Physical Activity Levels, Barriers, and Facilitators Encountered In Adolescents with and Without Autism Spectrum Disorder

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While physical activity is beneficial to adolescent health and development, only 25% of adolescents met the physical activity recommendations of 60 minutes of physical activity daily. Research has shown adolescents with developmental disabilities, particularly Autism Spectrum Disorder (ASD), are at a higher risk of being physically inactive. It has been reported that adolescents with ASD participated in 30% less physical activity weekly than typically developing (TD) adolescents. Further, this group may face more and/or different types of physical activity barriers than TD adolescents. Currently, there is limited research comparing the physical activity barriers and facilitators seen in adolescents with and without ASD. Therefore, this study aims at determine the physical activity levels, barriers, and facilitators of adolescents with and without ASD. **Methods:** Seven adolescents (15.4 ± 1.4 years of age) participated in the study; three were TD and four were diagnosed with ASD. Height and weight were measured and then the adolescents wore an ActiGraph accelerometer for one week to assess their physical activity levels. Time spent in moderate and vigorous intensity physical activity (MVPA) was determined using established cut-points. The adolescents also completed the Youth Risk Behavior Surveillance System physical activity questions. To measure physical activity barriers and facilitators the adolescents completed the PACE adolescent survey. The PACE survey divided questions into the following subscales: personal, social, environmental, beliefs, and self-

efficacy factors. **Results:** Only one of the seven participants met the recommendations for MVPA according to the accelerometers. Both TD and ASD adolescents spent most of their time in sedentary and light physical activity and more time in moderate than vigorous physical activity. Both groups of adolescents reported minimum amounts of physical activity barriers and the main category of barriers reported was classified as personal. A medium effect size (.54) was observed when comparing sedentary activity counts between the two groups. Large effect sizes were observed when examining moderate and vigorous physical activity minutes (1.1 and .98, respectively), meaning there was a large difference in time spent in the different intensities between the two groups of adolescents. In terms of barriers, more personal barriers were observed in TD adolescents (1.1) according to effect size analysis. Large effects were also seen in the benefits subscale (1.76), where TD adolescent saw more benefits to physical activity than the ASD adolescents. **Conclusion:** Many adolescents in this study failed to meet physical activity guidelines. While the TD adolescents reported more personal barriers, they also had a better understanding of the benefits physical activity gives them compared to ASD adolescents. Both groups accumulated copious amounts of light physical activity; so, one approach should be to shift the physical activity levels from light to moderate intensity. Further, helping ASD adolescents have a better understanding of how being physically active might benefit them could be another strategy to increase time spent in MVPA.

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Chapter I: Introduction

Participation in regular physical activity has been shown to be a very beneficial modifiable lifestyle habit. The Centers for Disease Control (CDC) released a statement stating that regular physical activity can reduce a person's risk of dying from the leading causes of death such as heart disease or cancer (Centers for Disease Control, 2015). Studies show that meeting physical activity has beneficial effects on mental health such as better quality of life and improved moods (Penedo & Dahn, 2005). By choosing not to engage in regular physical activity, individuals put themselves at a greater risk of contracting preventable diseases such as cardiovascular disease (CVD), high blood pressure, or type II diabetes.

Physical activity benefits are not refined to a single demographic, but span across all age groups. Regular physical activity engagement in adolescence improves strength and endurance as well as aiding in strong bone development (U.S. Department of Health and Human services, 2008). With the positive impacts physical activity as on health extensive research has determined the minimum amount of physical activity needed to achieve health benefits. Data from the 2015 National Health Interview Survey found that less than 50 percent of adults, aged 18 years or older, meet physical activity guidelines and are therefore not receiving the benefits that physical activity provides (National Health Survey and Statistics, 2015). More concerning numbers were seen when adolescent physical activity levels were examined. When the NHANES survey was administered in 2012, it was discovered that only roughly 25% of adolescents met the physical activity guidelines of 60 minutes of moderate-to-vigorous physical activity daily (Fakhouri et al., 2014). Even though physical activity has been shown to improve mental and physical health, schools are removing it from the curriculum and reducing active

minutes during the day. Between 1991 to 2003 there was a decline from 41.6% to 28.4% of high school students participating in daily physical education classes (Centers for Disease Control, 2004). These results highlights the need for focusing on adolescent physical activity habits.

Adolescents are at a very transitional point in their life. With many changes occurring physically, socially, and psychologically challenges can come to fruition and strategies are needed to deal with these challenges. One commonly observed challenge in adolescence is overcoming physical activity barriers. Researchers have been working to better understand the barriers to physical activity that adolescents are faced with. The research conducted in this age group normally concerns typically developing (TD) children and the barriers they are faced with (Allison, Dwyer, Goldenberg, & Fein, 2005; Sallis, Prochaska, & Taylor, 2000; Goh, Bogart, Sipple-Asher, Uyeda, & Hawes-Dawson, 2009). The most prevalent physical activity barriers in this age group include lack of time and the desire to participate in other activities such as video games (Allison et al., 2005). This information is effective for streamlining interventions for the majority of adolescents, but the literature is scarce regarding physical activity barriers in atypically developing adolescents.

The prevalence of developmental disorders has been rising, so it is imperative that more research is conducted in this population to better understand the barriers that these adolescents are faced with. In any given year roughly 15% – 20% of the American population will experience some sort of mental disorder, according to the National Research Council and Institute of Medicine the prevalence of mental disorders has increased by 15% since 1994 (National Research Council and Institute of Medicine, 2009). One developmental disorder that has increased in prevalence over the past two decades is Autism Spectrum Disorder (ASD). ASD is classified by the presence of neurodevelopmental disorders that interfere with or prohibit

regular social interactions and communication skills. Individuals with ASD also exhibit repetitive behaviors and other interests typical of this population (American Psychiatric Association, 2000). Adolescents with ASD face more challenges than their typically developing counterparts. The current literature suggests that adolescents with ASD are less likely to engage in physical activity. Rosser and Frey (2003) found that adolescents with ASD spend significantly less time in moderate activity when compared to their TD peers (98.8 ± .8 minutes/day vs. 132.7± .4 minutes/day). Since their behaviors are different from TD peers, it is possible that the barriers of adolescents with ASD to participate in physical activity could also be different.

There are several types of theories that have been created to help explain human behavior, and identify ways to better understand and/or intervene on key components that are related to the desired behavior. Theories enable researchers to examine health aspects such as physical activity patterns. A theory that is applicable to physical activity participation is the Social Cognitive Theory (SCT). SCT utilizes a number of key constructs, such as ones envrioment , behavior and experiences, to better understand the determinants of human behavior (Glanz, Lewis, & Rimer, 1997) and assesses three psychological factors that influence behavior: perceived self-efficacy/behavioral control, environmental factors and cognitive factors (Bandora, 2004).

In the past researchers have used certain aspects of the SCT to study the effectiveness of this theory related to physical activity. Some researchers set out to test the usefulness of the framework and found it to be effective when drafting physical activity interventions (Glanz, Lewis, & Rimer, 1997). Because SCT assesses behavioral traits it has become a broadly used tool for predicting physical activity as physical activity participation is impacted by intention and

outcome driven goals. A review of over 20 studies indicated that the SCT was able to account for 38-41% of intention and behavioral variance in adolescents' physical activity levels (Plotnikoff, Costigan, Karunamuni & Lubans, 2013). This study indicates that SCT is a useful tool in behavioral predication for physical activity.

SCT has also proved useful when identifying physical activity barriers and facilitators and their effect on overall physical activity. Ayotte, Margrett, & Hicks-Patrick (2010) examined the impact self-efficacy, outcome expectancies, perceived barriers, self-regulatory behaviors and social support had on physical activity participation in 256 middle aged men and women (ages 50 – 75 years). The study found that the more barriers that were present the less physical activity that was reported by participants. Further, when certain aspects of SCT were present the impact that the barriers had on overall physical activity was reduced. Elevated levels of self-efficacy was directly related to more positive outcome expectancies (βdirect = .45) and fewer perceived barriers (βdirect = –.41). Increased number of health conditions was also directly related to lower levels of overall physical activity (βdirect = .16). This study highlights the importance for focusing on multiple constructs of the SCT to draft an effective intervention and reduce the overall impact of barriers and produce more facilitators to physical activity.

Currently, there is limited research comparing the physical activity barriers and facilitators reported in TD adolescents to those with ASD (Orsmond & Kuo, 2011; Stanish et al., 2017). It has been reported that adolescents with ASD commonly face more barriers, but the desire to be active is still present in these individuals (Obrusnikova & Cavalier, 2011). Obrusnikova found that facilitators are key to participation in physical activity and the more present the more physical activity that was observed. Another study found that the two most popular facilitators to physical activity are self –efficacy and beliefs of the benefits of physical

activity (Bandura, 2004). Understanding possible differences in physical activity barriers/facilitators between adolescents with ASD and TD would enable those designing interventions to develop more specific and effective interventions for this population.

There are several notable different barriers that have appeared in the literature thus far. The most notable barrier to be observed in adolescents with ASD is the lack of people in the same age group to participate in physical activity (Obrusnikova & Cavalier, 2011). Pan (2009) found adolescents with ASD were limited by the opportunities to participate in physical activity. Traditionally physical activity studies in this population have measured physical activity using questionnaires, but two studies examined physical activity in adolescents using accelerometers (Pan, 2009; Bandi et al., 2013). To the best of our knowledge, no studies have examined the prevalence of physical activity using accelerometers and physical activity barriers and facilitators in adolescents with and without ASD together.

Purposes & Hypotheses

Purpose 1: To examine the physical activity levels between TD adolescents and adolescents with ASD.

Hypothesis: It is hypothesized that adolescents with ASD will have lower levels of physical activity than TD adolescents.

Purpose 2: To determine the physical activity barriers and facilitators that are present in adolescents with and without ASD.

Hypothesis: It is hypothesized that adolescents with ASD will have more physical activity barriers and physical activity facilitators than TD adolescents.

Significance

This study will contribute to the existing literature by expanding the scientific studies in concerning this demographic and enable more effective interventions to be created when targeting the population with ASD. Due to the lack of information about this population, it is important to gather as much information about their thoughts and opinions as they progress through this developmental period in their life. Adolescents with ASD differ greatly from the majority adolescents and information obtained from this study could be used to help design ways to improve physical activity in participants in this high-risk population.

Limitations

Some of the limitations would include the fact that the study will be conducted only in eastern North Carolina. Another limitation of the study is that there is no clearly established method of assessment of physical activity barriers and facilitators for adolescents with ASD. Finally, some adolescents may not fully understand the questions asked of them, may lie, or unknowingly provide false answers.

Delimitations

Delimitations ensure accuracy and what outcomes that you want to achieve are made possible. The study will be examining adolescents with and without ASD (aged 12-18). Adolescents with ASD will be in the moderate to the high functioning category.

Definitions

Physical Activity: Any bodily movement that requires voluntary muscle engagement and requires more energy than resting (World Health Organization, 2017)

- **Aerobic Activity**: exercise that is intended to improve the bodies Cardiovascular System. This activity also increases the ability of an individual to effectively transport oxygen to skeletal muscles (US Department of Health and Human Services, 2008)
- **Muscle-Strengthening**: In corporate muscle strengthening activities into the 60 minutes of daily activity to ensure proper muscular development (US Department of Health and Human Services, 2008).
- **Bone-Strengthening**: When engaging in the 60 minutes of PA a day incorporate bone strengthening activities to ensure proper bone development (US Department of Health and Human Services, 2008).
- **Moderate Physical Activity:** An activity that requires a moderate amount of effort (World Health Organization, 2017).
- **Vigorous Physical Activity:** An activity that requires a large amount of effort and heavy breathing and a rapid heart rate increase (World Health Organization, 2017).

Autism Spectrum Disorder (ASD): a group of developmental disorders with a wide range of symptoms and disabilities. Characteristics of this disorder include communication and social issues. It is also common to see habitual and obsessive behaviors in this population. (Autism spectrum disorder, 2014).

Typically Developing Children: children with behavior, intellectual ability, and functional skills that would typically be seen in children for their age, (not strictly based on IQ scores) (Hala, Pexman, & Glenwright, 2007).

Adolescence: A period of growth between childhood and adulthood, typically between ages 10-19 (Csikszentmihalyi, 2017).

Physical Activity Barriers: Anything that makes physical activity difficult or unattractive (Center for Disease Control, 2014)

Chapter II: Literature Review

Physical Activity

Physical inactivity has been an increasing health concern in the world for the past three decades. Regular physical activity provides benefits to every single system in the body. In adults, physical activity improves high density lipoprotein cholesterol and cardiovascular function, lowers blood pressure, builds stronger bones, prevents certain types of cancers, and reduces mortality (Silvestri, 1997). Health benefits have also been observed among youth and include the development and maintenance of healthy bones and muscles, decreased risk of obesity, type 2 diabetes, depression and anxiety, and improved psychological well-being (Jannesen & LeBlanc, 2010). Because of the importance of physical activity scientists have developed physical activity recommendations for adolescents. Scientists recommend that youth (6-18 years of age) engage in 60 minutes (1 hour) or more of aerobic physical activity each day at a moderate-to-vigorous-intensity and incorporate muscle and bone strengthening activities three days a week (US Department of Health and Human Services, 2008).

