and promote physical activity.

Barriers and Solutions to Physical Inactivity

Although the focus of this synthesis project is to investigate effective strategies to reduce sedentary lifestyles of adolescent youth, it is equally important to understand the barriers that restrict adolescents from being physically active.

Pabayo et al. (2014) constructed a study to examine the association between neighborhood economic poverty, social disintegration, safety, social disorder, and their effects on physical inactivity among adolescents in the Boston Massachusetts area. The researchers found that adolescents were not engaging in nearly as much physical activity as in years past. They theorized that the constant turnover of community members, which was mainly due to poor social economic status and the mistrust within the community, forced adolescents to stay indoors to occupy their free time.

The researchers contacted the surrounding schools in the city of Boston to recruit participants for their study. Eighteen schools agreed to allow their students to participate in their study. The target age was 14-19 years old high school students. Between 100-120 students agreed to complete the Boston Youth Survey (BYS) from each school. Of the chosen students, 69% (1,364) chose to be participants in the survey. The BYS was comprised of questions relating

to topics such as health behaviors, use of school and community resources, and indicators of positive youth development, with a particular focus on participants and their exposure to violence.

The results in this study found that of all the participants who took the BYS, 12.5% believed that the neighborhoods they lived in were unsafe, while 42.1% said their neighborhoods were always safe. The results also indicated that just under a quarter of the participants (24.1%) admitted that they did not participate in physical activity at all. The null multilevel model used to categorize data showed that social disintegration in local communities and high poverty levels, were linked to the high instances of sedentary behavior (15.5%- 39.8%) among the participants. Coincidentally, because of neighborhoods being impoverished and deteriorating, the BYS indicated that participants believed their neighborhoods were too dangerous and unsafe to play outside. Overall, the instability of local neighborhoods was found to be the main reason why adolescent youth showed a disinterest in being physically active within their community.

Similarly, in the city of Rio Branco, Brazil, scientific evidence has pointed out that physical inactivity in adolescents is a major epidemic in the region. Santos et al. (2018) investigated why adolescents were failing to meet the minimal recommendation of 300 minutes a week of regular physical activity.

A cross-sectional study of 1,391 (612 males, 691 females) high school students from both public and private schools, ages 14-18, was conducted to identify potential barriers contributing to adolescents physical inactivity. Questionnaires as well as a physical activity checklist were the main sources of data collection for the multistage conglomerate sampling procedure. Data collected was primarily focused on participants ages, circle of friends, number of similar aged

children living at their residence, the amount of time spent engaged in watching television, and time spent on the computer per day.

Once data was analyzed using the software program Stata 12, results indicated that over half (54.34%) of the sample had reported high levels of physical inactivity. Female participants reported much higher levels of physical inactivity (70.6%) than the male participants (35.9%). Interestingly, adolescents who had limited access to riding in a vehicle or public transit were 2.24%- 2.28% more likely to be sedentary than those who did engage in locomotion transit. Technology usage was identified as a barrier which reduced adolescent youths' level of involvement in physical activity. Males, when engaged in computer usage for more than two hours a day, were 1.97 times more likely to not participate in physical activity. Socioeconomic status was also a contributor to the decline in physical activity among adolescent youth. Those who went to public schools instead of private schools were 1.92 times more likely to be inactive. Lastly, the number of peers living in the homes of participants indicated that there was a decrease in physical activity, especially among female participants.

In addition to understanding barriers associated with reduced physical activity, Carbanas-Sanchez (2018) extended the conversation of how physical environment is associated with sedentary behaviors among adolescents. The purpose of the study was to review the relationship between characteristics of the physical environment in and around the homes of participants, and the sedentary behaviors measured by accelerometry and domain-specific sedentary behavior.

There were 1,578 participants (805 boys, 773 girls) belonging to private and public schools from urban and rural areas of Cadiz and Marid who participated in the study. All participants were part of a baseline cohort of an UP&DOWN study. Although the study took place from September 2011 to June 2012, each students participation was assessed for only

seven days. For data to be eligible for the study, a minimum of three days of recordings (10 hours minimal per day), including one weekend day, was required. Data was collected with the use of AntigraphTM accelerometers and processed with Actilife software.

Domain-specific leisure-time sedentary behaviors were self-reported using Youth Leisure-time Sedentary Behavior Questionnaires (YLSBQ) and the data was used to categorize the time participants spent performing leisure-time sedentary behaviors. Descriptive details about the home environment and occupancy were reported by the parents of participants. Home inventory included the size of the home/yard, number/type of rooms, and the type of electronics within the home. ALPHA questionnaires were used to collect data about the surrounding area of the homes of participants. PAMI scales were used to evaluate the number of facilities in the area, physical activity equipment available for use, and physical activity materials at the homes of participants. Based on the data collected, multiple variables were considered for analysis: media equipment at home, number of TV's and computers in the home, media equipment in participants bedroom (TV's and computers), density of media equipment at home per person and density of equipment per space of home. All the data collected for this study was analyzed through SPSS Statistics 21.0.

Comparing results based on gender, girls recorded significantly higher accelerometer measured sedentary behaviors with time on the internet, educational based sedentary behavior, and social-based sedentary behaviors. Boys were significantly more sedentary in behaviors of watching television and playing video games.

Considering physical environments, having a yard space did not impact screen-based sedentary behavior ($p=.37$). The amount of overall living space, however, did have a positive influence on participants engagement in educational sedentary behavior ($p=.41$). Outside of the

home, data collection was used to determine the type of facilities that were available to individuals within a 10-15-minute walking radius. Even if participants lived in an area with a plethora of opportunities to participate in recreational activity, there was no impact on how much time participants spent watching television (p=.049).

There were many factors that influenced participants behavior, and this was dependent on the availability of items within the home. Data showed that if equipment related to physical activity is present, there is a reduction in the amount of time participants engage in sedentary behavior. The more electronic media devices within the home, the less likely participants were to engage in activity. Participants in this study were positively influenced by excessive media devices in the home such as TV's and computers, and increased sedentary behavior related to screen time (p=.05) and time spent using video games (p=.020).

The physical environment was highly influential in the behaviors of adolescents. The researchers believed that decreasing the number of electronic devices that influence sedentary behavior while increasing the quantity of athletic equipment in the home would be beneficial to one's health by promoting activity and reducing sedentary behavior.

Benefits of Participation in Physical Activity

Alternatively, Fromel et al. (2012) performed a study that examined whether there were differences in adolescent girls' physical activity (PA) and physical inactivity (PI) structure, and levels based on overall participation in regular weekly physical activity. There were 497 girls, all who were 17 years old, that were categorized into four different groups based on their weekly participation in physical activity and were asked to log their PA and PI, as well as their ActiGraph GT1M accelerometers scores over a seven day period. Once data was analyzed in SPSS, results indicated that participants who engaged in regular physical activity at least twice a

week increased their pedometer step counts substantially when compared to those who did not participate in weekly physical activity. Those who performed multiple days of physical activity were those who participated in either scholastic sports or recreational sports outside of school.

The data obtained from this research linked the importance of adolescents and their involvement in organized activities outside of school. Even though most participants failed to meet the weekly recommended time of 60 minutes spent performing MVPA, involvement in physical activity did show an up-tick in step count as indicated from the pedometer readings.

Similarly, Mayorga-Vega et al. (2018) performed a study measuring physical activity and sedentary behaviors of 158 participants (83 males, 74 female), ages 13-16 years old, on days they spent in physical education class and days not involved in physical education classes by recording data using GT3X+ accelerometers. The objective was to determine whether participation in physical education class contributed to participants daily physical activity and non-sedentary behavior levels.

What the research found was that participants were more physically active on days they were involved in physical education class when compared to participants who did not have physical education class on the same days. Physical education classes contributed to 24.9-33.6% of the recommended physical activity levels (22.7-23.6% of the total daily). On days students had physical education class, of the average 71 minutes a day spent performing MVPA, physical education class contributed to 17.4 +/- 7.7 minutes. On non-physical education days, adolescents engaged in an average of 54 minutes of MVPA. Step counts indicated that of the average 11,036 steps accumulated on days spent in physical education class, an average of 2,737.9 steps occurred specifically during physical education class. Those who did not have physical education class averaged 8,478.5 steps per day. This follows the trend of other studies where children 8-11

years old, had significantly higher levels of activity in physical education classes than on days not spent in physical education (12,979 steps/day vs 11,809 steps/day) (Brusseau et al., 2011).

Intervention Programs

In addition to attempting to promote lifelong fitness and participation in physical activity from a school-based education program, Kudlacek & James (2011) studied the effects of intervention programs on overweight/obese adolescent youth. Participants of this study had to have a BMI between 25-35.5% to be considered. There were 27 females selected to participate in the study. The objective was to determine whether an eight week long, six sessions a week (40-60 minutes), intervention would reduce levels of obesity, promote positive behavioral changes, and increase participation in daily physical activity.

Tanita BC-418 MA devices, IPAQ questionnaires, and pedometers were used to evaluate changes before and after the intervention program. Participants recorded their daily activity readings of physical activity, physical inactivity, and their daily pedometer readings. After completing the intervention, INDARES questionnaires were used to measure the effectiveness of the program.

