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Physical activity in young adults with autism spectrum disorder: Parental perceptions of barriers and facilitators

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Abstract

The importance of physical activity in persons with disabilities is well known, yet the prevalence of inactivity remains high. The physical activity behaviors among adults on the autism spectrum are largely unexplored. It is presumed that sedentary behavior and obesity are a greater health issue among young adults on the autism spectrum who no longer receive Individuals with Disabilities Education Act services and supports such as school-based physical education. Using a phenomenology approach, the parents of eight young adults on the autism spectrum were interviewed about their perceptions of the barriers and facilitators to getting their young adults on the autism spectrum physically active. The purpose of this study was to investigate parent's perspective of physical activity barriers and facilitators of their adult children on the autism spectrum. Common themes of both physical activity barriers and facilitators included parents, behaviors associated with autism spectrum disorder, and access and opportunities.

Keywords

autism spectrum disorder, barriers, facilitators, physical activity, young adults

Autism spectrum disorder (ASD) is a high-prevalence neurodevelopmental condition which often results in significant impairment of social interactions and restricted, repetitive patterns of behavior (American Psychiatric Association (APA), 2013). ASD symptomatology is very heterogeneous in nature with severity of impairment ranging from mild to very severe. ASD symptoms are often recognized in childhood and persist throughout the life span (US Department of Health and Human Services (USDHHS), 2017a). Compared to the general population, individuals on the autism spectrum face significant medical conditions including increased rates of major psychiatric disorders, immune conditions, hypertension, diabetes, and obesity (Croen et al., 2015; Tyler et al., 2011). Individuals on the autism spectrum also often experience delays or deficits in the motor domain including flexibility, balance, gait postural stability, and movement speed (Pang et al., 2005). Although physical activity (PA) is known to prevent many medical conditions in the general population including cardiovascular disease, type 2 diabetes, metabolic syndrome, and some cancers (Physical Activity Guidelines Advisory Committee (PAGAC), 2008), most people in the United States do not meet the minimum PA guidelines for disease prevention (Carlson et al., 2010; Kohl et al., 2012).

Noting this trend in the general population, a greater proportion of individuals with disabilities do not meet these guidelines (Dickinson and Place, 2014; Sorensen and Zarrett, 2014; USDHHS, 2014) and typically do not exercise enough to obtain health benefits (Esposito et al., 2012). Many factors contribute to exercise deficiency among those on the autism spectrum including disordered sleep, psychopharmacological medicine, atypical eating patterns, metabolic abnormalities, social anxiety, environmental barriers, and other disabling characteristics associated with ASD (Obrusnikova and Cavalier, 2011; Obrusnikova and Dillon, 2011; Srinivasan et al., 2014). In addition, delays in acquiring proficiency in motor skills and poor physical fitness appear to be associated with physical inactivity of adolescents on the autism spectrum (Menear and Neumeier, 2015). For example, Duquette et al. (2016) found physical and social barriers

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to sport participation in their study sample of youth on the autism spectrum. Eaves and Ho (2008) interviewed parents of adult children on the autism spectrum regarding perceived PA barriers. Cost, lack of athleticism, lack of a partner or leader, ASD symptomatology, and lack of energy were contributing factors to their children's exercise deficiency. Eaves and Ho's (2008) study was a longitudinal investigation of the PA behaviors of children, adolescents, and young adults on the autism spectrum. They found less than 50% of the young adults in their sample engaged in moderate to vigorous PA at least 1 day per week. Moreover, this group spent an average of 13 h per day sitting.