Even with all the proven benefits that physical activity provides, American adolescents fail to participate in enough physical activity. In the year 2013 alone, the CDC reported that only 77% of adolescents aged 9-13 took part in a free time physical activity (Ogden, Carroll, Kit, & Flegal, 2014). The NHANES survey in 2012-2013 showed that less than three in ten high school students get at least 60 minutes of physical activity every day (Colberg et al., 2010). Further, the President's Council on Fitness and Sports and Nutrition reported that only one in three American adolescents are physically active every day (National Association for Sport and Physical Education, 1999).

While the amount of physical activity is low in adolescents, they are spending a lot of time in sedentary behaviors, such as watching TV and using a computer. The President's Council on Fitness and Sports and Nutrition reported that adolescents engage in seven and a half hours of screen time a day (Rideout, Foehr, & Roberts, 2010; Boone, Gordon-Larsen, Adair, & Popkin, 2007). Further, one study found that teens spend 30 or more hours a week engaged in screen time (American Heart Association 2008). This is in addition to the 32.5 hours a week adolescents spend at school and the four hours a week spent on homework (Aud, KewalRamani, & Frohlich, 2011).

Unfortunately, the school environment promotes sedentary behaviors as demonstrated by only six states requiring physical education in every grade, K-12 (National Association for Sport and Physical Education/American Heart Association, 2012). This data shows that adolescents spend a good portion of their week in a sedentary scholastic setting and then continue the sedentary behavior at home. Elevated levels of screen time, independent of physical activity, increase in the likely hood for high calorie diets, decreased sleep, and reduced metabolic health (Ekelund et al., 2006; Owen, Neuhaus, & Dunstan, 2011). If adolescents spent half of that time engaged in physical activity, they would meet the current physical activity guidelines.

Having adolescents achieve these physical activity guidelines is just the beginning of the issue. Once the adolescent is physically active, it is imperative that he/she remains active to receive lifelong health benefits from physical activity. Studies have highlighted the importance of becoming and staying active during adolescence. An example of this importance is from one study that found becoming inactive during the transition from adolescence to adulthood was associated with being overweight as an adult in males (OR=1.49, 95% CI: 1.18-1.89), and with

severe abdominal obesity in females (OR=1.80, 95% CI: 1.13-2.86) (Aaltonen et al., 2015). This study highlights the need for physical activity maintenance across all ages.

Habits are developed early on in life and are influenced by many various factors. Developmental psychology studies have shown that children react and emulate the world that they are exposed to (Wille et al., 2008). Learning and development through observation have a great impact on children's values and lifestyle choices in early stages of life. The habits that are developed early in life track have been shown to track into teenage years and then adulthood. These habits are formed by what they observe around them be it good or bad. A study conducted by Fuches (2004) found that children were over 15% more likely to participate in leisure time physical activity if they received support from friends and parents. Even if the parents are not regularly engaged in physical activity, positive reinforcement from parents has been shown to increase activity levels in adolescents (Trost et al., 2003). This influence of surroundings can have negative repercussions as well. For example, one study showed that the children of parents who were smoker are almost 30% more likely to consume tobacco products compared to children of parents who were nonsmokers (Stien et al., 1999). This study highlights not only the importance of exposing children to healthy lifestyle habits as soon as possible but also possible barriers to healthy habits. Since the need for exposure to healthy habits is important, it is imperative that researchers fully understand the barriers preventing adolescents from being active.

Autism Spectrum Disorder (ASD)

The American Psychiatric Association's Diagnosis and Statistical Manual of Mental Disorders (DSM) define Autism as a serious neurodevelopmental disorder that impairs a child's

ability to communicate and interact with others (Autism Spectrum Disorder, 2014). It also includes restricted repetitive behaviors, interests, and activities. Symptoms assessed include repetitive behaviors and actions and limitations in communications and cognitive functioning. Not all of these impairments have to be present so a scale of severity has been developed. These developmental differences cause significant impairment in social, occupational and other areas of functioning (Autism Spectrum Disorder, 2014). In 2004, the DSM amended the definition to include other disorders that were previously classified as separate conditions. The current definition of Autism includes Asperger's syndrome, childhood disintegrative disorder and pervasive developmental disorder. When diagnosing ASD, practitioners use a criterion published by DSM that scales individuals on a variety of traits indicative of having the disorder.

ASD rates have been increasing in the U. S. over the past decade. ASD prevalence has increased by a rate varying from six to15% each year from 2002 to 2010 (Christensen, Baio, & Braun, 2016). In 2015, the Centers for Disease Control reported that one in 45 children have ASD (Zablotsky, Black, Maenner, Schieve, & Blumberg, 2015). This statistic highlights the recent and rapid increase in this disorder across the nation. One probable reason for the increase in the ASD is that the modified diagnosis criteria has made it easier for clinicians to identify and report ASD cases; however, even before the amendment to the ASD definition the number of cases was rising.

ASD and Physical Activity

Children with ASD and other learning/social disorders are also at risk for physical inactivity because many adolescent physical activity opportunities involve social interaction. This is concerning because a study conducted in adolescents that were in the low functioning

category of ASD also reported benefits from being physically active (Kern, Koegel, Christensen, Baio, & Braun, 1982). Participants in the study ranged from age 12 to age 15 and were required to be able to stand and move without inhibition in order to participate in the study. The physical activity intervention consisted of a 10 to 15-minutes bout of moderate intensity jogging. Coaches helped explain where participants would be running, but allowed the adolescents to choose their own pace. Intensity was assessed via verbal cues and observation, i.e., if the child was flushed and sweating. The study found that after the adolescents participated in a 10-15-minute bout of physical activity, they were able to improve time spent on tasks as well as complete 30% more tasks that they were assigned (Kern et al., 1982).

Orsmond and Kuo (2011) aimed to explain the physical activity patterns of youth diagnosed with ASD by closely examining the activities that they choose to engage in on a daily basis. They recruited 393 families that possessed an adolescent diagnosed with ASD and administered questioners to the caregivers and the adolescent. The families interviewed had adolescents aged from 12 to 21 years of age. Families were asked to record in a daily physical activity log, and the adolescents and caregivers were asked to complete the physical activity survey. The study found that the adolescents spent their leisure time engaged primarily watching TV (1.96 hours/day) and using computers (.85 hours/day), while only spending 0.56 hours/day in daily physical activity. The results are concerning because sedentary activities have a much larger presence than time spent in physical activity. When physical activity did occur, it most often occurred under the supervision of professionals due to a lack of autonomy in adolescents with ASD. Further, the adolescents interviewed reported that they would choose to engage in more physical activity if they knew how. This study highlights the need for alternative interventions when working with adolescents with developmental disorders. In order to create

effective physical activity interventions in adolescents with ASD, more information is needed on the challenges that they face.

It appears that adolescents with ASD spend a large part of their free time in sedentary activities; however, the above research did not compare adolescents with ASD to TD adolescents. Stanish et al. (2017) compared physical activity levels in adolescents with and without ASD. Thirty-five adolescents with ASD and 60 TD adolescents ages 13-21 were enrolled in the study. Actical® accelerometers measured physical activity levels. Participants wore the accelerometer for seven days. Researchers also attempted to gather information about physical activity levels for the past year. A trained interviewer engaged both the adolescent and their parent when asking questions about the types of physical activities performed and the frequency of participation. Questions were asked to the adolescents and parents together so that they could deliberate and arrive at an agreement upon the most accurate estimates of physical activity participation. Total activity counts were 20 – 30 minutes lower among adolescents with ASD compared to TD adolescents on weekdays, weekends, and as a daily weighted average. Differences also existed for time spent in moderate-to-vigorous physical activity (MVPA), where adolescents with ASD spent an average of about 29 min/day in MVPA compared to 50 min/day among TD adolescents ($p < .001$). Furthermore, adolescents with ASD engaged in significantly fewer activities compared to TD adolescents (5.3 activities vs. 7.1 activities, $p=.03$). While the amount of time and number of activities ASD adolescents participated in was lower than TD adolescents, they did like to engage in similar activities, such as team sports and active gaming. Because of the similarity in activity choices, interventions have the potential to be more inclusive. Although children with ASD face more and different barriers, they do still find

enjoyment in being active and should not be excluded when designing physical activity interventions.

In contrast, Sandt and Frey (2005) found that youth with ASD (aged 8-15 years) had physical activity levels that were similar to those of TD youth. Physical activity levels were assessed via pedometer and surveys that were administered to the parents and the youth. Youth diagnosed with ASD were found to spend 127.5 ±72.3 minutes in total daily MVPA while TD youth spent 162.1 ± 45.6 minutes engaged in MVPA. Youth with ASD did have roughly 30 minutes less of total daily activity, but the difference was not significant. This study also provided insight to where the differences in physical activity did occur. When youth with ASD were participating in physical education, they were 9–10% less active than their TD peers (Sandt & Frey, 2005). The study leads to reason that TD and youth with ASD engage in similar levels of activity, but more engagement from both groups is necessary.

While the research is mixed regarding if youth with ASD have lower physical activity levels than TD youth, it has been reported that ASD adolescents' physical activity patterns through aging are similar to their TD counterparts in that physical activity levels decrease with age (US Department of Health and Human Services, 2000). Pan and Frey (2006) conducted a study to objectively measure physical activity patters in youth with ASD. All participants were recruited locally from a variety of methods. Participants were recruited from: local after school programs, special needs schools, and adapted physical activity programs. Participants were excluded if they could not understand verbal instructions or possessed severe behavior problems. Thirty youth, aged 10–19 years, were divided into three groups: elementary (n=9), middle (n=9) and high (n=12) school. Participants wore a 7164-uniaxial accelerometer and completed an activity questionnaire for seven consecutive days. The study utilized the Child/Adolescent

Activity Log for the physical activity questionnaire, which was completed daily during the same time period the monitor was worn. Adolescents were asked to recall activities that they had engaged in during their afterschool time (3:00 pm to bedtime) and they then were asked to report the total number of minutes that they engaged in a specific activity. Participants in the TD group reported that, 47% (*n*=14) accumulated a minimum of 60 min of daily MVPA. No differences were observed in physical activity or MVPA between weekdays and weekends. Participants participated in more bouts of 5- and 10-min continuous MVPA on weekends compared to weekdays (+1.4 and +.9 times/day). When broken up into school levels, 78% of elementary school (*n*=7) and 67% of middle school (*n*=6) youth accumulated recommended MVPA, while only .08% of high school youth (*n*=1) met this guideline. This study also noted that the activity bouts of the children with ASD were somewhat sporadic making it difficult to identify elevated levels of activity time. Because there is a sharp decline in physical activity levels as youth age, it is imperative that more research is conducted to better understand what is preventing them from engaging in physical activity.

When prescribing exercise to special populations, it is important to recognize that individuals enjoy different activities. Enjoyment is a component of physical activity that can promote longevity as well as other benefits. When prescribing exercise or, promoting physical activity, in youth with ASD, it is important to remember that these individuals may not be finding pleasure in the same activities as others. A study conducted by Eversole et al., (2016) examined the activities that 131 children (6-13 years of age) with and without ASD enjoyed. Further, the enjoyment of leisure time physical activity was compared between ASD (n=67) and TD (n=64) children. The study utilized the CAPE interview questionnaire to assess activity enjoyment in participants. The children also had their IQ levels assessed and the children with

ASD had their functional levels assessed. The most enjoyed activity for both groups was playing a computer/video game. The second most enjoyed activity for the group with ASD was watching TV or a rented movie. The second most enjoyed activity for TD children was spending time with friends and peers. Differences in activity enjoyment were compared by age group. Significant differences were seen among the children with ASD in enjoyment of overall ($p = .014$), informal ($p = .023$), recreational ($p = .009$), and self-improvement activities ($p = .006$), with less enjoyment reported in the older children. No significant differences were seen among the scores of the TD children. The study found that TD children and children with ASD had similar interests in activity preference, such as playing a video game or watching TV, but some differences between the groups did appear. Two activities, mainly playing games, stood out as being differently enjoyed between groups. Playing games (e.g., basketball, jump rope, hockey), ranked as the 6th most enjoyed activity for TD children and 27th for children with ASD. This could be caused by a lack of motor skill abilities to participate in these activities. Children with ASD were less likely to participate in formal types of physical activity. This study highlighted the fact that activity enjoyment is different in TD children and children with ASD. When interventions are implemented in this age group, it is important for individuals to be aware of the fact that children with ASD find enjoyment in different activities than their peers without ASD.

Children with ASD may be more likely to be less active as they move into adolescence because of less involvement in play environments and available activity programs become more competitive during adolescence, which is typically not appropriate for youth with ASD (Schultheis, Boswell, & Decker, 2000). Furthermore, in this population has been studied, and obesity rates are 27% more prevalent in than TD peers and obesity could make participating in physical activity more difficult (McCoy, Jackicic, & Gibbs, 2016). If this population does not

develop active leisure time activities, they will be more predisposed to sedentary behavior and the health risks associated with inactivity. It is necessary for alternative approaches to be used when promoting physical activity in this demographic.