Results indicated that physical activity among participants increased significantly where a significant increase would be recognized at 240 MET minutes per week. Participants of this study showed a 957 MET minutes per week on average. Comparing these numbers to the IPAQ scoring manual placed the results in the category of moderate physical activity (600-3,000 MET minutes per week). A significant increase in the amount of vigorous activity of 30 minutes by participants was recorded, indicating a 69% increase from the start of the intervention. An increase in moderate activity (6%) and walking (4%) was also observed. BMI recordings

indicated a minor decrease when comparing scores to adult scores, but there was no reduction when compared to teenage scores.

According to the INDARES questionnaire, data showed that the program was effective in changing the way participants felt about physical activity. Results showed that 48% of participants were somewhat willing to participate in a similar program like this again, 33% were willing, 14.8% very willing, and only 4.2% not willing at all. Additionally, 51.8% felt the program was beneficial, 41.1% felt it was very beneficial. In all, 88.7% of participants reported positive physical changes because of the intervention.

Similarly, Martin-Smith et al. (2019) incorporated a sprint interval training (SIT) program into a school-based curriculum to compare the difference between an intervention group (INT) and a control group (CON). The focus was to determine what effect the intervention would have on cardiorespiratory fitness (CRF), physical activity levels, and cardiometabolic risk (CMR) outcomes in adolescent youth.

There were 52 participants (INT: n=22, CON: n=30) that partook in a four week long intervention. Each week consisted of three, one-hour sessions for both the control and intervention groups. Prior to the intervention, SIT measures were collected for the intervention group, along with BMI's for both the control and intervention group. Cardiorespiratory fitness was measured before and after the intervention using a multistage fitness pacer test. Heart rate telemetry monitoring was used to measure heart rates of participants during each SIT session. Blood pressures were recorded before and after each SIT session as well. Before each session, cardiometabolic blood pressures were also measured. Participants were required to wear Uniaxial AciTrainer accelerometers at least nine hours per day during the weekday and eight hours on weekends to measure active and sedentary behaviors outside of the SIT intervention.

Results from this study showed that there were no significant changes among BMI scores or blood pressures because of the intervention. Maximum heart rates recorded for the intervention group over the course of the four weeks were not found to have any significant differences between the pretest and posttest (average HR: 186 bpm, 92% (1%) of HR max).

In a similar study, Ordonez et al. (2019) focused on incorporating an intervention program to promote physical activity within the everyday school curriculum. Its aim was to measure the effects of physical activity on not only overall physical fitness, but coordination and attention levels as well.

A twelve week intervention program was introduced into two bilingual public schools. Schools were selected according to their accessibility, their similar scheduling, and their similar socioeconomic environments. There were 89 participants from the sixth grade, with an average age of 11.1 years old, that were invited to participate in the study. Participants were randomly classified and divided into subgroups: control and experimental. Before implantation of the intervention, PAQ-C questionnaires were completed by participants to measure individuals' level of physical activity seven days prior to the start of the intervention.

All participants performed in two 45-minute activity lessons in physical education class per week. The experimental group participated in five additional workout sessions per week in the form of circuit training. During the first two weeks the experimental group performed in a fitness circuit measuring 250 meters. During the next four weeks participants went through the circuit twice (500 meters). For the last four weeks the participants completed three laps through the circuit training (750 meters).

Multiple variables were measured during this study. FACES tests were used to measure pre and post intervention levels of participants' attention level capability. Lower body strength

was also measured pre and post intervention using a standing long jump test. Cardiorespiratory was measured pre and post intervention using a 1-km test. Coordination levels were measured using a lateral jump test from the KTK (Korperkoordinations Test Fur Kinder). Lastly, heights and weights were measured pre and post intervention to calculate BMI values. All data was analyzed using the IBM SPSS Statistics 24 software.

Results from the study concluded that there were no significant differences between either the control or experimental groups in relation to physical activity levels. However, there were observable significant differences in pre and post test results within the variables' cardiorespiratory capacity (CON pre-6.46 (.83) vs post -6.20 (.75), EXP pre -6.42 (.75) vs post-5.61 (.68)), coordination (CON- pre- 26.40 (5.68) vs post-27.33 (5.90), EXP pre- 28.33 (6.89) vs post- 30.87 (5.68)), height (CON pre-1.47 (0.08) vs post- 1.50 (0.08), EXP pre- 1.48 (0.07) vs post- 1.49 (0.07)) and attention levels related to number of right choices (CON pre- 39.63 (8.58) vs post 41.00 (7.46), EXP pre- 39.80 (8.66) vs post- 45.27 (7.83), and efficacy (CON pre-38.07 (8.7) vs post-38.56(9.82), EXP pre- 38.20 (8.85) vs post- 43.80 (8.37)).

Researchers found that aerobic exercise, especially first thing in the morning, had a positive impact on improving cognitive functions for students in the area of information processing and attention levels. This potentially could have an impact on student overall academic performance.

Alternatively, Morris et al. (2019) examined increasing adolescent youth's physical activity levels by incorporating a physical activity learning (PAL) intervention program into an academic setting. The focus of the study was to measure the effectiveness of incorporating physical activity into a regular classroom setting and the effect it had on improving physical activity output.

There were 166 participants recruited for this study, 82 participants were part of the intervention group and 72 were in the control group. Classroom teachers were trained by Local School Games Organizers (SGO) prior to the study to lead PAL activities. The intervention was organized based off preintervention data collected in week one. The objective was to exceed the baseline data each week and continue to improve the number of steps per week until the conclusion of week six. Throughout the six-week intervention, participants were required to wear pedometers during PAL activities. Eight days prior to the intervention, and in the last eight days of the intervention, physical activity levels were measured using GTIM uniaxial accelerometers.

Based on accelerometry data, two subgroups were created: low active (achieving <45min/day of MVPA) and high active (achieving >45 min/day of MVPA). The data concluded that the high active intervention subgroups had the greatest significant increase in time spent in learner physical activity (LPA) when compared to the control (1.96% [4.23%] vs -0.95% [4.3%]). The intervention also concluded that there was a reduction in time spent in sedentary time with the high active intervention subgroup.

Similarly, He et al. (2011) was interested in reducing sedentary behaviors of adolescent youth and encouraging increased physical activity by targeting school systems to organize intervention programs. The purpose of this research was to identify the barriers and potential interventions to increase physical activity.

A research assistant conducted 20 minute semi-formal interviews with detailed field notes, with 14 principals and 39 classroom teachers from schools in the Middlesex London area using a semi-structured guide. Member checking was performed at the completion of each interview to ensure accuracy with what was transcribed. An inductive content analysis was completed independently and simultaneously to determine accuracy of the data. Data was

organized with the software program QSR Nvivo. The analysis was reviewed by a third researcher who read each transcript independently and debriefed each interviewee. Three key themes emerged from the qualitative data: concerns over adolescent youth and their excessive screen-related sedentary behaviors (SRSB), barriers limiting the promotion of physical activity, and potential interventions to promote physical activity.

All participants agreed that adolescent youth participate excessively in screen viewing activities when not in school and that parents are primarily responsible for allowing this behavior to occur. Children spent more than 3.4 hours a day engaged in SRSB, with only 30 minutes occurring during school hours. Barriers such as high demand from other subject areas, lack of resources, and no control over what happens outside of school hours were shown to have an impact on how much children engaged in physical activity. It was also perceived that parents did not model the appropriate behaviors for their children, often allowing their children to engage in SRSB instead of promoting physical activity.

Potential interventions included that the amount time spent in physical education must be increased from two days a week to daily physical education. It was also suggested that class time should be increased from 30 minutes to 45 minutes a day to improve levels of physical activity and to reduce time spent sedentary. The type of activities suggested for increasing student learning and engagement were non-competitive recreational sports to promote participation in and out of school. Lastly, parental involvement was highly encouraged to promote physical activity in and out of school since families play an important role in the lives of adolescent youths' and their development of behavior.

Summary

Adolescent youth are at an increased risk of developing poor sedentary lifestyle behaviors, especially considering the countless barriers that stand in their way. Developing effective strategies that reduce sedentary lifestyles require the process of recognizing potential barriers that enable adolescents from being physically active and the promotion of physical activity through either recreational program or intervention programs that foster lifelong physical activity and lifestyle changes.

It takes a collective effort to create positive change, and that begins with the parents of children. Limiting the amount of time that they allow their children to be sedentary at home as well as encouraging them to be involved in physical activity during the day can make a drastic change in one's lifestyle behaviors. Schools can promote change by integrating fitness intervention programs that increase cardiovascular and muscular health throughout all classrooms. Providing opportunities for free play during the school day has been shown to increase levels of MVPA in individuals.

Society has recognized that obesity along with other health risks such as Type II Diabetes, mental health, and a decline in overall fitness, are on the rise in the youth today because of excessive sedentary lifestyles. There is a magnitude of perceived barriers that adolescent youth must overcome to be able to fully engage in meaningful physical activity. Opportunities must be available and accessible for everyone if change is going to happen. School-based intervention programs are an excellent option for increasing physical activity levels of students since most of their day is spent at school.