Young adults on the autism spectrum and their parents experience challenges to the successful transition to adulthood across multiple domains including physical and mental health (Howlin and Moss, 2012). To date, the health effects of transition on PA participation when school-based supports are no longer available are unclear (Buchanan et al., 2017). Among adolescents without disabilities, the health effects of transition from high school to adult living are profound. For example, Kwan et al. (2012) found a 24% decrease in PA and significant incident increases in binge drinking and cigarette smoking during a 12-month window post high school graduation. Other studies report an increase in depression and loneliness (Fisher and Hood, 1987), negative mood (Aspinwall and Taylor, 1992), decrease in physical health (Aspinwall and Taylor, 1992), as well as low levels of well-being (Gall et al., 2000). PA during the transition from high school to adulthood is a protective health factor among those without disabilities. Bray and Kwan (2006) investigated the effects of vigorous PA on psychological well-being and self-reported illness during the first year of transition post high school graduation among a non-disabled sample. Results indicated that exercise-deficient participants reported lower psychological well-being and were twice as likely to have consulted a physician regarding an illness compared with sufficiently active participants. The emotional health effects of transition among individuals with cognitive disabilities are beginning to emerge in the literature. For example, Poppen et al. (2016) found that almost half of the transitioning students in their study receiving Individualized Education Program services experienced mental health issues including an increase in suicidal thoughts, worry/anxiety/nervousness, impulsive/dangerous behaviors, and physical or verbal aggression. Foley et al. (2016) found that transitioners with Down syndrome experienced more emotional and behavioral problems than an age- and gender-matched comparison group without disabilities. It is well known that services received for increasing health, function, and social integration for individuals on the autism spectrum significantly decline post-secondary education (Shattuck et al., 2011; USDHHS, 2017a). It is conceivable that PA services for transitioning adults on the autism spectrum are also lacking and this is supported by parent reports of limited PA opportunities for adolescents on the autism spectrum (Pan and Frey, 2006).

In this context, the parents or caretakers may be the key providers of PA opportunities post-secondary education for their adult children on the autism spectrum (Bishop et al., in press; Buchanan et al., 2017). The influence of parents or care providers on the PA of their adult children on the autism spectrum is important to explore because most adults on the autism spectrum are not independent and reside in supervised living, often with their family (Hewitt et al., 2017). Under these circumstances, adults on the autism spectrum are more dependent on their parents to provide basic needs throughout the life span than individuals with other disabilities or without disabilities (Schall et al., 2014). Due to the poor health profiles and higher risk for chronic disease compared to adults without ASD (Tyler et al., 2012), it is important to identify factors that influence health behaviors of young adults on the autism spectrum to inform pilot interventions to address these issues (Howlin and Taylor, 2012; Warren et al., 2012).

The present study

The purpose of this study was to investigate parent's perspective of PA barriers and facilitators of their adult children on the autism spectrum. This effort supports the recent calls for more research on the successful transition and health of adults on the autism spectrum (USDHHS, 2016a, 2016b, 2017a).

Theoretical framework

Social-ecological theory explains how the interactions of individuals and the environment shape one another (Bronfenbrenner, 1979). Based loosely on the social-ecological theory, this exploratory study used a phenomenology approach to understand the barriers and facilitators to PA for young adults on the autism spectrum from the perspective of the participants (Creswell, 2009). Parents were interviewed to gain an understanding of the barriers and facilitators they have faced in their attempts at getting their young adults on the autism spectrum to be physically active. Similar research has been conducted using social-ecological theory to explore PA engagement of individuals on the autism spectrum from the perspective of the parent by Buchanan et al. (2017).

Methods

Participants

Permission to conduct the study was obtained from a University Institutional Review Board. A purposeful,

Table 1. General information regarding participants.

Name	Gender	Age	Verbal skills	Day program or Special Olympics	Location (city, outside city)
Donavan	M	25	Good expressive	Special Olympics	Outside city
Ben	M	23	Some limited expressive	Day program	City
Charlie	M	28	Some limited expressive	Special Olympics	City
Jared	M	22	Some limited expressive	Day program	City
Timothy	M	23	Some limited expressive	Special Olympics	City
Andre	M	22	Good expressive	Day program	Outside city
Ethan	M	24	Non-verbal	Day program	Outside city
David	M	27	Good expressive	Day program	Outside city

convenience sampling of participants was attained from a community day program for adults on the autism spectrum and a local Special Olympics program located in the mid-Atlantic region. The community day program is a private day program for adults (18+) on the autism spectrum. Minimum enrollment guidelines of the day program included moderate behavioral control and self-regulation. A total of 20 adults on the autism spectrum attended the day program during data collection. A flyer was sent home soliciting parents to participate in the study. The parents of six young adults on the autism spectrum from the day program agreed to participate in the study. Because a larger sample size was desired, two more parents were recruited from a local Special Olympics program for a total of eight participants. Pseudonyms were used to protect the anonymity of both the young adults and their parents (Table 1).