Physical Activity Barriers

According to the ecological model, barriers can be classified into five main categories: intrapersonal, interpersonal, institutional, community, and policy. Intrapersonal barriers reflect characteristics of the individual, such as a negative attitude, which may prevent physical activity (McLeroy, Bibeau, & Steckler, 1988). Interpersonal barriers relate to formal and informal social networks and support systems, such as the lack of support from significant others, which may prevent physical activity. Institutional barriers occur within social institutions with organizational characteristics, such as a school not offering after-school physical activities to the students (McLeroy et al., 1988). Community barriers occur between organizations, institutions, and informal networks within defined boundaries, such as when recreational facilities within an urban municipality provide limited physical activity opportunities for all residents (McLeroy et al., 1988). Public policy barriers are local, state, and national laws and policies that may prevent physical activity, such as a law that prohibits rollerblading on city sidewalks (McLeroy et al., 1988). Another barrier that adolescents can be faced with is the physical environment, which can be defined as the availability of a safe environment to participate in physical activity residents (McLeroy et al., 1988).

Due to the low number of adolescents not meeting physical activity guidelines and subsequent health implications, many researchers are trying to understand the causes for the lack of physical activity participation. According to the Youth Risk Behavior Surveillance System

(YRBS), in America, less than half of adolescents are meeting physical activity recommendations, many factors contribute to this lack of physical activity, and more are being discovered as research progresses. When designing and implementing a physical activity intervention, it is important to understand that adolescents are faced with barriers daily. The obstacles facing today's youth are as diverse as the population. Both genetics and the environment can be inhibiting factors for an individual to participate in physical activities. For instance, children born with genetic disorders (e.g., sickle cell) will have a more challenging time engaging in continuous physical activity (McLeroy et al., 1988). Environmental barriers, such as severe weather or unsafe areas to participate in physical activity, can also have a large impact on physical activity participation as well. Romeroet al., (2001) found that access to afterschool programs and safe adults had a positive impact on physical activity levels for the youths living in low socioeconomic status neighborhoods. While the role diseases and the environment have as physical activity barriers among youth has been studied, other barriers to physical activity participation exist for adolescents.

When researchers examine physical activity levels in adolescents, there are many factors that need to be considered. For example, physical activity levels can be influenced by, but are not limited to, race, sex, and socioeconomic status. Lenhart et al., (2012) examined physical activity levels and sedentary behavior in a sample of students in the rural Philadelphia school system. This study assessed students on participation in physical activity both during and after school. Twenty-eight percent of females were reported as being sedentary compared to only 11% of males. The males in the study reported that one of the main ways that they stayed active was through participation in sports and other physically demanding outdoor activities. Tergerson and King (2002) found that female adolescents refrained from physical activity due to a lack of

"safe environments or sports teams". Different deterrents to physical activity have been noted across various levels of socioeconomic status as well. Humpert et al. (2006) examined the differences in physical activity barriers facing those in a low compared to a high socioeconomic status setting. The youth in the low socioeconomic status setting reported that proximity, cost, facilities, and safety were the biggest factors limiting physical activity, whereas high socioeconomic status participants reported more interpersonal barriers to physical activity, such as the desire to engage in other activities. The afore mentioned studies share a variety of similarities; the most common barriers reported were lack of motivation from friends and peers and that access to organized teams and activities helped raise their fitness levels (Humpert et al., 2006).

Causes of Physical Inactivity

Studies have shown that American adolescents have been accumulating less and less physical activity as time goes on. Fakouri and her team found that roughly 25% of U.S. adolescents aged 12–15 years met physical activity guidelines (Fakouri et al., 2014). Physical activity guidelines for adolescents include participating in at least 60 minutes of physical activity on all day of the week (US Department of Health and Human Services, 2008). This task should be obtainable for most adolescents, but majority of American adolescents fail to meet these guidelines. Researchers have aimed to find causes of physical inactivity in TD youth and have determined some causes of the sedentary behavior.

Scientists have explored trends in physical activity in adolescence and have discovered a commonality; physical activity decreases as age increases. Nelson, Neumark-Stzainer, Hannan, Sirard, and Story (2006) examined 2,516 adolescents and their physical activity levels over a

five-year period. The physical activity questions came from Godin Leisure-Time Exercise Questionnaire and Planet Health surveys. The surveys inquired about time and type of physical activity as well as activities performed during leisure time such as watching TV or using a computer. Adolescents were divided into groups based from their age, which allowed for data collection by age group to occur. The study found that MVPA in females declined 5.9 to 4.9 hours/week during the transition from early to mid-adolescence and from 5.1 to 3.5 hours/week during mid to late adolescence (Nelson et al., 2006). Males showed a slight delay in physical activity level decline in early to mid-adolescence (1 to 1.5 hours), but there was a large decline in mid to late adolescence (6.5 to 5.1 hours/week). There was an increase of computer usage and TV time of a minimum of 3 hours/week when progressing through each stage of adolescence. This longitudinal study showed that there are unfavorable changes in physical activity patterns as age increases. This means that interventions should focus on promoting and maintaining physical activity in all sexes and age groups.

O'Dea (2003) set out to determine what adolescents perceived as benefits and barriers to healthy lifestyle habits. O'Dea conducted focus group interviews that utilized standardized questions and prompts. Two hundred and thirteen students (51% female, 49% male) from grades 2-11 were recruited from 34 different schools in Australia. The participants were then divided into 38 focus groups where they participated in-group discussions that lasted approximately 20 – 30 minutes. The group discussions allowed researchers to gather information on what the adolescents perceived as major benefits and barriers to physical activity. The biggest facilitators reported were the social benefits (fun, team identity, development of life skills, and parental approval) followed by psychological enhancement benefits (sense of achievement, pride, sense of balance). The major barriers identified in the study were a preference for indoor activity, low

energy levels, and time constraints. The adolescents in the focus groups did note the health protection benefits that physical activity provides, but physical activity value did not increase because of health benefits. This study showed that adolescents see the value of physical activity and parental approval plays a role in physical activity participation. When examining activity levels in adolescents, it is important to remember that adolescence is a transitional period and many factors can influence activities. This period can be especially taxing on females due to the concern of body image.

Robbins, Pender, and Kazanis (2003) determined the most prevalent physical activity barriers faced by female adolescents. The researchers recruited 77 adolescent females (ages 11 to 14) for the study. All participants were enrolled in middle school and were considered to be inactive (not meeting physical activity guidelines). The participants completed a questionnaire that was based on the Transtheoretical model to assess their physical activity levels/barriers and what stage of change that they were currently a member of. The physical activity barriers were ranked on a scale of 1 to 5, and then an analysis was done to determine the most commonly reported barriers. Of these, the barriers with the highest mean and percentage scores were "I am self-conscious about my looks when I exercise" (mean = 2.80; 57.2%) and "I am not motivated to be active" (mean = 2.68; 58.5%). Differences emerged only in the responses of sixth and eighth graders who also identified "I am afraid to fail" and "I am feeling too lazy" as important barriers to physical activity. The study found that feelings of self-consciousness emerged as a major barrier to physical activity. This is important to consider when prescribing physical activity to individuals in this age group because enjoyment is the key to longevity.

When prescribing physical activity to female adolescents, it is important to consider factors that could potentially impact physical activity levels. When prescribing physical activity

to minorities it is important to note that, they may have slightly different values or characteristics. A study conducted by Bowen (2016) found two very distinct barriers to physical activity. The study was conducted in a New York City public high school setting. The researchers recruited 56 adolescent females 14 to 17 years of age from two different high schools. Their ethnic background was African American (55%), Hispanic (29%), Caucasian (5%), and others (11%). The majority (75%) of the females did not participate in regular physical activity because they did not want to sweat (55%) and to ruin their hair (39%). Seventy-five percent of females said they did not participate in physical education and of those that participated 44% reported that they were not active during physical education because they did not want to ruin their hair. Majority of girls sampled stated that they avoided physical activity and sweating because of aesthetics and the impact that physical activity had on their image for the day. This study indicates that there are many barriers (social, environmental and physical) to physical activity and not all the barriers are easy to distinguish and overcome, so it is imperative that clinicians accommodate for diverse types of barriers when prescribing exercise.

Female and male adolescents are faced report different barriers to physical activity. For example, females can be more concerned with body image whereas males can be more occupied with other activities such as screen time. Allison et al. (2005) conducted a study to understand what was either preventing or causing adolescent males to engage in or shy away from physical activity. The study involved 26 young males, ages 15 and 16, who recorded their physical activity over the course of one week. The adolescents were asked a series of questions to better understand their reasons for being active. The adolescents reported a number of several reasons for being active as well as a variety of barriers. The adolescents stated that the biggest intrinsic motivator for being physically active was the fun they received from doing the activity. The

largest extrinsic motivator was the social aspect provided by the physical activity. This highlights two of the many benefits that physical activity provides, reinforcing the need to provide access to physical activity to all. The biggest personal barrier to physical activity reported by the adolescents was that more emphasis was placed on academics by the parents than physical activity. The adolescent males also reported that they preferred to engage in technology-based activities in free time. This study showed that while adolescents enjoy physical activity, they encounter different types of barriers when trying to engage in the activities.

Martin, Marques, Sarmento, and Carreiro da Coasta (2015) conducted a systematic review to examine adolescents' perspectives on facilitators and barriers to physical activity. The study collected and researched articles that had been previously published in 'Web of Science', 'EBSCO', 'Psychinfo' and 'ERIC', all studies analyzed were from 2007 - 2014. In order for a study to be included in this research a set of inclusion criteria were established: (a) studies had to be concerned with perspectives and definitions that influence participation in physical activity; (b) barriers reported to the researcher had to come from the adolescent not parent reported; (c) all data collection concerning the adolescents were performed by utilizing qualitative methods (e.g. interviews and groups with a specific interest); (d) empirical studies; and (e) participants studied were: healthy, aged between 13 and 18 years and from urban areas in developed countries. Every article was reviewed by two researchers to ensure quality.

The study found that competitive physical activity and a performance motivational climate were not appreciated by adolescents and were considered a barrier to physical activity (Martins et al., 2015). The study found that adolescents who were continuously active throughout their life elicited positive attitudes towards physical activity. An association with

health benefits, improved physical appearance, fun and multiple social accompanied this positive attitude towards physical activity. Inactive adolescents did not mention the positive benefits associated with regular physical activity (mental health or weight control) but tended to focus more on the barriers. Fun was the most common facilitator of physical activity in the studies that were analyzed (nine of the 12 studies). The most fun was observed in activities that were challenging yet not competitive. The researchers found that adolescents enjoyed the idea of challenging themselves but did not want to appear as different or incompetent in front of their peers. Moreover, the most active adolescents received an elevated level of support from family and friends, emphasizing the need for a strong social support network. There are many various factors that influence an adolescent's physical activity habits. The most active adolescents were fulfilling the basic psychological needs, specifically competence, autonomy and interpersonal relations.

Adolescents with ASD and Physical Activity Barriers

When encouraging adolescents to participate in physical activity, it is important to remember that it is not one size fits all, just like when prescribing exercise to their adult counterparts. All children grow and develop in their own unique way and not all youth share the same interests, capabilities, or availability to physical activity. Some children grow and develop quicker than others allowing them to participate in more activities than others in the same age group as them. Because of the diversity in today's youth, research is necessary to fully understand the barriers to physical activity and how the barriers impact different groups of adolescents. One other commonality that studies in this area possess is that they do not include physical activity barriers/facilitators of special needs populations. A few studies have aimed to

examine barriers seen in adolescents with ASD to better understand what is prohibiting these adolescents from participating in regular physical activity (Obrusnikova & Cavalier, 2011)

Adolescents with disabilities are impacted by various factors that do not influence TD adolescents. For example, an adolescent with cerebral palsy reported that the main barriers preventing adolescents to be active was that physical activity was too difficult and tiring for them (Verschuren, Wiart, Hermans, & Ketelaar, 2012). Another major barrier reported by the participants and their caregivers in this study was the lack of skilled professionals to facilitate PA (Verschuren et al., 2012).

Another common developmental disorder that is restricting physical activity in today's youth is ASD. A common belief about youth with ASD is that they do not understand either the benefits of physical activity or the need for it. A study conducted by Stanish, Curtin, Phillips, Maslin, and Bandini (2016) found that adolescents aged 13 – 18 years of age with ASD did not fully comprehend the health benefits of physical activity, and regular participation had positive health correlations. When the adolescents were asked if and why physical activity they only responded, that the main reason they participated in physical activity was that it was important to be outside. The adolescents with developmental disabilities (or ASD) did not comprehend that positive health benefits are associated with increased levels of physical activity. Further, this study reported the lack of facilities and experienced professionals were primary barriers to physical activity participation in this population.

