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**The Barriers and Facilitators of After-School Physical Activity Participation for Children
with Autism Spectrum Disorders**

A Synthesis of the Research Literature

A Synthesis Project

Presented to the

Department of Kinesiology, Sport Studies, and Physical Education

The College at Brockport

State University of New York

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Education

(Physical Education)

by

Nicole Seaver

November 29, 2016

**THE COLLEGE AT BROCKPORT
STATE UNIVERSITY OF NEW YORK
BROCKPORT, NEW YORK**

Department of Kinesiology, Sport Studies, and Physical Education

**Title of Synthesis Project: The Barriers and Facilitators of After-School Physical Activity
Participation for Children with Autism Spectrum Disorders**

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Abstract

Children with disabilities are more likely to be sedentary in comparison to their typically developing peers. This especially occurs with children who are diagnosed with Autism Spectrum Disorders (ASD) as many of these individuals show impairments in motor and physical functioning. Research has shown that children with ASD have been found to be less physically active in an after-school setting in comparison to their peers of typical development. There are several categories of barriers and facilitators impacting the after-school physical activity levels of children with ASD. Previous research separates these barriers and facilitators into four categories including: interpersonal, intrapersonal, physical, and community/institutional. To date, several research studies have assessed the barriers and facilitators children with ASD encounter when participating in after-school physical activity, but there has been no attempt by researchers to prioritize their importance. Therefore, the purpose of this project was to synthesize relevant literature to prioritize the importance of the known barriers and facilitators of after-school physical activity participation for children with ASD. Coded data from 10 research articles were used to list all the known barriers and/or facilitators and both were prioritized by counting the number of times they were cited in the original literature. The most frequently cited categories of barriers in the literature were intrapersonal, followed by interpersonal, physical, and community/ institutional. The most frequently cited categories of facilitators were interpersonal, followed by physical, intrapersonal, and community/institutional.

Introduction

The U.S. Department of Health and Human Services (2010) recommends that children and adolescents, between the ages of six to 17 years-old should participate in 60 minutes or more of moderate to vigorous physical activity every day. Along with being physically active for at least 60 minutes per day, children should also take part in 20 minute bouts of vigorous activity, three days per week. By following the recommended physical activity guidelines, children can improve cardiovascular fitness, muscular strength and endurance, blood pressure, and overall mental health (Obrusnikova & Miccinello, 2012).

Children with disabilities are more likely to be sedentary in comparison to their typically developing peers. This especially occurs with children who are diagnosed with Autism Spectrum Disorders (ASD) as many of these individuals show impairments in motor and physical functioning (Memari, Ghaheeri, Ziaee, Kordi, Hafizi, & Moshayed, 2012). In 2009, approximately one in every 110 children in the United States, between the ages of three to 17 years-old, were diagnosed with ASD. Research indicates that a decline in levels of physical activity and opportunities at school can contribute to a reduction of overall physical activity for these children in an after-school environment (Memari et al., 2012).

A lack of opportunity is the primary factor that brings minimal physical activity to children with ASD (Memari et al., 2012). For example, communication and social skill deficits of children with ASD may lower their opportunities for peer interaction which ultimately may create challenges to participation in physical activity. Children with ASD also display inattentive and hyperactive behaviors, strong preference towards sedentary behaviors, narrowly focused interest in certain routines and procedures, and deficits in performance of fine and gross motor skills (Obrusnikova & Miccinello, 2012). In relation to a lack of opportunity there are

several categories of known barriers and facilitators impacting the after-school physical activity levels of children with ASD. Previous research separates these barriers into four categories including: interpersonal (e.g., lack of peer exercise partner), intrapersonal (e.g., playing video games), physical (e.g., lack of or unsafe equipment), and community/institutional (e.g., lack of physical activity programs to join). These four categories also have been used to determine known facilitators to after-school physical activity participation in children with ASD (Obrusnikova & Miccinello, 2012).

To date, several research studies have assessed the barriers and facilitators children with ASD encounter when participating in after-school physical activity. When finding these barriers in the literature, facilitators also have been discovered as a method of intervention.

Although there is professional literature on barriers to, and facilitators of, physical activity among children with ASD, there has been no attempt by researchers to prioritize the known barriers and facilitators of after-school physical activity participation. Therefore, it has not been determined which facilitator is the most successful method of intervention to the most common barriers faced by children with ASD.

The purpose of this project was to synthesize relevant literature to prioritize the importance of the known barriers and facilitators of after-school physical activity participation for children with ASD. Prioritizing the most prevalent barriers and facilitators cited in the literature will allow practitioners to target those variables with greatest potential impact in the after-school physical activity for children with ASD

Definitions

The following terms and definitions will be used in this project when synthesizing relevant literature:

Autism Spectrum Disorder (ASD). Characterized by neurological impairments in social communication deficits and the presence of restricted and repetitive behaviors, interests, or activities (Tyler, MacDonald, & Meneer, 2014).

Physical Activity. Movement of the body that enhances health and is produced from the expenditure of energy. Types of physical activity may include leisure activities such as play, dance, swimming, etc. (Memari et. al, 2012).

After-School Physical Activity. Extracurricular physical activities that take place in a community-based setting (Obrusnikova & Cavalier, 2011).

Leisure Activity. Activities that are participated in during free-time after school or work to bring members of a family together in a community-based setting (Dodd, Zabriskie, Widmer, & Eggett, 2009).

Barrier. A specific factor or characteristic that limits an individual from participating in physical activity (Obusnikova & Miccinello, 2012).

Facilitator. A factor that enables an individual to overcome the barriers to participating in physical activity (Obusnikova & Miccinello, 2012).

Delimitations

This synthesis project was delimited to focus specifically on after-school physical activity participation for children ages five to 18 years-old with ASD. Studies included in the review specifically focused on the current barriers and facilitators of after-school physical activity participation. Articles that did not explore barriers and/or facilitators of children with ASD and after-school physical activity participation were excluded.

Assumption

An underlying assumption of this project was that the barriers and facilitators that appear most frequently in the literature have the most impact on the participation levels of after-school physical activity of children with ASD.