Data collection

Data were gathered by observation and semi-structured interviews. For the observations, select participants were observed at the Special Olympics swim practice four times for 60 min each time. Another observation occurred during a local 5K race. Five participants completed the race and the first author (C.N.) participated as a running partner for one of the participants. One-to-one interviews were conducted with parents at their convenience and choice of location including the parent's home, during a Special Olympics practice, at the adult day facility, and at a local restaurant. Each interview lasted 30–45 min and included six questions regarding parent's perceptions of barriers and facilitators to PA for their adult child on the autism spectrum (see Appendix 1). Interviews were audio recorded and transcribed. Interviewer notes were written during each interview for content validity. All names have been changed to protect the anonymity of the study participants.

Data analysis

Interview transcripts were independently screened for common themes and coded by two of the authors using a line-by-line search method. Results were compared to assess agreement. Coding disagreements were discussed until agreement was reached. To increase data trustworthiness, reflexivity and triangulation were used. Reflexivity occurred after each observation or interview. Recalling the notes and rereading transcripts allowed the authors to reflect on the interview and the issues or ideas that surfaced. Triangulation allows for the convergence of multiple information sources to identify themes and was obtained through independent research tools (i.e. observations, interviews) to aid in data analysis (Creswell and Miller, 2000).

Results

Facilitators

During the interviews with the parents, three themes emerged as PA facilitators. First, parental attitudes, PA habits, financial resources, and available time were significant factors in the PA level of their children. Second, while most people consider the behavior characteristics typical of those on the autism spectrum as a hindrance, parents reported that some of these behaviors were beneficial in helping them consistently participate in physical activities. Finally, the availability of and access to PA community programs facilitated PA.

Parents. Parents reported that PA was important, and most of them were currently physically active themselves. For example, Ben's mom, when asked her thoughts about PA, remarked, "it needs to be part of your daily routine … a sedentary lifestyle is very unhealthy and leads to lots of problems. I personally believe that fitness is incredibly important." Donavan's dad said, "It's always been important for us as a family to be active." This was evident during one of the observations at a Special Olympics swimming practice when Donavan's dad dropped him off at the swimming practice and then worked out at the same facility. Jared's mom ran in a 5K race and three parents mentioned that they frequently exercise at the local community fitness center. Available time and resources was another parental factor that facilitated PA. In most cases, at

least one parent was available to drive their child to activities in the community. Two parents coached their son's Special Olympics sports team. At least three parents also had the financial resources to hire local college students to supervise their sons during the day and accompany them to the gym and during neighborhood walks.

Behaviors associated with ASD. Many behaviors associated with ASD are barriers to PA participation (Menear and Neumeier, 2015; Obrusnikova and Cavalier, 2011; Obrusnikova and Dillon, 2011). For example, motor skill deficits, lack of cognition in understanding rules and directions, and the unpredictability of the behaviors were presented as barriers to getting their adult children to be physically active. However, a few characteristics typical of those with ASD were PA facilitators.

Constant motion. Jared, for example, does not stop moving. From the moment he wakes up in the morning until the moment he goes to bed at night, Jared is walking or pacing. Jared frequently runs in local 5K and 10K races. When asked what Jared does to train for a race, his mother replied, "really he doesn't need much training. He paces back and forth, he paces around the house and we tell him to go outside and he just walks around." Jared was not the only one of the young adults on the autism spectrum who experienced difficulty standing or sitting still. Sandy spoke of how her son, David, is very active. She commented, "we never wanted him to be a couch potato as a little guy and that came true because he never sits. Even at home … most of the time he is moving." Charlie's dad said,

> When he goes to walk, when he is walking on the beach, we do a fair amount of walking, and he just walks and walks. When we go to the beach he could walk until he fell off the end of the earth. He's fat and he kind of gets his stride going. He's like 100 yards ahead of me and I am like, "slow down, stop!" Same with street walking, walking around the neighborhood, he just gets it going, he gets in his own little world.

For Jared, David, and Charlie, constant pacing and getting into a walking "zone" facilitated PA.

Routines. Many individuals on the autism spectrum develop strictly adhered routines (Block, 2016). Fitting exercise into Timothy's routine had been a struggle. Before 6 months of data collection, Timothy's parents hired a local college student to assist Timothy in developing a workout routine at a fitness facility. Timothy's parents reported that helping Timothy start a new activity is often challenging, but "fortunately, once you get him, it's feeding into his autism and OCD. Once you get him moving, now all of us can get him to do his 30-60-minute strength routine." Andre's parents are proponents of PA and have always wanted Andre to be more active. A stationary bicycle, elliptical, recumbent bicycle, and a treadmill are available for his use at their house. About 6 or 7 years prior to our data collection, Andre's father introduced Andre to a stationary bicycle by instructing him to stay on the bike for 1 min. When recounting the story, Andre's dad reported, "He didn't want to do it. I had to stay out of arms reach because he was trying to hit me the whole time." The following day, the amount of time required on the stationary bicycle was increased to 2 min, then 3 min the following day, and now Andre gets on one of the exercise machines for 50 min every day. Andre has been doing this for 6 or 7 years now and his father reported that "It is incorporated into his schedule so much, it is on his white board, you don't even have to tell him. He goes downstairs, turns on the TV and gets on whatever machine." For Andre and Timothy, once PA had been established in their routine, it stopped being a struggle to be active.