When comparing physical activity levels between TD adolescents and adolescents with ASD, it is important to remember that there are a variety of barriers and beliefs facing both groups. Stanish., Curtin, Must, Phillips, Maslin, & Bandini (2017), aimed to expand the research in this area to make exercise interventions in this realm more efficient. They compared physical

activity enjoyment, perceived barriers, beliefs, and self-efficacy between adolescents with and without intellectual disabilities (13-18 years). The age limit was slightly higher in adolescents with ASD (13-21 years) because youth with disabilities are permitted to remain in school until they turn 22 years of age. The screening and enrollment protocol involved an initial telephone interview with a parent to determine the eligibility of the adolescent to participate in the study followed by a 1-2-hour study visit. A questionnaire was used to gather information directly from adolescents about factors that may influence their participation in physical activity. Since the study aimed to compare adolescents with and without ASD, the items included on the questionnaire were those that could be applicable to both groups. The questionnaire was verbally administered by a trained research assistant on a one-on-one basis in a private room and took 20-30 minutes to complete. A slightly greater preference for doing yard work/housework was observed among adolescents with ASD, though this difference was not statistically significant (69% vs. 50%, p=.08). More adolescents with ASD reported that they "Don't like" participating in gym class at school compared to TD adolescents (16% vs. 2%, p=.02). Adolescents with ASD were also more likely to indicate a dislike for team sports (35% vs. 5%, p <.001). When asked "When you have the choice, what would you rather do in your free time?", 25% of adolescents with ASD selected "sports or exercise" and 75% selected "something else". Among TD adolescents, 58% selected "sports or exercise" (p<.01). Most adolescents in both groups reported that participating in sports and exercise was "A lot of fun" (59% of ASD vs. 75% of TD), but this was slightly different between the groups on this item (p=.03). Adolescents with ASD were also less likely to report that sports and exercise is "a way to make friends" (68% vs. 97%, p<.001). Adolescents with ASD were similar to TD adolescents to think that "sports and exercise will make them feel good" (81% vs. 95%, p=.06). When asked "Would you like to

do more sports and exercise?", 59% of adolescents with ASD answered positively compared to 82% of TD adolescents (p=.02). The biggest difference in barriers reported came from adolescents with ASD who stated that they were "afraid of getting hurt during sports and exercise" than their TD counterparts, although it was not a significant difference (54% vs. 33%, p=.07). Among those who indicated a fear of getting hurt, a much higher percentage of adolescents with ASD indicated that this would stop them from participating in sports and exercise compared to TD adolescents (73% ASD vs. 10% TD, p<.001). The study found that adolescents with ASD are willing and ready to participate in opportunities for physical activity. This study also found that over half of the adolescents with ASD stated that they would like to engage in more physical activity. Finally, this study showed that adolescents with ASD find enjoyment in physical activity, but they would like to participate in other types of activities than sports.

Obrunikova and Caralier (2011) explored barriers to physical activity in youth with ASD in an after-school setting. The participants were a convenience sample of 12 boys and two girls with ASD, ages 8–14 years (10.64 ± 1.65 years). All participants were recruited from an after-school program in Delaware that specifically served children with ASD. The youth's parents were asked a series of questions to ensure that their child would be able to interpret what was being asked of them in the study. Modified definitions of physical activity were utilized to ensure that the adolescents understood the activities in question. The youth were also asked to wear an accelerometer for a week as well as complete an activity questionnaire and photograph any barriers or facilitators that they encountered on a daily basis. Some of the photos were classified as unusable if they were multiple pictures of the same item or the child was unable to identify the barrier in the picture. Detailed analysis revealed that only three participants (21%)

met the recommendation of accumulating at least 60 min of MVPA on all days during the monitored week. Five participants (36%) did not meet the recommendation on any of the monitored days. All participants spent a larger percentage of time in light physical activity (15.4 ± 5.8 %, range=6.2–28.4) than in MVPA (6.0 ± 4.6%, range=1.5–13.9). The amount of time these participants spent in vigorous physical activity ranged from 0 to 14 min (1.3 minutes ± SD), indicating no participant met the recommendation of engaging in bouts of 20-min, continuous vigorous physical activity at least three times a week. The adolescents also photographed and reported barriers that they encountered. The most frequent intrapersonal responses in this study were playing video games or spending time on a computer (27% of intrapersonal barriers), watching favorite television shows or listening to music (17%), feeling tired (14%), or being bored with exercise (14%). A majority of the participants (94%) cited engagement in technology-based activities (e.g., playing video games, browsing the internet, watching television, or listening to music) as the most frequent reason for not engaging in MVPA after school. Majority of these barriers were reported every day that the youth recorded physical activity. The most frequently reported interpersonal barrier was the lack of a peer to engage in activities with. There were differences in facilitators for physical activity in the children surveyed. Adolescents who were higher functioning engaged in more team sports while individuals with low levels of functioning picked more activities that did not involve other participants. The most common interpersonal facilitator was support from friend, family, and pets. The most frequent community facilitator was the availability of physical activity programs in the community. This study highlights the fact that children with ASD are ready and willing to participate in physical activity regularly if adequate facilitators are present. It means future interventions for adolescents with ASD should implement activities focusing on those areas.

Another barrier that has been observed in adolescents with ASD is poor motor development. Over the past decade, researchers have studied the motor performance of individuals with ASD and found deficits in several areas of function including impairments in motor anticipation, dyspraxia, and postural control (Fournier et al., 2010). These impairments in development can impede and adolescents' ability to participate in physical activities that are commonplace for TD children, such as riding a bike playing a baseball or basketball. Fournier et al. (2010) studied the discrepancies in motor skills between TD youth and youth with ASD to determine if there was a significant difference in motor skill ability. Youth aged 6 – 15 were used in the study and all were recruited from local schools. Youth were excluded if the ASD diagnosis was severe or if they possessed a physical limitation that prevented them from completing the screening. The Test of Gross Motor Development-3rd Edition (TGMD-3) was used to assess gross motor skills. The TGMD-3 is comprised of 6 locomotor skills and 7 object control skills. Locomotor skills include run, horizontal jump, gallop, slide, skip, and hop. Object control skills include an overhand throw, underhand throw, two-hand catch, two-hand strike, one-hand strike, dribble, and kick. The TGMD-3 breaks down each skill into 3 to 5 criteria. If a criteria is met the child receives a 1, if the criteria are not met a 0 is recorded. Each skill was performed and scored twice. Scores for locomotor and object control skills were obtained by adding the score from each skill in the respective subsection, an overall score was obtained by summing the scores of the two subsections. Total TGMD-3 scores can range from 0 to 100 (i.e., the locomotor subset range is 0–46; the object control subset range is 0–54). Youth were also asked to complete a physical activity questionnaire that inquired about time spent in physical activity and the activities that they liked to engage in. Youth with ASD scored significantly lower on the locomotor (t (20) = 3.92, p = .0008; d = 1.67) and object control

((20) = 2.58, p = .018; *d* = 1.10) subscales than those without ASD. Youth with low motor skills scores reported in engaging in less physical activity as well as a smaller variety of activities. This study suggests that motor skill interventions could be a way of eliminating a prominent physical activity barrier seen in youth with ASD.

Screen time is becoming more prevalent as new technological advances have made access to them cheaper and easier. Studies in TD adolescents found that they spend over seven hours a day engaged in a screen (Rideout et al., 2010). Adolescents with ASD are at risk for an even greater amount of screen time due to their preference to engage in solitary activities. Studies have shown that a number of barriers face children with ASD (Verschuren et al., 2012), but the overall impact of these barriers on screen time have not been assessed. Researchers examined the relationship between physical activity barriers and the engagement in screen time in TD children and children with ASD (Verschuren et al., 2012). Fifty-three children with ASD and 58 TD ages 3-11 children completed the study. Parents completed a questionnaire that queried their perceived child/family, social, and community barriers to their child's participation in physical activity. Parents were also asked to complete a questionnaire that assessed participation in organized and unstructured physical activities. Parents were also asked to complete a study that quantified their child's participation in screen time activities. Barriers to physical activity were positively related to levels of screen time behavior in children with ASD for several of the variables examined. About 51% of parents of children with ASD reported 6 or more total barriers to physical activity, while none of the parents of TD children reported the number of barriers at this level (typically reported 3 to 4 barriers). The most commonly reported barrier to physical activity among TD children was family time constraints. Among the child/family level barriers that were queried, poor motor skills, behavior and learning problems,

and the need for supervision were frequently cited as barriers to physical activity in children with ASD. The total number of barriers reported was positively related to total weekly screen time (r=.32, p=.03) and weekday screen time (r=.32, p=.03) in both groups of participants. This study showed that children with ASD face many different barriers than their TD developing counterparts. Further, children with ASD may choose to engage in sedentary behavior for other reasons. This study showed that children with ASD face more barriers so more in-depth interventions are needed.

Due to the rising prevalence of ASD, it is imperative that more scientific literature is devoted to examining the barriers to PA facing youth with ASD. There are a number of different personal barriers that inhibit adolescents with ASD from participating in physical activity, such as limited social skills or the inability to perform certain tasks. Adolescents with ASD also need to ensure that they have access to facilitators of physical activity as well.

Summary

The literature acknowledges the benefits and importance of physical activity, yet many individuals of all age groups fail to meet the established recommendations. The studies reviewed show that habits developed early in life have an impact on lifestyle habits later in life. It is imperative that all people have access to physical activity so that the ability to gain the benefits of physical activity is not impaired. To do this, researchers must examine all factors influencing physical activity – barriers and facilitators. One demographic that is growing and lacking in research is the adolescent with ASD. By expanding the literature around this population, researchers will have the ability to compare and contrast adolescents with and without ASD and develop activity interventions that would be effective for both parties in question.

Chapter III: Methods

Participants and Recruitment Strategies

Participants for this study were adolescents aged 13-18 years old and two groups of adolescents were recruited: TD, and those diagnosed with ASD, as defined by American Psychiatric Institution (National Institute of Mental Health, Diagnostic criteria from DSM-V-TR, 2013). In order to participate in the study, the adolescents had to be free from injury or any medical condition that would prevent them from participating in physical activity. They were also required to be able to understand all of the questions that were asked of them and answer accordingly. Activity monitors were to be worn for a week so all participants were screened to make sure they were willing to do this.

All participants were recruited from the Greenville and Pitt County area and a variety of different recruitment methods were completed. The study was initially advertised on listserves to employees at East Carolina University (ECU) and the city of Greenville. In an effort to recruit TD adolescents, the researcher volunteered with the local J.H. Rose lacrosse team, and contacted the local Boys and Girls Club, area churches, and Boy Scout Troops. To recruit adolescents with ASD, the researcher provided physical activity instructional assistance to local middle and high school special needs classrooms. The researcher also contacted organizations that worked with those who have ASD, such as, Rocking Horse Ranch, the local Autism Society, the Autism Youth Basketball League, and Greenville's and Winterville's Parks and Recreation Departments.

A total of seven adolescents participated in the study; three were TD and four had ASD. The recruitment strategies that were most successful included ECU's listserve, the Boys and Girls Club, personal contacts, the Rocking Horse Ranch, and word of mouth from participants. All of the areas of the study were approved by ECU's IRB (Appendix A).

Design

The study design used to complete this study was the descriptive study design.

Procedures

The participants came to the Activity Promotion Lab on two separate occasions, separated by at least eight days, but no more than two weeks. Visit one was the longer visit (45 – 60 minutes) and was followed by visit two (15 - 30 minutes).

Visit one. The first items to be handled at this visit was introductions and the obtaining of participant assent and parental informed consent. Once this had occurred the parent or guardian completed demographic information while height and weight were assessed on the adolescent. Then the YRBS was administered by the researcher, followed by Standish physical activity barriers survey. Once the surveys had been completed the participant received the accelerometer and were instructed to wear the device during all waking hours of the day unless or participating in activities where it might get wet. The accelerometers were set to begin collecting data the day after the visit so the participant had an afternoon to get acquainted with the device. Finally, any questions were answered and the second visit was scheduled at the end of the first visit.

Visit two. At this visit, the accelerometer was returned and then the PACE survey was administered by the researcher. After all questions were answered, the participant received a 10 dollar Wal-Mart gift card.

Instruments

Anthropometrics. Height was assessed using a portable stadiometer and weight using a calibrated scale. All height (centimeters) and weight (kilograms) information was gathered once

participants had removed shoes. Body mass index (BMI) was calculated using the weight (kg)/height^2 (m) equation and then age and sex adjusted BMI percentiles were calculated using a calculator developed by the CDC which was available on the CDC's website (https://nccd.cdc.gov/dnpabmi/calculator.aspx). Then the adolescents were classified into one of the following BMI categories: underweight was defined as anything less than the 5th percentile, healthy weight was the 5th percentile to less than the 85th percentile, overweight was 85th to less than the 95th percentile, and obese was considered equal to or greater than the 95th percentile (Kuczmarski, Ogden, & Guo, 2002).

Physical Activity Levels. Physical activity levels were assessed with the YRBS and ActiGraph accelerometers.