Methods

The procedures used for the conduct of this synthesis, including those dealing with the literature search, the application of inclusion criteria, the coding and critiquing of relevant papers, and the plan for analyzing the findings in the literature, are described below.

Search Procedures

During the search for literature, the database Academic Search Complete was primarily used, along with Sport Discus with Full Text, and PsycINFO. The search of literature focused on articles published within the last 15 years, specifically 2001-2016. The following keywords were utilized during the literature research:

- Physical activity levels
- After-school physical activity
- Parent perceptions
- Autism Spectrum Disorders
- Children
- Disability
- Barriers
- Facilitators
- Leisure activities

Several combinations of keywords were used to narrow the search for possible literature to be used in this synthesis. These combinations produced 174 articles related to physical activity and individuals with ASD. The combinations that were used included:

- physical activity levels, and Autism Spectrum Disorders, and children
- physical activity levels, and Autism Spectrum Disorders, and parent perceptions
- barriers, and after-school physical activity, and Autism Spectrum Disorders
- facilitators, and after-school physical activity, and Autism Spectrum Disorders
- leisure activities, and disability, and children

Inclusion Criteria

After the database search for literature was complete, each paper was reviewed to determine whether it should be included in the synthesis. Each study that was selected for the review had to meet the following criteria:

- be published in English
- Be published between the years 2001-2016
- present original data
- focus on school-aged children five-18 years-old
- include the barriers and/or facilitators of after-school physical activity participation of children with disabilities or specifically ASD

Articles were excluded if they did not include barriers and/or facilitators to after-school physical activity participation. All the original studies used for this project utilized mixed methods of qualitative and quantitative data. Data in the original literature were primarily collected using participant surveys and interviews, but in a few cases triaxial accelerometers were used to record and compare levels of physical activity. The use of interviews and surveys

allowed for a more in-depth answer to the question of barriers leading to a lack of after-school physical activity participation.

Coding Procedures

The coding procedures involved abstracting information from 10 studies that met the inclusion criteria and entering it into a coding sheet that was designed through a Microsoft Word document program. Whenever possible, the information that was abstracted from the articles was directly stated by the authors. The following information was abstracted from each article: title, reference, purpose, participants, methods/analysis, after-school physical activity barriers, after-school physical activity facilitators, results/discussion, and recommendations. During this process, each article was examined for after-school physical activity barriers and/or facilitators.

The barriers and/or facilitators presented were entered under the appropriate category: interpersonal, intrapersonal, physical, community/institutional. The synthesis coding sheets for each article can be found in the Appendix.

Plan for Analysis

Coded data from the articles were used to categorize studies first by listing all the barriers and/or facilitators of after-school physical activity participation for children with ASD. After listing all the known barriers and/or facilitators both were placed into four known categories including: interpersonal, intrapersonal, physical, and community/institutional. Under each category, the most common single barriers and facilitators were prioritized by the number of times that each were cited in the original literature.

Results

The purpose of this section is to provide results from the review of literature conducted as part of this synthesis. The analysis of the 10 research articles included in this review examined all the possible barriers and/or facilitators of after-school physical activity participation for children with ASD and prioritized the barriers and facilitators by their prevalence in the literature. A summary of each study examined can be found below, followed by an integration of the findings.

Obrusnikova and Cavalier (2011) were one of the first to use a socioecological model (a theory-based framework for understanding the multi-faceted and interactive effects of personal and environmental factors that determine behaviors) to examine factors that influence participation of children with ASD in physical activity after-school. Using the Photovoice methodology (a participatory action tool that allows people who are not typically represented in programmatic planning to take photos of their reality, needs, and settings, and use them for reflection), 14 children with ASD, aged eight-14 years-old, were asked to express their perceptions of barriers and facilitators to physical activity. Photographs taken by the participants and follow-up discussions with a researcher identified barriers and facilitators that fit into intrapersonal, interpersonal, physical, and community/institutional categories (Obrusnikova & Cavalier, 2011). The most frequently reported intrapersonal barriers by children were playing video games or spending time on the computer, watching favorite television shows or listening to music, feeling tired, or being bored with exercise. Many of the children reported technology-based barriers because they felt that they lacked the skills, coordination, or balance to participate in physical activities they thought they would enjoy (Obrusnikova & Cavalier, 2011). The most frequent intrapersonal facilitators reported by children revolved around motivation to play

different types of sports as participants particularly enjoyed individual sports (e.g., bowling, swimming) and Wii sports (Wii Fit, golf, baseball, or tennis) (Obrusnikova & Cavalier, 2011). Interpersonal barriers reported by children were lack of same-aged exercise partner, parents' commitments, and traveling in the car. The lack of an exercise partner was related to siblings or friends either being distracting or not physically active (Obrusnikova & Cavalier, 2011). Interpersonal facilitators revolved around support from friends, parents, siblings, and pets (Obrusnikova & Cavalier, 2011). The most frequently cited physical barriers by children included bad weather and a lack of, or unsafe, equipment (Obrusnikova & Cavalier, 2011). Children cited only two community barriers: 1) lack of transportation to physical activity facilities and 2) lack of opportunities to participate in physical activity programs. Only one institutional barrier was cited as children stated that they were too busy doing homework after-school (Obrusnikova & Cavalier, 2011). Frequently cited community/ institutional facilitators included availability of physical activity programs, having access to parks or playgrounds, and having the proper instruction in schools (Obrusnikova & Cavalier, 2011).

