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Enjoyment, Barriers, and Beliefs about Physical Activity among Adolescents With and Without Autism Spectrum Disorder

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Abstract

We compared physical activity enjoyment, perceived barriers, beliefs, and self-efficacy between adolescents with ASD and typically developing (TD) adolescents. A questionnaire was verbally administered to 35 adolescents with ASD and 60 TD adolescents. Compared to TD adolescents, fewer adolescents with ASD enjoyed team sports (65% vs. 95%, $p<0.001$) and physical education (84% vs. 98%, $p=0.02$). A greater proportion of adolescents with ASD perceived that physical activities were too hard to learn (16% vs. 0%, $p<0.01$), and fewer adolescents with ASD believed that physical activity was a way to make friends (68% vs. 97%, $p<0.001$). Fewer adolescents with ASD preferred to do physical activity in their free time (25% vs. 58%, $p<0.01$). Most adolescents with ASD felt that physical activity is fun (84%), but the proportion was lower than TD adolescents (98%, $p=0.03$). Some perceptions about physical activity were similar between the two groups, but differences identified may inform program development.

The physiological and psychological health benefits associated with regular participation in physical activity for youth are well established and include improved health-related physical fitness (Morrow et al., 2013), improved bone health (MacKelvie, Khan, Petit, Janssen, & McKay, 2003), decreased body fat, and reduced depressive symptomatology (US Department of Health and Human Services [USDHHS], 2008a). The Physical Activity Guidelines for Americans recommend that children and adolescents ages 6-17 accumulate at least 60 minutes per day of moderate and vigorous intensity physical activity (USDHHS, 2008b) in order to achieve the health benefits. This activity should include aerobic activity and muscle- and bone-strengthening activities appropriate for a person's age. Despite strong evidence to support the health-related benefits of physical activity, American youth overall are not sufficiently active (Eaton et al., 2008; Troiano et al., 2008).

Children and adolescents with autism spectrum disorder (ASD) are no exception to the downward trends in physical activity. Recent research supports that youth with ASD do not

achieve the minimum recommendations and are less physically active than typically developing (TD) youth (Bandini et al., 2013; Obrusnikova & Cavalier, 2011; Tyler, MacDonald, & Menear, 2014). Further, a decline in physical activity with age has been observed among children and adolescents with ASD (Memari, Ghaheri, Ziaee, Kordi, Hafizi, & Moshayedi, 2012; Pan & Frey, 2006; MacDonald, Esposito, & Ulrich, 2011). These low physical activity levels likely contribute to the poor health-related fitness (Pan, 2014; Tyler et al., 2014) and high rates of overweight and obesity identified in youth with ASD (Broder-Fingert, Brazauskas, Lindgren, Iannuzzi, & Van Cleave, 2014; Curtin, Anderson, Must, & Bandini, 2010; Egan, Dreyer, Odar, Beckwith, & Garrison, 2013). Given the importance of physical activity for improving the health and wellbeing of youth with disabilities (Rimmer & Rowland, 2008), additional research is needed to understand and promote it among subgroups such as those with ASD (Sorensen & Zarrett, 2014). The unique benefits that physical activity may afford youth with ASD have been summarized in review papers (Lang, Koegel, Ashbaugh, Regester, Ence, & Smith, 2010; Sorenson & Zarrett, 2014) and a meta-analysis (Sowa & Muelenbroek, 2012) and include improved social skills, self-regulation, behavioral skills, and academic performance, as well as decreases in disruptive and stereotyped behavior. These benefits underscore the need to study and understand this behavior.

