

# Preliminary efficacy of a daily living skills intervention for adolescents with high-functioning autism spectrum disorder

Autism  
2018, Vol. 22(8) 983–994  
© The Author(s) 2017  
Article reuse guidelines:  
sagepub.com/journals-permissions  
DOI: 10.1177/1362361317716606  
journals.sagepub.com/home/aut  


Amie Duncan<sup>1</sup>, Lisa A Ruble<sup>2</sup>, Jareen Meinzen-Derr<sup>1</sup>,  
Carrie Thomas<sup>1</sup> and Lori J Stark<sup>1</sup>

## Abstract

Daily living skills deficits are strongly associated with poor adult outcomes for individuals with high-functioning autism spectrum disorder, and yet, there are no group interventions targeting daily living skills. Seven adolescents with autism spectrum disorder and their parents participated in a feasibility pilot of a 12-week manualized group treatment targeting specific daily living skills (i.e. morning routine, cooking, laundry, and money management). Outcomes included the Vineland Adaptive Behavior Scales, Second Edition (Vineland-II) age equivalence scores and four goal attainment scaling scores. Adolescents demonstrated significant improvement on two Vineland-II subdomains and on all goal attainment scaling scores at post-treatment and 6-month follow-up. The intervention has promise for improving critical daily living skills' deficits that affect independent living and employment. Limitations and implications for future studies are discussed.

## Keywords

adolescents, autism spectrum disorders, daily living skills, goal attainment scaling, interventions—psychosocial/behavioral

## Introduction

It is estimated that 50,000 adolescents with autism spectrum disorder (ASD) are exiting from high school each year (Roux et al., 2013). Outcomes in adulthood are poor even for individuals with high-functioning ASD, which is defined as those who have average or higher intelligence quotients (IQs) (full-scale IQ  $\geq 70$  (for a review, see Magiati et al., 2014). Farley et al. (2009) found that 56% of adults with high-functioning ASD lived with their parents and only 12% were living independently in their own residence without any support (Anderson et al., 2014; Roux et al., 2015). Only 54% of adults with high-functioning ASD had either a paid full-time or part-time job, and the remainder were volunteering, participating in day programs, working in supported employment, or unemployed (Farley et al., 2009). These outcomes are both surprising and alarming because it is generally expected that high-functioning individuals with ASD would have a more positive adult outcome due to their intact cognitive abilities and less severe autism symptomatology compared to their peers with ASD and a comorbid intellectual disability (for a review, see Roux et al., 2015).

One factor likely contributing to poor adult outcomes is the lack of services to facilitate a successful transition to the adult world of employment, postsecondary education, independent living, and community participation (Roux et al., 2015; Taylor and Seltzer, 2011). Many in the field have labeled this a crisis because so many individuals with ASD are coming of age at a time when there are few services available to address their specific needs (Harwood and Novotny, 2017; Wong et al., 2015). In a recent study on transition planning (Snell-Rood et al., 2017), parents of adolescents with ASD reported that there were few supports or interventions in the high-school setting that addressed skills that are critical to living independently,

<sup>1</sup>Cincinnati Children's Hospital Medical Center, USA

<sup>2</sup>University of Kentucky, USA

## Corresponding author:

Amie Duncan, Developmental and Behavioral Pediatrics, Cincinnati Children's Hospital Medical Center, 3333 Burnet Avenue, MLC 4002, Cincinnati, OH 45229, USA.  
Email: amie.duncan@cchmc.org

and that such services were even more likely to be absent for high-functioning adolescents with ASD (Bal et al., 2015). Parents stated that they are often left to fill in any gaps in skills that are critical to a successful transition to adulthood when they are not addressed in the school setting or through adult services. These impressions were confirmed by special educators in the same study who reported that there was no time for instruction on functional skills as the core curriculum took priority (Snell-Rood et al., 2017). While the Individualized Education Plans (IEPs) of high-functioning adolescents with ASD are required to have transition plans that address goals in the areas of employment, postsecondary education, and independent living, there is often little time to work on these goals, despite the need, because students are often included in regular education classrooms and may have a full academic class load that prevents them from being pulled out for services. One recent study found that high-school students with high-functioning ASD were less likely to receive any life skills training than those with ASD and a comorbid intellectual disability (Chiang et al., 2017).

Thus, an emerging area to promote independence in adulthood is the implementation of services that directly address critical areas such as daily living skills (DLS), which are activities required for everyday independence at home and in the community, college, and workplace (Bal et al., 2015). Farley et al. (2009) found that greater DLS in high-functioning young adults with ASD were associated with better outcomes in the areas of employment, independent living, and friendships (see also Klinger et al., 2015; Orsmond et al., 2013; Shattuck et al., 2012; Wei et al., 2013). Furthermore, in a large sample of adults diagnosed with ASD as children, Klinger et al. (2015) found that DLS predicted successful employment outcomes even more than factors such as cognitive ability, language skills, and autism symptomatology.

Despite the clear importance of DLS to adult outcome, adolescents with ASD have DLS that fall far below what would be expected based on their cognitive abilities and chronological age (Duncan and Bishop, 2015; Kanne et al., 2011; Matthews et al., 2015). Duncan and Bishop (2015) found that in a sample of over 400 high-functioning adolescents with ASD (i.e. IQ > 85), over 50% had deficient DLS that fell at least 1 standard deviation below their full-scale IQ score. Practically speaking, this indicates that many adolescents with ASD had DLS age equivalence scores that were 5–6 years below their chronological age (see also Bal et al., 2015).

DLS that are often deficient in adolescents with ASD include personal hygiene, managing medications, doing laundry, preparing meals, using a checking/savings account, budgeting for purchases, and navigating the community (see Duncan et al., 2014). In a recent study, families reported that DLS in the areas of home care, transportation, financial, self-care, relationship, and self-advocacy still

needed to be addressed after graduation from high school (Chiang et al., 2017). Several evidence-based teaching strategies (e.g. technology, video modeling, and behavioral strategies such as reinforcement and prompting) have been identified as effective in teaching adaptive behavior skills, including DLS, to adolescents and young adults with ASD (Bennett and Dukes, 2014; National Autism Center, 2015; Wong et al., 2015). Other evidence-based strategies such as parent-implemented intervention, prompting, social narratives, task analysis, and visual supports have been shown to lead to adaptive behavior skill acquisition for children with ASD (Flynn and Healy, 2012; Hong et al., 2015; Hume and Reynolds, 2010; National Autism Center, 2015; Wong et al., 2015). Interestingly, while several studies have demonstrated successful acquisition of DLS in adolescents with ASD using evidence-based strategies, these studies are case studies or single subject design studies, are designed for individuals with ASD and a comorbid intellectual disability, focus on simplistic or very specific DLS (e.g. toileting, counting money), and/or take place in the classroom with minimal parental involvement (Bennett and Dukes, 2014; National Autism Center, 2015; Wong et al., 2015), thus limiting the practice and generalization of these skills in real-world settings. There are currently no existing evidence-based group interventions that target DLS for high-functioning adolescents with ASD to prepare them for independence in adulthood (Duncan and Bishop, 2015; Kanne et al., 2011; Matson et al., 2012; Matthews et al., 2015; Palmen et al., 2012; Smith et al., 2012).

