

Promoting Physical Activity for **Students with Autism Spectrum Disorder:** *Barriers, Benefits, and Strategies* **for Success**

KRISTI S. MENEAR
WILLIAM H. NEUMEIER

A number of reports have indicated that overweight, obesity, and inactivity occur at higher rates in individuals with autism spectrum disorder (ASD) than in the general population (Curtin, Anderson, Must, & Bandini, 2010; Curtin, Bandini, Perrin, Tyber, & Must, 2005; Egan, Dreyer, Odar, Beckwith, & Garrison, 2013; Phillips et al., 2014; Rimmer, Yamaki, Lowry, Wang, & Vogel, 2010; Todd, Reid, & Butler-Kisber, 2010). Many children with ASD fall short of the nationally recommended physical activity levels (Bandini et al., 2013; Feehan et al., 2012;

Pan & Frey, 2006), largely due to issues with social impairment, emotional regulation, physical regulation, common attributes of individuals on the autism spectrum, and below-optimal motor

Kristi S. Menear (kmenear@uab.edu) is an associate professor and department chair in the Department of Human Studies, and William H. Neumeier is a doctoral student in the Lifespan Developmental Psychology Program and a pre-doctoral trainee at the UAB Nutrition & Obesity Research Center, at the University of Alabama at Birmingham in Birmingham, AL.



skills and fitness levels (Obrusnikova & Cavalier, 2011; Pan, 2014; Srinivasan, Pescatello, & Bhat, 2014; Staples & Reid, 2010). The purposes of this article are to (1) review factors that can improve the physical activity statistics of students with ASD, (2) outline the researched benefits of physical activity for students with ASD, and (3) summarize strategies for success in physical education.

Barriers to Physical Activity in Students with ASD

The higher rates of overweight, obesity, and inactivity in students with ASD can be attributed to a number of factors ranging from sensory stimulation and social anxiety to physical barriers and disabilities (Obrusnikova & Cavalier, 2011). Other identified factors include psychopharmacological treatment, genetics, disordered sleep, and atypical eating patterns (Curtin, Jojic, & Bandini, 2014). More severe autism and intellectual disability have also been viewed as contributing factors (D. Green et al., 2009; Ho, Eaves, & Peabody, 1997).

Poor or delayed motor skills appear to heavily affect physical activity in individuals with ASD, including fitness and motor skill components such as hand-eye coordination, perceptual issues, and difficulties with balance (Meneer, Smith, & Lanier, 2006; Fournier, Hass, Naik, Lodha, & Caurough, 2010; Pan, 2014; Provost, Lopez, & Heimerl, 2007; Srinivasan et al., 2014). These differences in coordination and motor skills in students with ASD have been observed and reported by parents, teachers, and other caregivers (Provost et al., 2007). In fact, the majority of children with ASD display weaknesses in posture, movement, and strength (Kurtz, 2008). This lack of motor coordination can be frustrating for a child with ASD as he or she struggles to keep up with his or her peers in physical activity. The child may fall behind when participating in group activities because of the competitive or ongoing nature of the activities.

Difficulties with motor coordination may be partially explained by biological differences in the brain of individuals with ASD. These biological differences have been investigated via neuroimaging studies, which have discovered structural brain differences between individuals with ASD and individuals without ASD. Neuroimaging research on persons with ASD is ongoing, making it difficult to currently pinpoint specific neurological effects on an individual basis (Lenroot & Yeung, 2013; Maximo, Cadena, & Kana, 2014). Whether these structural brain differences are causes or results of ASD is unknown. Structural differences, as well as the behaviorally expressed symptoms of ASD, may contribute to the barriers faced by individuals with ASD when approaching physical activity.

Situations and environments that demand social understanding or that lack structure can be very challenging for individuals with ASD, and, as a result, these situations can lead to isolation, outbursts, depression, and higher stress levels (Goodwin et al., 2006). Physical activities and organized sports or play often present difficult scenarios for students with ASD (Meneer & Smith, 2008; Obrusnikova & Dillon, 2011; Ohrberg, 2013), which results in reduced participation. Similarly, children with ASD who engage in peer interactions less often than typical peers are also less physically active (Pan, Tsai, & Hsieh, 2011). In physical activity settings such as physical education, a child with ASD may have difficulty following activity-specific rules, particularly when learning

a new activity; keeping pace with the speed of a game and with how the players' roles may change throughout the game (i.e., moving from offense to defense); or interpreting and responding to multiple methods of communication used by teammates (e.g., hand movements, verbal cues, signs of disappointment, celebrations).