There have been only a few research efforts to explain the low physical activity levels of youth with ASD. Obrusnikova & Cavalier (2011) used Photovoice methodology to examine perceived barriers and facilitators to afterschool physical activity in children with ASD ages 8-14. The most frequently reported barriers included time spent engaging in sedentary activities (i.e., playing video games, watching television), feeling tired, feeling bored with physical activity, lack of a peer partner, lack of parent time, inclement weather, lack of transportation, and lack of/unsafe equipment. Parent-reported barriers for children with ASD include child's lack of motivation/interest, lack of time, engagement in sedentary activities, parent lack of time, lack of peers with whom to engage, lack of community programs available, and inclement weather (Obrusnikova & Muccinello, 2012). Similarly, Pan & Frey (2005) found that time spent in sedentary pursuits was negatively correlated with physical activity among youth with ASD. Given the importance of understanding the factors that influence physical activity behavior for developing and improving interventions (Baumann et al., 2012), there is a need to study these factors in youth with ASD more thoroughly. The correlates and determinants of physical activity among TD children have been extensively reviewed (e.g., Baumann et al., 2012; Sallis, Prochaska, & Taylor, 2000; Uijtdewilligen et al., 2011) and examples of consistent influences on participation include: previous engagement in physical activity, self-efficacy, gender, age, family social support, available opportunities, and physical competence. There have been no studies to determine whether the physical activity correlates identified for TD youth are generalizable to adolescents with ASD. The extent to which the factors associated with participation are shared or different between TD youth and those with ASD can help to determine the need for specially tailored interventions for adolescents with ASD and/or the appropriateness of existing programs for inclusion. A comparison of these two groups may be particularly salient in light of the known differences in physical activity levels.

The objective of this study was to assess physical activity enjoyment, perceived barriers, beliefs, and self-efficacy among adolescents with ASD and to determine whether these factors differ from TD adolescents. Given that adolescents with ASD should have opportunities to express their own feelings, beliefs, and perceptions, we sought to directly query these youth through an interview instead of relying on proxy reporting by a parent. The importance of self-reporting in individuals with a disability has been emphasized in previous work (Potvin, Snider, Prelock, Kehayia, & Wood-Dauphinee, 2013; Verdugo, Schalock, Keith, & Stancliffe, 2005). It seems that adolescents themselves would most accurately report their feelings about physical activity which would be valuable for informing future programs. Considering the disparities in physical activity participation that have been identified between adolescents with ASD and TD adolescents, we expected that those with ASD would report more barriers to physical activity, lower enjoyment, and lower self-efficacy.

Method

Participant Recruitment and Enrollment

Adolescents with ASD ages 13-21 and TD adolescents ages 13-18 participated in the study. The age limit was slightly higher in the ASD group because youth with disabilities are permitted to remain in school until they turn 22 years of age, and our inclusion criteria required that participants be enrolled in middle or high school. Informed consent was obtained from a parent and adolescents aged ≥18 years who were under their own guardianship. Adolescents aged ≤18 years and those ≥18 years but under guardianship indicated their willingness to participate by signing an assent form. Consent and assent forms used simple explanations and were read out loud to the adolescents in the presence of a parent. Participants were required to be in good health and were excluded from participating if they had any of the following conditions: chronic illness such as heart disease or cancer; physical disability such as cerebral palsy, spina bifida, or muscular dystrophy; schizophrenia or psychosis; or an acute or chronic injury at the time of screening that would limit typical physical activity. Adolescents were required to be verbally communicative and to reside at home with a parent. The study protocol and all materials were approved by the university Institutional Review Board for the protection of human subjects.

Adolescents with ASD throughout the state were recruited for participation from several sources, including schools for children with ASD, disability service agencies (e.g. area Arc offices), community organizations, Special Olympics, special education parent advisory councils, Craigslist™, newspapers, from an in-house database of participants from previous studies, and with the assistance of the Interactive Autism Network (IAN) Research Database at the Kennedy Krieger Institute and Johns Hopkins Medicine. TD adolescents were recruited through many of these same outlets as well as general community-based agencies and organizations. Recruitment materials were provided to organizations and families through email, mail, listservs, websites, bulletin boards, and in person at community events or conferences. Interested parents contacted the study coordinator directly.

The screening and enrollment protocol involved an initial telephone interview with a parent to determine the eligibility of the adolescent to participate in the study followed by a 1-2 hour study visit. Parents of adolescents with ASD also completed the Autistic Diagnostic Interview, Revised (ADI-R) (Rutter, Le Couteur, & Lord, 2003) to verify their child's autism status prior to the study visit. For inclusion in the study, adolescents needed to meet the cut-off scores in the Reciprocal Social Interactions domain (cut-off score is 10) and at least one other domain (i.e., Language/Communication [cut-off score is 8] and/or Repetitive Behaviors/Interest [cut-off score is 3]). Adolescents with ASD completed the Kaufman Brief Intelligence Test, 2nd edition (KBIT-2; Kaufman & Kaufman, 2004), and their parents completed the Vineland Adaptive Behavior Scales II (VABS-II; Sparrow, Balla, & Cichetti, 2005) to assess their child's level of adaptive functioning. We used this information to characterize the sample.