Surviving and Thriving in the Real World (STRW) is a group intervention for high-functioning adolescents with ASD developed to fill the gap in the literature by targeting complex, age appropriate skills in a time-limited manner across the DLS areas of personal, domestic/household, and finance. The first aim of this study was to explore and evaluate the initial feasibility of the STRW group intervention for adolescents with high-functioning ASD on the acquisition of DLS. Factors such as attendance rate and parent and adolescent ratings and feedback on intervention content were utilized to evaluate feasibility.

The second aim was to examine the use of two different outcome measures, the Vineland Adaptive Behavior Scales, Second Edition (Vineland-II; Sparrow et al., 2005) and goal attainment scaling (GAS; Ruble et al., 2012), to assess progress on DLS after participants completed the intervention. We hypothesized that participants in the STRW intervention would demonstrate progress on the Vineland-II and GAS from baseline to post-treatment and 6-month follow-up.

## Method

### Participants

Adolescents between the ages of 14 and 18 years who had a previous diagnosis of ASD from a medical professional

at a local hospital and also met criteria for a diagnosis of ASD based on the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Lord et al., 2012), a full-scale IQ  $\geq 70$  (as this is the definition of high-functioning ASD), and deficient DLS as measured by the Vineland-II were recruited for this study. Participants were excluded from the study if they had significant aggressive behaviors or mental health issues that required treatment outside the scope of the current intervention. All adolescent participants had one parent who participated in the study. The study was approved by the institutional review board for human subjects, and parental informed consent was obtained prior to data collection.

**Recruitment.** Participants were recruited via a research registry of adolescents with ASD at the investigators' institution. In a chart review, 51 adolescents met inclusion criteria of age, diagnosis of ASD, IQ  $\geq 70$ , and deficient DLS and were sent an invitation letter describing the study. The invitation letter included a stamped, return addressed, "Do Not Contact" postcard that parents could mail back if they did not want to be contacted about the study. If sufficient families (a minimum target of eight adolescent-parent dyads) did not contact study personnel in response to the recruitment letter describing the study, the recruitment plan allowed the research staff to call any additional families who had not returned a "Do Not Contact" postcard within 10 days to increase recruitment of sufficient participants. As 12 parents directly contacted research staff to learn more about the study within 10 days of the mailing, no phone calls to additional participants were required because the target was met. Parent participants were compensated US\$50 for baseline, post-treatment, and 6-month follow-up assessment visits. Adolescent participants were compensated US\$50 for the baseline assessment visit.

## Intervention

**Surviving and Thriving in the Real World (STRW).** STRW was developed to teach critical DLS to high-functioning adolescents with ASD and their parents using empirically based strategies for skill acquisition, mastery, and generalization. The intervention consisted of 12-weekly 90-minute concurrent parent and adolescent group sessions. The STRW intervention targeted four areas: (1) Morning Routine (i.e. hygiene and self-care activities that need to be completed each morning); (2) Kitchen/Cooking (i.e. kitchen safety and cooking in the microwave, in the oven, and on the stovetop); (3) Laundry (i.e. sorting clothing, using the washing machine and dryer, and folding and putting clothing away); and (4) Money Management (i.e. understanding the cost of items, purchasing items, using a savings/checking account, and budgeting money). The above four areas were chosen because they were identified as critical for a successful adult transition after an iterative

process involving surveys, focus groups, and individual therapy sessions in the clinic and school settings with adolescents with ASD and their parents. Intervention sessions typically began with the parents and adolescents together to (1) provide an overview of the current sessions' goals and activities and (2) discuss progress toward DLS goals being targeted and completion of weekly homework assignments. The parents and adolescents were then divided into their respective groups to work on session-specific content. Weekly homework assignments were given to the adolescent to encourage generalization of skills to the home and/or community environments (e.g. purchase items at a grocery store using a pre-defined budget and cook scrambled eggs on the stove).

**Adolescent group.** Each week, one DLS was targeted through didactics, discussion, demonstration, and in vivo practice using empirically based strategies (e.g. behavioral, technology, video modeling). Therapists sought to increase awareness of the adolescent's knowledge of specific DLS deficits and identify strategies promoting skill acquisition. For example, in the sessions targeting laundry, the adolescents were taught to sort clothes and to use a washing machine and dryer by (1) watching a video of another adolescent sorting clothes and using a washing machine and dryer, (2) completing a task analysis on the steps for doing laundry, (3) discussing a handout that included written steps and pictures of how to do laundry, (4) in vivo practice choosing the appropriate washing machine and dryer settings for clothing types, (5) sorting and loading clothing, and (6) utilizing a laundry phone app to assist with tasks such as folding. While social skills were not directly taught, appropriate social skills (e.g. listening to others, engaging in back and forth conversation) were modeled and reinforced by therapists throughout sessions.

**Parent group.** Each week, parents were taught how to utilize evidence-based strategies (e.g. visual strategies, technology, modeling, prompt fading, and incorporating special interests) to both promote practice of DLS by their adolescent and generalize the DLS to home and community environments. The therapist first reviewed the content and strategies being utilized in the adolescent group and then provided didactics and engaged in role plays of how parents should use the strategies to target and increase their adolescent's independence with these DLS. A behavior contract was implemented to directly target practice of specific DLS goals to increase acquisition, mastery, and generalization. Behavior contracts were individualized for each adolescent based on their skill level and experience and specified the level of independence and frequency with which the adolescent should perform the targeted skill (e.g. Sam will cook chicken nuggets and fries in the oven two times this week with one prompt from his mother). The behavior contract also defined the reward

adolescents would receive from their parent for successfully completing the targeted DLS. When new skills were introduced in sessions, these were subsequently added to the behavior contract along with additional rewards. Each adolescent's behavior contract and progress toward goals were reviewed each week with parents and the therapist provided feedback and problem solving to refine the practice of skills at home. The parent sessions were also designed to foster a positive environment for parents by normalizing DLS deficits and discussing effective strategies that lead to skill acquisition and increase motivation and buy-in from the adolescent.

## Measures

**Demographics.** Mothers completed a questionnaire on individual and family demographic information including race, ethnicity, maternal education, and household income.

**ADOS-2.** The ADOS-2 (Lord et al., 2012) is a clinician-administered assessment for evaluating autism symptomatology and it was used to verify the diagnosis of ASD. All adolescents had a documented ADOS-2 Module 3 or 4 administered by a research-reliable, certified trainer of the ADOS-2 within 2 years prior to enrolling in the study in their medical record and all met criteria for a diagnosis of ASD.

**Cognitive abilities.** Both the Differential Ability Scales, Second Edition (Elliot, 2007) and Stanford–Binet Intelligence Scales, Fifth Edition (Roid, 2003) were used to assess verbal, nonverbal, and full-scale IQ. Participants' cognitive abilities were assessed at the baseline assessment ( $N=2$ ) or through a previous research or clinical assessment conducted within the last 2 years ( $N=5$ ) as documented in their medical record.