In a similar study, Obrusnikova and Miccinello (2012) assessed parental perceptions of the benefits of physical activity and factors that influence participation of children with ASD in after-school activities. Data were collected from 103 parents using an online open-ended questionnaire and focus group interviews. Data also were analyzed using a socioecological model and parents reported 225 facilitators and 250 barriers of after-school physical activity participation (Obrusnikova & Mincinello, 2012). The researchers narrowed these large numbers of barriers and facilitators by significance in relation to the number of participants that responded to each, reporting only their top findings into four categories: intrapersonal, interpersonal, physical, and community/institutional. Parents reported in both the questionnaire and interviews

that they believed the intrapersonal barriers to their children's level of physical activity were a lack of motivation or interest in physical activity and the child's preference to engage in sedentary activities after school (Obrusnikova & Mincinello, 2012). They reported that they try to combine sports to some of their child's narrow interest such as videos games like Wii sports to facilitate (Obrusnikova & Mincinello, 2012). Parents reported in both the questionnaire and interviews three interpersonal barriers as to why their child lacked participation in physical activity (Obrusnikova & Mincinello, 2012). These three reasons included: 1) children with ASD require too much attention from the parents who have a full-time job or other responsibilities at the house, 2) the duty of providing transportation to programs is difficult, and 3) parents have a difficult time adjusting to the lack of motivation that their child possesses. Similar to results obtained with children, parents reported that playing with siblings or certain peers facilitated participation in physical activity of children with ASD (Obrusnikova & Mincinello, 2012). Parents reported similar findings, stating that inclement weather along with the presence of insects led to physical barriers of their child's physical activity participation (Obrusnikova & Mincinello, 2012). Several specific outdoor (bicycle, trampoline, basketball hoop, playground equipment, pool, fenced in backyard) and indoor (Wii Fit, gym in basement, stationary bike, tumbling mats) resources were cited as aides to facilitating their child's physical activity participation (Obrusnikova & Mincinello, 2012).

In a study conducted by Davidson (2009) parents reported similar community barrier findings in relation to a lack of programs to accommodate individuals with disabilities and an overall lack of facilities although parents believed that institutional barriers included their child not receiving the appropriate physical education to learn proper skills (Obrusnikova & Mincinello, 2012). Parents reported the most important institutional facilitator was for their

child to receive proper adapted physical education instruction as this would lead to the learning of specific sport skills and physical activity resources that can be utilized after-school (Obrusnikova & Mincinello, 2012).

An earlier study by King, Law, Hanna, King, Hurley, Rosenbaum, Kertoy and Petrenchik (2006) used a similar socio-ecological model of analysis as Obrusnikova and Miccinello (2012). This study focused on the predictors of leisure and recreation participation of children with physical disabilities and is a prime example of how children with disabilities other than ASD struggle with socialization (King et al., 2006). The participants of this study included 427 families and children with physical and functional limitations in three age groups (6-8, 9-11, 12-14). Data were collected via home interviews and self-administered standardized questionnaires. The leading barriers expressed by participants were listed as being the functional ability of the child and the existence of unsupportive environments to participate in recreation and leisure activities (King et al., 2006). The leading facilitators listed by participants were family participation in social and recreational activities and supportive relationships with peers and members of the community.

Along with studies conducted by Obrusnikova and colleagues, several studies have investigated after-school physical activity participation of children with ASD through the use of accelerometry. In a study conducted by Sandt and Frey (2005) levels of physical activity were compared between children with and without ASD. Children ages five to 12 years wore an accelerometer for five days (four weekdays, one weekend day). No differences in physical activity participation were found between children with and without ASD. Children with ASD were found to be more active in school, rather than after-school. Most children with ASD from this study reported that they went directly home after-school and engaged in sedentary

technology-based activities (Sandt & Frey, 2005). Technology-based activities such as video games and televisions distract children from the opportunity of being physically active, and parents reported that these activities were a part of the daily routine for their children. In many cases, television or video game viewing was used to occupy children with ASD so parents could complete household duties or interact with other children in the home (Sandt & Frey, 2005).

Memari and associates (2012) also examined physical activity patterns in children with autism spectrum disorders through the use of accelerometry. The participants of this study included 80 children with ASD in a cross-sectional examination. These researchers examined demographics and the behavioral and clinical profiles of the children. All physical activity data were collected over a seven-day period. Results of this study displayed a difference in gender indicating that girls were less physically active than boys. It was found that participants were less physically active on weekend days versus weekdays. Barriers of physical activity participation were identified as being household structure (support from family) and sedentary pursuits of children with ASD (Memari et al., 2012).

Later in 2015 Memari, Panahi, Ranjbar, Moshayedi, Shafei, and Kordi (2015) conducted a similar study investigating the daily physical activity involvement of children with ASD aged six-15 years-old. Results of this study revealed that children with ASD were predominantly engaged in solitary play and very little in social play activities. The findings indicated that financial burden and a lack of opportunity were the leading barriers to physical activity participation (Memari et al., 2015). This study also found that gender, family income, and household structure were found to be the leading influences to facilitating physical activity (Memari et al., 2015).

Tyler and colleagues (2014) examined the physical activity and fitness of school-aged children with ASD. Using accelerometry and a series of fitness testing, physical activity levels of 29 participants with ASD were analyzed. The findings included that the number one facilitator to increasing after-school physical activity participation was through the intervention of an adapted physical activity program, allowing for children with ASD to enhance motor skills and learn resources that can be carried out in an after-school setting (Tyler et al., 2014).

While many of the studies described above did not specify participants with ASDs level of functioning, two studies examined physical activity participation of children with High Functioning Autism Spectrum Disorders (HFASD). One of the studies was conducted on six families with children ages four through 13 with HFASD. The purpose of this study was to discover the determinants and challenges in physical activity participation in families with children with HFASD from a family systems perspective (Ayvazoglu, Kozub, Butera & Murray, 2015). Through the use of accelerometers and parent interviews, challenges discovered for this population were understanding physical activity in children with ASD, living with a child with ASD, and community awareness of ASD. The determinants of physical activity participation were the child's need for support from the community and support from parents and extended family (Ayvazoglu et al., 2015).

The second study dealing with HFASD was conducted to extend the research on adaptive functioning of children ages seven to 12 using the Adaptive Behavior Assessment System-II. This study found that barriers to physical activity participation included deficits in socialization, household and family structure, and the individual's ability to possess self-direction (Lopata, Fox, Thomeer, Smith, Volker, Kessel, McDonald & Lee, 2012). These researchers believed that

the leading method of intervention to these barriers are whole family participation and having a support system in community programs.