YRBS. The YRBS was developed in the early 1990s to survey adolescent health risk factors that are responsible for the leading causes of death (Centers for Disease Control, 2014). The YRBS is concerned with behaviors that contribute to unintentional injuries and violence, sexual behaviors tied to unintended pregnancy and sexually transmitted diseases, alcohol and other drug use, tobacco use, unhealthy dietary behaviors, and inadequate physical activity. YRBS also assesses obesity and other health aliments that cause premature death and other health problems that affect the quality of life. Participants in this study completed the physical activity questions from YRBS (Appendix B). The questionnaire was interview-administered by a trained researcher. Appendix B shows the PA questions of the YRBS.

Studies have been conducted to confirm that the physical activity questions are a reliable and valid method to assess physical activity. Brener et al. (1999) examined the reliability of the YRBS at assessing certain aspects of participant's lives. Assessing physical activity behaviors, researchers achieved a kappa value of no lower than 14 % indicating moderate reliability for

every topic discussed in the YRBS. Another group of researchers examined the validity of the physical activity questions in the YRBS (Tropedet al., 2003). The study found that high school aged students tended to underestimate the time spent in moderate activity and overestimate the time spent in vigorous physical activity. The authors reported that when utilizing only the self-reported data only 21.6% of students met moderate physical activity guidelines, but the ActiGraph data indicated that 90.4% of students in fact met the established guidelines. These findings demonstrate the need for further explanation of YRBS questions as well as other forms of assessment to achieve accurate results. Regardless of one study indicating that the questions result in an under reporting of physical activity level, the physical activity questions in the YRBS are still used in the surveillance method. The YRBS questions are concerned with weekly physical activities that the participant engages in. The survey assesses all modes of physical activity as well as the amount of time that the adolescent spent engaged in a particular activity. This questionnaire allows the researcher to get a weekly screen shot of the activity levels that the person is engaging in.

Activity Monitor. The ActiGraph is an accelerometer that is commonly used in physical activity studies has been proven to be a valid and reliable measure of physical activity assessment (Sasaki, John, & Freedson, 2011). All adolescents wore the activity monitor on their right hip for a period of seven consecutive days. In order to meet inclusion criteria for data analysis, the activity monitor had to be worn for at least four out of seven days, including one weekend day, and for at least eight hours per day. The activity monitor is an objective measure of physical activity and allows for the time spent and intensity of the physical activities to be determined.

Accelerometer cut points. It is important to choose accurate cut-points for physical activity when utilizing accelerometers in research. Multiple cut-points have been published for adolescents and thus it is important to select cut-points that yield accurate representations of the physical activity intensities. In this study, the physical activity intensity cut-points developed by Everson and her team were utilized. The physical activity cut-points are: sedentary < 100 counts per minute, light physical activity 100 - 2999 counts per minute, moderate physical activity 3000 - 5199 counts per minute, vigorous physical activity ≥ 5200 counts per minute, and MVPA was ≥ 3000 counts per minute. These cut-points were selected because of the five widely used cut-points, researchers found Evenson et al.'s cut-points yielded the most accurate results when predicting energy expenditure (Trost, Loprinzi, Moore, & Pfeiffer, 2011).

Physical Activity Barriers. Two different surveys were used to measure the physical activity barriers that might be present in the adolescents. The first questionnaire used was developed by Stanish et al. (2010). This survey assessed physical activity enjoyment, barriers, and beliefs about physical activity in adolescents with and without ASD. The questionnaire was developed from questionnaires that used items to assess barriers and facilitators to physical activity in this population (Rilley, Rimmer, & Rubin, 2001; Motl, 2001; Salmon, Owen, Crawford, Bauman, & Sallis, 2003; Wu & Pender, 2002). The survey was pilot tested for clarity before it was used by Stanish et al. (2010). Then the survey was tested for reliability by administering the survey twice separated by 14-21 days. A question was considered reliable when either the kappa value was greater than .6 or the percentage of agreement was above 80%. Twenty-six of the original 33 questions met this criterion and were included in the data analysis. Appendix C shows the questions found in this survey, which mainly have yes or no responses and then have follow up questions to gain greater information as to why the participant engages

in that particular activity. This allows the participant to explain why the activity matters to them in their own words. The results from this survey were used in the individual description of the adolescents' barriers to physical activity in the results section.

The PACE survey was also used to asses physical activity barriers and facilitators (Appendix D). The PACE survey is a widely used survey that classifies barriers and facilitators into different categories in order to better understand the barriers and facilitator that are present (Quelly, Norris, & DiPietro, 2016). The survey was developed to be used specifically with adolescents and features questions about some scenarios commonly seen in this age range. All of the questions asked are based on a Likert scale that ranges from one to five, with one being the lowest and a five being the highest. The barriers or facilitators are classified into the following subscales: personal, social, environmental, beliefs/benefits, and self-efficacy. Questions in the personal subscale are concerned with the way the individual perceives himself or herself in a physical activity setting. The social subscale is concerned with who and how the individual interacts with others during physical activity. Questions in the social subscale focus on friends and family members as well as the preferences to participate in physical activity in a group setting or on an individual basis. The environmental subscale is related to anything in the physical surroundings that can facilitate or limit physical activity. This can include access and transportation to areas to participate in physical activity such as recreation centers or sidewalks. The beliefs/benefits subscale questions are concerned with the overall expectations from the physical activity, such as improved health or better sleep. Finally, the self-efficacy subscale asks questions related to the confidence that the participant has that he or she can complete and activity. These questions are also concerned with how well a participant perceives their ability to accomplish tasks. To score items on the PACE survey they are broken down by subscales. The

scores for each question within that subscale are added together and then the total score is divided by the number of questions that comprise the subscale. For the five subscale(s) some of the values were reversed scored so that the highest value was always five.

Statistical Analysis

Means and standard deviations were calculated for demographic information and each group's physical activity levels and physical activity barriers and facilitators. Frequencies were also calculated for demographic variables. Effect sizes (ES) were calculated for time spent in the different physical activity intensities and barriers/facilitators. The ES values were interpreted as follows: >.8 is a large, .5 is a medium and <.2 is a small effect (Cohen, 1998).

Chapter IV: Results

A total of seven adolescents (three TD and four ASD) participated in this study. Table 1 shows the adolescent's individual demographic information. The average age of the adolescents was 15.4 ± 1.4 years and two were female and the other five were males. Overall the adolescents were considered healthy weight based on the average BMI percentile. All participants resided in Pitt county North Carolina, and 71% of the adolescents identified as Non-Hispanic white, while 14.5% were either Native American or Asian. All of the adolescents came from a family with a household income greater than $50,000 and had a least one parent that had obtained a college degree.

When comparing the two groups, the adolescents were of similar age, but the TD group was comprised of two males and one female whereas, the ASD group had three males and one female (Table 1). The ASD adolescents were shorter, weighed more, and on average they were considered overweight, compared to the TD group which was taller, weight less, and considered a healthy weight (Table 3). One of the TD adolescents was Non-Hispanic white, one was Native American, and the other identified as Asian. All of the ASD adolescents were classified as Non-Hispanic white. Adolescents from both groups came from families that had a similar income and education level.

Table 1.

Anthropometrics for the Individual Adolescents

	Typically Developing			
Sex	Male	Male	Female	
Participant #	101	103	102	
Age (years)	15	15	15	
Height (cm)	166	172	154	
Weight (kg)	58.7	69.8	50.8	
BMI (kg/m^2)	21.3	23.6	21.4	
BMI percentile	68^{th}	85^{th}	67^{th}	
	Autism Spectrum Disorder			
Sex	Male	Male	Male	Female
Participant #	201	203	204	202
Age (years)	13	17	17	16
Height (cm)	151	172	167	154
Weight (kg)	55.8	86.2	67	73
BMI (kg/m^2)	24.5	29.1	24.0	31.1
BMI percentile	93^{rd}	96^{th}	79^{th}	96^{th}

Note: BMI = body mass index

TD Individual Information

When examining the adolescents as a group it is easy to see patterns emerge, but it is also important to understand the individuals in this population since there were large differences in age. The first TD participant was a male 15 years of age. He was actively engaged in outdoor activities and participated in other forms of active recreational activities. The physical activity that interested him the most was independent play outside although he was involved with the swim team and other sports. There were minimum amounts of barriers to physical activity reported across all different types of categories. The only barrier reported was within the personal subscale because he did not believe that he was good at team sport. There were no days in which he was unable to wear the accelerometer for extended periods of time. According to the YRBS he reported that he met aerobic and strength training physical activity recommendations but not for flexibility training.

The second TD was a female 15 years of age and was also extremely active. She was involved with multiple sports teams and reported multiple avenues for leisure time physical activity. At the time of the study she was participating in soccer multiple days a week. She reported feelings of competence in self-efficacy when asked about sports and participation in physical activity. She reported few barriers to physical activity and no injuries that restricted her physical activity. The only barrier to physical activity was a lack of time and energy to participate. The accelerometer was worn everyday with no reported complications. According to the YRBS she reported that he met aerobic and strength training physical activity recommendations, but not for flexibility training.

The last TD that participated in the study was a male 15 years of age. He reported that he enjoyed participating in leisure time physical activity as well as organized team events. At the time of the study he was participating on a swim team and was in the pool multiple times a week.

He reported that he enjoyed being active on his own and with friends, but also stated that he prefers to engage in sedentary behavior over being physically active, which was his only barrier to physical activity. During the week that he wore the accelerometer he swam three days so the monitor was unable to record this physical activity although he did log swimming on the sheet that was provided to him. The most commonly reported was a lack of time due to a busy schedule with school and extracurricular activities. Although he still met the criteria for wear time. He reported that he met the recommendations for MVPA in the YRBS survey, but did not meet the guidelines for flexibility training although he did meet the recommendations for strength training.

ASD Individual Information

All four of the adolescents with ASD were diagnosed by a registered clinician and enrolled in special needs classes. This group consisted of three males and one female ranging in age from 13 – 16 years old. All the participants reported an affinity for physical activity and attended some physical activity classes in school throughout the week. Table 2 shows the physical activity data along with barriers and facilitator scores from the PACE survey. When examining physical activity based off of the accelerometers only one of the participants met the recommendations for physical activity.

The first ASD participant was a male 13 years of age. He was diagnosed as high functioning by his clinician and participating in multiple forms of organized physical activity. He reported that he enjoyed playing basketball and baseball and at the time of the study was on a basketball team. He was also participating in classes at an equestrian therapy clinic twice a

week, and received one day of physical education class at school. He reported minimum amounts of barriers and had a large area at home that he enjoyed participating in independent physical activity. The main barrier that he stated was the lack of other people to be active with. He also reported that playing with his dog and parents was something that he really loved doing. He did report that he engaged in a large amount of screen time and that he enjoyed doing that more than physical activity when he had the opportunity. In the YRBS he reported that he met the aerobic guidelines to physical activity but not for the flexibility or muscle/bone strengthening activities.

The second participant was a female 16 years of age. She was diagnosed as borderline high functioning and was currently holding an assisted employment position. At the time of the study, she was participating on two different sports teams, baseball and swimming and attended classes at an equestrian therapy clinic. She reported that she enjoyed playing sports and engaged in physical activity at least three days a week at school. She was also involved with other sports teams throughout the year. She reported that she enjoyed participating in independent physical activity and her mom said that it was one way that she could unwind. She reported no barriers had a significant impact on her overall level of physical activity. She was unable to participate in her normal physical activity for that day due to illness and other day baseball practice was canceled and she reported that she was less physical activity than she would normally have on that day.

The last two participants were male twins and both were 17 years old. Participant 203 was diagnosed as borderline high functioning. He was actively involved with the baseball team and engaged in regular physical with their parents/guardians at least three days a week. He participated in five days of physical activity at school weekly and lived an environment

convenient for physical activity. He reported that he enjoyed physical activity and that it was a fun to be active with friends. According to the YRBS data, he met the requirements for aerobic activity and flexibility training, but not for muscle and bone strengthening activities. The only barrier that he reported was dealing with self-image and did not fully understanding the benefits of physical activity.

Participant 204 was the twin brother of participant 203 and was diagnosed as low functioning. During the study period, he was involved with a baseball team and was active with his parents and guardians' multiple days of the week. He participated in five days of physical activity at school weekly and had reported that he was happy with being active at home. According to the YRBS data, he met the requirements for aerobic activity and flexibility training but not for muscle and bone strengthening activities. He said that he was good at sports, but did not mind being active on his own. The main barrier to physical activity that he reported was that he did not like being hot.

Table 2.

Time Spent in Different Physical Activity Intensities and Reported Barriers to Physical Activity of the Individual Adolescents.

	Typically Developing			
Participant #	101	103	102	
Light PA (mins/week)	1584	725	438	
MVPA (min/week)	272.25	88.5	98	
MVPA (min/day)	39	18	24	
PA Barriers				
Personal	2	2	1	
Social	1	0	0	
Environmental	0	0	0	
PA Facilitators				
Benefits/beliefs	4	5	3	
Self-efficacy	2	3	2	
	Autism Spectrum Disorder			
Participant #	201	203	204	202
Light PA (mins/week)	1935	1274	1180	854
MVPA (min/week)	98	152	482	372
MVPA (min/day)	59	19	59	93
PA Barriers				
Personal	1	2	2	3

Social	1	1	1	1
Environmental	0	0	0	1
PA Facilitators				
Beliefs/benefits	1	4	5	3
Self-efficacy	2	3	2	1

Notes: PA = physical activity, MVPA = moderate-to-vigorous physical activity

Table 3.