Access and opportunities. Access and opportunities to PA programs and locations played a significant role in the PA of the young adults on the autism spectrum in our study. Most of our study participants lived in a city with thriving Special Olympics and therapeutic recreation programs. Many participants frequently used the community recreation centers and enjoyed the quick and easy access to the outdoors.

Special Olympics. The Special Olympics program in the city of five of our eight young participants provides year-round activities to individuals with intellectual disabilities. Six of the eight young adults participated in at least one Special Olympics activity; many were multi-sport athletes. Donavan participates in eight activities, keeping him very active throughout the year. Donavan's dad reported that "right now we are doing track, tennis, swimming … In the fall he does golf volleyball, soccer. Winter he does basketball, bowling." It is apparent that the thriving Special Olympics program is a key factor in getting Donavan physically active.

Local community exercise facility. Charlie, Timothy, and Ben frequently attended a local community recreation center to exercise. Ben's mom regularly attends the community recreation center and believes the staff sufficiently accommodates him. She said, "I don't know what kind of training they give their people. They are awesome over there … they just seem to get it. I have had nothing but positive experiences … They have been extremely accommodating." Apart from having access to the local community exercise facility, having a staff that is knowledgeable about individuals with disabilities is important.

Community programs. Special Olympics and the community day program sponsor a running race each year and many study participants run in each event. A local indoor

trampoline park reserves 1 h each week for individuals with disabilities and Ben is a frequent visitor. The community therapeutic recreation department hosts additional activities throughout the year such as Challenger Baseball and Basketball. All of these community activities increase the opportunities for young adults on the autism spectrum to be physically active.

Hiking and walking. Hiking and walking were two activities frequently completed by our participants' adult children. Ben is responsible for daily dog walks and Timothy's mom reported that he, "usually walks for 2-4 miles a day." Andre's mom previously worked for the National Forest Service and the family frequently hikes the local nature trails.

Barriers

The three factors found to be facilitators (i.e. parents, behaviors associated with ASD, access/opportunities) for PA were also exercise barriers. While the factors were identical (i.e. parents, behaviors associated with ASD, access/opportunities), their applications differed.

Parents. The adult children on the autism spectrum recently graduated from secondary education, yet still resided at home. As a result, parents still played a significant role in how much and what types of PA their children completed.

Parental attitudes. All parents interviewed stated that PA was important; however, not all were physically active. In the interview with Phillip's mom, Delaina, she mentioned that she never saw her parents participate in PA. Partly because PA was not a part of her life growing up, Delaina has not incorporated PA into her lifestyle. During our interview she identified available discretionary time as a factor to her limited PA and admitted "there is not a lot done for PA honestly around our house." Jared's father reported that "I was in the Army, so forced exercise, mandatory fun; so since I am no longer required to be in physical condition … I have gone off running."

Parental concerns. Seven of the eight parents expressed concern about their sons participating in some activities. For example, when asked why they did not register Donavan for certain recreational activities, Donavan's parents replied, "We just didn't feel he could focus and would be too much of a challenge for a coach." Ben's mom is very protective and does not permit him to walk the dog or walk throughout the neighborhood independently, even though he is familiar with the neighborhood because "I tend not to ever leave him exposed to any safety risks because he is too vulnerable. He just doesn't know what to do." Because of some of the challenges and behaviors Jared has, his parents elect to be his one-to-one aide during most activities. The level of supervision limits Jared's access to PA opportunities. Jared and his mother enjoy running at a local track. This affords Jared's mother to run at a slower pace than Jared while maintaining supervision. Jared's mother commented that "I wouldn't feel comfortable" with Jared running in the neighborhood. Jared played baseball for one season but his mother pulled him out due to her boredom during his practices and games. Andre has been aggressive when negotiating participating in some physical activities with his parents. As a result, his parents will not ask him if he wants to participate because "we don't want aggressive behaviors."