Chapter 4

Results, Discussion and Recommendations for Future Research

The purpose of this chapter is to present the results of the review of literature on effective strategies for reducing sedentary lifestyles of adolescent youth and how these results align with the purported research questions which guided this synthesis project. Additionally, recommendations for future research, as it relates to reducing sedentary lifestyle behaviors of adolescent youth, and the long-term effects it may have on the overall health of students in the future, are presented.

The results of this review of literature revealed that it is imperative to create more opportunities for adolescent youth to be involved in physical activity throughout their daily lives to reduce sedentary lifestyle behaviors. Adolescent youth who are at a greater risk of living sedentary lifestyles are those who are constantly exposed to and engage in electronic devices usage with minimal supervision such as television, game consoles, cell phone and computers. Multiple interventions have been found to increase the amount of time adolescent youth participate in physical activity and they have also been shown to reduce the amount of time spent sedentary. Increasing opportunities for students to engage in physical activity more frequently and for longer durations throughout the day have a direct correlation of increasing physical activity energy expenditure and reducing time spent sedentary.

Discussion

Interpretations

There were several research questions that were presented as part of the literature review. The first question examined was, “What is the impact that sedentary lifestyles have had on adolescent youths’ physical fitness?” The results from several research studies show that

adolescent youth who do not engage in regular physical activity are at an increased risk of becoming overweight and obese. Long term risks are associated with non-communicable diseases such as coronary heart disease, Type II Diabetes, and certain cancers. Payabo et al. (2014) indicated that only 8% of Americans meet the recommended amount of daily physical activity as prescribed. In Fromel et al. (2012), the researchers found that the females who participated in organized physical activity three to four times a week had a significantly higher number of steps/day (9,472) than girls who didn't participate in any organized physical activity (7,900). Participation in regular organized activities outside of school was shown to greatly increase participants energy output as opposed to participants who did not engage in any physical activity.

The second research question that was examined was, "What are the barriers associated with the decline in physical activity in adolescent youth?" The results from several studies indicated that there are various barriers that adolescent youth must overcome to properly engage in physical activity. Carbanas-Sanchez et al. (2019) noted that the home environment is where people invest most of their time and it has a direct impact on how people determine what they will do. Accelerometer data indicated that the number of electronic devices within a household per person had a strong association with sedentary behavior ($p=.002$), screen-based sedentary behavior ($p=.005$) and time spent engaged with gaming consoles ($p=.020$). Electronic devices within a bedroom was related to higher screen-based sedentary behavior ($p=.001$) and time on the internet ($p=.045$). Pabayo et al. (2014) revealed that neighborhood fragmentation and safety influence whether or not adolescent youth play outside in their neighborhoods. About 12.5% of participants in the study felt their neighborhood was too unsafe to play outside, and that parents would not let them go out to play. Another 24.1% of participants indicated they would rather not

engage in physical activity because of their rundown neighborhood. Similarly, Santos et al. (2018) found that the environment which participants live in affects their daily physical activity. Living in Rio Branco, participants with inactive locomotion (walking, cycling), were at 2.24-2.28 greater odds of living sedentary lifestyles compared to participants who did participate in active locomotion. The reason behind their inactive locomotion was due to the high levels of vehicle congestion on the roadways, as well as the fear of being mugged on the streets and robbed of their belongings. Research also found that participants who attended public school were 1.92 times more likely to be physically inactive compared to those who went to private school. Families who can pay for extracurricular activities and fitness memberships are those who are more engaged in physical activity when compared to those less fortunate.

The third question addressed asked, "What are effective strategies to promote more involvement in physical activity?" The results from the following studies show that physical activity can be increased because of the introduction of interventions aimed to reduce sedentary behaviors and increase physical activity.

Kudlacek & James (2011) found through their research that intervention programs proved to be successful at increasing physical activity among 17-year-old obese (BMI <25-35.5) adolescent females, based on MET minutes per week data (957 MET minutes/week). When comparing pre-test scores to post-test (measured in METs-min/week), a significant increase in physical activity was observed in categories of walking (1,815 vs 2,046), moderate physical activity (4,113 vs 4,551) and vigorous physical activity (2,490 vs 5,220). Physical activity intensity level records indicated that there was a 69% increase in vigorous activity efforts. However, regardless of effort, there were no major significant decreases in BMI among participants because of the intervention program.

Similarly, the Martin-Smith et al. (2019) study showed how a sprint interval training program can greatly improve adolescent involvement in high levels of MVPA when compared to a control group. By promoting higher levels of physical activity, the study observed a decline in time spent being sedentary by the intervention group by 60 minutes over the 4-week period. Adolescents who occupy their free time engaged in physical activity will reduce the amount of time dedicated to being sedentary. The reduction of time being sedentary is a side effect of more time spent being physically active.

Morris et al. (2019) examined how a physically active learning (PAL) intervention program could reduce the amount of time students in school spent sedentary. Providing cross-curriculum opportunities for students to be active during classroom lessons greatly improved the amount of time students spent performing MVPA. Although the intervention showed increased health benefits of a PAL, participants who already carried on active lifestyles substituted MVPA and sedentary time with time spent in LPA.

Ordonez et al. (2019) discussed the importance of physical activity and providing opportunities for students to engage more in meaningful MVPA. Increasing the amount of time engaged in physical activity was found to improve variables such as cardiorespiratory capacity, coordination, and improve cognitive functions such as information processing and attention. More opportunity to engage in MVPA, rather than just regular PE alone, should be addressed in schools.

The last research question that was studied was, “How is physical activity being promoted inside as well as outside of school?” The results from this suggest that more opportunities need to be provided for students to engage in meaningful physical activity. Mayorga et al. (2018) found through their research that on days students had physical education

classes their levels of physical activity were significantly higher compared to students who didn't have physical education class. Similarly, Mayorga et al. (2018) discussed that more time should be spent dedicated to participating in physical education class. They found that 30-minute lessons had little significance in engaging students in physical activity when compared to a 60-minute class time. He et al. (2011) suggested that increasing the number of days and time students are in physical education class will significantly improve time spent in physical activity and reduce time spent sedentary.

Carbanas-Sanchez et al. (2019) discussed how the home environment is influential in how adolescent youth spend their free time. Their research showed that reducing the number of electronic devices within the home and having equipment readily available for play, can have a significant effect on reducing sedentary behavior and promoting physical activity.

Implications

When examining previous research done on discovering effective strategies for reducing sedentary lifestyles, it appears as though most researchers would agree on the fundamental components of reducing sedentary lifestyle behaviors and promoting physical activity. Researchers have developed similar conclusions on increasing physical activity to reduce sedentary lifestyle behaviors. The accumulated research points to the fact that more opportunities must be provided for adolescent youth to engage in meaningful physical activity to offset time spent being sedentary. As parents, educators, and administrators understand that adolescent youth are not meeting the daily recommended amount of time engaged in physical activity, it should put into perspective that their children and students are at risk of developing chronic lifestyle behaviors and are jeopardizing their future health. By recognizing the challenge now,

interventions can be implemented at home and in the school systems to promote physical activity as a more rewarding alternative to being sedentary.

There were some studies that indicated an adverse effect on physical activity because of the intervention program implemented. Morris et al. (2019) reported that participants who were the least active benefitted from the LPA intervention. However, those who typically are highly active showed a decrease in time spent in MVPA, indicating a negative effect of the intervention program.

From the findings found within all the studies, the results confirm existing theories regarding strategies for reducing sedentary behaviors. Much of the research points to reducing the amount of time spent engaged in sedentary behaviors and increasing opportunities for adolescent youth to engage in meaningful physical activity. Recognizing and removing barriers that promote inactivity will lead to opportunities for adolescent youth to participate in activities that encourage healthy lifestyle behaviors. Parents are role models. Since behaviors are learned, it is imperative that parents participate in and encourage the positive behaviors they wish for their children. As educators, creating opportunities throughout the school day where children can play and be active instead of having to sit in a chair will greatly reduce time spent sedentary. Periodic physical activity has been shown to stimulate students' ability to focus and learn. Understanding that living excessive sedentary lifestyles over an extensive period can lead to future health complications, the research has shown broad solutions proven to reduce sedentary behaviors and promote physical activity in and outside of school systems.

Recommendations for Future Research

In reviewing the data base on effective strategies for reducing sedentary behaviors of adolescent youth, the following limitations were noted regarding the studies under review. The

use of accelerometry devices could have potentially caused participants to modify their normal behavior. The validity of the data would be compromised because of such behavior. Activities that would not allow the use of accelerometers, such as swimming, would also provide inaccurate physical activity recordings as well. Another limitation worth noting was that researchers felt their intervention programs were short in duration. Had the intervention continued longer than a few weeks, the researchers felt they would have yielded results more favorable to their hypotheses. Lastly, the lack of follow up testing to measure the sustainability of physical fitness in participants was not performed, thus there was no evidence on whether any intervention program was effective at reducing sedentary behaviors long term.