Anthropometrics for the Adolescents Overall and by Group.

	TD	**ASD**	**ALL**
	n=3	**n=4**	**N=7**
Anthropometrics	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**
Age (years)	15.0 ± 0.0	15.7 ± 1.9	15.4 ± 1.4
Height (cm)	164.0 ± 9.2	161.0 ± 10.1	162.3 ± 9.0
Weight (kg)	59.8 ± 9.5	70.5 ± 12.7	65.9 ± 11.9
BMI percentile	73^{rd} ± 10.1	91^{st} ± 8.1	83^{rd} ± 12.5

Note: TD=typically developing, ASD=Autism Spectrum Disorder, BMI = body mass index

Purpose 1

Table 4 shows the physical activity data for all the adolescents and then by TD and ASD participants. All the adolescents met the criteria of four days of wear time and wore the accelerometer for on average 15 hours/day. Overall the adolescents spent the majority of the day in sedentary activities follow by light intensity physical activities. Further, on average they did not meet the physical activity recommendation of 60 minutes of MVPA per day. When examining the individual accelerometer data, only one adolescent met the physical activity guidelines of 60 minutes of MVPA daily. In contrast, data from the YRBS survey four of the adolescent's reported that they participated in at least 60 minutes of MVPA four or more days a week. After calculating the effect size between the two groups, medium effects were observed between TD and ASD for sedentary time, and large effects were found for moderate, and vigorous physical activity. The ASD adolescents participated in more time in sedentary, moderate, and vigorous physical activity than TD adolescents.

For the TD there was an average wear time of 13 hours daily and most of the time was spent in either light or sedentary activities. None of the TD adolescents met the physical activity recommendations of 60 minutes of MVPA daily. This data is opposite of the YRBS data, where all the TD adolescents reported meeting the guidelines for aerobic exercise. Two of the three adolescents also reported that they met the physical activity guidelines for flexibility and muscular training.

When examining the physical activity data for the ASD adolescents, the average wear time was 16 hours daily. And like with the TD, the ASD adolescents also spent majority of their time in either light or sedentary activities. Only one of the ASD adolescents met the

recommendations of 60 minutes daily. Data from the YRBS indicated that all the ASD participants reported that they met the recommendations for flexibility training and none met recommendations for muscular strength training. The ASD group of participants also reported that they did not meet the aerobic activity guidelines according to the YRBS.

Table 4.

Physical Activity Levels for the Adolescents Overall and by Group.

	TD	**ASD**	**ALL**	
	n=3	**n=4**	**N=7**	
Physical Activity	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Effect Size**
Sedentary (min/day)	591 ± 97	705 ± 315	671 ± 300	.54
Light (min/day)	172 ± 112	187 ± 65	184 ± 83	.18
Moderate (min/day)	22 ± 18	41 ± 17	34 ± 22	1.1
Vigorous (min/day)	7 ± 1.52	11 ± 6	10 ± 6	.98
Wear time (min/day)	787 ± 2.6	1002 ± 311	910 ± 248	

Note: TD = typically developing, ASD = Autism Spectrum Disorder

Purpose 2

Table 5 shows the reported physical activity barriers and facilitators for all adolescents and by group. Overall the adolescents reported very few barriers, the subscale with the highest value was Personal. When examining the personal barriers ASD adolescents claimed that it was difficult for them to learn certain skills needed for sports. In contrast, the TD adolescents reported two main physical activity barriers within in the personal subscale. The first barrier reported was the way they looked playing sports and the second barrier was that they would rather be using their free time for sedentary activities. The personal barriers had a large effect size when comparing the two groups of adolescents meaning that TD adolescents reported more personal barriers than the ASD adolescents. The higher barrier in this area could be caused by the fact that TD adolescents were more concerned with how others are perceiving them than the ASD adolescents. Effect size analysis indicated no differences were observed for the social and environmental subscales between TD and ASD adolescents. The results indicated that overall adolescents with ASD did not have more barriers to physical activity than TD adolescents.

Regarding facilitators to physical activity, all the adolescents reported that they had beliefs in the benefits that physical activity provides (Table 5). Moreover, all the adolescents, regardless of group (TD or ASD), reported parental involvement as being a major facilitator for physical activity participation. This was demonstrated by all the adolescents reporting a score of five (extremely important) when asked about the importance of parental assistance and support to their physical activity habits. A large effect size was observed when comparing beliefs in the benefits of physical activity, where the TD adolescents had a higher score than ASD adolescents.

This large effect size could be due to one out liar in the ASD adolescents who reported a large number of barriers and did not fully understand the benefits of physical activity, such as increased health from physical activity. There was a low effect size observed in the self-efficacy subscale, where the TD adolescents had a slightly higher score for self-efficacy towards being physically active than the ASD adolescents.

Table 5.

Barriers and Facilitators for Physical Activity Participation among All Adolescents and by Group.

	TD	**ASD**	**ALL**	
Physical Activity	**n=3**	**n=4**	**N=7**	
Item	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Effect Size**
Barriers				
Personal	3.3 ± .88	2.2 ± .99	2.7 ± .94	1.11
Social	1.0 ± 1.00	1.0 ± .58	1.2 ± .75	0
Environmental	1.0 ± 1.00	1.0 ± 1.00	1.2 ± .60	0
Facilitators				
Benefits	4.3 ± .54	3.0 ± .89	3.6 ± .71	1.76
Self-Efficacy	2.6 ± .57	2.3 ± 1.7	2.4 ± 1.20	.25

Note: TD = typically developing, ASD = Autism Spectrum Disorder

Chapter V: Discussion

The main purpose of this study was to determine and compare the physical activity levels, barriers, and facilitators of adolescents diagnosed with and with ASD. The physical activity levels of the ASD and TD adolescents were similar in that most of their time was spent in sedentary and light physical activity. While both groups spent more time in moderate than vigorous physical activity, few adolescents did enough to meet physical activity recommendations. Further, this group of ASD and TD adolescents reported roughly the same amount of physical activity barriers and facilitators. Finally, similar types of physical activity barriers and facilitators were reported between the two groups.

Purpose 1

When examining reported physical activity levels in adolescents with ASD, adolescents tend to overestimate physical activity levels (Pan and Frey, 2008), this result was also present in the current study. Further, results from the current study reiterates the claims of the Department of Health and Human Services (2008) that adolescents are failing to meet physical activity recommendations. This lack of meeting physical activity guidelines has also been reported in past research focusing on ASD adolescents (Stanish et al., 2016).

When comparing the activity levels of the TD and ASD adolescents, there was a medium effect size when observed in sedentary time and a large effect size when examining moderate and vigorous physical activity. The large effect size means that adolescents with ASD spent more time in moderate and vigorous physical activity than TD adolescents. This finding is similar to Stanish et al. (2017), who found that adolescents were also more likely to engage in

light physical activity than moderate or vigorous. However, not all studies comparing physical activity levels between TD and ASD adolescents have reported these findings. For example, Stanish et al. (2016), found that TD and ASD reported similar levels of physical activity and others have reported, that adolescents with ASD spent less time in moderate and vigorous activity and more time in light physical activity (Stanish et al., 2017; Sandt and Frey, 2005). In the current study all of the participants with ASD were involved in multiple types of organized play. A study conducted on adolescents concluded that with proper coaching and instruction organized sports facilitate increases in MVPA (Guagliano, Lonsdale, Rosenkranz, Parker, Agho, & Kolt, 2015). Another possible reason for the difference in findings is that a lack of available resources has been a commonly reported barriers and in the current study this was not an issue.

Purpose 2

The current study also examined the barriers and facilitators to physical activity in these two groups of adolescents. One of the biggest barriers reported by TD adolescents in a past study was with the way that they looked when participating in physical activity (Margrett & Hicks-Patrick, 2010); this finding was also present in the current study. There were some differences concerning the results reported from past research and the present study regarding physical activity barriers and adolescents with ASD. Previous studies have reported that the barriers with the largest impact were a fear of getting hurt and lack of facilities or people to be active with (Stanish, et al., 2006). In the present study the largest barrier reported was that it was difficult to learn the skills needed to effectively play a sport. Fun and encouragement are excellent ways for adolescents to find entertainment and confidence in what they are doing; it is

possible that the adolescents in the current study had previous exposure to physical activity and not getting hurt that minimized this barrier for them. To better understand this possible barrier additional research is needed that examines the adolescents' history of physical activity instead to only measuring physical activity over one week. Another possible explanation could be due to the heavy parental and family support. All participants in this study reported that parental and family support were major facilitators to their participation in physical activity. Other studies also reported low barriers to physical activity as well making it seem as though low barriers are seen in adolescents with ASD (Sandt and Frey, 2005, Obrunikova, Cavalier, 2011) however, this result should be taken with caution, as the sample sizes for existing studies for this population are low and may not represent all adolescents with ASD. When comparing the barriers identified by TD and ASD adolescents, the TD adolescents had more personal barriers than the ASD adolescents. This is different than past studies, which have not, directly assessed personal barriers.

The results of this study show that one of the biggest facilitators to engage in physical activity for both groups was the parental support that they received. Allison et al. (2005) also found that fun and parental support were among the biggest facilitators to physical activity for all adolescents in this age range. When examining facilitators to physical activity a large effect size was observed in benefits seen in physical activity and only a small effect size was observed in self – efficacy. Another study conducted by Obrunikova and Caralier (2011) found that relationships and communications with others were very large facilitators to physical activity. The facilitators in the current study were similar to those found in previous studies where self-efficacy and belief in the benefits of physical activity are ranked as important.

There were a number of findings that were reinforced by this study, but there were also some unique situations encountered in this study. In order to gather data from these two different groups of adolescents, a variety of methods for recruitment and communication were required. These situations and the strategies used to overcome them are discussed below.

Barriers to Recruitment and Study Completion

Every study has its own challenges for recruitment and data collection. One of the most difficult parts of the study was getting the parents of the adolescent involved in the study. Parental involvement was important because many of the participants could not drive and the parents were need to sign the informed consent document and complete the demographic questionnaire. Communication and scheduling with parents was a key part of the research process, but also served as a major barrier. Another difficulty was not being able to communicate with the adolescents and the parents at the same time. Not being able to communicate with both parties at the same time made scheduling meeting times very difficult, as the times that worked for the adolescents were not always convenient for their parents. Another important barrier was convincing adolescents that the study was important and something that they would want to participate in. At times it was challenging to convince the adolescent that participation would not harm his/her social status.

There were also some barriers related to the study procedures that were encountered, such as ensuring the accelerometer was worn properly and through all hours of the day; however, based off the wear time data this possible barrier did not occur. In addition, adolescents, like all populations, are subject to misunderstanding survey questions so ensuring that the questions

were presented in a manner that everyone involved would understand was another challenge given the wide variability in cognitive levels. Finally, another study barrier was having both study visits take place on ECU's campus. Because the visits took place on ECU's campus the parents had to be present, which not all parents had time for and some chose not to participate in the study as a result of this. Making the study participation conducive to the adolescents and their parents needs to be considered when planning any study.

While ASD and TD adolescents had many common barriers related to recruitment and study completion, there were some barriers that were unique to the ASD population and made recruitment even more challenging. Many of the parents of the ASD adolescents who could have participated were very busy and this proved to be particularly difficult. Having a constant and flexible approach to scheduling was imperative when working with special populations. Another difficulty was relying on teachers and teacher's aids to be liaisons between the researcher and parents. Some of the instructors did not fully understand the scope of the study and how it could specifically benefit the adolescents under their care, so having them explain the study appropriately to the parents was a challenge. Further, when trying to schedule appointments being aware that social difficulties do arise and learning to handle them was a big step in this process. Making sure that there was constant contact with the participants and parents was also very important. On certain days the participants that you are working with can be very receptive to you and other days can be more challenging so understanding that certain days would be difficult for the participant was an important factor to consider when scheduling the visit. Working with ASD adolescents also required persistence and perseverance especially when scheduling study visits. Even with these difficulties, this population is in need of more research, but different and creative strategies for recruitment and data collection are necessary so that the

data collection process becomes more streamlined and effective. I will continue to implement these strategies in my future research with ASD or other populations.

Future Research Studies

This study encountered many challenges, but these challenges have provided valuable guidance for future studies. A number of strategies that were employed failed to provide results, but their failure can be tracked and explained. One strategy that did not work as planned was volunteering at local middle and high schools. While attending the schools improved the ability to build relationships with teachers, and ASD adolescents, the communication between them and the parents was a large barrier. Volunteering with the lacrosse sports team at J.H. Rose High school also did not show to fruitful related to recruitment with TD. The athletes were interested in their performance, but were more concerned with sport specific tests than overall physical activity levels. Thus, while we thought interacting with the local schools was going to be a good way to recruit ASD and TD, it turned out not to be successful. Another method that did not work as well as planned was reaching out to the local organizations – those focused on Autism and those who worked with TD. I do not believe that the Greenville area is accustomed to scholars coming into local schools or organizations with the intent of conducting applied research. Having researchers participate in community events could provide gateways to participants that were previously unavailable.