Measurement Instrument

A questionnaire was used to gather information directly from adolescents about factors that may influence their participation in physical activity. A validated instrument to measure physical activity correlates among youth with ASD has not been developed, therefore, a questionnaire that we developed for an equivalent study involving adolescents with an intellectual disability (under review) was used. Considering that there are similarities in the common traits associated with ASD and intellectual disability (e.g., limitations in communication/language and social interaction), it was determined appropriate to use a questionnaire developed for adolescents with an intellectual disability for this study of adolescents with ASD.

Items and constructs found in existing questionnaires in the scientific literature were used to develop an appropriate instrument for this population (Heller, Rimmer, & Rubin, 2010; Motl et al., 2001; Salmon, Owen, Crawford, Bauman, & Sallis, 2003; Ward et al., 2006; Wu & Pender, 2002). Social Cognitive Theory (Bandura, 1986) and the social-ecological model (Brofenbrenner, 1994; Sallis, Owen, & Fisher, 2008) guided the selection of specific items for the questionnaire which addressed physical activity enjoyment, perceived barriers, beliefs, and generalized self-efficacy. Our interdisciplinary research team used its extensive experience and knowledge with youth with developmental disabilities to modify and refine questions to ensure clarity for adolescents with cognitive and communication limitations. Since "physical activity" is a broad and relatively abstract term that may be difficult for adolescents with intellectual disabilities or ASD to conceptualize, the phrase "sports and exercise" was used. The questionnaire comprised close-ended questions and was designed to be administered as a structured interview with questions being read out loud to participants and response choices recorded by the interviewer. The questionnaire was developed to be easily answerable without relying on an adolescent's ability to interpret and/or communicate abstract concepts. As such, we opted for close-ended questions and simple forced-response choices to make it easier for adolescents to report their answers. Since the study aimed to compare adolescents with ASD and TD adolescents, the items included on the questionnaire were those that could be applicable to both groups.

The questionnaire included 33 items. Of those, 9 items targeted physical activity enjoyment and preferences for where and with whom youth participate. Examples of these questions included: “How much do you like to go for a walk?” and “How much do you like participating in gym class at school?” There were 3 questions on enjoyment of non-physical activities: watching television and playing video games, reading, and arts & crafts. The maximum number of response choices for each question was limited to three and included simple, concrete options. For the enjoyment questions, the response choices were: “Like it”, “It’s okay”, and “Don’t like it”. Twelve questions targeted perceived personal, social, and environmental barriers to physical activity such as: “Are you ever too busy to do sports and exercise?”; “Are you ever afraid of getting hurt doing sports and exercise?”; “Do you think that sports and exercise are too hard to learn?”; and “Do you think it is ever too hot or cold to do sports and exercise?” As noted, although adolescents with ASD may experience unique barriers to participation directly associated with their disability, the questionnaire addressed barriers that were relevant to both adolescents with ASD and TD adolescents in order to make comparisons between the groups. The perceived barrier questions were two-tiered. The first part of the question asked, for example: “Are you ever bothered by how you look when you’re doing sports and exercise?” or “Do you ever think that sports and exercise are boring?” When a participant responded “Yes” to the first question, they were asked a second, follow-up question: “Does that stop you from participating a lot?” The response choices were “Yes” and “No”. This two-tiered approach allowed us to distinguish whether a factor such as being “bothered by how you look” actually hindered participation in physical activity, or if it was simply acknowledged by an adolescent but did not influence their behavior. Two questions asked about whether participants had a pet (considered a facilitator of physical activity; Martin, Wood, Christian, & Trapp, 2014), and whether they walked, biked, ran, or played catch with their pet. Four questions targeted beliefs about physical activity. Examples of these questions included: “Do you think sports and exercise are good for you?” and “Do you think that doing sports and exercise is a way to make new friends?” Once again, the response choices for these questions were “Yes” and “No”. The final three questions addressed generalized self-efficacy; for example: “How good are you at doing sports and exercise?” Participants had the options to choose “Very good”, “Okay”, and “Not good” for the self-efficacy questions.