**Vineland Adaptive Behavior Scales, Second Edition (Vineland-II).** The Vineland-II (Sparrow et al., 2005) is a well-established standardized measure of adaptive behavior that measures skills in the Communication, Socialization, and DLS domains. The DLS domain comprised the Personal (e.g. personal hygiene, self-care), Domestic (e.g., cooking, doing laundry), and Community (e.g. money management, navigating the community) subdomains. Several items, but not all the items in these subdomains, directly correspond to goals being targeted in the STRW intervention (i.e. the targeted skills of Laundry and Kitchen/Cooking correspond to 12 of the 24 items assessed on the Vineland-II Domestic subdomain). Parents rate their child's ability to perform a task independently as *Usually*, *Sometimes*, or *Never*. The Vineland-II was used at the baseline assessment to confirm that the adolescent had deficient DLS, defined as the DLS domain standard score or 1 of the 3 DLS subdomain v-scale

scores being 15 points or more below their full-scale IQ. Vineland-II v-scale scores were converted to standard scores when confirming deficient DLS. The Vineland-II was also used at the post-treatment and 6-month follow-up assessment. The Vineland-II is typically used to measure an individual's adaptive behavior profile at a particular point in time (e.g. Kanne et al., 2011) and is less often used as an outcome measure in intervention studies because it may not be sensitive to short-term changes (e.g. Drahota et al., 2011). Thus, raw and age equivalence scores on the three DLS subdomains were selected as outcome measures as they would be sensitive to progress on individual items that were targeted in the intervention.

**Daily Living Skills Goal Attainment Scaling.** GAS is an approach used to measure an individual's progress on specific goals against their baseline performance. GAS considers that individuals may have different starting points and different end goals based on their profile of strengths and difficulties. GAS has successfully been used to assess outcomes in clinic (e.g. Pfeiffer et al., 2011) and school-based interventions (Ruble et al., 2013) with individuals with ASD and thus holds promise for assessing change in DLS. Change over time is assessed by comparing the individual's post-treatment and 6-month follow-up GAS scores to their baseline skills, which are always scored as  $-2$ . As each individual is compared to their baseline skill, this measure is considered to be a more sensitive and accurate approach to measuring the outcomes of individualized behavioral interventions delivered in clinic and school settings (Pfeiffer et al., 2011; Ruble et al., 2012, 2013; Schaaf et al., 2014). Detailed information regarding a specific goal (e.g. definition of goal, prompting required, environment in which behavior occurs or does not occur) is obtained to assess baseline skills and define progress on the targeted goals. In this study, each parent participant completed a clinical interview that assessed their adolescent's individual skills in the areas targeted by the STRW intervention including *Morning Routine* (consisted of 11 items such as wakes self up in the morning, completes various self-care tasks), *Kitchen/Cooking* (consisted of 27 items such as uses a knife to cut food, uses the microwave, turns the oven on and off), *Laundry* (consisted of 13 items such as sorts clothing, operates the washing machine, puts clothing away into drawers/closet), and *Money Management* (consisted of 17 items such as knows the cost of items, uses a debit card to purchase items, budgets weekly expenses). Thus, there was a total of 68 possible items that were assessed during the interview through both open-ended and follow-up questions about skill level (e.g. "Tell me about your teen's ability to use the microwave to make food"), number and type of prompts required to complete skill, and frequency with

**Table 1.** Goal attainment scaling scoring description and examples.

Level	Description	Example
-2	Child's present level of performance	John completes two out of eight steps of his morning routine independently and requires two verbal prompts
-1	Progress	John will complete four out of eight steps of his morning routine independently with only one verbal prompt and a visual reminder (e.g. checklist)
0	Expected level of outcome	John will complete six out of eight steps of his morning routine independently with only a visual reminder
+1	Somewhat more than expected	John will complete eight out of eight steps of his morning routine with only a visual reminder
+2	Much more than expected	John will complete eight out of eight steps of his morning routine without any prompts or visual reminders

which skill is completed independently and with prompts. As each adolescent participant had different baseline skill levels in the above items and there were items that some adolescents had already mastered (e.g. taking their medications in the morning) or that were not applicable (e.g. did not pack a backpack because they were home-schooled), the number of items that were targeted in each of the four areas differed for each participant. For example, the number of items targeted in the area of Morning Routine for each participant ranged from 5 to 10 items with a mean of 7.4 items targeted. A trained research coordinator conducted the interview with parent participants at the baseline assessment and then developed and scored the GAS using a 5-point scale (see Table 1) to create goals for each participant in the four areas. At baseline, all adolescent participants received a score of -2 representing their specific skill level. At post-treatment and 6-month follow-up, no improvement would be represented by a participant remaining at a -2, progression from -2 to -1 would indicate progress (i.e. 50% better performance), and a score progression from -2 to 0 would indicate expected level of outcome (i.e. 100% better performance). The goal of the STRW intervention was for each participant to reach a score of "0" on the items assessed across the four targeted areas. The same research coordinator conducted the interview with parent participants at the post-treatment and 6-month follow-up assessments to determine whether progress had been made in each of the targeted areas. The therapists facilitating the STRW intervention did not have access to the Daily Living Skills Goal Attainment Scale (DLS GAS).

**Acceptability form.** After the conclusion of each session, parent and adolescent participants completed acceptability forms to assess the helpfulness of intervention content. For each item, participants were asked to rank helpfulness on a 5-point scale with a rating of 1 indicative of "not helpful" and a rating of 5 indicative "very helpful." Over the 12 sessions, parents rated 55 items and adolescents rated 75 items. Adolescents had more items to rate because their sessions often contained more content.

### *Treatment fidelity*

All parent group sessions were facilitated by the first author (A.D.). All adolescent group sessions were facilitated by a psychology postdoctoral fellow and three to four psychology graduate students for a ratio of one to two graduate students per adolescent. The first author provided clinical supervision for 1 h each week to discuss intervention content and any issues that may have arisen during the previous week's session. All group sessions were filmed and the first author reviewed all taped sessions. Fidelity checklists were developed by the first author based on session content and goals. The first author reviewed all sessions for fidelity, and checklist ratings were at or above 90% for each parent and adolescent group session. A research coordinator also reviewed 25% of parent and adolescent group sessions for fidelity, and checklist ratings were at or above 93% for each session.

### *Satisfaction and feedback session*

After the final session, all parent and adolescent participants were invited to participate in a satisfaction and feedback session to share their perspectives about intervention content including skills that were targeted, strategies that were utilized to teach skills, use of the behavior contract, and homework assignments. The parent and adolescent participants were also asked open-ended questions such as (1) what was helpful over the course of the intervention, (2) what was not helpful, and (3) what could be changed or added to improve the intervention. Five out of the seven parents and four out of the seven adolescents completed the satisfaction and feedback session. All responses were recorded by a psychology graduate student.