Benefits of Physical Activity for Students with ASD

Biological Benefits. Physical activity has been linked to cognitive performance. Neuroimaging (fMRI) studies have also demonstrated that higher fitness levels in children are associated with increased hippocampal and dorsal striatum volume, areas of the brain associated with attention span, focus, and problems involving response and motor coordination (Chaddock, Erickson, Prakash, Kim, et al., 2010; Chaddock, Erickson, Prakash, VanPatter, et al., 2010). An overall analysis of 59 articles published between 1947 and 2009 showed significant improvements in achievement and cognitive scores for children with higher physical activity levels (Fedewa & Ahn, 2011). Therefore, there is reason to believe that these same benefits can be seen in children with ASD (Nicholson, Kehle, Bray, & Van Heest, 2011; Srinivasan et al., 2014), though further investigation is needed into biological changes in children with ASD following exercise training.

Behavioral Benefits. Research investigating physical activity in students with ASD has shown behavioral improvements. Physical activity intervention studies have shown that a jogging exercise led to decreases in maladaptive behaviors for approximately 40 minutes following the exercise, and further research with exercise interventions supports the claim that exercise decreases disruptive behaviors in the short term for children with ASD (Celiberti, Bobo, Kelley, Harris, & Handelman, 1997; Petrus et al., 2008; Rosenthal-Malek & Mitchell, 1997; Oriol, George, Peckus, & Semon, 2011). In addition, cycling has been shown to develop self-efficacy (Todd et al., 2010) and playing active video games has been shown to decrease repetitive behaviors (Anderson-Hanley, Tureck, & Schneiderman, 2011). Therefore, exercise may not only provide overall

© iStockphoto/CEFuture



health and wellness benefits but may also improve undesirable behaviors exhibited by students in this population (Srinivasan et al., 2014).

Improvements in attention span, social behavior, and learning have also been shown in individuals with ASD following aerobic exercise. Running for 45 minutes had a positive effect on attention span and impulse control in five of six children for a two-hour period post-exercise (C. K. Bass, 1985). Improvements due to exercise have also been seen in responding to school tasks, behaving appropriately in a quiet room, and playing in an outside area (Kern, Koegel, Dyer, Blew, & Fenton, 1982). Similar improvements have been seen in exercise programs using swimming, therapeutic horseback riding, and cycling (Pan, 2010; M. M. Bass, Duchowny, & Llabre, 2009; Lang et al., 2010).

Individuals with ASD have also demonstrated improvements during physical education, exercise, and recreational-setting research interventions designed to measure motor skills and activity

participation. Structured physical education has been shown to increase moderate-to-vigorous physical activity (MVPA) in students with ASD (Pan, 2008). Physical activity interventions have increased sustained participation in snowshoeing, walking, and jogging (Todd & Reid, 2006). One treadmill exercise program that increased the frequency, speed, and elevation on the treadmill successfully decreased the body mass index of individuals with severe autism (Pitetti, Rendoff, Grover, & Beets, 2007). A 20-week simulated developmental horseback riding program reported improved motor proficiency and sensory integrative functions among participants (Wuang, Wang, Huang, & Su, 2010). These interventions support the inclusion of students with ASD in quality physical education programs. Physical educators should be prepared to use the literature and scientific knowledge base, including the summaries provided in this article, to advocate for appropriate inclusion and against purposeful exclusion of students with ASD in physical education.



Strategies for Success during Physical Education

Research indicates that children with ASD, like their peers without disabilities, spend significantly less time in MVPA compared to sedentary activities (MacDonald, Esposito, & Ulrich, 2011). As with all other students, physical educators have a responsibility to engage students with ASD in lessons that teach motor skills and provide a variety of game, sport, and fitness experiences to apply those skills. Physical educators who teach students with ASD have access to a plethora of articles that provide pedagogical strategies. One of the purposes of this article is to remind readers of the practical value and benefit of using these strategies and the related articles to support their advocacy efforts and professional development.