Because of the experience in this study I believe that many things could have been performed differently. In the future I would construct the IRB to be flexible with the location at which the study activities are conducted. Collecting data at other sites, instead of ECU's campus would have minimized a main barrier that was encountered. These sites could include either

local schools or institutions where the researcher travels to the participant for data collection instead of making the participant come to the researcher. Further, I would explore the possibility of the consent form being able to be sent home for parental approval and then returned by the parent before the visit, via email or by the adolescent at the study visit. If the consent form was sent home for approval this would enable another individual to bring the adolescent to the study for data collection to take place without the parent present. Modifying the age range could also yield more participants as younger individuals are more frequently with their parents or caregivers making communication with the participants and the parents/caregivers much easier.

One last strategy that could be employed for a more successful recruitment would be to host an event where multiple participants meet for an incentive and then the data collection could take place at the event. The event could occur at ECU or another site (such as a trampoline park) where multiple participants could interact and discuss interests that they have. This could occur in a field day setting or a tournament event with different prizes such as ECU attire or a trophy. Adolescents would have the opportunity to meet each other and see how participation in the study is not considered "uncool". This would also present an opportunity showcase the researcher's interest in this population. Another benefit to hosting an event is that the parents are also given a chance to unwind and have a break while their child is engaged in activities in a safe environment. A final benefit to hosting an event is that it would enable parents to communicate directly with the researcher and scheduling would be made much easier by doing so.

As stated earlier, developing relationships with either different organizations or people who work with adolescents, TD or ASD, is important. Within the ASD population these groups/people serve as gate keepers. Building a positive relationship between the researcher and gate keepers can take time, therefore it is important to start building these relationships before

data collection occurs so that the study comes as no surprise to the people that you are in contact with. Building these relationships early is important due to the fact that some of these people are very busy and have a number of other events that they are planning in the interim. All of these strategies may be employed in an effort for more successful recruitment. Without my participation in this study I would not have firsthand knowledge of what strategies to employ and potential barriers that could arise when using them.

Conclusion

All in all this study reinforced ideas that had been found in previous studies. A novel aspect of the study was the use of accelerometers to measure physical activity levels; this most studies have not used this assessment method with the ASD population before. Adolescents, those with and without ASD, are not meeting physical activity recommendations and the problem is continuing to grow. Although most adolescents did not meet physical activity recommendations, they also reported few barriers to participating in physical activity. Therefore, additional research is needed to understand the reason behind this. Regardless of adolescent group, the biggest barriers to physical activity dealt with self-image, whereas, the biggest facilitators was parental support. These are two areas where additional attention is needed as they could be used to potentially increase physical activity. This study provided valuable information into the physical activity levels of the two different groups as well as providing some explanation to the physical activity patterns as well. Future studies should employ different recruitment and data collection methods to gather more participants as well as improve the data being collect from them.

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Appendices

Appendix A. IRB Letter of Approval

Notification of Initial Approval: Expedited

From: Biomedical IRB

To: Nicholas Leahy

CC:
Katrina DuBose
Nicholas Leahy

Date: 9/27/2017

Re: UMCIRB 17-001313
A COMPARISON OF BARRIERS ENCOUNTERED IN TYPICALLY DEVELOPING ADOLESCENTS TO ADOLESCENTS WITH AUTISM SPECTRUM DISORDER

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 9/26/2017 to 9/25/2018. The research study is eligible for review under expedited category #4,7. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the

document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

Name	Description
Adolescent Interview.pdf	Surveys and Questionnaires
Assent form	Consent Forms
Datasheet	Data Collection Sheet
Demographic Survey	Surveys and Questionnaires
Email	Recruitment Documents/Scripts
Full paper most recent_8-24-17_kd.docx	Study Protocol or Grant Application
Informed Consent	Consent Forms
PA Log	Surveys and Questionnaires
PA YRBS	Surveys and Questionnaires
PACE adolescent physical activity survey.pdf	Surveys and Questionnaires
Parental Permission	Consent Forms
Recruitment Flyer	Recruitment Documents/Scripts

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

Appendix B. Youth Risk Behavior Physical Activity Questions

1. On how many of the past 7 days did you exercise or participate in sports activities that made you sweat and breathe hard, such as basketball, jogging, fast dancing, swimming laps, tennis, fast bicycling, or similar aerobic activities?

A. 0 days

B. 1 day

C. 2 days

D. 3 days

E. 4 days

F. 5 days

G. 6 days

H. 7 days

2. On how many of the past 7 days did you exercise or participate in physical activity for at least 20 minutes that made you sweat and breathe hard, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar aerobic activities?

A. 0 days

B. 1 day

C. 2 days

D. 3 days

E. 4 days

F. 5 days

G. 6 days

H. 7 day

3. On how many of the past 7 days did you participate in physical activity for at least 30 minutes that did not make you sweat or breathe hard, such as fast walking, slow bicycling, skating, pushing a lawn mower, or mopping floors?

A. 0 days

B. 1 day

C. 2 days

D. 3 days

E. 4 days

F. 5 days

G. 6 days

H. 7 days

4. On how many of the past 7 days did you do stretching exercises, such as toe touching, knee bending, or leg stretching?

A. 0 days

B. 1 day

C. 2 days

D. 3 days

E. 4 days

F. 5 days

G. 6 days

H. 7 days

5. On how many of the past 7 days did you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting?

A. 0 days

B. 1 day

C. 2 days

D. 3 days

E. 4 days

F. 5 days

G. 6 days

H. 7 days

6. During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? (Add up all the time you spent in any kind of physical activity that increased your heart rate and made you breathe hard some of the time.)

A. 0 days

B. 1 day

C. 2 days

D. 3 days

E. 4 days

F. 5 days

G. 6 days

H. 7 days

7. Yesterday, did you walk or bicycle for at least 30 minutes at a time? (Include walking or bicycling to or from school.)

A. Yes

B. No

8. On how many of the past 7 days did you walk or bicycle for at least 30 minutes at a time? (Include walking or bicycling to or from school.)

A. 0 days

B. 1 day

C. 2 days

D. 3 days

E. 4 days

F. 5 days

G. 6 days

H. 7 days

9. On an average school day, how many hours do you watch TV?

A. I do not watch TV on an average school day

B. Less than 1 hour per day

C. 1 hour per day

D. 2 hours per day

E. 3 hours per day

F. 4 hours per day

G. 5 or more hours per day

10. On an average school day, how many hours do you play video or computer games or use a computer for something that is not school work? (Count time spent on things such as Xbox, PlayStation, an iPod, an iPad or other tablet, a smartphone, YouTube, Facebook or other social networking tools, and the Internet.)

A. I do not play video or computer games or use a computer for something that is not school work

B. Less than 1 hour per day

C. 1 hour per day

D. 2 hours per day

E. 3 hours per day

F. 4 hours per day

G. 5 or more hours per day

11. During the weekend, on how many hours per day do you watch TV?

____ I do not watch TV on an average school day
____ Less than 1 hour per day
____ 1 hour per day
____ 2 hours per day
____ 3 hours per day
____ 4 hours per day
____ 5 or more hours per day

12. During the weekend, how many hours per day do you play video or computer games or use a computer for something that is not school work? (Include activities such as Nintendo,

Game Boy, PlayStation, Xbox, computer games, and the Internet.)

____ I do not play video or computer games or use a computer for something that is not school work

____ Less than 1 hour per day
____ 1 hour per day
____ 2 hours per day
____ 3 hours per day
____ 4 hours per day
____ 5 or more hours per day

13. In an average week when you are in school, on how many days do you go to physical education (PE) classes?

A. 0 days

B. 1 day

C. 2 days

D. 3 days

E. 4 days

F. 5 days

14. During an average physical education (PE) class, how many minutes do you spend actually exercising or playing sports?

A. I do not take PE

B. Less than 10 minutes

C. 10 to 20 minutes

D. 21 to 30 minutes

E. 31 to 40 minutes

F. 41 to 50 minutes

G. 51 to 60 minutes

H. More than 60 minutes

15. During the past 12 months, on how many sports teams did you play? (Include any teams run by your school or community groups.)

A. 0 teams

B. 1 team

C. 2 teams

D. 3 or more teams

16. During the past 12 months, how many times were you injured while exercising, playing sports, or being physically active and had to be treated by a doctor or nurse?

A. 0 times

B. 1 time

C. 2 times

D. 3 times

E. 4 times

F. 5 or more times

17. During the past 12 months, how many times did you have a concussion from playing a sport or being physically active?

A. 0 times

B. 1 time

C. 2 times

D. 3 times

E. 4 or more times

Appendix C. Physical Activity Barriers Survey

ID# ☐☐☐☐

ADOLESCENT INTERVIEW

Interviewer Name: _____ Date: _____

Interviewer Script: ***We are interested in knowing what kinds of things teenagers like to do in their free time, and how they feel about exercise, sports, and other activities. You may have never been in a research interview before. In some ways an interview is like a conversation because I'll be asking you questions and you'll be telling me what you like and don't like. But it's a little different than a regular conversation because I'll be asking you to pick an answer that you think is the best answer for you.***

I am going to ask you some questions and show you the answer choices **[interviewer shows the response card to the participant and reads the choices out loud].** ***For example, if I asked you how much you like swimming and you didn't like it AT ALL, you would say "Don't like it," or point here. There are no right or wrong answers. If you don't understand a question, just ask me to explain it. Feel free to stop and ask me to repeat things any time you want. Do you have any questions now?***

OK, let's get started!

1. How much do you like watching TV and playing video or computer games?
- ☐ Like it
- ☐ It's okay
- ☐ Don't like it

2. How much do you like doing things like arts & crafts, drawing, painting, or scrapbooking?
- ☐ Like it
- ☐ It's okay
- ☐ Don't like it

3. How much do you like to read?
- ☐ Like it
- ☐ It's okay
- ☐ Don't like it

4. How much do you like to go for a walk?
- ☐ Like it
- ☐ It's okay
- ☐ Don't like it

5. How much do you like to do work around the house like yard work and housework?
- ☐ Like it
- ☐ It's okay
- ☐ Don't like it

6. How much do you like participating in sports and exercise in gym class at school?
- ☐ Like it
- ☐ It's okay
- ☐ Don't like it
- ☐ Don't take gym

ID# ☐☐☐☐

7. How much do you like doing team sports?

- ☐ Like it
- ☐ It's okay
- ☐ Don't like it

(*Note to interviewer:* If respondent asks for clarification, say: "Things like soccer, basketball, and softball.")

8. How much do you like doing sports and exercise that you do by yourself?

- ☐ Like it
- ☐ It's okay
- ☐ Don't like it

(*Note to interviewer:* If respondent asks for clarification, say: "Things like swimming, running, riding a bike, or dancing.")

(*Note to interviewer:* If participant consistently answers that they do not like doing sports and exercise, say the following: "I know you said you don't like sports and exercise, but as an interviewer, I need to ask everyone the same questions. So I have a few more questions about sports and exercise.")

[At this point, interviewer takes the response card back from the participant.]

9. If you had the choice, would you rather do sports or exercise…

- ☐ By yourself
- ☐ With your friends
- ☐ With your family

(*Note to interviewer:* If respondent selects more than one answer, say: "What is your #1 choice?" in an effort to get them to choose just one.)

10. If you had the choice, would you rather do sports or exercise…

- ☐ At home
- ☐ At a gym or recreation center
- ☐ At school

(*Note to interviewer:* If respondent selects more than one answer, say: "What is your #1 choice?" in an effort to get them to choose just one.)

11. When you have the choice, what would you rather do in your free time?

- ☐ Sports or exercise
- ☐ Something else

***Interviewer Script:* That was great – thanks for answering those questions. Now I have some questions about things that might stop you from participating in sports and exercise. Remember, there are no right or wrong answers here! Each answer is either "Yes" or "No."**

ID# ☐☐☐☐

Barriers to Physical Activity
Personal Barriers

If respondent is not clear what is meant by "a lot," you can clarify by saying:
- **"What I mean by a lot is: does it stop you from participating most of the time?"**

OR
- **Restate the question: "Does this stop you from participating most of the time?"**

12. Are you ever too busy to do sports and exercise?
☐ No
☐ Yes → **If YES: Does this stop you from participating a lot?**
☐ No
☐ Yes
(*Note to interviewer:* To restate this question, say: "If you are too busy to do sports and exercise, does that stop you from participating a lot?")

13. Are you ever too tired to do sports and exercise?
☐ No
☐ Yes → **If YES: Does this stop you from participating a lot?**
☐ No
☐ Yes
(*Note to interviewer:* To restate this question, say: "If you are too tired to do sports and exercise, does that stop you from participating a lot?")

14. Do you ever think that sports and exercise are boring?
☐ No
☐ Yes → **If YES: Does this stop you from participating a lot?**
☐ No
☐ Yes
(*Note to interviewer:* To restate this question, say: "If you think that sports and exercise are boring, does that stop you from participating a lot?")