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

1. Research performed using wearable technology such as smart watches devices as a main source for data collection.
2. A longitudinal study on effective strategies of reducing sedentary lifestyles of adolescent youth.
3. Research on intervention programs that are designed to improve how adolescent youth perceive physical activity.

Wearable technology has become widely accepted today. Devices such as smart phones and smart watches are equipped with the ability to record a magnitude of data that would be more beneficial for data collection when compared to the traditional equipment used in the current studies. Accelerometers and heart rate monitors were used independently in several of the reviewed studies and only provided specific data related to the device used. Smart devices can record multiple health related components simultaneously, providing more detailed information

on the overall health of the users. Devices are capable of recording heart rate, pulse, blood pressure, sleep, GPS location, distance traveled, step count, change in speed, as well as detecting sedentary activity. More precise data would allow researchers to accurately assess the effectiveness of specific strategies used to reduce sedentary lifestyles.

The use of wearable devices such as a fitness trackers and Fitbit can provide constant data whenever the device is worn. The accuracy of data collected with such devices would minimize the need for researchers to be physically present to observe participants in person. If participants were equipped with such devices, it would reduce the amount of time and effort spent by researchers to collect data from their many participants as well. Studies that were reviewed in this project would benefit greatly if they were performed once again with the use of fitness trackers, Fitbit, and other wearable smart devices. The quantity and quality of data collected would far outweigh the fitness data collected from, questionnaires, accelerometers, heart rate monitors, and information that is self-reported.

Summary

Overall Summary

The purpose of this literature review was to determine effective strategies for reducing sedentary behaviors among adolescent youth. Delimiting variables were used to do an exhaustive data-based search which yielded 10 articles. These articles were then systematically used to determine effective strategies for reducing sedentary lifestyles among adolescent youth**.**

Research revealed that there are several effective strategies that parents, teachers, and administrators can impose to curve behaviors to mitigate sedentary lifestyles of adolescent youth. Recognizing that behaviors learned today can become lifelong habits, it is imperative that adolescent youth are exposed to as many opportunities to engage in meaningful physical activity

as possible. At home, parents/guardians can be influential role models and disciplinarians by monitoring the amount of time their children are engaged in sedentary behavior and physical activity. Creating opportunities and positive experiences can be beneficial to teaching their children how to enjoy physical activity. Intervention programs implemented into school systems have been shown to increase student daily physical activity levels. Since children already spend the better part of their day at school, it would be beneficial to the student if opportunities to participate in unstructured play time and daily physical education existed.

The research has shown that interventions are successful at creating short term change in reducing sedentary behaviors. The next step for researchers is to investigate how to keep adolescents engaged in physical activity substantially more than in sedentary behaviors to create lifelong habits. The overall health benefits of physical fitness outweigh the risks of being sedentary and developing chronic health related illnesses.

References

Abarca-Sos, A., Bois, J. E., Aibar, A., Julián, J. A., Generelo, E., & Zaragoza, J. (2016). Sedentary behaviors by type of day and physical activity in Spanish adolescents: A socio-ecological approach. *Perceptual & Motor Skills*, *122*(1), 286–298.

Barrier. (2020). In *Merriam-Webster's online dictionary*. Retrieved from https://www.merriam-webster.com/dictionary/barrier.

Bassett, D. R., John, D., Conger, S. A., Fitzhugh, E. C., & Coe, D. P. (2015). Trends in physical activity and sedentary behaviors of United States youth. *Journal of Physical Activity & Health*, *12*(8), 1102–1111.

Bassett-Gunter, R., Rhodes, R., Sweet, S., Tristani, L., & Soltani, Y. (2017). Parent support for children's physical activity: A qualitative investigation of barriers and strategies. *Research Quarterly for Exercise & Sport*, *88*(3), 282–292.

Biddle, S. J. H., Petrolini, I., & Pearson, N. (2014). Interventions designed to reduce sedentary behaviors in young people: A review of reviews. *British Journal of Sports Medicine*, *48*(3), 182–186. https://doi.org/10.1136/bjsports-2013-093078

Brusseau, T. A., Kulinna, P. H., Tudor-Locke, C., van der Mars, H., & Darst, P. W. (2011). Children's step counts on weekend, physical education, and non-physical education days. *Journal of Human Kinetics*, 27, 123–134.

Cabanas-Sánchez, V., Izquierdo-Gómez, R., García-Cervantes, L., Castro-Piñero, J., Conde-Caveda, J., & Veiga, O. L. (2019). Environmental correlates of total and domain-specific sedentary behavior in young people. The UP&DOWN study. *European Journal of Sport Science*, *19*(5), 696–706.

Drenowatz, C., Wartha, O., Fischbach, N., & Steinacker, J. M. (2013). Intervention strategies for the promotion of physical activity in youth. / Interventionsmaßnahmen zur Förderung körperlicher Aktivität bei Kindern und Jugendlichen. *German Journal of Sports Medicine. Deutsche Zeitschrift Fur Sportmedizin*, *64*(6), 170–175.

Erinosho, T., Hales, D., Vaughn, A., Mazzucca, S., & Ward, D. S. (2016). Impact of policies on physical activity and screen time practices in 50 child-care centers in North Carolina. *Journal of Physical Activity & Health*, *13*(1), 59–66.

Frömel, K., Pelclová, J., Skalik, K., Nováková Lokvencová, P., & Mitáš, J. (2012). The association between participation in organized physical activity and level of physical activity and inactivity in adolescent girls. / Vztah Mezi Organizovanou Pohybovou Aktivitou a Úrovní Pohybové Aktivity a Inaktivity U Adolescentních Dívek. *Acta Universitatis Palackianae Olomucensis. Gymnica*, *42*(1), 7–16.

Granich, J., Rosenberg, M., Knuiman, M. W., & Timperio, A. (2011). Individual, social, and physical environment factors associated with electronic media use among children: Sedentary behavior at home. *Journal of Physical Activity & Health*, *8*(5), 613–625.

He, M., Piché, L., Beynon, C., Kurtz, J., & Harris, S. (2011). Screen-related sedentary behaviors of school-aged children: Principals' and teachers' perspectives. *Health Education Journal*, *70*(1), 32–38. https://doi.org/10.1177/0017896910363332

Kudláček, M., & James, L. (2011). Effects of a school-based intervention program for adolescents: With a special focus on the overweight/obese population. / Efekty Školního Intervenčního Programu Pro Adolescenty—S Důrazem Na Jedince S Nadváhou/Obezitou. *Acta Universitatis Palackianae Olomucensis. Gymnica*, *41*(2), 17–26.

Martin-Smith, R., Buchan, D. S., Baker, J. S., Macdonald, M. J., Sculthorpe, N. F., Easton, C., Knox, A., & Grace, F. M. (2019). Sprint interval training and the school curriculum: Benefits upon cardiorespiratory fitness, physical activity profiles, and cardiometabolic risk profiles of healthy adolescents. *Pediatric exercise science*, *31*(3), 296–305.

Mayorga-Vega, D., Martínez-Baena, A., & Viciana, J. (2018). Does school physical education really contribute to accelerometer-measured daily physical activity and non-sedentary behavior in high school students? *Journal of Sports Sciences*, *36*(17), 1913–1922.

McKenzie, T. L., Baquero, B., Crespo, N. C., Arredondo, E. M., Campbell, N. R., & Elder, J. P. (2008). Environmental correlates of physical activity in Mexican American children at home. *Journal of Physical Activity & Health*, *5*(4), 579–591.

Morris, J. L., Daly-Smith, A., Defeyter, M. A., McKenna, J., Zwolinsky, S., Lloyd, S., Fothergill, M., & Graham, P. L. (2019). A Pedometer-based physically active learning intervention: The importance of using preintervention physical activity categories to assess effectiveness. *Pediatric Exercise Science*, *31*(3), 356–362

Ordóñez Dios, A. F., Polo Recuero, B., Lorenzo Calvo, A., & Shaoliang, Z. (2019). Effects of a school physical activity intervention in pre-adolescents. / Efectes d'una intervenció escolar sobre diversos aspectes en la preadolescència. *Apunts: Educació Física i Esports*, *136*, 49–61.

Physical activity. (n.d.) *In choose my plate: US Department of Agriculture*. Retrieved from https://www.choosemyplate.gov/resources/physical-activity-what-is#:~:text=Physical%20activity%20simply%20means%20movement,be%20moderate%20or%20vigorous%20intensity.

Santos, M. S., Dalamaria, T., Pinto, W. J., Farias, E. S., Cunha, M. A., & Souza, O. F. (2018). Physical inactivity in adolescent students in the western Brazilian Amazon. *Journal of*

Exercise Physiology Online, 12–18.

Sedentary behavior. (n.d.). In *Marriam-Webster.com Dictionary*. Mariam-Webster, Retrieved from http://www.marriam-webster.com/dictionary

World Health Organization. (2020). Recognizing adolescence. Retrieved from https://apps.who.int/adolescent/second-decade/section2/page1/recognizing-adolescence.html#:~:text=Defining%20terms.,and%2019%20years%20of%20age.&textOther%20overlapping%20terms%20used%20in,to%20combine%20adolescents%20and%20youth.