Behaviors associated with ASD

Lack of interest. Many parents reported that their adult child on the autism spectrum displayed little interest in PA. Ben's mom, when discussing opportunities to be active in community programs, said, "They do a lot of things, a lot of activities, most of which Ben is not interested in. That is a personal barrier. It is hard to find something that he is interested in." Ethan's sister ran track in high school and Ethan's mom has tried taking him to the track to run. But Ethan "gets bored with that and shows no interest." Team sport activities appear to be the least motivating for a number of participants. Sandy describes her attempts at getting David involved in team sports, "as far as organized sports, he doesn't have that focus or interest in organized sports." David has shown interest recently in soccer, but as for the other team sports, "he just really wasn't interested."

Perseveration. A common characteristic of individuals on the autism spectrum is perseveration (Block, 2016). They may develop an intense preoccupation with an object or task which, if interrupted, results in intense agitation (Vismara and Lyons, 2007). A few parents mentioned this issue with their adult child. Charlie was temporarily removed from bowling because of the challenges associated with perseveration at the bowling alley. His father relates,

> There would be 15 kids' … names up there and he was in, like, second place, doing really well, second place by one stroke, and it's like, 'Charlie, you are beating all these other people, you are doing amazing'… Then he starts perseverating …We had to back out of bowling … We took two years off.

Andre also has perseveration issues, but his issue is both positive and negative. Andre's daily workout routine includes selecting a cardio machine (e.g. treadmill, elliptical, stationary bike) and exercising for 50 min, precisely. Occasionally, the family will go out of town and stay in a hotel. The parents relate that "When we are at a hotel we have to scope everything out. He is really stuck on the 50-minute thing. Some hotels only go up to 30. That could be an issue with his behavior." Timothy has obsessive compulsive disorder (OCD), which manifests itself similar

to perseveration. His parents report that "The worst thing is that we are stuck in one spot for 20 minutes … The more you prompt him, the harder it is for him to move … His OCD is bad."

Motor skills. Another characteristic of ASD is poor motor control (Menear and Neumeier, 2015). Lack of ability to imitate motor patterns and execute motor skills may prevent a person on the autism spectrum from successfully participating in certain activities. Charlie has never been able to ride a bike because "he is a little bit nervous about imbalance, falling down." Ethan never learned to ride a bike. His parents struggled to teach him because "he was unsteady, and he likes to be steady."

Aggression. Aggressive behaviors toward others were a significant factor in the choices of physical activities among our participants. For two young adults, aggressive behaviors were a critical factor in activity selection. Andre is very large, and his parents were very worried about what could possibly happen to other people if Andre got upset and aggressive toward others. At one point, Andre's behavior and aggressiveness were so intense that his parents called the police for fear of their safety. When asked what prevents them from registering Andre for certain activities they replied, "Behaviors, he will just say 'no' start yelling, could escalate to aggressive behaviors. Sometimes we don't ask because we don't want aggressive behaviors." Jared is not as big as Andre, but he has many experiences throughout his life where he was physically aggressive with others. Jared's mom reported that "He does horseback riding, but he used to kick the horses and the volunteers." Just prior to data collection, another aggressive incident occurred. His mom relates, "A couple weeks ago, for the second time, he did it a few months ago, he was hitting people so we had to take him out of the program because we can't take that risk." Jared's behavior is unpredictable and volatile, so his parents prefer that he participates in individual activities. They mention, "I guess that's why running; he has never had a behavioral issue running, I believe. It's a safe environment." He is frequently registered for swimming and running because "he enjoys those" and "they are all individual sports that don't require hand-eye coordination." They fear if he participates in team sports, "Somebody could get hurt very easily if the switch goes off."

Hypersensitivity. Timothy "doesn't do well with fluorescent lights." The lighting in one exercise facility is particularly inconsistent and Timothy struggles to maintain composure in the gym. His parents report that "the lights usually make it worse, make him more hyper, and if he gets way too many lights he gets tics and almost seizures." He also struggles in the bowling alley, but his parents are not sure of the cause. Getting him to the bowling alley was, "like pulling teeth." They enrolled him in basketball and soccer, but he frequently ran down the field or court with his hands over his ears. His parents worried about the presence of his peers. They worry about "kids too loud, kids running into him, kids might touch him." Previously, swimming was an enjoyable activity and he would spend 3 h a day in the pool, but now "he can't be in the water." They expressed hope that Timothy will acclimate to the pool so the family can enjoy swimming again. Jared also struggles with swimming. His mom reported that Jared "had an aversion to getting wet. If he got a couple drops of water on his clothes, he would rip them off."