### *Analyses*

To evaluate feasibility, attendance rates and acceptability ratings were completed after each session. To evaluate change in DLS across the baseline, post-treatment, and 6-month follow-up sessions, paired sample *t* tests were

**Table 2.** Participant characteristics at baseline.

	Age (years: months)	VIQ	NVIQ	FSIQ	Converted DLS personal v-scale	Converted DLS domestic v-scale	Converted DLS community v-scale	Vineland DLS SS	Maternal education
1	14:2	102	121	112	65	65	65	62	Associate's degree
2	18:6	81	77	77	70	65	60	63	Bachelor's degree
3	16:6	95	85	90	70	65	80	68	Graduate degree
4	15:3	81	84	82	90	90	65	77	Bachelor's degree
5	16:2	86	83	84	85	70	60	68	Some college
6	17:11	95	87	90	60	55	70	59	Bachelor's degree
7	17:9	87	84	85	75	65	70	66	Bachelor's degree

VIQ: verbal IQ; NVIQ: nonverbal IQ; FSIQ: full-scale IQ; DLS: daily living skills; SS: standard score. V-scale scores and SS were assessed at baseline. V-scales were converted to standard scores.

conducted on (1) Vineland-II DLS domain and subdomain raw scores, (2) Vineland-II DLS subdomain age equivalence scores, and (3) GAS total score and GAS item score in the four targeted areas of the intervention. Statistical significance was defined as  $p \leq 0.05$ . While multiple outcome measures were analyzed in this study, a  $p$  value adjustment was not made because this study was a pilot study.

## Results

Of the 51 invitation letters mailed out, 12 parents directly contacted the research staff. From these 12 inquiries, 8 adolescents with ASD were recruited and enrolled in this study. One participant did not complete the post-treatment assessment and was excluded from analyses in this study. The demographics of the seven adolescents with ASD and their participating parent are shown in Table 2.

### Treatment attendance

The mean attendance rate for all seven participants was 94%. Four of the seven parent and adolescent participants attended all 12 sessions. Three participants missed one to three sessions.

### Acceptability ratings

**Parent participants.** The mean rating for helpfulness of intervention content (on a scale of 1 to 5 with 1 being "not helpful" and 5 being "very helpful") across all 12 sessions for parent participants was 4.53. The session that was ranked the lowest ( $M=4.38$ ) was the session focused on money management, which targeted a range of skills including understanding and evaluating the prices of items and using checking and savings accounts. The sessions that ranked the highest were the sessions on cooking in the oven ( $M=4.64$ ) and the graduation ceremony ( $M=4.72$ ).

**Adolescent participants.** The mean rating for helpfulness of intervention content across all 12 sessions for adolescents was 4.06. The session that was ranked the lowest (i.e.

$M=3.75$ ) was the session focused on money management. The sessions that ranked the highest were the sessions on cooking in the microwave ( $M=4.35$ ) and the graduation ceremony (i.e.  $M=4.50$ ).

### Vineland-II DLS

**Raw scores.** The raw scores on the three Vineland-II DLS subdomains corresponding to the targeted skills taught in STRW and the total raw score of the DLS domain were examined at baseline, post-treatment, and 6-month follow-up. From *baseline to post-treatment*, paired sample  $t$  tests revealed statistically significant improvement in the raw scores on the Domestic subdomain ( $t(6)=2.85$ ,  $p=0.03$ ;  $d=1.1$ ) and DLS domain ( $t(6)=2.86$ ,  $p=0.03$ ;  $d=-1.3$ ). The effect sizes for the above analyses were large (Cohen, 1988). The majority of adolescents demonstrated improvement from baseline to post-treatment on each of the three subdomains and overall DLS domain. Specifically, when examining progress based on maintenance or improvement at the individual level, the following was observed: on the Personal subdomain, three of the seven participants demonstrated progress; on the Domestic subdomain, six of the seven demonstrated progress; on the Community subdomain, five of the seven demonstrated progress; and on the DLS domain, six of the seven demonstrated progress (see Figure 1).

From *baseline to follow-up*, paired sample  $t$  tests revealed statistically significant improvement in the raw scores on the Community subdomain ( $t(6)=4.41$ ,  $p=0.005$ ;  $d=1.7$ ) and DLS domain ( $t(6)=3.880$ ,  $p=0.01$ ;  $d=1.5$ ). Similar to the results at post-treatment, the majority of adolescents demonstrated improvement from baseline to 6-month follow-up on each of the three subdomains and overall DLS. Specifically, when examining progress based on maintenance or improvement at the individual level, the following was observed: on the Personal subdomain, six of the seven participants demonstrated progress; on the Domestic subdomain, five of the seven demonstrated progress; on the Community subdomain, six of the seven demonstrated progress; and on the DLS domain, six of the seven demonstrated progress.

**Table 3.** Vineland-II daily living skills subdomain age equivalent scores at baseline, post-treatment, and 6-month FU.

	Personal			Domestic			Community		
	Baseline	Post	FU	Baseline	Post	FU	Baseline	Post	FU
Entire sample									
Mean (SD)	9.4 (2.9)	12.0 (3.7)	11.7 (1.9)	8.6 (1.8)	10.9 <sup>a</sup> (2.0)	11.4 (2.5)	8.8 (1.4)	11.3 (3.5)	12.0 <sup>b</sup> (2.8)
Individual participants									
1	5.9	6.9	8.8	7.0	9.7	11.8	7.5	6.6	8.9
2	8.5	17.3	14.0	8.6	15.0	15.0	9.0	15.5	14.0
3	8.8	8.5	10.5	8.0	8.6	11.0	10.8	8.3	10.5
4	12.5	11.5	12.5	11.8	10.7	11.0	7.0	11.8	10.8
5	12.5	11.5	10.5	9.7	10.3	7.0	7.5	9.7	8.9
6	5.9	15.0	14.0	6.5	10.7	10.7	9.8	11.8	15.5
7	11.5	14.0	11.5	8.5	11.5	13.3	9.7	15.8	15.0

FU: follow-up; SD: standard deviation.

All age equivalence scores are reported in years for the group mean and for individual participants.

<sup>a</sup>Significant difference between baseline and post-treatment ( $p < 0.05$ ).

<sup>b</sup>Significant difference between baseline and 6-month FU ( $p < 0.05$ ).

From *post-treatment to follow-up*, there were no significant changes in the raw scores on the Vineland-II DLS domain and subdomains. When examining progress based on maintenance or improvement at the individual level, the following was observed: on the Personal subdomain, three of the seven participants demonstrated progress; on the Domestic subdomain, six of the seven demonstrated progress; on the Community subdomain, three of the seven demonstrated progress; and on the DLS domain, five of the seven demonstrated progress.

**Age equivalence scores.** The age equivalence scores for the entire sample and individual participants are presented in Table 3. From baseline to post-treatment, the mean age equivalence score increased in all three subdomains from baseline to post-treatment, but paired sample  $t$  tests revealed statistically significant improvement in the age equivalence scores only on the Domestic subdomain ( $t(6)=2.46$ ,  $p=0.05$ ;  $d=0.9$ ). The Domestic subdomain mean age equivalence score was 8.6 years at baseline and 10.9 years at post-treatment.