Use Social Stories to Prepare Students for Activity. Setting the students up for success in physical education can begin even before they arrive to class. Providing the student with ASD with a lesson preview or using a social story before physical education class will help the student know what to expect from the lesson, environment, and teacher (Barry & Burlew, 2004; Grenier & Yeaton, 2011; Sandt, 2008). The social story can be read to, with, or by the student. For example, the physical educator can create a social story for the lesson using a visual form of communication such as the picture exchange communication system (A. Green & Sandt, 2013). The story is then sent to the student so he or she can look at it before physical education class. The teacher can also provide one or two pieces of equipment that represent the activities the

student will do in physical education, along with directions for how to practice a motor skill using the equipment. The student can practice the motor skill before physical education. This approach orients the student to what the lesson will address and helps him or her to transition from class to class. The physical educator may use a continuation of the social story during physical education, allowing the student to progress using a similar method as the one that members of the multidisciplinary team use with the student (Menear & Smith, 2011). This method could help physical education routines become better aligned with those of other classes, and it provides the student with continuity that can be comforting and predictable.

Prepare the Environment. Physical educators should prepare the environment in advance to address the student's sensory challenges. This often involves focusing on communication and preventing challenging behaviors (Groft-Jones & Block, 2006). Visual supports can be very helpful and may include hanging a large clock on the wall, placing a large timer in a prominent place, posting lesson transitions where the student can see them from a distance, designating activity boundaries for all portions of the lesson, and preselecting the student's equipment for the day using one color that is unique for that student or that student's team (Fittipaldi-Wert & Mowling, 2009; Hovey, 2011; Lee & Poretta, 2013; Menear & Smith, 2011; Simpson, Gaus, Biggs, & Williams, 2010; Zhang & Griffin, 2007). In combination, these strategies provide predictability, which helps reduce anxiety and prepare students for routine scenarios.

Adapt the Curriculum and Teaching Practices. Physical educators should honor the student's developmental level and learning needs during each lesson. This may include having a "safe" physical activity for the student to do when the class lesson becomes too demanding (Meneer & Smith, 2008). Safe activities and teaching strategies include focusing on individual fitness activities (Meneer & Smith, 2008), limiting team sports (Pan & Fry, 2006), assigning teams instead of allowing for peer selection (Simpson et al., 2010), providing constant positive feedback (Groft-Jones & Block, 2006; Thren & Engstrom, 2009), using explicit and concrete language when giving directions (Groft-Jones & Block, 2006), using activities or pedagogical approaches that need only minimum social cues for successful implementation (Orsmond, Krauss, & Seltzer, 2004), and using individual, environmental, and task constraints to individualize developmentally appropriate lessons (Pope, Breslin, Getchell, & Ting, 2012). Physical educators should continuously evaluate not only the student's motor skill progression but also his or her developmental progression, which may allow for a fading of some of the strategies listed here.

Conclusion

Physical activity is an area of deficit for many students in today's society, but physical activity and physical education are even more challenging for students with ASD. Their challenges can range from social and environmental stressors to biological factors. In addition to the physical and psychosocial benefits of structured movement activities, research continues to discover more and more cognitive benefits related to regular exercise. Physical educators should use the professional literature and sound pedagogy to design lessons that set all children up for success, including those with ASD.

References

Anderson-Hanley, C., Tureck, K., & Schneiderman, R. L. (2011). Autism and exergaming: Effects on repetitive behaviors and cognition. *Psychology Research and Behavior Management*, 4, 129-137.

Bandini, L. G., Gleason, J., Curtin, C., Liviadini, K., Anderson, S. E., Cermak, S. A., ... Must, A. (2013). Comparison of physical activity between children with autism spectrum disorders and typically developing children. *Autism*, 17, 44-54.

Barry, L. M., & Burlew, S. B. (2004). Using social stories to teach choice and play skills to children with autism. *Focus on Autism and Other Developmental Disabilities*, 19, 45-51.

Bass, C. K. (1985). Running can modify classroom behavior. *Journal of Learning Disabilities*, 18, 160-161.