Prior to data collection, the questionnaire was pilot-tested with four adolescents with an intellectual disability and six TD adolescents to verify the clarity of all questions and to test the interview procedures. Participants were asked for their feedback on the questionnaire and were debriefed to assess whether any of the instructions, questions, or response choices were unclear or hard to answer. The wording of questions and instructions were refined based on this pilot test, and two items were removed: “How much do you like doing puzzles, playing board or card games?”, and “Do people ever make fun of you when you do sports and exercise?” Although pilot testing was not conducted on participants with ASD because this group was added to the larger study after the pilot testing, about half of participants with ASD did complete the questionnaire twice in an assessment of reliability (see below).

Interview Procedures

The questionnaire was verbally administered by a trained research assistant on a one-on-one basis in a private room and took 20-30 minutes to complete. Participants were compensated for their involvement in the study with a gift card. All interview procedures, including the instructions given to participants, pace and tone of questioning, and establishing rapport with participants were standardized and care was taken not to provide feedback or to lead participants toward a given response. Visual materials were developed and used to assist with communication during the interview, if needed. For a subset of questions, a card with the printed response choices (e.g., the word “Yes” or “No”) gave participants the option of pointing to their selection in text rather than verbalizing it. Participants could also refer to the card if they needed a reminder of the response choices. In addition to the printed text, some response choices included a corresponding symbol (e.g., smiling face to indicate “Like it”) to clarify the option. If it was judged that a participant failed to understand the intended meaning of a question, the interviewer marked the response as invalid. Observable behaviors and cues during the interview were used to assist in making this judgment, such as an unusually long pause before responding to a question, a rapid response before the interviewer had completed asking the question, high levels of distraction or inattention while a question was asked, and/or consistently responding “I don’t know” when a question was repeated. Any response that was marked as invalid by the interviewer was excluded from further analysis. If more than 20% of the responses (i.e., ≥7 of the 33 questions) were marked as invalid for a given participant, the entire interview was excluded from analysis.

Test-retest reliability of the questionnaire was assessed by comparing the responses from a subset of participants (n=15 with ASD; n=20 TD) who repeated the interview within 14-21 days. A question was considered reliable when kappa > 0.60 and/or percent agreement ≥80% (Hinkley et al., 2012). Of the original 33 questions, 26 questions met these reliability criteria for both adolescents with ASD and TD adolescents. The 7 questions that were eliminated from further analysis included: 2 questions on physical activity enjoyment, 2 questions on barriers to physical activity, and all 3 of the questions on generalized self-efficacy. The final 26 questions for the analysis included: 7 on physical activity enjoyment, 3 on enjoyment of non-physical activities, 10 on barriers to physical activity, 2 on whether the participant had a pet and if they were active with their pet, and 4 on physical activity beliefs.

Statistical Methods

Participant characteristics were summarized with proportions and compared by chi-square tests. All of the variables on the questionnaire were categorical. Preference questions that used a 3-tier response scale of “Don’t like it”, “It’s okay”, or “Like it” were dichotomized into “Don’t like it” vs. “Okay/Like it”. We tested the statistical significance of differences in response proportions between the groups using Pearson chi-square or Fisher’s exact test (when expected cell sizes were very small). The two-part questions that queried physical activity barriers and their impact on participation were analyzed as separate items. Results where $p<0.05$ were considered to be statistically significant. Analyses were performed in SAS version 9.2 and IBM SPSS Statistics Version 20.

Results

Thirteen participants were determined to be ineligible for participation either during the phone screen or at the enrollment visit. The reasons for ineligibility were that the adolescent: did not have a formal diagnosis of ASD/did not meet criteria on the ADI-R (n=3); had a physical disability or sensory impairment (n=4); was outside of the age range (n=3); or was out of high school/had a residential school placement (n=3). Thirty-five adolescents with ASD (29 males, 6 females) and 60 TD (36 males, 24 females) adolescents completed the study, however, three participants were excluded from the analysis of the questionnaire (n=32). Two participants had a high number of invalid questions (one had 10 invalid questions and one had 22 invalid questions) and one participant did not respond to any interview questions. These three participants were included in the summary of participant characteristics (Table 1, n=35). The sample was predominantly white and over 70% of parents of adolescents in this study were college-educated. Of those non-white participants, 7 were black (6 TD, 1 ASD), 3 were Hispanic/Latino (1 TD, 2 ASD), 6 were Asian (4 TD, 2 ASD), and 9 indicated that they belonged to other or mixed racial/ethnic categories (8 TD, 1 ASD). Adolescents with ASD had an average IQ score of 78; approximately half (51.4%) were also classified as having an intellectual disability (i.e., composite KBIT and Vineland scores of ≤75) (Table 1). Adolescents with ASD were slightly older than TD adolescents (15.9 years vs. 15.3 years, p=0.06), and were more likely to be male (83% vs. 60%, p=0.02).