From *baseline to follow-up*, the mean age equivalence score increased in all three subdomains, but paired sample  $t$  tests revealed statistically significant improvement in the age equivalence scores only on the Community subdomain ( $t(6)=3.59$ ,  $p=0.01$ ;  $d=1.6$ ). The Community subdomain mean age equivalence score was 8.8 years at baseline and 11.3 years at follow-up.

From *post-treatment to follow-up*, there were no significant changes in the age equivalence scores on the Vineland-II subdomains.

### Daily Living Skills Goal Attainment Scale

The mean DLS GAS item score at post-treatment and follow-up in each of the four targeted areas and total score for

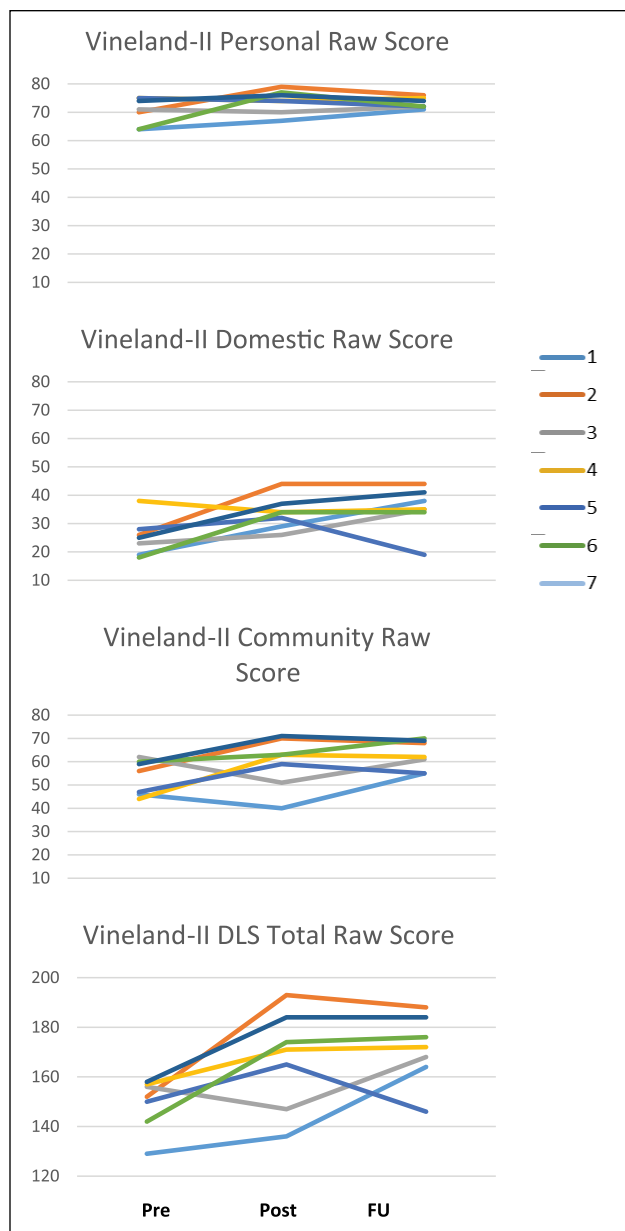
the entire sample and each participant are shown in Table 4 and Figure 2. From *baseline to post-treatment*, paired sample  $t$  tests revealed statistically significant improvement in the mean item score in all four areas and in the total score: Morning Routine,  $t(6)=-12.73$ ,  $p < 0.001$ ;  $d=4.8$ ; Kitchen/Cooking,  $t(6)=-12.57$ ,  $p < 0.001$ ;  $d=4.8$ ; Laundry,  $t(6)=-8.84$ ,  $p < 0.001$ ;  $d=3.3$ ; Money Management,  $t(6)=-6.76$ ,  $p=0.001$ ;  $d=2.6$ ; and Total score,  $t(6)=-16.69$ ,  $p < 0.001$ ;  $d=6.3$ . As can be seen in Table 4, while not all participants achieved a score of 0 in the four targeted areas, all seven adolescents demonstrated improved functioning on each targeted area and on their Total score.

From *baseline to follow-up*, paired sample  $t$  tests revealed statistically significant improvement in the mean item score in all four areas and in the total score: Morning Routine,  $t(6)=-12.73$ ,  $p < 0.001$ ;  $d=2.7$ ; Kitchen/Cooking,  $t(6)=-12.57$ ,  $p < 0.001$ ;  $d=6.6$ ; Laundry,  $t(6)=-8.84$ ,  $p < 0.001$ ;  $d=3.7$ ; Money Management,  $t(6)=-6.76$ ,  $p=0.001$ ;  $d=1.8$ ; and Total score,  $t(6)=-16.69$ ,  $p < 0.001$ ;  $d=5.1$ . All participants demonstrated improved functioning on each targeted area and on their Total score from baseline to 6-month follow-up.

From *post-treatment to follow-up*, there were no significant changes in the mean item scores in the four areas and total score of the GAS. Thus, participants maintained their post-treatment gains but did not improve further.

### Discussion

To our knowledge, STRW is the first manualized group intervention targeting DLS in high-functioning adolescents with ASD (i.e.  $IQ \geq 70$ ). The results of this small feasibility pilot study are promising, especially given that high-functioning adolescents with ASD have significant DLS deficits (e.g. Duncan and Bishop, 2015) that are not typically addressed through school or clinical services.



**Figure 1.** Vineland-II daily living skills subdomain and domain raw scores at baseline, post-treatment, and 6-month follow-up for each participant.

More importantly, these deficits impact successful adult outcomes in areas such as employment, independent living, postsecondary education, and community participation (e.g. Farley et al., 2009; Klinger et al., 2015). Both parent and adolescent participants had high rates of attendance and consistently rated the helpfulness of intervention content as somewhat to very helpful. Interestingly, both adolescents and parents rated the first session on money management as least helpful, which may be due to the large amount of material that was covered.

Overall, the adolescents demonstrated improved DLS on both the Vineland-II and the DLS GAS after

participating in the STRW intervention. Specifically, we found a statistically significant improvement when examining raw scores and age equivalence scores on the Vineland-II Domestic subdomain and DLS domain from baseline to post-treatment. Mean age equivalence scores of the participants on the Vineland-II Domestic subdomain were measured as 8.6 years at baseline and improved to 10.9 years at post-treatment. Thus, the adolescents gained over 2 years of skills over the course of a 12-week group intervention that was maintained at the 6-month follow-up. Adolescents demonstrated significant improvement on the Community subdomain from baseline to follow-up such that their age equivalence score was 8.8 years at baseline and 12.0 years at follow-up.

In regards to change at the individual level on the Vineland-II, six out of the seven participants made progress on the Domestic subdomain from baseline to post-treatment. It seems likely that this area saw the most progress at post-treatment because the Domestic subdomain has 11 items (out of a possible 24 items) that were directly targeted during the sessions on kitchen safety/cooking and laundry. In comparison, the Personal subdomain has 6 items (out of a possible 41 items) that were targeted during the sessions on morning routine, and the Community subdomain has 10 items (out of a possible 44 items) that were targeted during the sessions on money management. Furthermore, adolescent participants clearly enjoyed the sessions on cooking and laundry as evidenced by the high ratings they received on the acceptability forms. Interestingly, from baseline to follow-up, six out of the seven participants made progress on the Personal and Community subdomains. It is possible that these skills may take longer to acquire, especially the skills targeted in the sessions on money management (e.g. purchasing items, using a debit/credit card, creating a budget).