Integration of Findings

For the purpose of this synthesis four categories of after-school physical activity barriers and facilitators for children with ASD were grouped according to the four categories proposed by Obrusnikova and Cavalier (2011) and Obrusnikova and Miccinello (2012). These four categories of barrier and facilitators included: intrapersonal, interpersonal, physical, and community/institutional. Both the categories and individual barriers and facilitators were prioritized based on their prevalence in the literature.

Barriers to after-school physical activity. Table1 provides an integration of results from the review of literature on the barriers to after-school physical activity for children with ASD. The table includes four sections labeled prioritized categories of barriers, prioritized single barriers, number of occurrences in reviewed literature (out of 10 articles), and the references of literature from which the barriers occurred. Categories of barriers, and barriers within the categories, were prioritized by the number of times each was cited in the literature.

Table 1.

Barriers of After-School Physical Activity

Prioritized Categories of Barriers	Prioritized Barriers Within Categories	Number of Occurrences in Reviewed Literature Out of 10 Articles	References
1. Intrapersonal	1. Preferred Sedentary Activities (playing legos, board games, reading books)	6	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012), (Sandt & Frey, 2005), (Memari et. al, 2012), (Tyler et. al, 2014), (Memari et. al, 2015)
	2. Lack of Motor Skills	5	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012), (Memari et. al, 2012), (Davidson, 2009), (King et. al, 2006)
	3. Technology-Based Activities (computer, iPad, television)	4	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012), (Sandt & Frey, 2005), (Tyler et. al, 2014)
	4. Lack of Motivation or Feeling Bored	3	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012) (Memari et. al, 2015)
	5. Impaired Socialization & Communication Skills	2	(Obrusnikova & Mincciello, 2012), (Lopata et. al, 2012)
2. Interpersonal	1. Household Structure	4	(Memari et. al, 2015), (Memari et. al, 2012), (Davidson, 2009), (Lopata et. al, 2012)

	2. Lack of Peer Exercise Partner	3	(Obrusnikova & Cavalier), (Obrusnikova & Mincciello, 2012), (Tyler, et. al, 2014)
	2. Parents Do Not Have Time	3	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012), (Davidson, 2009)
	4. Financial Burden	1	(Memari et. al, 2015)
	4. Being Transported	1	(Obrusnikova & Cavalier, 2011)
3. Physical	1. Lack of Equipment/ Unsafe Equipment	2	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012)
	1. Inclement Weather	2	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012)
4. Community/ Institutional	1. Lack of Physical Activity Programs	4	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012), (Sandt & Frey, 2005), (Memari et. al, 2015)
	2. No Transportation Provided	2	(Obrusnikova & Cavalier, 2011), (Memari et. al, 2012)
	3. Understanding/ Awareness of ASD	1	(Ayvazoglu et. al, 2015)
	3. Not Enough Developmentally Appropriate PE	1	(Obrusnikova & Mincciello, 2012)
	3. Homework	1	(Obrusnikova & Cavalier, 2011)

According to Table 1 the most frequently cited categories of barriers in the literature were intrapersonal, followed by interpersonal, physical, and community/ institutional. Throughout the studies participants cited their interest in sedentary activities, particularly those involving technology, as the most frequent barrier to participating in physical activity after school (Obrusnikova & Cavalier, 2011). They cited numerous reasons that seemed as excuses for not exercising to gain more time to engage in technology-based activities. For example, participants stated that “physical activity is boring;” “I get tired to exercise;” “exercise interferes with my time;” or “I could be home playing video games” (Sandt & Frey, 2005). Often it has been found that children with ASD have difficulties performing motor tasks requiring certain levels of gross-motor skills, coordination, and balance (Tyler et al., 2014). Interpersonal barriers also were frequently mentioned throughout the studies in the review of literature. In this category of after-school physical activity barriers household structure, lack of peer exercise partner, and parents stating they do not have enough time in their schedule were listed as leading barriers. Community barriers were centered around a lack of after-school physical activity programs and transportation to existing programs (Obrusnikova & Miccinello, 2012). The leading institutional barriers were due to children receiving too much homework and not experiencing developmentally age-appropriate physical education in school (Obrusnikova & Cavalier, 2011).

Facilitators of after-school physical activity. Table 2 provides an integration of results from the review of literature on the facilitators of after-school physical activity for children with ASD. The table includes four sections labeled: prioritized categories of facilitators, prioritized facilitators, Number of occurrences in reviewed literature (out of 10 articles), and the references of literature from which the facilitators occurred. Prioritized categories of facilitators and

facilitators within the categories were prioritized by the number of times each were cited in the literature.

Table 2.

Facilitators of After-School Physical Activity

Prioritized Categories of Facilitators	Prioritized Facilitators Within Categories	Number of Occurrences in Reviewed Literature	References
1. Interpersonal	1. Support from Family Members (parents, siblings, pets)	7	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012), (Memari et. al, 2012), (Memari et. al, 2015), (Tyler et. al, 2014), (Ayvazoglu et. al, 2015), (King et. al, 2006)
	2. Peer Are Physically Active	3	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012), (Tyler et. al, 2014)
2. Physical	1. Good Weather Conditions	3	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012), (Tyler et. al, 2014)
	2. Playground at House	2	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012)
	2. Pool at House	2	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012)
	4. Good Surface for Running/ Walking	1	(Obrusnikova & Cavalier, 2011)
	4. Direct Exercise Equipment	1	(Obrusnikova & Cavalier, 2011)

3. Intrapersonal	1. Playing Individual Sports (tennis, swimming)	1	(Obrusnikova & Cavalier, 2011)
	1. Feeling Rewarded	1	(Obrusnikova & Cavalier, 2011)
	1. Physical Activity Involving Favorite Figures (Star Wars)	1	(Obrusnikova & Cavalier, 2011)
	1. Maximizing Success and Achievement in Physical Activity	1	(Obrusnikova & Mincciello, 2012)
	1. Self-Direction	1	(Lopata et. al, 2012)
4. Community/ Institutional	1. Physical Activity Programs Available in the Community	3	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012), (Tyler et. al, 2014)
	1. Developmentally Appropriate Physical Education in School	3	(Obrusnikova & Cavalier, 2011), (Obrusnikova & Mincciello, 2012), (Tyler et. al, 2014)
	3. Improving Physical Activity Programs	1	(Memari et. al, 2012)
	3. Trained Staff	1	(Obrusnikova & Mincciello, 2012)
	3. Available Parks and Playgrounds	1	(Tyler et. al, 2014)