15. Are you ever afraid of getting hurt doing sports and exercise?
☐ No
☐ Yes → **If YES: Does this stop you from participating a lot?**
☐ No
☐ Yes
(*Note to interviewer:* To restate this question, say: "If you are afraid of getting hurt doing sports and exercise, does that stop you from participating a lot?")

16. Do you think that sports and exercise are too hard to learn?
☐ No
☐ Yes → **If YES: Does this stop you from participating a lot?**
☐ No
☐ Yes
(*Note to interviewer:* To restate this question, say: "If you think a sport or exercise is too hard to learn, does that stop you from participating a lot?")

ID# ☐☐☐☐

17. Do you think you are good at doing sports and exercise?

☐ No
☐ Yes

If NO: Does this stop you from participating a lot?

☐ No
☐ Yes

(*Note to interviewer:* To restate this question, say: "If you think you are not good at doing sports and exercise, does that stop you from participating a lot?")

If respondent is not clear what is meant by "a lot," you can clarify by saying:

- **"What I mean by a lot is: does it stop you from participating most of the time?"**

OR

- **Restate the question: "Does this stop you from participating most of the time?"**

18. Do you like how you feel when you're doing sports and exercise?

☐ No
☐ Yes

If NO: Does this stop you from participating a lot?

☐ No
☐ Yes

(*Note to interviewer:* To restate this question, say: "If you don't like how you feel when you're doing sports and exercise, does that stop you from participating a lot?")

19. Are you ever bothered by how you look when you're doing sports and exercise?

☐ No
☐ Yes → **If YES: Does this stop you from participating a lot?**

☐ No
☐ Yes

(*Note to interviewer:* To restate this question, say: "If you are bothered by how you look when you're doing sports and exercise, does that stop you from participating a lot?")

20. Do you usually have someone to do sports or exercise with?

☐ No
☐ Yes

(*Note to interviewer:* If respondent answers that they do this with a pet, say: "I'll be asking about pets in a minute. This question is about people.")

If NO: Does this stop you from participating a lot?

☐ No
☐ Yes

(*Note to interviewer:* To restate this question, say: "If you don't have someone to do sports and exercise with, does that stop you from participating a lot?)

ID# ☐☐☐☐

21. Do you have a pet?

☐ No
☐ Yes → **If YES: Do you walk, run, bike, or play catch with your pet?**
☐ No
☐ Yes

Environmental/Access Barriers

22. Do you think it is ever too hot or cold to do sports and exercise?

☐ No
☐ Yes → **If YES: Does this stop you from participating a lot?**
☐ No
☐ Yes
(*Note to interviewer:* To restate this question, say: "If it's too hot or cold to do sports and exercise, does that stop you from participating a lot?")

If respondent is not clear what is meant by "a lot," you can clarify by saying:
- **"What I mean by a lot is: does it stop you from participating most of the time?"**

OR
- **Restate the question: "Does this stop you from participating most of the time?"**

23. Do you usually have a place to do sports and exercise?

☐ No
☐ Yes

If NO: Does this stop you from participating a lot?
☐ No
☐ Yes
(*Note to interviewer:* To restate this question, say: "If you don't have a place to do sports and exercise, does that stop you from participating a lot?")

***If YES:* You said you have a place to do sports and exercise. Do you usually have a way to get to that place?**

☐ No
☐ Yes

(*Note to interviewer:* If respondent needs clarification, you can say: "By 'a way,' I mean a ride, somebody to take you, you can walk there…")

If NO: Does this stop you from participating a lot?
☐ No
☐ Yes
(*Note to interviewer:* To restate this question, say: "If you don't have a way to get to a place to do sports and exercise, does that stop you from participating a lot?")

***Interviewer Script:* We're almost done – you've been doing great! Now I'm going to ask you some more specific questions about sports and exercise to see what you think about them.**

ID# ☐☐☐☐

Physical Activity Beliefs & Benefits

24. How much fun do you have doing sports and exercise?

- ☐ A lot of fun
- ☐ Some fun
- ☐ No fun at all

25. Do you think sports and exercise are good for you?

- ☐ No
- ☐ Yes

26. Do you think that doing sports and exercise is a way to make new friends?

- ☐ No
- ☐ Yes

27. Do you think that doing sports and exercise will make you feel good?

- ☐ No
- ☐ Yes

(*Note to interviewer:* If respondent asks whether you mean feel good *during* or *after* exercise, say: "What I mean is during exercise.")

28. Would you like to do more sports and exercise?

- ☐ No
- ☐ Yes

(*Note to interviewer:* If respondent needs clarification, say: "What I want to know is, would you like to do more sports and exercise than what you do now?")

Interviewer Script: ***We're almost done. I have three more questions for you that ask how good you feel you are at doing certain sports and exercise. Once again, there aren't any right or wrong answers.***

These are the answer choices for the next questions **[interviewer reads the answer choices out loud and hands the response card to the participant.]**

Generalized Self-Efficacy for Physical Activity

29. How good are you at doing sports and exercise?

- ☐ Very good
- ☐ Okay
- ☐ Not good

(*Note to interviewer:* If respondent makes the comment that he/she "doesn't want to seem cocky" or something that conveys that they're being modest, you can say: "You don't need to be modest.")

ID# ☐☐☐☐

30. How good are you at doing team sports?

- ☐ Very good
- ☐ Okay
- ☐ Not good

(*Note to interviewer:* If respondent asks for clarification, say: "Things like soccer, basketball, and softball.")

31. How good are you at doing sports and exercise that you do by yourself?

- ☐ Very good
- ☐ Okay
- ☐ Not good

(*Note to interviewer:* If respondent asks for clarification, say: "Things like swimming, running, riding a bike, or dancing.")

Thank you very much for taking the time to answer our questions. You did a great job!

Appendix D. PACE Survey

Physical Activity Stages

- **Physical activity** is any activity that increases your heart rate and makes you get out of breath some of the time.
- **Physical activity** can be done in sports, playing with friends, or walking to school.
- Some examples of **physical activity** are running, brisk walking, rollerblading, biking, skateboarding, dancing, swimming, soccer, basketball, football, & surfing.

1. In a typical week, how many days do you do physical activity for <u>60 minutes</u> or more?

Mark the answer that is true for you.

Zero	One	Two	Three	Four	Five	Six or more
0	1	2	3	4	5	6+
○	○	○	○	○	○	○

(If you answered between "0" and "4" to question 1, go to question 3.)

(If you answered "5" or "6 or more" to question 1, go to question 2.)

3. Do you think you will start doing 60 minutes of physical activity <u>5 or more days</u> a week in the next 6 months?

1	○ No, and I do **not** intend to in the **next six months**.
2	○ Yes, I intend to in the **next six months**.
3	○ Yes, I intend to in the **next 30 days**.

2. How many months have you been doing 60 minutes of physical activity on 5 or more days per week?

1	○ Less than 6 months
2	○ 6 months or more

Physical Activity Change Strategies

The following are activities, thoughts, and feelings people use to help them change their physical activity. Think of any similar experiences you may be having or have had in the past month. Then rate HOW OFTEN you do each of the following.

PLEASE:

*** Fill in each circle completely.**

*** Erase all changes completely.**

	Never 1	Almost Never 2	Sometimes 3	Often 4	**Many Times 5**
1. I look for information about physical activity or sports.	O	O	O	O	O
2. I keep track of how much physical activity I do.	O	O	O	O	O
3. I find ways to get around the things that get in the way of being physically active.	O	O	O	O	O
4. I think about how my surroundings affect the amount of physical activity I do. (Surroundings are things like having exercise equipment at home or a park near by.)	O	O	O	O	O
5. I put reminders around my home to be physically active.	O	O	O	O	O
6. I reward myself for being physically active.	O	O	O	O	O
7. I do things to make physical activity more enjoyable.	O	O	O	O	O
8. I think about the benefits I will get from being physically active.	O	O	O	O	O
9. I try to think more about the benefits of physical activity and less about the hassles of being active.	O	O	O	O	O
10. I say positive things to myself about physical activity.	O	O	O	O	O
11. When I get off track with my physical activity plans, I tell myself I can start again and get right back on track.	O	O	O	O	O
12. I have a friend or family member who encourages me to do physical activity.	O	O	O	O	O
13. I try different kinds of physical activity so that I have more options to choose from.	O	O	O	O	O
14. I set goals to do physical activity.	O	O	O	O	O
15. I make back-up plans to be sure I get my physical activity.	O	O	O	O	O

Physical Activity Pros & Cons

The following statements are different beliefs about physical activity.
Please rate **HOW IMPORTANT** each statement is to your decision to do physical activity.
Use the following scale:

PLEASE:

*** Fill in each circle completely.**

*** Erase all changes completely.**

HOW IMPORTANT IS EACH STATEMENT TO YOU WHEN DECIDING WHETHER OR NOT TO DO PHYSICAL ACTIVITY?	**Not Important 1**	**Slightly Important 2**	**Moderately Important 3**	**Very Important 4**	Extremely Important 5
1. I would feel embarrassed if people saw me doing physical activity.	O	O	O	O	O
2. Physical activity would help me stay fit.	O	O	O	O	O
3. My parents would be happy if I did physical activity.	O	O	O	O	O
4. There is too much I would have to learn to do physical activity.	O	O	O	O	O
5. I would feel better about myself if I did physical activity.	O	O	O	O	O
6. I would need too much help from my parents to do physical activity.	O	O	O	O	O
7. I do not like the way physical activity and exercise makes me feel.	O	O	O	O	O
8. I would have fun doing physical activity or playing sports with my friends.	O	O	O	O	O
9. I would have more energy if I did physical activity.	O	O	O	O	O
10. Physical activity takes time away from being with my friends.	O	O	O	O	O

Physical Activity Confidence

There are many things that can get in the way of physical activity.
Rate **HOW SURE** you are that you can do physical activity in each situation.
Please answer **ALL** questions.

PLEASE:

*** Fill in each circle completely.**

*** Erase all changes completely.**

	I'm sure I can't 1	I probably can't 2	Neutral 3	I probably can 4	I'm sure I can 5
1. Do physical activity even when you feel sad or stressed?	○	○	○	○	○
2. Set aside time for physical activity on most days of the week?	○	○	○	○	○
3. Do physical activity even when your family or friends want you to do something else?	○	○	○	○	○
4. Get up early, even on weekends, to do physical activity?	○	○	○	○	○
5. Do physical activity even when you have a lot of schoolwork?	○	○	○	○	○
6. Do physical activity even when it is raining or really hot outside?	○	○	○	○	○

Physical Activity Family Support

During a typical week, how often has a member of your household: (For example, your father, mother, brother, sister, grandparent, or other relatives)

	Never 1	1-2 days 2	3-4 days 3	5-6 days 4	Every day 5
1. Watched you participate in physical activity or play sports?	○	○	○	○	○
2. Encouraged you to do sports or physical activity?	○	○	○	○	○
3. Provided transportation to a place where you can do physical activity or play sports?	○	○	○	○	○
4. Done a physical activity or played sports with you?	○	○	○	○	○

Physical Activity Friend Support

During a typical week, how often:

PLEASE:

*** Fill in each circle completely.**

*** Erase all changes completely.**

	Never 1	1-2 days 2	3-4 days 3	5-6 days 4	Every day 5
1. Do your friends encourage you to do sports or physical activities?	○	○	○	○	○
2. Do your friends do physical activity or play sports with you?	○	○	○	○	○
3. Do your friends or classmates tease you about not being good at physical activities or sports?	○	○	○	○	○
4. Do your friends ask you to walk or bike to school or to a friend's house?	○	○	○	○	○
5. Do your friends tell you that you are doing well in physical activities or sports?	○	○	○	○	○

Closest Friend Support

	0 Friends	1 Friend	2 Friends	3 Friends	4 Friends	5 Friends
6. How many of your five closest friends are physically active on a regular basis?	○	○	○	○	○	○

Physical Activity Enjoyment

PLEASE:

*** Fill in each circle completely.**

*** Erase all changes completely.**

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1. I enjoy doing physical activity.	O	O	O	O	O

Physical Activity Recreation Choices

2. What do you usually do when you have a choice about how you spend recreational time?

Almost always choose activities like TV, reading, listening to music, or computers	O
Usually choose activities like TV, reading, listening to music or computers	O
Just as likely choose active or inactive recreation	O
Usually choose activities like bicycling, dancing, outdoor games or active sports	O
Almost always choose activities like bicycling, dancing, outdoor games or active sports	O

Physical Activity Environmental Factors

How much do you agree with the following statements?

PLEASE:

*** Fill in each circle completely.**

*** Erase all changes completely.**

	Strongly disagree 1	2	Somewhat disagree 3	Neutral 4	Somewhat agree 5	Strongly agree
1. At home there are enough supplies and pieces of sports equipment (like balls, bicycles, skates) to use for physical activity.	O	O	O	O	O	
2. It is difficult to walk or jog in my neighborhood because of things like traffic, no sidewalks, dogs, gangs and so on.	O	O	O	O	O	
3. There are playgrounds, parks, or gyms, close to my home or that I can get to easily.	O	O	O	O	O	
4. It is safe to walk or jog in my neighborhood during the day.	O	O	O	O	O	