Adolescent participants made significant individual progress on all four areas of the DLS GAS (i.e. Morning Routine, Kitchen/Cooking, Laundry, and Money Management) from both baseline to post-treatment and baseline to follow-up. All DLS GAS items that were targeted were given a score of -2 at baseline and the goal was to achieve a score of 0 (i.e. expected outcome and 100% better performance). At post-treatment, participants made the most progress in the Morning Routine area and were very close to meeting the goal of achieving a post-treatment mean item score of 0 (actual score: -0.03). Kitchen/Cooking was the next area of substantial improvement where they achieved a post-treatment mean item score of -0.53, followed by Laundry where they achieved a post-treatment mean item score -0.75. While some progress was made in the area of Money Management, the post-treatment mean item score of -1.31 is only a slight improvement from the baseline of -2. At 6-month follow-up, participants maintained or made progress in all GAS areas as compared to baseline. The largest mean item score



**Table 4.** Mean item score at post-treatment and 6-month FU on goal attainment scale target areas.

	Routine		Kitchen/Cooking		Laundry		Money		Total	
	Base mean item score	Post mean item score	FU mean item score	Post mean item score	FU mean item score	Post mean item score	FU mean item score	Post mean item score	FU mean item score	Post mean item score
Entire sample										
Mean	-2.0 (0.0)	-0.03 <sup>a</sup>	-0.14 <sup>a</sup>	-0.53 <sup>a</sup>	-0.35 <sup>a</sup>	-0.74 <sup>a</sup>	-0.33 <sup>a</sup>	-1.31 <sup>a</sup>	-1.07 <sup>a</sup>	-0.71 <sup>a</sup>
(SD)		(0.41)	(0.70)	(0.31)	(0.25)	(0.38)	(0.46)	(0.27)	(0.53)	(0.29)
Individual participants										
1	-2.0	0.00	0.17	-0.53	-0.66	-0.64	0.09	-1.50	-0.81	-0.79
2	-2.0	0.40	0.80	-0.44	-0.61	-0.92	-0.17	-1.34	-1.09	-0.69
3	-2.0	0.25	0.00	-0.38	-0.40	-0.29	-0.50	-0.91	-0.69	-0.42
4	-2.0	-0.40	0.20	-0.31	-0.04	-0.22	-0.22	-1.00	-0.55	-0.50
5	-2.0	-0.17	-0.44	-1.11	-0.03	-1.09	0.18	-1.40	-0.77	-1.03
6	-2.0	-0.67	-1.44	-0.19	-0.29	-1.18	-0.55	-1.32	-1.85	-0.97
7	-2.0	+0.40	-0.25	-0.74	-0.40	-0.88	-1.17	-1.68	-1.75	-0.80

FU: follow-up; SD: standard deviation.

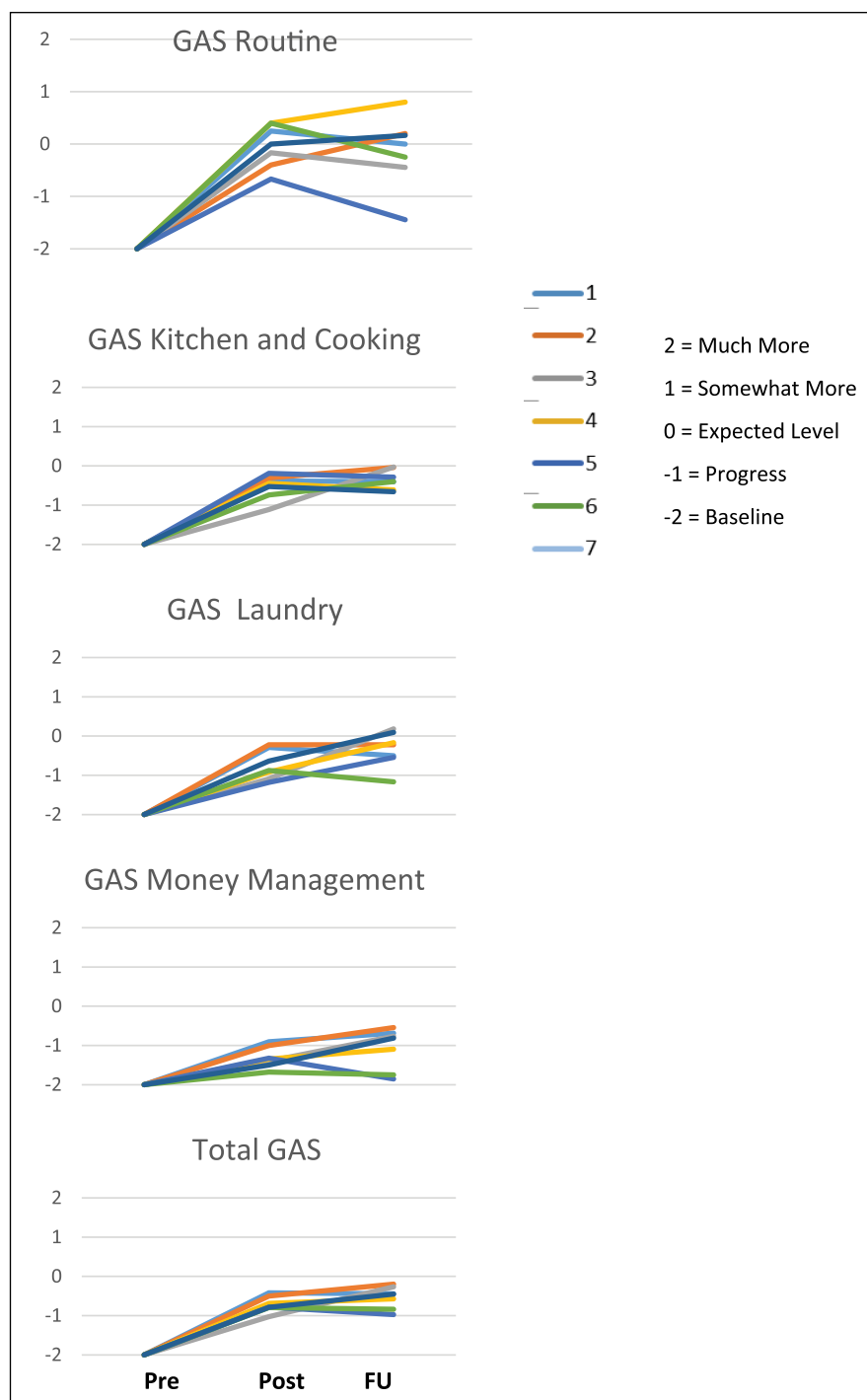
The mean item score at pre-assessment for each of the four target areas and total score equals -2. The goal of the STRW intervention was to have participants make progress to a score of 0 at post-treatment and 6-month follow-up.