World Health Organization. (2020). Why is moderate-intensity and vigorous-intensity physical activity? Retrieved from https://www.who.int/dietphysicalactivity/physical_activity_intensity/en/

Zhen Cong, Du Feng, Yin Liu, & Esperat, M. C. (2012). Sedentary behaviors among Hispanic children: Influences of parental support in a school intervention program. *American Journal of Health Promotion*, *26*(5), 270–280.

Appendix A

Article Grid

Author	Title	Source	Purpose	Methods & Procedures	Analysis	Findings	Discussion/ Recommendations Research Notes –

							Commonalities/ Differences
Abarca-sos, A., Bois J., Aibar A., Julian J., Generelo E., Zargoza J. (2016)	Sedentary behaviors by type of day and physical activity in Spanish adolescents: A social-ecological approach	*Perceptual and Motor Skills Vol. 122(1).*	To determine the relationship between PA and sedentary screen time activity based on the time of day and type of day.	1,609 adolescents participated. Questionnaires used to assess PA and sedentary behaviors. Study approved by education department and headmasters. 14 public, and 4 private schools participated in study.	Relationship between PA and sedentary behavior evaluated with Pearson correlations.	Significant negative relationships found between screen time behavior and PA on weekdays, but no significant relation found on weekends.	Implementation of different strategies for sedentary behaviors to improve adolescent health. Further research with socio-ecological perspective is needed
Bassett, Conger, Fitzhugh, Coe (2015)	Trends in physical activity and sedentary behavior of United States youth	*Journal of Physical Activity and Health*	To create a review of literature on time trends in PA and Sedentary behaviors in the US.	Literature search using PubMed to locate peer-reviewed articles related to obesity and PA trends in youth. Access to National databases for statistical data.	Articles reviewed by authors	Intervention needed to reduce future projections of obesity. A sociological model looked at to reduce sedentary behavior and promote PA.	Increase individual's knowledge, skills, and attitude toward PA to influence behavior change. Influences from parents, teachers, and peers can improve PA. More time spent in after school programs to increase PA.
Biddle D., Petrolini I.,	Interventions designed to reduce	*School of Sport, Exercis*	To synthesize systematic reviews and	10 eligible articles chosen for review, 5	Articles screened by title and	Interventions had some significan	To expand interventions by targeting different types

Pearson N. (2014)	sedentary behaviors in young people, A review of reviews.	*e & Health Sciences.*	meta-analyses to intervention aid and to reduce sedentary behaviors among children of adolescents.	meta-analysis and 5 systemic reviews. Focus was on interventions to promote obesity and /to change several lifestyle behaviors. Papers were located via computerized and manual searches. English language systemic reviews or meta-analyses of interventions aiming at reducing sedentary behavior in children.	abstract. If no abstract or entire article, articles retrieved and screened to determine if it met inclusion criteria.	ce in reducing sedentary behavior. But effects are small. Strategies in reducing sedentary behavior included involvement of family, behavioral interventions, tv monitoring devices.	of sedentary behaviors.
Drenowatz C., Wartha O, Fischbach N, Steinacker J. (2013)	Intervention strategies for the promotion of physical activity in youth	*German Journal of Sports Medicine Vol. 64 (6).*	The review provides an overview of strategies that focus on environmental changes to help promote physical activity, as well as educational	Literature searches were performed, focusing on specific programs that promoted physical activity which had already been	Articles were reviewed by the authors	Long term sustainability of physical activity is in question regarding how effective promotional programs really are.	Most positive strategy: Multi-component – modifying traditional classroom learning allowing for active breaks and access to recreational areas during recess and after schools is

			approaches to build sustainable programs. Promotion of physical activity is the focus, but it's also important to understand what is causing sedentary behaviors to occur in the first place.	evaluated, to enhance the decision-making process on future intervention programs to increase physical activity in youth. The promotion of physical activity was the focus, so studies that focused on obesity interventions were excluded.		More research is required to fully understand strategies in how to promote PA as an important public health issue.	important to promoting PA. Programs extending over a long period of time are more susceptible to be successful than to short (few weeks) programs. Perceived barriers need to be low. Programs have a higher success rate if the population is willing to participate. Programs must be easily accessible, inexpensive, and limit the number of barriers to promote the promotion of physical activity.
Carbanas-Sanchez V., Izquierdo-Gomez R., Garcia-Cervantes L.,	Environmental correlates of total and domain-specific sedentary behavior in young people. The	*European Journal of Sport Science*	The purpose was to review the relationships between characteristics of the physical environment in and around the homes of	Participants (1,578 12-year-old +-2.5) (805 boys) belonged to schools based in Cadiz and Madrid and were a part of a baseline	SPSS Statistics 21.0 was used to analyze data. Analyses performed were separate	Stat sig: Comparing gender: girls recorded higher accelerometer-measured sedentary behavior, time on internet,	The home environment is where people invest most of their time and has an impact in how people determine what they will do (to be active or sedentary).

Castro-Pinero J., Conde-Caveda J., Veiga O. L.	UP&DOWN study		participants, and the sedentary behaviors measured by accelerometry, and domain-specific sedentary behavior of adolescent youth.	cohort of the UP&DOWN study. Schools were in both urban and rural areas and were both private and public schools. Data was collected from September 2011- June 2012. For data to be eligible for the study, recordings of at least 3 days (1 weekend day) for 10 hours minimal per day. Data collection per participant lasted 7 days. Total leisure time sedentary behavior was monitored for 7 consecutive days by	d by gender	educational based sedentary behavior, and social-based sedentary behavior. Boys were more sedentary watching TV and playing video games As a whole: Yard space did not impact screen-based sedentary behavior (p=.37) Amount of living space had higher influence in educational based SB (p=.41) regardless of the number of facilities nearby, it did not	The number of PA materials, TV's at home, availability of computers in own bedroom are directly associated with sedentary behavior of participants. *(Associations varied based on domain-specific Sedentary behavior, and differences were noticeable based on gender). Although limited data is out there to determine how size, space and design of a house impact PA and SB. This study indicated that the home space was directly related to educational based SB in boys. Potentially, because the number of rooms increases the chances of having an appropriate environment to

				ActigraphTM accelerometers. Data was processed with Actilife software. Domain-Specific Leisure-time sedentary behavior was self-reported using Youth Leisure-time Sedentary Behavior Questionnaires (YLSBQ) and used to categorize the time participants spent doing leisure-time Sedentary behaviors. Descriptive details about the home the participant live in were reported by parents. Inventory included size of		impact how much time participant spent in front of the TV (p=.049). The less PA materials participants had in their home, the more likely they were to spend time on a device (p<.001), playing video games(p=.006), and surfing the internet (p=.001) the more media equipment per pupil in the home had a positive association with accelerometer measured SB (p=.002),	study in (private). Having a yard was linked to reduced sedentary behavioral habits associated with screen time in boys. According to the ALPHA questionnaire, a favorable environment reduces total SB and time playing video games in boys Girls behavior may be influenced by environmental barriers where boys are influenced by availability/accessibility to recreational spaces. Physical environment is associated with sedentary behavior among adolescent youth. Increasing the quantity of equipment at

				home/yard, number/type of rooms, type of electronics ALPHA questionnaire used to collect data about the surrounding areas around the home of participant (residence, neighborhood, safety, environment local facilities, recreational infrastructure). PAMI scales used to evaluate number of facilities in the area, physical activity equipment available for use, and physical activity materials at home or housing complex. Questionnaire used to		screen-based SB (p=.005), and time on video games (p=.020) the number of TVs in the home had a positive influence in participants engaging in watching TV (p=.045) and less time engaged in educational based SB (p=.001) (Doing Homework) computers in the bedroom caused participants to engage more in surfing the internet (p=.045)	home, reducing the number of televisions and computers could reduce time engaged in screen based Sedentary behavior and more time engaged in more meaningful Sedentary behavior, such as studying or doing homework.