Cognition. A large proportion of individuals on the autism spectrum have lower cognitive abilities (APA, 2013; Block, 2016; USDHHS, 2017b). Of the eight young adults in this study, deficits in cognition were mentioned as a barrier to some modes of physical activities for three of the young adults. Jared has competency in some sport skills, but "he doesn't understand the rules or team playing." Donavan's parents also expressed a concern about Donavan's ability to participate in team sports. Ben's mom expressed concern that Ben "just doesn't know what to do."

Unpredictable behaviors. Charlie's parents stated that his unpredictable behaviors prevent him from participating in certain activities. "If he wants to say something or do something, it's hard to stop him, it's gonna sort of happen." Donavan's parents discussed how the unpredictability is an issue for him. They said, "you never knew what he might say … you just never knew what Donavan was doing, you just had to keep watching him." Andre's parents have been very cautious about the activities they ask him to engage in. They reported that "he doesn't take much for it to turn." They mentioned his behaviors can change quickly and "over something stupid, stuff it wasn't even anything, then he would go off." And since Andre is very large, they were afraid of what he would do when he got really upset. Jared's parents mentioned that the biggest barrier was his unpredictability. "The behavioral issues are probably the main obstacle with him because we rarely get any warning."

Access and opportunities. Five of the eight participants live a city that has a thriving, active, and engaged Special Olympics program and a therapeutic recreation department. However, three of the participants do not live in the city resulting in significant access issues.

Location. Two of the young adults live in a smaller city located 45 min away from the adult day program. This city does not have a Special Olympics program or a community recreation program. The distance to get to a larger city with more access is too far and "not worth the effort" so

these two young adults are not afforded similar PA opportunities. Donavan lives in a town outside the city. His parents report that "it has been hard" getting him to activities, and they "don't take advantage of it [community recreation] like others might." Delaina lives outside the city and while she would like to ride bikes with her son, the city she lives in "is filled with lots of hills and it is difficult to ride bikes." Jared's mother also wished that bike riding was a feasible option for Jared, but they reside close to a busy road and "there is nowhere to go right out of our house." Timothy participates in some Special Olympics programs and there are certain activities that he likes more than others. His parents would like for him to participate in more Special Olympics sports, but "the biggest hassle is getting him there." Before moving to the area, Jared resided in a large city in a different region of the state. He participated in an ice skating program provided by the recreation department. However, when they moved to their new home, "there is no program here." Sandy lives outside the city and mentioned, "we don't have as many activities" as they do in the city.

Discussion

PA is important for all people, but especially for young adults on the autism spectrum. As noted earlier, there has been very limited research examining the implications of the transition from school-based physical education to community-based recreation in young adults on the autism spectrum (Buchanan et al., 2017). However, preliminary research with young adults with other disabilities suggests that this transition leads to young adults with disabilities being less active than they were younger and significantly less active compared to young adults without disabilities (Howlin and Moss, 2012; Kwan et al., 2012). Our results with a select group of young adults on the autism spectrum found six of our eight participants to be very active when given proper support at home and when they live in an area where there are PA programs available. The high number of active participants is contrary to previous research, although not surprising based on the recruitment process followed by the researchers which included recruiting participants from the local Special Olympics program.

Parental support appeared to be the biggest contributor in keeping our sample of young adults on the autism spectrum physically active. This includes encouraging their children to be physically active, transporting their children to places to be physically active, and having the financial means to join health clubs and to pay for local college students to be physically active with their children. If resources are available, the recruitment of local college students to provide supervision may increase PA. College students may be able to provide transportation, support, and supervision. A few participants in this study successfully leveraged the assistance of college peer students. Buchanan et al. (2017) also commented on the support that helped participants have a more successful experience or feel more comfortable in the PA setting. So, a combination of proximity and support seems to be critical in getting young adults on the autism spectrum to be physically active, yet proximity and support can be a real challenge for many parents, particularly those who live in rural areas or who have limited funds.