Bass, M. M., Duchowny, C. A., & Llabre, M. M. (2009). The effect of therapeutic horseback riding on social functioning in children with autism. *Journal of Autism and Developmental Disorders*, 39, 1261-1267.

Celiberti, D. A., Bobo, H. E., Kelley, K. S., Harris, S. L., & Handleman, J. S. (1997). The differential and temporal effects of antecedent exercise on the self-stimulatory behavior of a child with autism. *Research in Developmental Disabilities*, 18, 139-150.

Chaddock, L., Erickson, K. I., Prakash, R. S., Kim, J., Voss, M. W., VanPatter, M., & Kramer, A. F. (2010). A neuroimaging investigation of the association between aerobic fitness, hippocampal volume, and memory performance in preadolescent children. *Brain Research*, 1358, 172-183. doi:10.1016/j.brainres.2010.08.049

Chaddock, L., Erickson, K. I., Prakash, R. S., VanPatter, M., Voss, M. W., Pontifex, M. B., & Kramer, A. F. (2010). Basal ganglia volume is associated with aerobic fitness in preadolescent children. *Developmental Neuroscience*, 32, 249-256. doi:10.1159/000316648

Curtin, C., Anderson, S. E., Must, A., & Bandini, L. (2010). The prevalence of obesity in children with autism: A secondary data analysis using nationally representative data from the National Survey of Children's Health. *BMC Pediatrics*, 10(11). doi:10.1186/1471-2431-10-11

Curtin, C., Bandini, L. G., Perrin, E. C., Tybor, D. J., & Must, A. (2005). Prevalence of overweight in children and adolescents with attention deficit hyperactivity disorder and autism spectrum disorders: A chart review. *BMC Pediatrics*, 5(48). doi:10.1186/1471-2431-5-48

Curtin, C., Jojic, M., & Bandini, L. G. (2014). Obesity in children with autism spectrum disorder. *Harvard Review of Psychiatry*, 22, 93-103. doi:10.1097/HRP.0000000000000031

Egan, A. M., Dreyer, M. L., Odar, C. C., Beckwith, M., & Garrison, C. B. (2013). Obesity in young children with autism spectrum disorders: Prevalence and associated factors. *Childhood Obesity*, 9, 125-131. doi:10.1089/chi.2012.0028

Fedewa, A., & Ahn, S. (2011). The effects of physical activity and physical fitness on children's achievement and cognitive outcomes: A meta-analysis. *Research Quarterly for Exercise and Sport*, 82, 521-535.

Feehan, K., O'Neil, M. E., Abdalla, D., Fraga-Pinkham, M., Kondrad, M., Berhane, Z., & Turchi, R. (2012). Factors influencing physical activity in children and youth with special health care needs: A pilot study. *International Journal of Pediatrics*, Article ID 583249. doi:10.1155/2012/583249

Fittipaldi-Wert, J., & Mowling, C. M. (2009). Using visual supports for students with autism in physical education. *Journal of Physical Education, Recreation & Dance*, 80(2), 39-43.

Fournier, K. A., Hass, C. J., Naik, S. K., Lodha, N., & Cauraugh, J. H. (2010). Motor coordination in autism spectrum disorders: A synthesis and meta-analysis. *Journal of Autism and Developmental Disorders*, 40, 1227-1240.

Goodwin, M. S., Groden, J., Velicer, W. F., Lipsitt, L. P., Baron, M. G., Hofmann, S. G., & Groden, G. (2006). Cardiovascular arousal in individuals with autism. *Focus on Autism and Other Developmental Disabilities*, 21, 100-123.

Green, A., & Sandt, D. (2013). Understanding the picture exchange communication system and its application in physical education. *Journal of Physical Education, Recreation & Dance*, 82(2), 33-39.

Green, D., Charman, T., Pickles, A., Chandler, S., Loucas, T., Simonoff, E., & Baird, G. (2009). Impairment in movement skills of children with autistic spectrum disorders. *Developmental Medicine & Child Neurology*, 51, 311-316.

Grenier, M., & Yeaton, P. (2011). Previewing: A successful strategy for students with autism. *Journal of Physical Education, Recreation & Dance*, 82(1), 28-34.