The most frequently cited categories of facilitators found in Table 2 were interpersonal, followed by physical, intrapersonal, and community/institutional. The interpersonal facilitators of peer and family support occurred most frequently during the analysis of results. In the study conducted by Obrusnikova and Miccinello (2012) it was found that peers and pets, along with whole family support, take a prominent role in influencing after-school physical activity participation for children with ASD, regardless of their social impairments (Obrusnikova & Miccinello, 2012). Research suggests that physical and community/institutional factors also

have seemed to have the capacity to facilitate or hinder the engagement of participants with ASD in after-school physical activity. Physical or community environments that have been found to be important in physical activity opportunities for children with ASD including resources such as sidewalks, swimming pools, parks, playgrounds, physical activity programs, and transportation all seemed to facilitate engagement in after-school participation (Memari et al., 2012). As a way to increase motivation toward physical activity participation, research states that children need to build a foundation through developmentally appropriate physical education (Tyler et al., 2014). The relationship between physical activity and social support has been established in research with children without disabilities (Obrusnikova & Cavalier, 2011). Parents believed that the most important institutional facilitator for their child was receiving the proper adapted physical education instruction, teaching their child sport skills and resources that can be carried out in the community (Tyler et al., 2014).

Discussion

Findings from the examination of the review of literature prioritize the leading barriers and facilitators of after-school physical activity participation for children with ASD. The following sections include a discussion on the limitations associated with the study that may have affected results, advice for practitioners based on the results of this synthesis, and recommendations for future research.

Limitations

This synthesis summarizes a review of literature that met the established coding criteria. The studies included in the review of literature were ranked by the number of barriers and or facilitators they displayed, but not weighted, or grouped per their strengths and limitations. As a

result of this, the findings from studies in the review of literature with more intensive research designs and larger sample sizes were given no more influence than findings from studies with weaker designs and smaller sample sizes. Results were primarily based on counts of qualitative findings, for example many of the findings came from opinion-based interviews of parents versus statistical findings from children. The breadth of the review of literature displayed a variety of study designs and measures, often making a comparison among the studies difficult. Also, many of the studies displayed a small participant sample size which could raise questions of reliability and validity. Consequently, the results show a ranking of the known barriers and facilitators to after-school physical activity participation for children with ASD, but limited information is present on statistical findings of this population.

Advice for Practitioners

After the completion of the review of literature, stated facilitators of after-school physical activity participation of children with ASD were prioritized by the number of times they occurred as a recommendation in the literature. The most common facilitator discovered throughout the literature was participation of the whole family, or family cohesion. Family cohesion refers to the degree of commitment, help, and support that family members provide to one another (King et al., 2006). Family support has been recommended by researchers as a top method to facilitating physical activity for children with ASD, but little to no research has been conducted on its effectiveness for this population, although research on the effectiveness of family cohesion has been conducted for individuals with physical disabilities. For this population, there was a higher child preference for engaging in recreational and leisure activities because family cohesion was found to increase the child's interest in the activity. Association between higher levels of functional ability and a supportive family were discovered, as support

increased cognitive, physical, and emotional functioning of children (King et al., 2006). This research can be used as a foundation for practitioners as they can play an important role in helping children and families to recognize multiple factors that influence participation of children with ASD.

When implementing family cohesion strategies, practitioners will find it beneficial to first formally assess children's functional ability and activity preferences. From there the practitioner should compare family engagement in social activities to recreational physical activities to determine the successes occurring for the child during activities with family support. To be effective, it is important for the practitioner to conduct personal interviews of each family they work with, collecting information on activity preferences and discussing options that the family has for successfully participating in physical activity. Prior to implementing this method of intervention it is imperative that the practitioner expresses all concerns on the importance of family cohesion and the physical and social benefits it can bring to the child when taking part in activities that are based in a community setting (Hall, 2012).

Recommendations for Future Research

Within the literature reviewed, there were relatively few studies suggesting a need for more resources to be created to allow children with ASD to successfully participate in after-school physical activity. Future studies should examine the relationship of the best facilitator to overcome physical activity barriers of children with ASD. Few of the studies conducted analyses of gender comparisons and children with and without ASD. Less than half of the studies summarized in the review of literature described effect sizes or magnitudes of the barriers and or facilitators observed. By reporting the effect sizes researchers and practitioners can be guided toward interventions that are most likely to impact outcomes of interest.

Nearly all the reviewed studies described a practical framework for the research, while only a few of the studies presented a theoretical basis for the work. Through the use of theory, researchers may be enabled to more easily identify relevant studies from other disciplines, consider new relationships and plans of action, strengthen intervention design and measurement, and ultimately progress the field more effectively and efficiently of finding the best facilitator to increasing after-school participation of children with ASD.

Improved understanding of the specific social and motor behaviors of children with ASD could inform intervention developers, improving interventions and physical activity goals. Future research should further examine the relationship between the barriers and facilitators of after-school physical activity of children with and without ASD as described above. Results from this type of research could help parents and physical activity coordinators apply findings of programs and interventions to meet the specific needs of children with ASD.

The results of this synthesis have shown family cohesion as being the number one facilitator for after-school physical activity participation. However, no study has made an attempt to research this single method of intervention. Future research on after-school physical activity participation for children with ASD should test the effectiveness of family cohesion in comparison to already known facilitators of physical activity barriers. In these studies researchers should conduct interviews of families and their children on recreational physical activity preferences. In addition, future research on this topic would benefit from continuing to identify ways to measure key outcomes of facilitators that increase physical activity participation. Studies conducted in the future should use larger sample sizes and stronger research designs that include follow-up research. Adequate follow-up of interventions have been found to be limited in studies conducted on physical activity participation for children with ASD.