The distributions of responses to questions about physical activity enjoyment and their differences in the two groups are presented in Table 2. Enjoyment of walking and participating in individual sports (“sports that you can do by yourself”) did not differ significantly between TD adolescents and adolescents with ASD. A slightly greater preference for doing yard work/housework was observed among adolescents with ASD, though this difference was of borderline significance (69% vs. 50%, p=0.08). More adolescents with ASD reported that they “Don’t like” participating in gym class at school compared to TD adolescents (16% vs. 2%, p=0.02). Adolescents with ASD were also more likely to indicate a dislike for team sports (35% vs. 5%, p <0.001). When asked “When you have the choice, what would you rather do in your free time?”, 25% of adolescents with ASD selected “sports or exercise” **and 75% selected “something else”.** Among TD adolescents, 58% selected “sports or exercise” (p<0.01). Most adolescents in both groups reported that participating in sports and exercise was “A lot of fun” (59% of ASD vs. 75% of TD), but there was a significant difference between the groups on this item (p=0.03).

The questionnaire included three questions on enjoyment of non-physical activities: watching television and playing video games, reading, and arts and crafts. There were no significant differences in the proportions of adolescents who reported enjoyment of television and video games (97% ASD and 100% TD, p=.35) or reading (81% ASD and 82% TD, p=0.91) using the dichotomized variable (“don’t like it” vs. “okay/like it”). The difference in the proportion of adolescents who reported liking arts and crafts was non-significant, but approached statistical significance (87% ASD and 72% TD p=0.10).

Several significant group differences on the items that queried adolescents about their beliefs about physical activity emerged (Table 3). Adolescents with ASD were less likely to

report that sports and exercise is “a way to make friends” (68% vs. 97%, p<0.001). Adolescents with ASD were somewhat less likely to think that “sports and exercise will make them feel good” (81% vs. 95%, p=0.06). When asked “Would you like to do more sports and exercise?”, 59% of adolescents with ASD answered positively compared to 82% of TD adolescents (p=0.02). The groups did not differ in their belief about whether sports and exercise were “good for them.”

The responses to questions about barriers to participation in physical activity and their differences in the two groups are presented in Table 4. Adolescents with ASD were more likely to report that they were “afraid of getting hurt during sports and exercise” (54% vs. 33%, p=0.07). Among those who indicated a fear of getting hurt, a much higher percentage of adolescents with ASD indicated that this would stop them from participating in sports and exercise compared to TD adolescents (73% ASD vs. 10% TD, p<0.001). None of the TD adolescents and few (16%) of adolescents with ASD felt that “sports and exercise are too hard to learn,” but this was a significant difference (p<0.01). A fairly similar proportion of adolescents in both groups reported that they are “bothered by how they look while doing sports and exercise” (30% of ASD vs. 25% of TD, p=0.61). Among those who were bothered by how they look, more adolescents with ASD reported that this negatively affected their participation (56% vs. 13%, p=0.06). Equal percentages of TD adolescents and adolescents with ASD reported that it was sometimes too hot or cold (outside) to do sports and exercise (52% each, p=0.99). However, among those who responded positively, significantly more adolescents with ASD indicated that it stopped their participation (94% vs. 39%, p>0.001). Most adolescents with ASD (81%) and TD adolescents (93%) indicated that they usually have someone to do sports and exercise with (p=0.08). We observed no statistically significant difference in the proportion of adolescents between the groups who reported that they: “are ever too busy to do sports and exercise”, “think sports and exercise is boring”, **“**think you are good at doing sports and exercise”, or “usually have a place to do sports and exercise”.

Discussion

We examined physical activity enjoyment, perceived barriers, and beliefs through direct reporting by adolescents with ASD, and sought to determine if the factors they identified differed from those reported by TD adolescents. Overall, adolescents with ASD enjoy participating in physical activity, have positive beliefs about physical activity, and report factors known to facilitate participation in physical activity. However, the adolescents with ASD in this study also perceived several barriers that seemingly inhibit their participation in physical activity. Differences did exist between adolescents with ASD and TD adolescents on several of the interview items. These differences may help to explain the known disparities in physical activity levels between these groups and also are useful for informing program development.