Groft-Jones, M., & Block, M. E. (2006). Strategies for teaching children with autism in physical education. *Teaching Elementary Physical Education*, 17(6), 25-28.

Ho, H. H., Eaves, L. C., & Peabody, D. (1997). Nutrient intake and obesity in children with autism. *Focus on Autism and Other Developmental Disabilities*, 12, 187-192.

Hovey, K. (2011). Six steps for planning a fitness circuit for individuals with autism. *Strategies*, 24(5), 12-16.

Kern, L., Koegel, R. L., Dyer, K., Blew, P. A., & Fenton, L. R. (1982). The effects of physical exercise on self-stimulation and appropriate responding in autistic children. *Journal of Autism and Developmental Disorders*, 12, 399-419.

Kurtz, L. (2008). *Understanding motor skills in children with dyspraxia, ADHD, autism, and other learning disabilities: A guide to improving coordination*. London, England: Jessica Kingsley.

Lang, R., Koegel, L. K., Ashbaugh, K., Regester, A., Ence, W., & Smith, W. (2010). Physical exercise and individuals with autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders*, 4, 565-576.

Lee, J., & Poretta, D. L. (2013). Enhancing the motor skills of children with autism spectrum disorders: A pool-based approach. *Journal of Physical Education, Recreation & Dance* 84(1), 41-45.