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Appendix

Coding Sheet 1

Title:	Perceived Barriers and Facilitators of Participation in After-School Physical Activity by Children with Autism Spectrum Disorders
Reference:	Obrusnikova & Cavalier (2010)
Purpose:	To assess barriers to and facilitators of after-school participation in moderate to vigorous physical activity as perceived by children with ASD, determining if physical activity patterns exist in relation.
Participants:	Participants included 12 boys and 2 girls with ASD.
Methods/Analysis:	A Social Responsiveness Scale was administered to parents, validating participants SRS. Participants wore an accelerometer 8 hours per day, for 7 days, recording all physical activity levels. Photo-voice methodology was used to elicit children's perceptions of barriers to and facilitators of after-school MVPA. Data were analyzed into three stages. The first stage was to conduct systemic open coding and to create a codebook. The second stage was assessment of inter-coder reliability. The third stage consisted of categorizing concepts and fitting them into six levels of the socioecological model.

<p>After-School PA Barriers:</p>	<ol style="list-style-type: none"> 1. Intrapersonal <ul style="list-style-type: none"> - playing video games or computer - watching tv or listening to music - feeling tired - feeling bored with physical activity - lack of skill or motor control - playing legos, imaginative or board games - reading books or magazines - other 2. interpersonal <ul style="list-style-type: none"> - lack of peer exercise partner (friends, siblings) - parents do not have time - being driven somewhere - other 3. Physical <ul style="list-style-type: none"> - inclement weather - lack or unsafe equipment - other 4. Community/Institutional <ul style="list-style-type: none"> - lack of transportation to physical activity programs - homework for school - lack of physical activity programs to join
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<p>After-School PA Facilitators:</p>	<ol style="list-style-type: none"> 1. Intrapersonal <ul style="list-style-type: none"> - playing individual sports (tennis, swim, etc.) - playing Wii sports/fit - playing team sports (soccer, basketball, etc.) - involving favorite figures/ interest (Star Wars) - feeling rewarded (medal, party) - feeling refreshed 2. interpersonal <ul style="list-style-type: none"> - friends are supportive or physically active - parents are supportive or physically active - siblings are supportive or physically active - doing chores at home - pets are physically active 3. Physical <ul style="list-style-type: none"> - direct exercise equipment (bike, scooter) - supportive exercise equipment (sneakers, fan) - a playground at the house - a swimming pool at the house - good surface for walking or running - good weather 4. Community/Institutional <ul style="list-style-type: none"> - physical activity programs available in the community - parks and playgrounds available in the community - school prepares for after-school physical activity
<p>Results/Discussion:</p>	<p>The most frequent cited barriers were intrapersonal, followed by interpersonal, physical, community, and institutional. The most frequent facilitators were physical, followed by intrapersonal, interpersonal, community, and institutional.</p>
<p>Recommendations:</p>	<p>A multi-pronged approach can be a successful tool when designing physical activity interventions for children and adolescents with ASD.</p>

Coding Sheet 2

Title:	Parent Perceptions of Factors Influencing After-School Physical Activity of Children with Autism Spectrum Disorders
Reference:	Obrusnikova & Miccinello (2012)
Purpose:	To assess parental perceptions of the benefits of physical activity and the factors that influence participation of children with Autism Spectrum Disorders in physical activity after school.
Participants:	Data were collected from 103 parents of children with ASD.
Methods/Analysis:	Data were collected through the use of online surveys and personal interviews. Qualitative analysis was conducted, by parent formal interviews and online surveys.

<p>After-School PA Barriers:</p>	<ol style="list-style-type: none"> 1. Intrapersonal <ul style="list-style-type: none"> - lack of motivation or interest in PA - lack of time - engagement in sedentary activities - impaired social and communication skills - lack of independence - health issues - impaired attention and comprehension - impaired motor performance 2. interpersonal <ul style="list-style-type: none"> - parents do not have time or energy - lack of peer exercise partner 3. physical <ul style="list-style-type: none"> - inclement outdoor conditions - lack of equipment/ resources 4. community/ institutional <ul style="list-style-type: none"> - lack of community PA programs or locations - lack of staff training - not enough developmentally appropriate PE
<p>After-School PA Facilitators:</p>	<ol style="list-style-type: none"> 1. Intrapersonal <ul style="list-style-type: none"> - emphasizing enjoyment of physical activity - using managerial strategies to promote PA - maximizing success and achievement in PA 2. Interpersonal <ul style="list-style-type: none"> - friends/peers are supportive or physically active - parents are supportive or physically active - siblings are supportive or physically active - dogs are physically active 3. Physical <ul style="list-style-type: none"> - appropriate resources at/around house - good outdoor conditions 4. community/institutional <ul style="list-style-type: none"> - availability of community PA programs or locations - trained staff - school offers after-school PA opportunities
<p>Results/Discussion:</p>	<p>Advantages, disadvantages, facilitators, and barriers of physical activity were found.</p>

Recommendations:	Future recreational programs should use pre-existing education settings to create and establish more opportunities for children with ASD.
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Coding Sheet 3

Title:	Comparison of Physical Activity Levels Between Children With and Without Autistic Spectrum Disorders
Reference:	Sandt & Frey (2005)
Purpose:	To compare daily, physical education, recess, and after school moderate to vigorous physical activity levels between children with and without ASD.
Participants:	Children ages 5 to 12 years old.
Methods/Analysis:	Participants wore a uniaxial accelerometer for five days. Accelerometry was used to collect quantitative data of children physical activity participation.