<sup>a</sup>Paired sample *t* tests indicated that there was a significant difference between (1) baseline and post-treatment and (2) baseline and 6-month follow-up for all mean item scores for the entire sample (all *p*'s < 0.01).

gains were made in the areas of Laundry (mean score of -0.33 at follow-up) and Money Management (mean score of -1.07 at follow-up). The lower improvement on Money Management may be related to the complexity of this domain and the limited exposure participants had prior to the intervention as compared to the other DLS targeted in the intervention. Specifically, all seven participants had limited knowledge and experience with concepts such as purchasing items, using a checking account, and budgeting. This complexity, coupled with money management being the last set of skills targeted in the intervention, may have contributed to less improvement. In future iterations of the intervention, we plan to introduce money management concepts earlier in the sequence of sessions and program for the use of money skills each week to provide adolescents maximal exposure and the necessary practice that may be needed to make improvements in this area.

One major and promising finding from this study was the significant progress on targeted DLS that was made in a short period of time. Specifically, while adolescents with ASD in this study had a mean chronological age of 16.7 years at baseline, their Vineland-II DLS subdomain mean age equivalence scores ranged from 8 to 9 years at baseline. This 8-year gap between age and DLS is similar or somewhat larger than what has been reported in other studies (e.g. Duncan and Bishop, 2015). However, adolescent participants gained approximately 2 to 2.5 years' worth of DLS over the course of the 12-week intervention that was maintained or improved at 6-month follow-up. This is a clinically meaningful change that illustrates that we may be able to partially close the gap between chronological age and functional DLS, which has practical implications for outcomes in adulthood. The current intervention package achieved these outcomes by utilizing common evidence-based teaching strategies that have been proven to lead to skill acquisition in adolescents with ASD in other areas. The evidence-based strategies taught in the current intervention are applicable to other DLS that will need to be acquired and mastered in the future (e.g. creating a monthly budget based on one's paycheck, cleaning and maintaining a household, and planning meals and then going grocery shopping).

This pilot and feasibility study also allowed us to explore measures that would be sensitive to change. In this study, the DLS GAS appeared most sensitive to treatment progress. This is not unexpected as the GAS is an idiographic measure for capturing individual baseline skills and thus reflecting individual progress against baseline skill level. In contrast, the Vineland-II DLS subdomain and domain raw scores were not as sensitive to change, which is not surprising as there are items on the DLS subdomains that were not targeted in the intervention (e.g. working at a part-time job, navigating the community) and thus would not be expected to show change. Second, the Vineland-II is not necessarily designed to be



**Figure 2.** GAS mean item score at baseline, post-treatment, and 6-month follow-up for each participant.

an outcome measure for treatment studies, but is rather designed to be used as an assessment of current adaptive functioning. For example, two adolescents with ASD showed regression in their skills on the Vineland-II DLS Community subdomain from baseline to post-treatment. Based on their GAS scores and discussion in the group sessions with both parents and teens, it did not appear that these adolescents lost skills or regressed. Rather, it appears

that the parents of these participants overestimated their adolescent's independence in completing DLS tasks at baseline and then acquired a more realistic understanding of how independent their adolescent was after completing the intervention in which they had the opportunity to observe their adolescent performing these skills. Thus, it seems possible that parents of adolescents with ASD may have more accurately completed the Vineland-II items at

post-treatment and follow-up because they had a better understanding of DLS and were also more familiar with the measure.

At the feedback and satisfaction session, parents reported that they appreciated getting individualized feedback on how they were approaching the acquisition of specific DLS and found it beneficial to hear other parents discuss their experiences with implementing the behavior contract. Adolescents noted that they enjoyed the hands-on activities (e.g. cooking in the oven, folding clothing, budgeting for the pizza party) and liked using apps and videos to learn and practice newly taught skills. Not surprisingly, based on the low ratings and difficulties experienced with acquiring skills in the area of money management, both parent and adolescent participants expressed the need to focus on these concepts throughout the intervention in order to make the topic less overwhelming and allow for additional skill building. In addition to money management, parents requested the following: (1) a session focused on coping with growing up and transitioning to adulthood; (2) a session specifically on grocery shopping (e.g. preparing a list, navigating the grocery store, purchasing items) as part of the Kitchen/Cooking sessions; and (3) incorporating money management concepts into all sessions (e.g. having the adolescent purchasing personal care items when working on their morning routine). We plan to address these recommendations in future iterations of the intervention.

### Limitations

As this study was a feasibility study, there were several limitations including a small sample size such that only seven adolescent participants with ASD and their parents completed the study. The small sample size makes it difficult to address the implications of demographic factors such as race, ethnicity, and maternal education. Such factors will need to be examined in a fully powered randomized clinical trial. This study also lacked a control group. The research team that assessed adolescent and parent participants at baseline, post-treatment, and 6-month follow-up were not blind such that they were aware of the purpose of the study. All participants expressed interest in the study shortly after being provided information about the study, which may limit generalizability of findings based on the motivation and interest of these participants. The primary outcome measures were based solely on parent report, which may have led to rater bias such that parents may have felt compelled to report that the intervention had positive effects on targeted DLS goals. Future iterations of the intervention will seek to include more comprehensive outcome measures that may eliminate bias including (1) a direct observation and assessment of skills targeted in the intervention, (2) completion rate of weekly homework assignments as reported by both parent and adolescent participants, and (3) self-report measures of DLS from adolescents with ASD.

### Future directions

This study is a first step in the development and evaluation of a DLS intervention for high-functioning adolescents with ASD. The initial results of this original, manualized group treatment for high-functioning adolescents with ASD and their parents are promising. Furthermore, given the link between DLS and outcomes in the areas of employment, postsecondary education, independent living, and community participation, such interventions are sorely needed. The next steps will be to refine the intervention and finalize the manual (available upon request by contacting the first author), based upon the results of this study including feedback on the intervention content, and to conduct a more rigorously designed randomized clinical trial. Future studies should also investigate the role of individual factors (e.g. cognitive abilities, executive functioning abilities, sensory issues, anxiety symptoms) and family factors (e.g. parental over-involvement in daily routines, household stress) that may not only contribute to DLS deficits but also impact the effectiveness of interventions targeting acquisition of DLS. For example, if an individual with ASD has a relative weakness in verbal comprehension abilities and a relative strength in their nonverbal reasoning skills, it may be particularly beneficial to implement nonverbal learning strategies such as a task analysis, visual checklist, and video modeling to increase the likelihood of skill acquisition. Finally, it will be important to identify other DLS areas (e.g. using public transportation) that could be targeted in this and other interventions for adolescents with ASD.

### Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported in part by the Jack H. Rubinstein Foundation Award by Jack Rubinstein Foundation for Developmental Disabilities and by the National Center for Advancing Translational Sciences of the National Institutes of Health, under Award number 5KL2TR001426-03. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

### References

- Anderson KA, Shattuck PT, Cooper BP, et al. (2014) Prevalence and correlates of postsecondary residential status among young adults with an autism spectrum disorder. *Autism* 18: 562–570.
- Bal VH, Kim S, Cheong D, et al. (2015) Daily living skills in individuals with autism spectrum disorder from 2 to 21 years of age. *Autism* 19: 774–784.
- Bennett KD and Dukes C (2014) A systematic review of teaching daily living skills to adolescents and adults with autism spectrum disorder. *Review Journal of Autism and Developmental Disorders* 1: 2–10.
- Chiang H, Ni X and Lee Y (2017) Life skills training for middle and high school students with autism. *Journal of Autism and Developmental Disorders* 47: 1113–1121.