The majority of adolescents with ASD reported that they enjoy going for a walk, participating in gym class, and doing individual physical activities. Most adolescents with ASD also felt that doing physical activity is good for them, will make them feel good, and is fun. These positive perceptions suggest that adolescents with ASD would readily embrace

opportunities to engage in physical activity. This is supported further by the fact that over half of the adolescents with ASD indicated that they would like to do more physical activity then they are presently doing. Considering that youth with ASD may experience a lack of access to physical activity opportunities (Pan & Frey, 2006; Rosser Sandt & Frey, 2005), efforts are needed to increase the availability of appropriate programs for these youth. Service providers are encouraged to include adolescents with ASD in existing school and community programs through providing the facilitators necessary to promote their success. Such facilitators could involve offering a range of activities and supports, reducing/eliminating attitudinal, physical, or policy barriers, partnering with families and/or disability organizations, training staff, and respecting individual differences. It is notable, though not surprising, that adolescents with ASD reported lower enjoyment of group physical activities (i.e., gym class and team sports) compared to TD adolescents, and were less inclined to feel that physical activity is a way to make friends. The social limitations associated with ASD may influence the feelings of these adolescents toward group activities and developing friendships. Despite these differences, well-designed inclusive programs that offer activity choices and support have the potential to meet the needs and preferences of all participants.

Adolescents with ASD expressed enjoyment of watching television and playing video games. This finding was expected in light of a recent study found that children and adolescents with ASD spent even more time viewing television and playing video games compared to their TD siblings (Mazurek & Wenstrup, 2013). Children with ASD generally spend more time in sedentary behavior than TD children which is likely due to additional screen time (Must et al., 2014). In the present study, 75% of adolescents with ASD indicated that they would prefer to do something other than physical activity in their free time. It is reasonable to assume that at least some of those adolescents would prefer to watch television. Engaging in these sedentary activities has been identified as a barrier to physical activity in previous work on children with ASD (Obrusnikova & Cavalier, 2011), and time spent in sedentary pursuits has been negatively associated with physical activity (Memari et al., 2012; Pan & Frey, 2005). Creative strategies are needed to increase the success and enjoyment of youth with ASD in physical activity so that it may become a preferred pursuit in their free time over screen time. Success and enjoyment are more likely to be realized when adolescents with ASD are offered a choice of activities, individualized instruction, and the necessary supports. For example, activities that combine technology and physical activity, such as active video gaming, may be particularly appealing to adolescents with ASD.

Of the barriers that were addressed in the interview, those most frequently reported by adolescents with ASD were that they were too busy to do physical activity, physical activity was boring, they were afraid of getting hurt, and it was too hot or cold to do physical activity. Feeling bored with physical activity and inclement weather have both been previously reported by children with ASD as barriers to physical activity (Obrusnikova & Cavalier, 2011), and parents reported that their child being too busy was also a barrier (Obrusnikova & Muccinello, 2012). An essential next step may be to identify and test strategies for overcoming the intrapersonal barriers so that adolescents with ASD may more easily engage in physical activity. Being too busy (i.e., lack of time) was also reported by the TD adolescents in this study as a barrier to physical activity. Schoolwork, employment,

extracurricular activities, and family responsibilities all place demands on the time of adolescents, and those with ASD may have additional burdens associated with therapy and/or medical appointments. Making physical activity a priority is likely to involve a commitment by families to adjust schedules and to build participation into a regular routine. For adolescents, this may involve reducing screen time to create time for physical activity. Finding physical activity boring may suggest that these adolescents have not had positive and/or rewarding experiences in physical activities. It may also indicate that adolescents with ASD were not regularly offered a variety of options for physical activity so they had limited opportunities to select a preferred activity. Once again, providing adolescents with ASD a range of activities and supports may increase their motivation and interest in physical activity.