<p>After-School PA Barriers:</p>	<p>2. available programs become more competitive with age</p> <p>1. Intrapersonal - sedentary-based activities - playing video games, watching television</p> <p>2. Interpersonal - lack of motor skills, community programs become more competitive with age</p> <p>3. Physical N/A</p> <p>4. Community/Institutional - difficult to find activity opportunities</p>
<p>After-School PA Facilitators:</p>	<p>1. Intrapersonal -N/A</p> <p>2. Interpersonal -N/A</p> <p>3. Physical -N/A</p> <p>4. Community/Institutional -N/A</p>
<p>Results/Discussion:</p>	<p>There were no significant differences of physical activity levels between children with and with out ASD. All children were able to meet the minimum physical activity requirements.</p>
<p>Recommendations:</p>	<p>Children with ASD may still be at-risk for developing sedentary behaviors as they mature due to: a) the potential overuse of technology-based activities during leisure time, b) loss of school recess time.</p>

Coding Sheet 4

<p>Title:</p>	<p>Children with Autism Spectrum Disorder and Patterns of Participation in Daily Physical and Play Activities</p>
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Reference:	Memari, Panahi, Ranjbar, Moshayedi, Shafiei, Kordi, & Ziaee (2015)
Purpose:	To determine patterns of participation in daily physical and play activities of children with ASD.
Participants:	Daily physical activity involvement of 83 children with ASD was investigated.
Methods/Analysis:	Descriptive data for general records were reported (Mean, Standard Deviation).
After-School PA Barriers:	<ol style="list-style-type: none"> 1. Intrapersonal <ul style="list-style-type: none"> - lack of motivation - fear of injury 2. Interpersonal <ul style="list-style-type: none"> - financial burden - household structure 3. Physical <ul style="list-style-type: none"> - N/A 4. Community/Institutional <ul style="list-style-type: none"> - lack of program opportunities
After-School PA Facilitators:	<ol style="list-style-type: none"> 1. Intrapersonal <ul style="list-style-type: none"> -N/A 2. Interpersonal <ul style="list-style-type: none"> - household structure, family involvement in physical activity 3. Physical <ul style="list-style-type: none"> N/A 4. Community/Institutional <ul style="list-style-type: none"> N/A

Results/Discussion:	Children were predominantly engaged in solitary play, rather than social play activities.
Recommendations:	More resources need to be created for successful physical activity participation.

Coding Sheet 5

Title:	Physical Activity in Children and Adolescents with Autism Assessed by Triaxial Accelerometry
Reference:	Memari, Ghaheri, Ziaee, Kordi, Hafizi, & Moshayed (2012)
Purpose:	To examine physical activity patterns in children with ASD, also addressing physical activity determinant factors through the use of triaxial accelerometry.
Participants:	80 children and adolescents with ASD.
Methods/Analysis:	Data were collected through the investigation of demographics, children's behavioral and clinical profile, and physical activity data that was measured through the use of an Actigraph GT3X, for seven consecutive days. ANOVA was used to compare means of physical activity variables in age groups, as well as socioeconomic status. A t-test was used to determine statistical differences in gender, weight groups, and household structure.

After-School PA Barriers:	<ol style="list-style-type: none"> 1. Intrapersonal <ul style="list-style-type: none"> - sedentary pursuits - complexity of games, lack of motor skills 2. Interpersonal <ul style="list-style-type: none"> - household structure - family support 3. Physical N/A 4. Community/Institutional <ul style="list-style-type: none"> - transportation
After-School PA Facilitators:	<ol style="list-style-type: none"> 1. Intrapersonal N/A 2. Interpersonal <ul style="list-style-type: none"> - family support 3. Physical N/A 4. Community/Institutional <ul style="list-style-type: none"> - improving physical activity programs
Results/Discussion:	There was a substantial reduction in activity across the adolescent years of individuals with ASD. Girls were less physically than boys, as participants were remarkably less active in school than at home.
Recommendations:	There is a significant need for improving physical activity programs, especially for girls.

Coding Sheet 6

Title:	Physical Activity and Physical Fitness of School-Aged Children and Youth with Autism Spectrum Disorders
Reference:	Tyler, MacDonald, & Menear (2014)

Purpose:	To examine the physical activity and fitness of children with school-aged children with ASD to typically developing peers.
Participants:	29 participants completed a series of fitness, along with measure of body mass index, and physical activity levels taken with the use of accelerometry.
Methods/Analysis:	Data were collected over a 3 day period. MANCOVA was used to determine each physical fitness variable. ANCOVA was used to determine physical activity levels between children with and without ASD.
After-School PA Barriers:	<ol style="list-style-type: none"> 1. Intrapersonal <ul style="list-style-type: none"> - sedentary activities - technology-based activities 2. Interpersonal <ul style="list-style-type: none"> - lack of peer engagement 3. Physical <ul style="list-style-type: none"> - N/A 4. Community/Institutional <ul style="list-style-type: none"> - N/A
After-School PA Facilitators:	<ol style="list-style-type: none"> 1. Intrapersonal <ul style="list-style-type: none"> - N/A 2. Interpersonal <ul style="list-style-type: none"> - peer/ sibling support 3. Physical <ul style="list-style-type: none"> - environmental determinants 4. Community/Institutional <ul style="list-style-type: none"> - physical education - community-based PA programs
Results/Discussion:	Children with ASD are less physically active and fit than typically developing peers overall. Although children with ASD did show better results than typically developing peers in some fitness testing.

Recommendations:	Public health initiative need to include children and youth with ASD, helping to increase physical activity levels.
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Coding Sheet 7

Title:	School Performance, Lack of Facilities, and Safety Concerns: Barriers to Parents' Support of Their Children's Physical Activity
Reference:	Davidson (2009)
Purpose:	To identify the barriers to parents' support of their children's physical activity (PA) and to develop a survey to assess such barriers.
Participants:	82 parents of elementary school-aged children participated in small-group interviews.
Methods/Analysis:	Parents reported barriers to supporting their children's PA and suggested possible solutions. This information was used to develop the Barriers to Activity Support Scale (BASS), which was completed by 75 of the 82 parents along with a survey that assessed the parents' support for their children's PA.