- Lenroot, R. K., & Yeung, P. K. (2013). Heterogeneity within autism spectrum disorders: What have we learned from neuroimaging studies? *Frontiers in Human Neuroscience*, 7, 733. doi:10.3389/fnhum.2013.00733
- MacDonald, M., Esposito, P., & Ulrich, D. (2011). The physical activity patterns of children with autism. *BMC Research Notes*, 4, 422. doi:10.1186/1756-0500-4-422
- Maximo, J. O., Cadena, E. J., & Kana, R. K. (2014). The implications of brain connectivity in the neuropsychology of autism. *Neuropsychology Review*, 24, 16–31. doi:10.1007/s11065-014-9250-0
- Meneer, K. S., & Smith, S. (2008). Physical education for students with autism: Teaching tips and Strategies. *Teaching Exceptional Children*, 40(5), 32–37.
- Meneer, K. S., & Smith, S. C. (2011). Teaching physical education to students with autism spectrum disorders. *Strategies*, 24(3), 21–24.
- Meneer, K. S., Smith, S., & Lanier, S. (2006). A multipurpose fitness playground for individuals with autism: Ideas for design and use. *Journal of Physical Education, Recreation & Dance*, 77(9), 20–25.
- Nicholson, H., Kehle, T. J., Bray, M. A., & Van Heest, J. (2011). The effects of antecedent physical activity on the academic engagement of children with autism spectrum disorder. *Psychology in the School*, 48, 198–213.
- Obrusnikova, I., & Cavalier, A. (2011). Perceived barriers and facilitators of participation in after school physical activity by children with autism spectrum disorders. *Journal of Developmental and Physical Disabilities*, 23, 195–211.
- Obrusnikova, I., & Dillon, S. R. (2011). Challenging situations when teaching children with autism spectrum disorders in general physical education. *Adapted Physical Activity Quarterly*, 28, 113–131.
- Ohrberg, N. J. (2013). Autism spectrum disorder and youth sports: The role of the sports manager and coach. *Journal of Physical Education, Recreation & Dance*, 84(9), 52–56.
- Oriel, K. N., George, C. L., Peckus, R., & Semon, A. (2011). The effects of aerobic exercise on academic engagement in young children with autism spectrum disorder. *Pediatric Physical Therapy*, 23, 197–193. doi:10.1097/PEP.0b013e318218f149
- Orsmond, G. I., Krauss, M. W., & Seltzer, M. M. (2004). Peer relationships and social and recreational activities among adolescents and adults with autism. *Journal of Autism and Developmental Disorders*, 34, 243–256.
- Pan, C. Y. (2008). School time physical activity of students with and without autism spectrum disorders during PE and recess. *Adapted Physical Activity Quarterly*, 25, 308–321.
- Pan, C. Y. (2010). Effects of water exercise swimming program on aquatic skills and social behaviors in children with autism spectrum disorders. *Autism*, 14, 9–28.
- Pan, C. Y. (2014). Motor proficiency and physical fitness in adolescent males with and without autism spectrum disorders. *Autism*, 18, 156–165.
- Pan, C. Y., & Frey, G. C. (2006). Physical activity patterns in youth with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 36, 597–606.
- Pan, C. Y., Tsai, C. L., & Hsieh, K. W. (2011). Physical activity correlates for autism children in middle school physical education. *Research Quarterly for Exercise and Sport*, 82, 491–498.
- Petrus, C., Adamson, S. R., Block, L., Einarson, S. J., Sharifnejad, M., Harris, S. R. (2008). Effects of exercise interventions on stereotypic behaviors in children with autism spectrum disorder. *Physiotherapy Canada*, 60, 134–145.
- Phillips, K. L., Schieve, L. A., Visser, S., Boulet, S., Sharma, A. J., Kogan, M. D., . . . Yeargin-Allsopp, M. (2014). Prevalence and impact of unhealthy weight in a national sample of US adolescents with autism and other learning and behavioral disabilities. *Maternal and Child Health Journal*, 18, 1964–1975. doi:10.1007/s10995-014-1442-y
- Pitteti, K. H., Rendoff, A. D., Grover, T., & Beets, M. W. (2007). The efficacy of a 9-month treadmill walking program on the exercise capacity and weight reduction for adolescents with severe autism. *Journal of Autism and Developmental Disorders*, 37, 997–1006.
- Pope, M., Breslin, C. M., Getchell, N., & Ting, L. (2012). Using constraints to design developmentally appropriate movement activities for children with autism spectrum disorders. *Journal of Physical Education, Recreation & Dance*, 83(2), 35–42.
- Provost, B., Lopez, B. R., & Heimerl, S. (2007). A comparison of motor delays in young children: Autism spectrum disorder, developmental delay, and developmental concerns. *Journal of Autism and Developmental Disorders*, 37, 321–328.
- Rimmer, J. H., Yamaki, K., Lowry, B. M., Wang, E., & Vogel, L. C. (2010). Obesity and obesity-related secondary conditions in adolescents with intellectual/developmental disabilities. *Journal of Intellectual Disability Research*, 54, 787–794.
- Rosenthal-Malek, A., & Mitchell, S. (1997). Brief report: The effects of exercise on the self-stimulatory behaviors and positive responding of adolescents with autism. *Journal of Autism and Developmental Disorders*, 27, 193–202.
- Sandt, D. (2008). Social stories for students with autism in physical education. *Journal of Physical Education, Recreation & Dance* 79(6), 42–45.
- Simpson, C., Gaus, M., Biggs, M. J., & Williams, J., Jr. (2010). Physical education and implications for students with Asperger's syndrome. *Teaching Exceptional Children*, 42(6), 48–56.
- Srinivasan, S. M., Pescatello, L. S., & Bhat, A. N. (2014). Current perspectives on physical activity and exercise recommendations for children and adolescents with autism spectrum disorders. *Physical Therapy*, 94(6), 1–46.
- Staples, K. L., & Reid, G. (2010). Fundamental movement skills and autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 40, 209–217.
- Thren, N., & Engstrom, D. (2009). Autism and Asperger syndrome: Effective teaching methods to appropriately challenge all students, regardless of ability, in an inclusive physical education setting. *PSAHPERD Journal*, Fall, 19–22.
- Todd, T., & Reid, G. (2006). Increasing physical activity in individuals with autism. *Focus on Autism and Other Developmental Disabilities*, 21, 167–176.
- Todd, T., Reid, G., & Butler-Kisber, L. (2010). Cycling for students with ASD: Self-regulation promotes sustained physical activity. *Adapted Physical Activity Quarterly*, 27, 226–241.
- Wang, Y. P., Wang, C. C., Huang, M. H., & Su, C. Y. (2010). The effectiveness of simulated developmental horse-riding program in children with autism. *Adapted Physical Activity Quarterly*, 27, 113–126.
- Zhang, J., & Griffin, A. J. (2007). Including children with autism in general physical education: Eight possible solutions. *Journal of Physical Education, Recreation & Dance*, 78(3), 33–37, 50.