A fear of getting hurt during physical activity could be partly attributed to overprotection by parents and/or service providers who may have concerns about safety. Not knowing how to engage in activities or use equipment, difficulty following rules, and/or having poor motor skills have been reported as barriers to physical activity among youth with disabilities (Shields, Synnot, & Barr, 2012; Yazdani, Yee, & Chung, 2013) and may also increase to a fear of getting hurt especially as games and sports get more complex in adolescence. It is important that parents are knowledgeable about the available options so that they may advocate for programming that meets the needs and skill level of their child. Additionally, participating in physical activity as a family may reduce fears and promote enjoyment.

A large proportion of adolescents with ASD indicated that they are good at doing physical activity, have someone with whom to do physical activity, have a place to do physical activity, and have a way to get to that place, all of which can be considered factors that facilitate physical activity participation. These positive findings imply that the adolescents with ASD in this study were confident in their ability to be physically active and felt that they had some level of social and environmental support. While this is encouraging and should be considered in efforts to promote physical activity among adolescents with ASD, a lack of transportation to programs and a lack of a peer exercise partner were barriers to physical activity participation reported previously by children with ASD (Obrusnikova & Cavalier, 2011). It may be that the families in our study had more resources available to them and were able to offer their child additional support, therefore, it cannot be assumed that all youth with ASD are receiving these supports.

The findings of this cross-sectional study should be considered in light of its limitations and strengths. The study was based on small non-representative samples of adolescents with ASD and TD adolescents, which may not reflect the respective source populations. Further, there were only 6 females with ASD in our sample which was inadequate to explore sex differences. Although efforts were made to recruit a sample with socioeconomic and racial/ethnic diversity, the final sample was predominantly white and well-educated. As such, the generalizability of the results is limited. Also, seven of the items on the questionnaire, including all three that addressed self-efficacy, did not meet the criteria for reliability and were not included in the analysis. While the omission of these questions was necessary to ensure that the overall interview was reliable, the consequence is that some potentially meaningful correlates were not examined.

Future research is needed to examine additional factors that could hinder or facilitate physical activity behavior among youth with ASD. Studies that examine the concordance of perceived barriers among youth and their parents may also assist in addressing those factors that inhibit participation. Longitudinal observational studies and experimental studies that are consistent with cause-and-effect associations among various factors and physical activity behavior in youth with ASD are needed for effective program design in community settings.

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Table 1

Comparison of Characteristics between Adolescents with ASD and TD Adolescents

	TD Adolescents (n=60)	Adolescents with ASD (n=35)	
	Mean (SD) or %	**Mean (SD) or %**	**p-value**
Age (y)	15.3 (1.5)	15.9 (1.7)	0.06
KBITIQ	--	78.0 (28.0)	--
Vineland ADAP Composite[a]	--	62.5 (12.1)	--
Male (%)	60% (n=36)	83% (n=29)	0.02
At least 1 parent with college degree	82% (n=49)	71% (n=24)	0.22

[a] n=29

Table 2

Enjoyment of Physical Activities

	TD (n=60)	ASD (n=32)	Difference in Proportions[a]	
	n (%)	n (%)	% (95% CI)	p-value
Walking				
Don't Like It	4 (6.7)	4 (12.5)	−5.8 (−18.9,7.3)	0.44[b]
It's Okay/Like It	56 (93.3)	28 (87.5)		
Yard Work/Housework				
Don't Like It	30 (50.0)	10 (31.3)	18.7 (−1.7,39.2)	0.08
It's Okay/Like It	30 (50.0)	22 (68.7)		
Gym Class				
Don't Like It	1 (1.7)	5 (16.1)	−14.4 (−27.8,−0.99)	0.02[b]
It's Okay/Like It	56 (98.3)	26 (83.9)		
Team Sports				
Don't Like It	3 (5.0)	11 (35.5)	−30.5 (−48.2,−12.8)	<0.001[b]
It's Okay/Like It	57 (95.0)	20 (64.5)		
Individual Sports and Exercise				
Don't Like It	3 (5.0)	3 (9.4)	−4.4 (−15.9,7.1)	0.42[b]
It's Okay/Like It	57 (95.0)	29 (90.6)		
What would you rather do in your free time?				
Sports /Exercise	35 (58.3)	8 (25.0)	33.3 (13.8,52.8)	<0.01
Something Else	25 (41.7)	24 (75.0)		
How much fun do you have doing sports /exercise?				
No Fun at All	1 (1.7)	5 (15.6)	−13.9 (−26.9,−0.97)	
Some Fun	14 (23.3)	8 (25.0)	−1.7 (−20.1,16.7)	0.03[b]
A Lot of Fun	45 (75.0)	19 (59.4)	15.6 (−4.6,35.8)	