After-School PA Barriers:	<ol style="list-style-type: none"> 1. school performance 2. lack of facilities 3. multiple children with different needs 4. safety from crime 5. parents' work commitments 6. cost 7. lack of programs 8. lack of information 9. lack of sidewalks 10. lack of playgrounds/parks 11. lack of home resources <p>Community-based, intrapersonal, interpersonal</p>
After-School PA Facilitators:	Provide parents with evidence of the benefits PA can bring to child.
Results/Discussion:	Parents reported community-based, interpersonal, and intrapersonal barriers to supporting their children's PA. Top barriers included the importance of children's school performance, a lack of facilities, and concerns about safety. Parents who reported greater barriers reported lower support for their children's PA.
Recommendations:	Results provide preliminary evidence for the reliability and validity of the BASS and highlight the need to address barriers during the development of family-based PA programs.

Coding Sheet 8

Title:	Determinants and challenges in physical activity participation in families with children with high functioning autism spectrum disorders from a family systems perspective
Reference:	Ayvazoglu, Kozub, Butera, & Murray (2015)

Purpose:	To discover the determinants and challenges in PA participation in families with children with HFASD from a family systems perspective.
Participants:	Six families with children with HFASD aged 4 through 13 participated in the study.
Methods/Analysis:	Quantitative data were collected through the use of RT3 accelerometers. Qualitative data were gathered from Q-sort methodology were used to stimulate discussion in parent interviews.
Ranked After-School PA Barriers:	<ol style="list-style-type: none"> 1. Understanding PA in children with ASD 2. Living with a child with ASD 3. Awareness of ASD at school and community settings
Ranked After-School PA Facilitators:	Need for support from school, community, extended family.
Results/Discussion:	Findings revealed that levels of MVPA in children with HFASD varied between 85 min and 405 min for seven days. Parents of children with HFASD in this study were inactive. Parents highlighted many essential issues: understanding PA in children with HFASD, living with a child with HFASD, awareness of ASD at school and community settings.
Recommendations:	Barriers from study need to be addressed if PA is to emerge as a means for improving health related concerns and general family cohesion.

Coding Sheet 9

Title:	Determinants and challenges in physical activity participation in families with children with high functioning autism spectrum disorders from a family systems perspective
Reference:	Ayvazoglu, Kozub, Butera, & Murray (2015)
Purpose:	To discover the determinants and challenges in PA participation in families with children with HFASD from a family systems perspective.
Participants:	Six families with children with HFASD aged 4 through 13 participated in the study.
Methods/Analysis:	Quantitative data were collected through the use of RT3 accelerometers. Qualitative data were gathered from Q-sort methodology were used to stimulate discussion in parent interviews.
Ranked After-School PA Barriers:	<ol style="list-style-type: none"> 1. Understanding PA in children with ASD 2. Living with a child with ASD 3. Awareness of ASD at school and community settings
Ranked After-School PA Facilitators:	Need for support from school, community, extended family.

Results/Discussion:	Findings revealed that levels of MVPA in children with HFASD varied between 85 min and 405 min for seven days. Parents of children with HFASD in this study were inactive. Parents highlighted many essential issues: understanding PA in children with HFASD, living with a child with HFASD, awareness of ASD at school and community settings.
Recommendations:	Barriers from study need to be addressed if PA is to emerge as a means for improving health related concerns and general family cohesion.

Coding Sheet 10

Title:	School Performance, Lack of Facilities, and Safety Concerns: Barriers to Parents' Support of Their Children's Physical Activity
Reference:	Davidson (2009)
Purpose:	To identify the barriers to parents' support of their children's physical activity (PA) and to develop a survey to assess such barriers.
Participants:	82 parents of elementary school-aged children participated in small-group interviews.
Methods/Analysis:	Parents reported barriers to supporting their children's PA and suggested possible solutions. This information was used to develop the Barriers to Activity Support Scale (BASS), which was completed by 75 of the 82 parents along with a survey that assessed the parents' support for their children's PA.

Ranked After-School PA Barriers:	<ol style="list-style-type: none"> 1. school performance 2. lack of facilities 3. multiple children with different needs 4. safety from crime 5. parents' work commitments 6. cost 7. lack of programs 8. lack of information 9. lack of sidewalks 10. lack of playgrounds/parks 11. lack of home resources <p>Community-based, intrapersonal, interpersonal</p>
Ranked After-School PA Facilitators:	Provide parents with evidence of the benefits PA can bring to child.
Results/Discussion:	Parents reported community-based, interpersonal, and intrapersonal barriers to supporting their children's PA. Top barriers included the importance of children's school performance, a lack of facilities, and concerns about safety. Parents who reported greater barriers reported lower support for their children's PA.
Recommendations:	Results provide preliminary evidence for the reliability and validity of the BASS and highlight the need to address barriers during the development of family-based PA programs.

Coding Sheet 11

Title:	ABAS-II Ratings and Correlates of Adaptive Behavior in Children with HFASDs
Reference:	Lopata, Fox, Thomeer, Smith, Volker, Kessel, McDonald, & Lee (2012)

Purpose:	This study was conducted to extend the research on adaptive functioning of children, ages 7-12, with high-functioning autism spectrum disorders using the Adaptive Behavior Assessment System-II. The specific purposes included examination of: 1) the ABAS-II adaptive profile, 2) relative strengths and weaknesses, 3) predictors of adaptive functioning for children with HFASDs.
Participants:	Participants included 41 children , ages 7 to 12 years old enrolled in two treatment studies for children with HFASDs.
Methods/Analysis:	Analyses indicated that age and IQ did not predict ABAS-II composites, whereas total ASD symptoms negatively predicted overall adaptive functioning. Significant inverse correlations were found between ASD social symptoms of restricted and repetitive behaviors and the ABAS-II social and practical daily living composites.
After-School PA Barriers:	socialization, home living, self-direction,
After-School PA Facilitators:	community programs
Results/Discussion:	Results indicated significant deficits on overall adaptive functioning and all three adaptive composites. Relative weakness were found in the skill areas of social, home living, and self-direction and relative strengths in academic and community use. No significant correlations were found between ASD social symptoms and adaptive social skills or between ASD communication symptoms and adaptive language/ communication skills.
Recommendations:	N/A