- Cohen J (1988) *Statistical Power Analysis for the Behavioral Sciences*. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum.
- Drahota A, Wood JJ, Sze KM, et al. (2011) Effects of cognitive behavioral therapy on daily living skills in children with high-functioning autism and concurrent anxiety disorders. *Journal of Autism and Developmental Disorders* 41: 257–265.
- Duncan AW and Bishop SL (2015) Understanding the gap between cognitive abilities and daily living skills in adolescents with autism spectrum disorders with average intelligence. *Autism* 19: 64–72.
- Duncan AW, Will M, Martin K, et al. (2014) Microanalysis of daily living skills in adolescents with ASD. In: *International Meeting for Autism Research*, Atlanta, GA, 14–17 May.
- Elliot CD (2007) *Differential Ability Scales—Second Edition*. New York: Harcourt Brace Jovanovich.
- Farley MA, McMahon WM, Fombonne E, et al. (2009) Twenty-year outcome for individuals with autism and average or near-average cognitive abilities. *Autism Research* 2: 109–118.
- Flynn L and Healy O (2012) A review of treatments for deficits in social skills and self-help skills in autism spectrum disorder. *Research in Autism Spectrum Disorders* 6: 431–441.
- Harwood R and Novotny T (2017) Youth with autism spectrum disorder transitioning to adulthood. U.S. Department of Health & Human Service. Available at: <https://www.hhs.gov/blog/2017/04/06/youth-autism-spectrum-disorder-transitioning-adulthood.html>
- Hong ER, Ganz JB, Ninci J, et al. (2015) An evaluation of the quality of research on evidence-based practices for daily living skills for individuals with autism spectrum disorder. *Journal of Autism and Developmental Disorders* 45: 2792–2815.
- Hume K and Reynolds B (2010) Implementing work systems across the school day: increasing engagement in students with autism spectrum disorders. *Preventing School Failure* 54: 228–237.
- Kanne SM, Gerber AJ, Quirnbach LM, et al. (2011) The role of adaptive behavior in autism spectrum disorders: implications for functional outcome. *Journal of Autism and Developmental Disorders* 41: 1007–1018.
- Klinger LG, Klinger MR, Mussey JL, et al. (2015) Correlates of middle adult outcome: a follow-up study of children diagnosed with ASD from 1970–1999. In: *International Meeting for Autism Research (IMFAR)*, Salt Lake City, UT, 13–16 May.
- Lord C, Rutter M, DiLavore PC, et al. (2012) *Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) Modules 1–4*. Los Angeles, CA: Western Psychological Services.
- Magiati I, Tay XW and Howlin P (2014) Cognitive, language, social and behavioural outcomes in adults with autism spectrum disorders: a systematic review of longitudinal follow-up studies in adulthood. *Clinical Psychology Review* 34: 73–86.
- Matson JL, Hattier MA and Belva B (2012) Treating adaptive living skills of persons with autism using applied behavior analysis: a review. *Research in Autism Spectrum Disorders* 6: 271–276.
- Matthews NL, Pollard E, Ober-Reynolds S, et al. (2015) Revisiting cognitive and adaptive functioning in children and adolescents with autism spectrum disorder. *Journal of Autism and Developmental Disorders* 45: 138–156.
- National Autism Center (2015) *Findings and Conclusions: National Standards Project, Phase 2*. Randolph, MA: National Autism Center.
- Orsmond GI, Shattuck PT, Cooper BP, et al. (2013) Social participation among young adults with an autism spectrum disorder. *Journal of Autism and Developmental Disorders* 43: 2710–2719.
- Palmen A, Didden R and Lang R (2012) A systematic review of behavioral intervention research on adaptive skill building in high-functioning young adults with autism spectrum disorder. *Research in Autism Spectrum Disorders* 6: 602–617.
- Pfeiffer BA, Koenig K, Kinnealey M, et al. (2011) Effectiveness of sensory integration interventions in children with autism spectrum disorders: a pilot study. *American Journal of Occupational Therapy* 65: 76–85.
- Roid GH (2003) *Stanford-Binet Intelligence Scales*. 5th ed. Rolling Meadows, IL: Riverside Publishing.
- Roux AM, Shattuck PT, Cooper BP, et al. (2013) Postsecondary employment experiences among young adults with an autism spectrum disorder. *Journal of the American Academy of Child and Adolescent Psychiatry* 52: 931–939.
- Roux AM, Shattuck PT, Rast JE, et al. (2015) *National Autism Indicators Report: Transition into Young Adulthood*. Philadelphia, PA: Life Course Outcomes Research Program, A.J. Drexel Autism Institute, Drexel University.
- Ruble LA, McGrew JH and Toland MD (2012) Goal attainment scaling as an outcome measure in randomized controlled trials of psychosocial interventions in autism. *Journal of Autism and Developmental Disorders* 42: 1974–1983.
- Ruble LA, McGrew JH and Toland MD (2013) Mechanisms of change in COMPASS consultation for students with autism. *Journal of Early Intervention* 35: 378–396.
- Schaaf RC, Benevides T, Mailloux Z, et al. (2014) An intervention for sensory difficulties in children with autism: a randomized trial. *Journal of Autism and Developmental Disorders* 44: 1493–1506.
- Shattuck PT, Narendorf SC, Cooper B, et al. (2012) Postsecondary education and employment among youth with an autism spectrum disorder. *Pediatrics* 129: 1042–1049.
- Smith LE, Maenner MJ and Seltzer MM (2012) Developmental trajectories in adolescents and adults with autism: the case of daily living skills. *Journal of the American Academy of Child and Adolescent Psychiatry* 51: 622–631.
- Snell-Rood C, Ruble L, Kleinert H, et al. (2017) Stakeholder perspectives on transition planning, implementation, and outcomes for students with autism spectrum disorder. *Manuscript submitted*.
- Sparrow SS, Cicchetti DV and Balla DA (2005) *Vineland Adaptive Behavior Scales (Vineland-II)*. Circle Pines, MN: American Guidance Services.
- Taylor JL and Seltzer MM (2011) Employment and post-secondary educational activities for young adults with autism spectrum disorders during the transition to adulthood. *Journal of Autism and Developmental Disorders* 41: 566–574.
- Wei X, Yu JW, Shattuck P, et al. (2013) Science, technology, engineering, and mathematics (STEM) participation among college students with an autism spectrum disorder. *Journal of Autism and Developmental Disorders* 43: 1539–1546.
- Wong C, Odom SL, Hume KA, et al. (2015) Evidence-based practices for children, youth, and young adults with autism spectrum disorder: a comprehensive review. *Journal of Autism and Developmental Disorders* 45: 1951–1966.