				take inventory on media equipment available in participants home/bedroom Variables considered for analysis: media equipment at home, # of TVs, computers, media equipment in participants bedroom including TV and computer. Density of media equipment at home per person and density of equipment per space.		**GIRLS** physical environment had no association with accelerometer SB (p=.037) and time on video games (p=.046) for Females the greater number of PA materials the less time girls spent on screen-based SB (p= .012), watching TV (p=.043), and being on the internet (p=.012) equipment in the bedroom = reduced accelerometer measurements (p=.033),	

						computers in bedroom = more time on the internet (p=.035).	
Erinosho Temitope, Hales D., Vaughn A., Mazzucca S., Ward D. (2016)	Impact of policies on physical activity and screen time practices in 50 child-care centers in North Carolina	*Journal of Physical Activity and Health*	To assess physical activity and screen time policies in child-care centers and their associations with physical activity and screen time practices and pre-school children physical activity.	Data from 50 child-care centers reporting on presence/absence of written policies on physical activity and screen time. Accelerometers used to measure volume and intensity of children's PA.	(SAS) used to describe director reported policies, observed PA, and screen time practice, and child MVPA and sedentary activity.	Less than 25 centers reported having written policies about PA. fewer had written policies about teacher led PA and time limits to watching TV. Fewer center had policies on duration of E-M.	Recommended opportunities to engage in free-choice and teacher-led activities daily and at least 60 minutes of outdoor play.
Fromel K, Pelclova J, Skalik K, Lokvencova P, Mitas J. (2012)	The association between participation in organized physical activity and level of physical activity and	*Acta Universitatis Palackianae Olomucensis. Gymnica*	Using objective and subjective methods, this cross sectional study examined whether there was a difference in physical	Physical activity was monitored of 497 girls (17.94 +/- .52 years old). Girls were organized into 3 different groups (G1-no PA per	Statistics 9 (StatSoft, 2009) and SPSS 18 were used for data analysis. Significant levels	No statistical differences were found between groups 2-4 based on active energy expenditure or steps.	Girls involved in organized PA in general achieved more steps/day than those not involved in organized PA. Involvement in organized physical activity has the

	inactivity in adolescent girls		activity and physical inactivity structure and levels in girls who do not participate in organized physical activity and girls who do regularly participate in physical activity (1x, 2x, >3x a week).	week, G2-1x per week, G3-2x per week, G4->3x per week). IPAQ questionnaire was used to monitor weekly PA. Weekly PA was also monitored using ActiGraph GT1M Accelerometers (10 hr./day for 7 days). Data collected was analyzed according to scoring for younger adults established by Freedson, Melanson, and Sirard (1998), to identify boundaries between light and moderative activity measured in METS. Daily PA and PI logs were kept,	were set at $p<.05$.	G4 had a significantly higher step count per day than G1. Mean values for weekdays were significantly higher for all groups than compared to the weekends. G4 had sig. higher step count on both weekday and weekends than G1. G4 had had the highest value of MET-minute/day in leisure-time activity. G4 had highest (min x day) of physical	potential to increase the number of steps/days High values of energy expenditure were in all groups except group 1 (No activity). Higher energy expenditure was reported during school time, when compared to leisure time, riding in a vehicle, or at home. No group exceeded 2 min/day while performing vigorous PA (far from the recommended 60 min/week). The study advocates for the increase in the amount of MVPA in organized PA classes. A positive link can be made between number/week participation in

				and self-recorded by participants to document times when accelerometer was worn and physical activity vs physical inactivity.		inactivity due to time spent studying and sitting at school.	organized PA and PA levels. The study shows that PA needs to be increased and PI needs to be reduced during times after school.
Granich, Rosenberg, Knuiman, Timperio (2011)	Individual, and physical environment factors associated with electronic media use among children: Sedentary behavior at home	*Journal of Physical Activity and Health*	Determine relationship between individual and home/social/physical electronic environment factors, and E-M usage in children 11-12-year old	Questionnaire completed by participants to measure leisure activities Self-reported E-M per day throughout study. Daily questionnaire used to investigate PA, individual E-M usage, and family members EM usage.	SPSS V15.0, Logistic regression modeling, Backward Variable elimination used to ID predictors of E-M usage.	E-M usage exceeds daily recommended usage- may contribute to obesity. Factors within family home have strong influence on children's E-M usage.	Parental education needed to regulate children's' E-M time and be a part of child's PA.
He Meizi, Leonard Piche, Charlene Beynon, Joanne Kurtz,	Screen-related sedentary behaviors of school-aged children: Principals' and teachers'	*The Health Education Journal*	To identify key barriers and solutions to school children limited physical activity.	5^{th} and 6^{th} grade administrators (14) and teachers (39) participated in in-person interviews. Detailed notes used	In-person interviews. Content analysis of data to create coding templates.	Excessive screen related sedentary behaviors (S-RSB) potentially impacting cognitive/	Reduce screen time and increase PA to improve health benefits. Increase PE classes from 2x a week to daily. Increase from 30m to 45m.

Steward Harris (2011)	perspectives			to record data.	QSR Nivivo version 2 used to organize data.	physical health. Parents responsible for sedentary behavior. Key barriers and solutions developed to promote PA.	Identify alternative non-competitive recreational sports for students Parents need to active participants in their child's PA.
Kudlacek M, James L. (2011)	Effects of a school-based intervention program for adolescents-with a special focus on the overweight/obese population	*Acta Universitatis Palackianae Olomucensis. Gymnica*	To examine the effects of intervention programs for adolescents, and to promote lifelong participation in physical activity.	Participants were recruited using flyers that were mailed to participating schools. Criteria required to be a participant included having a BMI >25-35.5). Only 27 female participants met the criteria. Average age was 17.72. Consent forms were required before participation.	Descriptive statistics were used as pre/post test and measured with Tanita device and the IPAQ questionnaire. Data was analyzed using Statistica 8CZ program. Statistical data was analyzed with	Physical activity was increased significantly (957 MET minutes per week). This would be considered Moderate PA due to the METS falling between 600-3,000 MET minutes per week. A 69% increase in vigorous activity was	Participants felt communication between them, and facilitators should improve to improve success (more meetings and guidance). Nutrition plans would have promoted more success. Results were proven to be nonsignificant based on the BMI scores. Results only showed a reduction in BMI when using calculations for adults, not for teens.

				Data was collected through questionnaires (IPAQ), self-recordings, internet, pedometers, and body measurements (height, fat, and BMI). Results from questionnaire (pre/post) were compared using a scoring protocol (www.ipaq.ki.se/). The intervention program, lasting 8 weeks, 6 days a week, increased PA in several areas of fitness. Specific fitness tests were used for individual participants due to the	basic statistics.	observed (30 min.) BMI was decreased slightly using adult scores, but not with teenage scores. 48% of participants were somewhat willing to participate in the program, 33%-willing, 14.8% - very willing, 4.2% not willing). 51.8% felt the program was beneficial, 41.1% felt it was very beneficial to them. 14% felt the program was very successful, 29.6% it	Programs that lasted longer would potentially yield more significant results regarding BMI reduction. The 8 weeklong intervention is unlikely to have a sig. effect on the childhood obesity epidemic. A nutritional plan should be taken into consideration in future testing. A presentation providing alternative activities instead of participating in sedentary activities, proved to be effective in reducing sedentary behavior. Parental/family encouragement was found to be very low among participants.

				nature of obesity of participants. Modifications were necessary. The program was analyzed to see if it had reduced obesity, behavioral changes and promoted participation. Tanita BC-418 MA and the pedometer were used to evaluate the changes before and after the intervention. Participants recorded pedometer readings, PA, and PI. INDARES was used to measure the effectiveness of the program.		was somewhat successful. Support-51.8% felt unsupported by family members. 88.7% reported good physical changes because of intervention.	This could reduce success in participants. Physical activity is linked to weight reduction, improved mental and social status = beneficial to improving overall health for teenagers.
Martin-Smith R,	Sprint interval training	*Pediatric Exercis*	To look at the effects of a 4-week	56 participants (34 males,	IBM SPSS version	52 participants were	It was found that a 4-week school-based

Duchan D, Baker J, Macdonald M, Sculthorpe N, Easton C, Knox Allen, Grace F, (2019)	and the school curriculum: Benefits upon cardiorespiratory fitness, physical activity profiles and cardiometabolic risk profiles of healthy adolescents.	*e Science. Vol. 31 (3).*	school-based sprint interval training (SIT) intervention on cardiorespiratory fitness (CRF), and physical activity levels in adolescents, as well as cardiometabolic risk (CMR) outcomes in adolescents.	age 16) gave written informed consent to participate. A quasi-experimental design was used with 2 higher level PE classes. The intervention group (n-24, 14m, 10f) and control group (n-32, 20m, 12f). The intervention group participated in SIT protocol where the control group continued in regular PE lessons (3x1 hour/week) for four weeks. SIT measures were collected 7 days pre/post intervention. Heights, weight, BMI, waist, and hip	22.0 was used to analyze data.	included in the final analysis of physical and physiological measurements. No significant differences were recorded between groups for pre/post observations concerning BMI, hip circumference, waist circumference, hip to waist ratio, systolic BP, or diastolic BP. No significant difference was observed for Maximal HR between	SIT significantly improved CRF and self-selected habitual PA following a summer vacation period. It has shown to improve CRF in health, overweight, and obese adolescents. There was a decline in CRF (7.3%) in the control group. It was unclear if this was a result of participants returning to school from summer vacation or from a poorly ran PE program not promoting PA. PE classes aim to increase MVPA but show little effect on overall PA levels. This study shows the increase in MVPA because

				circumference were all measured and calculated. Questionnaires were used to measure sexual maturation. Cardiorespiratory fitness was measured with a multistage fitness test. Uniaxial AciTrainer accelerometers were worn to measure habitual activity and sedentary time behaviors outside of SIT activity. Sedentary time (<100 counts per min) light PA (101-2999 CPM), Moderate (3000 – 5200 CPM) and vigorous pa (>5200 CPM).		pre and posttest.	of SIT intervention. Outside of school, sedentary behaviors declined, (time spent sedentary declined by 60 minutes in the independent group). SIT overcomes barriers because there is limited need for equipment. It was perceived to be more enjoyable to adolescents as well when compared to aerobic/endurance exercise because of the reward gained.