Sample sizes may vary slightly due to missing values

[a] Difference (TD-ASD) calculated for row 1 response choice (i.e., "Don't Like It" and "Sports/Exercise")

[b] p-value from Fisher's exact test

Table 3

Beliefs about Physical Activity

	TD (n=60)	ASD (n=32)	Difference in Proportions[a]	
	n (%)	**n (%)**	**% (95% CI)**	**p-value**
Do you think sports and exercise are good for you?				
Yes	60 (100)	31 (96.9)	3.1 (−2.9,9.2)	0.35[b]
Do you think sports and exercise is a way to make friends?				
Yes	58 (96.7)	21 (67.7)	29.0 (11.9,46.0)	<0.001[b]
Do you think doing sports and exercise will make you feel good?				
Yes	57 (95.0)	25 (80.7)	14.3 (−0.61,29.3)	0.06[b]
Would you like to do more sports and exercise?				
Yes	49 (81.7)	19 (59.4)	22.3 (2.7,41.9)	0.02

Sample sizes may vary slightly due to missing values

[a] TD-ASD

[b] p-value from Fisher's exact test

Table 4

Perceived Barriers to Physical Activity

	TD (n=60)	ASD (n=32)	Difference in Proportions[a]	
	n (%)	n (%)	% (95% CI)	p-value
Are you ever too busy to do sports and exercise?				
Yes	33 (55.0)	17 (54.8)	0.2 (−21.4,21.7)	0.98
Stops participation	13 (39.4)	11 (64.7)	−25.3 (−53.5, 2.9)	0.09
Do you think that sports and exercise are boring?				
Yes	22 (36.7)	14 (46.7)	−10.0 (−31.6,11.6)	0.36
Stops participation	11 (50.0)	10 (71.4)	−21.4 (−53.0,10.1)	0.20
Are you ever afraid of getting hurt doing sports and exercise?				
Yes	20 (33.3)	15 (53.6)	−20.2 (−42.2,1.8)	0.07
Stops participation	2 (10.0)	11 (73.3)	−63.3 (−89.3,−37.4)	<0.001
Do you think that sports and exercise are too hard to learn?				
Yes	0 (0)	5 (16.1)	−16.1 (−29.1,−3.2)	<0.01[b]
Stops participation	0	2 (40.0)	n/a	n/a
Are you ever bothered by how you look when you're doing sports and exercise?				
Yes	15 (25.0)	9 (30.0)	−5.0 (−24.7, 14.7)	0.61
Stops participation	2 (13.3)	5 (55.6)	−42.3 (−78.9,−5.5)	0.06[b]
Is it ever too hot or cold to do sports and exercise?				
Yes	31 (51.7)	16 (51.6)	−0.1 (−21.6,21.7)	0.99
Stops participation	12 (38.7)	15 (93.7)	−55.0 (−75.9,−34.2)	<0.001
Do you think you are good at doing sports and exercise?				
No	11 (18.6)	7 (22.6)	−4.0 (−21.7,13.8)	0.66
Stops participation	3 (33.3)	5 (71.4)	−38.1 (−83.6,7.4)	0.31[b]
Do you usually have someone to do sports and exercise with?				
No	4 (6.7)	6 (19.4)	−12.7 (−28.0,2.6)	0.08[b]
Stops participation	0	3 (60.0)	−60.0 (−100,−17.1)	0.17[b]
Do you usually have a place to do sports and exercise?				
No	5 (8.3)	5 (15.6)	−7.3 (−21.7,7.1)	0.31[b]
Stops participation	1 (20.0)	3 (75.0)	−55.0 (−100.0,0.04)	0.21[b]
You said you have a place to do sports and exercise. Do you have a way to get to that place?				
Yes	54 (98.2)	23 (88.5)	9.7 (−3.1,22.5)	0.09[b]
Do you have a pet?				
Yes	43 (71.7)	24 (77.4)	−5.7 (−24.4,12.9)	0.56
If you have a pet, do you walk, run, bike, or play catch with your pet?				
Yes	24 (57.1)	14 (58.3)	−1.2 (−26.0,23.6)	0.93

*Sample sizes may vary slightly due to missing values

[a]TD-ASD

[b] p-value from Fisher's exact test