Our results regarding the positive effect of parental support are similar to results found in studies of after-school PA in children on the autism spectrum (Obrusnikova and Cavalier, 2011) and in young adults with intellectual disabilities (e.g. Taliaferro and Hammond, 2016; Temple and Walkley, 2007). We also found that in a few cases parents proved to be barriers to PA by not encouraging their children to be physically active or providing support in terms of helping their children join programs. Providing information about PA programs and arranging support to help parents get their young adult children on the autism spectrum to these programs may help overcome parental barriers.

Another important finding in this study was how behaviors associated with ASD could serve as a facilitator in some situations and a barrier in other situations. Obsessive focus on maintaining a PA routine facilitated regular participation in PA by several of the participants in our study. Apparently, the often-repeated ASD characteristic of an obsessive need to maintain routines clearly facilitated maintenance of PA. Many parents noted that it took a long time to build PA routines, but once created their children fiercely followed the PA program to completion. On the other hand, other common ASD characteristics such as sensitivity to lights and sounds (which manifested itself in a few participants in fitness clubs), difficulties in social situations (which was reported in unsuccessful attempts at team sport and group activities), gross motor deficits (which made participation in certain sports difficult), and behavioral outbursts toward others prevented young adults from being physically active. Similar challenges were reported in parent interviews with children on the autism spectrum (e.g. Eaves and Ho, 2008; Must et al., 2015; Obrusnikova and Cavalier, 2011; Obrusnikova and Miccinello, 2012). Eaves and Ho (2008) specifically used the general term "ASD symptomatology" when they discussed barriers to PA in adults on the autism spectrum.

People tend to gravitate toward different modes of PA (PAGAC, 2008). Some young adults on the autism spectrum were not able to understand team sports or possess the skills to successfully play. Others could not participate in activities with other people. Our data indicate that an array of available physical activities will increase the odds that individuals on the autism spectrum will engage in a suitable activity. The challenge then is for parents to find a way to take advantage of characteristics associated with

ASD that can actually facilitate regular PA in their adult children on the autism spectrum.

A final important finding in this study, and perhaps the most challenging for parents and those who want to support PA in young adults on the autism spectrum, is the availability of active recreation activities. Buchanan et al. (2017) noted that parents reported how the availability of exercise facilities and public parks was a facilitator for regular PA in their adult children on the autism spectrum. City recreation departments must make every effort to make PA programs accessible for everyone, or they should create programs specific to individuals on the autism spectrum.

Limitations

This study is not without its limitations. All of the participants in this study were male. Females on the autism spectrum may have a different perspective on PA. Five participants were recruited from one location, a day program for young adults with autism that is inherently biased in their selection process. The remaining participants were selected through contacts at Special Olympics and were previously active. All participants resided in a common location. The data collection was limited to one interview and two field observations, which limited the depth and scope of the data.

Conclusion

Parents play a significant role in the PA level of their young adults on the autism spectrum. As their primary caretakers, their attitudes, beliefs, and involvement in physical activities greatly affect their adult children's PA levels and the activities they participate in. Many stereotypical behaviors associated with ASD contribute to the facilitation or hindrance of PA participation. Those on the autism spectrum may have a lack of interest in PA, in general, or certain sports, in particular. They also may perseverate completing activities that many would find insignificant, lack motor control, display aggressive behaviors, have lower cognitive levels that make understanding rules and directions difficult, or may display unpredictable behaviors that raise fear among parents. Finally, access and opportunities affect PA levels in young adults on the autism spectrum. Residing close to programs and the availability of programs played an important role in the physical activities of these young adults on the autism spectrum, and the lack of available programs prevented other participants from engaging in physical activities.

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Appendix 1

Autism spectrum disorder interview questions

1. Do you regularly participate in physical activity? If so, what do you do for activity? We define regularly participating in physical activity as three or more times per week for 30 min or more per session. Our definition of physical activity is: *Moving your arms and/or legs. Your heart beats faster and you breathe harder. If done long enough, you start sweating. For example, walking, jogging, working out at the gym, doing sit-ups, playing a sport such as tennis, soccer or Wii Fit, or dancing.*
2. Have you tried to get your young adult with autism spectrum disorder (ASD) to be physically active with you when you are active? How did that go?
3. Please describe any success stories (if any) you have at getting your young adult with ASD to be regularly physically active?
4. What do you think were some facilitators (helpful things) that enabled you to get your young adult with ASD to be regularly physically active?
5. Please describe any unsuccessful stories (if any) that prevented you in getting your young adult with ASD to be regularly physically active?
6. What do you think were some reasons/challenges that prevented you to get your young adult with ASD to be regularly physically active?