				Accelerometers must be worn 9 hours during the weekday and 8 hours during a weekend day. Heart rate telemetry was used to measure heart rate during SIT sessions. Blood pressure before and after Sit session were recorded each session. Cardiometabolic blood measures were taken before each session			
Mayorga-Vega D., Martinez-Baena A., Vician	Does school physical education really contribute to accelerometer-measured	*Journal of Sports Sciences. Vol. 36 (17).*	To compare the accelerometer-measured physical activity and sedentary behaviors between	394 adolescents (211 boys, 183 girls) ages 13-16, were invited to participate in the study. 158 students	Descriptive statistics were calculated for participants. Statistical	Sample population was found to be a balanced representation between	Findings: participants were more physically active on days they were in PE class than participants on non-PE days

a J. (2018)	daily physical activity and non-sedentary behavior in high school students?		days spent in physical education, days not in physical education and weekend days. It also investigated what physical education classes provide to adolescents daily physical activity.	were used in this study (83 boys, 75 girls). Criteria to be a participant included being enrolled in grades 9th-12th, participated in regular PE classes, can participate in physical activity with no underlying health issues, and have a signed consent form by their parent/legal guardian. Students were excluded from the study if they did not participate 100% of the recorded PE sessions, did not wear their devices for the set amount of time, (600	analyses were performed using SPSS version 21.0.the significance level was set at p<.05.	boys and girls. Boys were significantly heavier and taller than girls (p<.05). No significant difference was found between boys and girls concerning BMI.	and weekend days. Children 8-11 years old in other studies had significantly higher levels of activity on PE days than non-PE days USA 12,979 vs 11809, Hong Kong 9,930 vs 9,016). Comparing 30-minute,60-minute lesson and no lesson days, there were significant differences in pedometer readings for 60-minute lessons, but not for 30-minute lessons when compared to non-PE days. 30-minute lessons are not significant to non-PE days possibly due to amount of instruction. Pedometers have limitations, they can only measure total PA, where

				min/day), having at least two of the three non-PE days with the required device wear time, and not wearing their device at least one time during the 2 day weekend. Physical activity and sedentary behavior were objectively measured by GT3X+ accelerometer. Data was analyzed using ActiLife Lifestyle Monitoring system Software version 6.9.2. Anthropometric measurements: body mass and height used to calculate BMI.			accelerometers provide specific information regarding intensity. 15-17 min of MVPA equates to about 25% of adolescent daily recommended MVPA. Days participants were PE, the percentage of student achievement of daily MVPA was higher than those on non-PE days. = PE has a positive contribution on adolescents daily physical activity levels. lower levels of sedentary behavior were recorded on days participants had PE class, compared to days not in PE class.

				Research protocol was approved by the Ethical Committee of the University of Granada. Principals and PE teachers were notified of the study, and with approval consent forms were administered to students. Data was collected during the months of March- June 2014.			
McKenzie, T. L., Baquero, B., Crespo, N. C., Arredondo, E. M., Campbell, N. R., & Elder,	Environmental correlates of physical activity in Mexican American children at home	*Journal of Physical activity and Health (2008)*	To use direct observations of participants (at home and in school) to assess potentially modifiable factors that could improve PA and control the rise of obesity in	Trained observers assessed PA and associated physical and social environmental variables in the home of 139 Mexican American children.	Histograms and scatter plots used to test for normally. Pearson moment product correlations used to assess relationship between	Family and home environment play significant role in the development of children. Time spent indoors watching media on devices were related to	Improve home environment to increase and promote physical activity.

J. P. (2008)			Mexican Americans. Variables such as gender and overweight status are utilized to determine PA engagement.		PA and variables. Chi-square tests used to test similarities. Linear regression used to identify predictors of MVPA and EER.	children's sedentary behavior.	
Morris J., Daly-Smith A., Defeyter M., Mckenna J., Zwolinsky S., Lloyd S., Forthergill M., Graham P. (2019)	A pedometer-based physically active learning intervention: The importance of using preintervention physical activity categories to assess effectiveness	*Pediatric Exercise Science Vol 31(3).*	Focus was to evaluate the effectiveness of a physically active learning (PAL) intervention on adolescent's physical activity levels while looking at multiple groups to uncover past practice intervention effects brought by pre-	166 participants were eligible to participate in the study. 5 classes were recruited from 6 different schools. Permission was granted by head teachers and parents, and assent was obtained from pupils. Leeds Beckett University Ethics Committee	Accelerometer data was downloaded using ActiLife 6 and analyzed in KineSoft. Analysis of covariance test used SPSS version 24 to identify significant intervention	Intervention participants improved overall time spent in LPA (4.6% vs 4.32%), as well as discovered trends showing improvement for sedentary time (5.9% vs 5.6%). Group interactions did not show a	The pedometer-based PAL intervention identified statistically significant increases in LPA vs the control. LPA displaced sedentary time with MVPA in the intervention group. Results showed that LPA replaced sedentary time with MVPA in the intervention groups due to improvement of physical activity.

			intervention physical activity levels.	granted ethical permission to conduct this study. Samples were randomized and paired by Socioeconomic status and determine by a coin toss to either be in the control or intervention group. 82 participants were in the intervention group while 72 were part of the control group. Participants who did not have >3 valid days of physical activity, their data were discarded from the study. Teachers received one-on-one PAL training from Local	effects on sedentary time, Low physical activity (LPA), and MVPA. From accelerometry data of MVPA, two subgroups were created (low active-<45 min/day MVPA, and high active->45 min/day of MVPA). Tests were running to look for differences between subgroups for sedentary time, LPA, and MVPA.	significant difference between MVPA or sedentary time. The low active intervention group did show significant improvement in time spent in LPA (5.05% vs 4.05%). The high active intervention subgroup had the greatest significant increase in time spent in LPA vs the control (1.96 vs 4.31%).	LPA was shown to increase, but not for MVPA or time spent being sedentary. Benefits for increasing LPA are reducing systolic blood pressure, diastolic blood pressure, and high-density lipoprotein cholesterol levels. The least active participants benefitted most from the intervention, but both intervention subgroups showed a significant increase in time spent in LPA, the high active subgroup showed a decrease in percentage of time spent in MVPA. This is an indication that people who participate regularly in physical activity may be negatively affected by the use of LPA

				Schools Games Organizer (SGO) prior to the study. Participants wore pedometers to support the delivery of PAL lessons through (1) each school set a target number of steps that had to be achieved over the 6-week period and (2) the data had to be incorporated into classroom activities. Baseline pedometer scores were recorded in the first week and used to set benchmark goals for the duration of the study. Physical activity was assessed by GTIM uniaxial accelerometers by			programs because time is taken away from engaging in MVPA. The small sample size could produce results that are unrealistic and imprecise for planning interventions.

				participants wearing the monitors for 8 days prior to the intervention, and the final 8 days of the intervention. A minimal of 480 minutes per day constituted as a valid day. Heights, weights were collected using Seca 217 stadiometer (Anthropometrics). BMI was calculated off scores. Maturation was calculated using gender specific equations to predict children's age from a peak height velocity.			
Ordonez D., Polo	Effects of a school physical	*Apunts: Educació*	To determine the	Data was collected from two	A Garmin Forerun	A T-test was performed	Significant differences were observed

R., Lorenzo C., Shaoliang Z (2019)	activity intervention in pre-adolescents	*Física i Esports*	potential effects of regular physical activity intervention on physical fitness, coordination and attention.	bilingual public schools throughout the academic school year (Oct 3rd – Dec 23rd). Schools were chosen because they had similar schedules, the researchers had easy access to the school population, and they are located in similar socioeconomic environments. 89 sixth grade students (m=11.1 years old) were analyzed (44 from CEIP Doctor Tolosa Latour school, 45 from CEIP Los Almendros School).	ner 235 GPS was used to measure each circuit distance each segment of the intervention. Data was analyzed using the IBM SPSS Statistics 24 software.	to determine any significant in physical activity levels between control and experimental groups. The data from physical activity within the past seven days during recess, free time during the school day and free time outside of school showed no significance between groups. Significant differences were observed for variables cardiorespiratory capacity,	between the control and experimental group for variables cardiorespiratory capacity, coordination, and attention levels. An intervention program performed during classes in the morning had a positive influence on attention levels, which could help to improve academic performance. *Aerobic exercise could have an impact on improving cognitive functions such as information processing and attention. Programs should be developed to promote healthy school environments, improved knowledge in health and nutrition, and increased physical activity for all

				Students were divided into subgroups. Participants were randomly classified as either being in the control or in the experimental group. Prior to starting the intervention, PAQ-C questionnaires were handed out to participants. This was used to measure students MVPA 7 days prior to beginning the intervention. FACES test was administered pre and post intervention to measure attention levels.		coordination, height, and attention levels in both the number of right choices and efficacy.	children. Promoting healthy lifestyles through free play should be a focus in schools. Interventions can improve coordination, physical conditions and attention

				Lower body muscle strength was measured at the beginning and end of the study using a standing long jump test. Cardiorespiratory was tested pre and post-intervention using a 1-km test. The lateral jump test from the KTK (Kurperkoordinations test Fur Kinder) was used to test coordination levels. Heights and weights were measured before and after the study. This data was used to calculate BMI.			

				The control performed two 45-minute sessions of PE per week. The experimental group performed the same sessions along with additional physical work, 5 times per week (circuits) Circuits started at 250m for the first two weeks. and increased by 250m for the following 4 weeks. For the final four weeks, the circuit was increased to 750m.			
Pabayo R., Molnar B., Cradock A., Ichiro K. (2014)	The relationship between neighborhood socioeconomic characteri	*American Journal of Public Health Vol 104 (11).*	To determine the association between neighborhood economic deprivation,	Data came from a biennial survey known as the Boston Youth Survey (BYS).	Multilevel logistic modeling was used to determine associati	12.5% reported their neighborhood as being unsafe, 45.5% as sometime	High social fragmentation was associated with an increased probability for physical inactivity

	stics and physical inactivity among adolescents living in Boston, Massachusetts		social fragmentation, safety, and social disorder on physical inactivity among a selection of public high school students. Neighborhood perception of safety and student-reported social cohesion as mediators between Socioeconomic characteristics and physical activity were also investigated.	Ages of respondents were 14-19 years old. 18 schools participated in the survey. Random selection of students was selected until a total of 100-120 students were selected for each school. Students who were present the day of the survey were invited to participate in the study. Passive consent was used to gain permission to participate in the study. 69% of students chose to participate in the study. A sample size of 1364 students was the result.	on between area-level socioeconomic characteristics of the community and physical inactivity.	safe, and 42.1% as always safe. 24.1% (n-328) said they did not participate in physical activity. From previous year's results, this number is slightly lower (26.9% in 2007). Across neighborhoods, participants reporting no participation in physical activity ranged from 15.5% - 39.8%). Higher social fragmentation in neighborhoods was associated with an increased	among adolescents. No other neighborhood characteristic was found to be significantly associated with physical inactivity. A safer environment that feels safe to parents may be conducive for parents to allow their children to participate in outdoor physical activities. An unsafe environment may prohibit students to play outside, thus decreasing their physical activity overall. This study was strong in the sense that it had a large sample size, it was diverse, it represented all students attending public schools in Boston. Measurement of physical activity in school or at home was not

						likelihood of no reported PA. Those living in high poor neighborhoods were less likely to participate in PA every day.	possible, it was self-reported by students in a questionnaire.
Santos M., Dalamaria T., Pinto W., Farias E., Cunha M., Souza O. (2018)	Physical inactivity in adolescent students in the Western Brazilian Amazon	*Journal of Exercise Physiology online*	To identify the prevalence of and factors associated with physical inactivity in adolescent youth in the city of Rio Branco.	A cross-sectional study of high school students. Sample size was 1,391 students (612 males, 691 female). The study was approved by the Research Ethics Committee of the Federal University of Acre. To be considered for this study, participants had to be 14-18 years old, and regularly	Stata 12 program was used to analyze the data.	Physical inactivity among participants was 54.34% Females reported a higher level of physical inactivity compared to males (70.6% vs 35.9%). Participants with inactive locomotion had a 2.24-2.28 greater odds of being inactive when compared to those who had active	Female participants showed a higher inactivity rate than males. Male participants were physically inactive when associated with passive locomotion and >2 hours of computer usage. Female inactivity was associated with passive locomotion, or having two or more adolescents in the same home, and attending public schools. Active locomotion in the city of Rio, such as walking or cycling, is

				enrolled in high school. A structured questionnaire was used to assess participants level of physical activity. A self-administered physical activity checklist was also administered. 300 minutes or less of physical activity per week was considered physically inactive.		locomotion. Male students reporting 2 or more hours of computer time were 1.97% more likely to be inactive. 1.92% of public-school students were more likely to be inactive than students enrolled in public schools. Female participants with two or more adolescents in their home were more likely to be physically inactive.	not conducive because of intense are traffic and feelings of insecurity due to increased theft. The Environment is also a factor with the rainy season lasting several months of the year, active locomotion is not possible. Hence, why many participants use passive locomotion. Private schools tend to enroll families of wealth, who can pay for fitness center memberships, and sporting institutions.
Spruijt-Metz d., Nguyen-	Reducing sedentary behavior in minority	*International Journal of Pediatr*	The purpose was to create, apply, and	School selection was based on Latin student	Baseline data was collected three months	At the start of the intervention, 60%	Results showed a decrease in sedentary behavior but did not increase

Michel S., Goran M., Chih-Ping C., Huang T. (2008)	girls via a theory-based, tailored classroom median interventi on	*ic Obesity Vol. 3 (4).*	test a theory-based classroom media intervention known as *Get Moving!* to increase physical activity and decrease sedentary behaviors of Latina middle school girls.	population (60% or higher). Seven schools with a mixed SES were chosen from a list produced by the California Board of Education and the Roman Catholic Archdiocese . Schools were chosen based on their free or reduced lunch programs offered to students. Teachers at each school were contacted to recruit individual classes where all students chose to participate in the study. Parental consent and child assent forms, offered in both English and	prior to interven tion. Interven tions. After the 5-7-day interven tion, follow-up data was collecte d roughly three months later for a post interven tion. Physical Activity – a modifie d previous day physical activity recall (PDPA R) instrum ent was used to assess PA and sedentar y behavio r in blocks of 30-minute	of participan ts were normal weight while 17% were at risk of overweigh t. 20% were considere d overweigh t. With recommen dation for daily physical activity to be 30-60 minutes per day, only 16% of participan ts fell below the 30 minutes while 74% met the 60-minute recommen dation. The interventi on had a significant effect on reducing sedentary behavior but did	physical activity or significantly change participants BMI. With decreased sedentary behavior, it has been shown to improve percentile of being overweight and body fat improve aerobic fitness. Increasing intrinsic motivation had been shown to reduce sedentary behavior, but these changes require a lot of effort and mental focus. The intervention program didn’t influence BMI or body fat, but it did lead investigators to hypothesis that future interventions should be longer, more intense, and more comprehensive to have a

				Spanish, were given to students. Study procedures were approved by the University of Southern California's Institutional Review Board. 666 students completed surveys (85% response rate) and 617 participated in the follow-up survey. The data analysis used only responses from female participants (n-459). The study focus was to improve PA and reduce sedentary behavior in Latina girls, so only girls took part in the intervention. 136 (29.6%) girls	bouts through out each day of the interven tion. Meanin gs of Physical Activity Scale (MPAS) was used to assess the meaning of physical activity by utilizing a Likert scale respons e format. Exercise Self-Regulati on question naire (SRQ-E) was used to measure motivati on for physical activity by using a 3-point Likert	not have any significant effect on physical activity of any intensity, BMI percentile s, or percent body fat. The interventi on had a significant effect on increasing intrinsic motivatio n but had no effect on other areas of motivatio n or the meaning of physical activity.	significant effect. Findings from this study suggest that school-based interventions decrease sedentary behavior and may be effective tools for obesity prevention.

				received intervention from all 4 schools. All girls in the intervention classrooms were available to participate in the intervention. 136/246 (55.3%) participated in the intervention. Physical activity and sedentary behaviors were measured using self-reported measures. A media-based intervention program delivered to students during 5-7 in class sessions for 5-7 consecutive school days during the spring semester. Students were informed about	scale response. Ethnicity was assessed using Phinney's ethnic Identity scale, which was a check list. Height, weight, and body fat were measured using a Tanita TBF 300/A analyzer. Data from the PDPAR was processed in SAS using codes provided by the creators of PDPAR. All analyses were performed using		

				sedentary behaviors and physical activity, as well as participated in learning activities to teach them how to engage in physical activity and reduce time spent engaged in sedentary behaviors. Each classroom broke students into groups of 7-10 children to create their own animated public service announcement to promote physical activity to girls just like them.	SPSS v 13.0.		
Zhen Cong, Du Feng, Yin Liu, & Espert,	Sedentary behaviors among Hispanic children: Influences of parental	*American Journal of Health Promotion*	To examine environmental factors and the effects of parental support on sedentary	A longitudinal quasi-experimental design conducting interviews with parents	Growth curve analysis was used to examine trajectories of	Parental support reduced sedentary behaviors among children Girls were	It was recommended that parents take an initiative in being a part of their children's PA.

M. C. (2012)	support in a school intervention program		behaviors among Hispanic children.	of children ages 5-9 years old. Questionnaires were also used to collect data on children's sedentary behavior. Self-reported data on parental participation in promoting PA for their children	sedentary behaviors among the children of parents participating in this study.	less sedentary than boys normally. Intervention was successful in reducing children's sedentary behaviors over time.	