Iterative Development of a Daily Living Skills Intervention for Adolescents with Autism Without an Intellectual Disability

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Abstract

Daily living skill deficits commonly co-occur in individuals with autism spectrum disorder (ASD). These deficits in adolescence are associated with poor outcomes, in both employment and independent living skills as adults. Currently, there are no interventions that directly target daily living skill acquisition in adolescents with ASD without an intellectual disability to facilitate a successful transition to adulthood. In this paper, we discuss the development, refinement, and initial efficacy studies of Surviving and Thriving in the Real World (STRW), a 14-session group treatment for both adolescents with ASD and their parent/caregiver that promotes attainment of critical daily living skills. We summarize initial feasibility studies that have been instrumental in the iterative development of STRW. The structure, core treatment elements, and content of STRW are described in detail. Lastly, we discuss the transition of the in-person STRW intervention to STRW-telehealth, which allows for adolescents with ASD to work on daily living skills in their own home with support from a therapist.

Keywords Adolescents · Autism spectrum disorder · Daily living skills · Adaptive behavior · Intervention

Background

It is currently estimated that over 250,000 adolescents with autism spectrum disorder are enrolled in high school with approximately 50,000 graduating each year and entering the adult world (Baio et al., 2018). It is estimated that at least 50% of individuals with ASD do not have a comorbid intellectual disability (Centers for Disease Control & Prevention, 2014), and as such should have goals that include going to college, getting a job, and living on their own as they transition from high school to the adult world. However, despite their cognitive abilities, adolescents with ASD without an ID have bleak adult outcomes (Farley et al., 2009; Howlin & Magiati, 2017; Orsmond et al., 2013; Shattuck et al., 2012). These adolescents have lower rates of participation in vocational and educational activities after graduating high school, even when compared to those with ASD and a comorbid ID (Shattuck et al., 2012). Indeed, the rates of college graduation are lower for those with ASD as compared to those with typical development (Roux et al., 2015). One study found that only 55% of young adults with ASD were employed, which was significantly lower when compared to other young adults with intellectual and developmental disabilities (Shattuck et al., 2012). Approximately 50% of adults with ASD without ID are living with their parents and require significant supports with everyday activities (Magiati et al., 2014). These poor outcomes are startling because while these adolescents may be doing well in areas such as academics, they do not have the life skills to allow them to truly thrive in the in the real world by meeting goals related to living independently, enrolling and graduating from college, and finding and maintaining employment.

While individuals with ASD without an ID have core impairments in the areas of social-communication and restrictive and repetitive behaviors and interests (APA, 2013), their daily living skills (DLS) are also impaired and typically fall far below their chronological age (Duncan & Bishop, 2015; Kanne et al., 2011). DLS are the tasks that

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are required for everyday independence at home, school, and in the community and are typically acquired by certain ages throughout one's development (e.g., most 2–3-year-olds learn to dress and feed themselves, most 8–10-year-olds are able to bathe themselves independently). The three main areas of DLS (Sparrow et al., 2016) include personal (e.g., brushing teeth, showering, taking medication, managing one's health), domestic (e.g., cleaning, cooking, doing laundry), and community (e.g., managing time, spending and saving, getting and maintaining a job). DLS typically require instruction, practice, and feedback from others before they are mastered and completed independently. Mastery and independence of DLS are the foundation for achieving adult milestones such as managing college classes, maintaining a job, and living independently. For example, DLS such as washing one's work uniform, showering, keeping track of one's work schedule, and arranging transportation are expected and essential when working at a part-time or full-time job.

Adolescents with ASD with average or above average cognitive abilities may have DLS that are 6 to 8 years or more below their age (Duncan & Bishop, 2015; Kanne et al., 2011). While DLS appear to continue to improve throughout adolescence (Bal et al., 2015), these skills often plateau or get worse as individuals with ASD move into adulthood as their DLS do not keep pace with those expected at older chronological ages (Clarke et al., 2020; Smith et al., 2012). The lack of quality adult services and decreased activities (e.g., social, employment, college) may lead to the decrease in DLS often seen after graduation from high school (Baghdadli et al., 2012; Chiang et al., 2017; Magiati et al., 2014; Tantam, 2003; Taylor & Seltzer, 2011). As they get older, the gap between DLS and age widens (Duncan & Bishop, 2015; Kanne et al., 2011; Klin et al., 2007; Perry et al., 2009 {Kanne, 2011 #2282), which then makes it difficult for individuals with ASD to achieve their long-term goals.

Several studies have identified DLS as a predictor of a more positive and successful adult outcome for adolescents with ASD (Clarke et al., 2020; Farley et al., 2009; Klinger et al., 2015; Smith et al., 2012; Taylor & Mailick, 2014). Notably, one recent study found that while the DLS of individuals with ASD declined after they exited high school, those who had higher DLS were more likely to pursue postsecondary education and be employed (Clarke et al., 2020). These poor outcomes in adulthood are both unexpected and sobering because parents and professionals often expect adolescents with ASD without ID to make a successful and seamless transition to the adult world because of their intact cognitive abilities. Addressing adult outcomes in those with ASD is critical not only for individuals, but for society as a whole. The economic burden of ASD is estimated to be approximately $460.8 billion in 2025, which is greater than that of other chronic conditions such as diabetes and ADHD

(Leigh & Du, 2015). This is likely exacerbated by the lack of quality, affordable services for adolescents with ASD and their families (Baghdadli et al., 2012; Chiang et al., 2017; Magiati et al., 2014; Tantam, 2003). Cost effective treatments that improve areas of functioning, such as DLS, may not only lead to improved adult outcomes, but decrease cost of care in adulthood (Leigh & Du, 2015). Adolescence may be a critical time to intervene by identifying critical DLS that need to be acquired in order to increase the likelihood of continued skill development and maintenance, even in the face of few adult services. Overall, it is clear that DLS are a critical component to success, and the link between DLS and adult outcome underscores its importance as a treatment target for this population.

Individuals with typical development appear to develop DLS somewhat automatically through direct instruction, experiences, and interactions with adults and peers at home, school, and in the community (Sparrow et al., 2005). While the social-communication challenges (e.g., understanding expectations, fewer peer interactions) and restrictive and repetitive behaviors and interests (e.g., rigid thinking, resistance to change) associated with a diagnosis of ASD may affect successful acquisition of DLS (Hume et al., 2014; Kapp et al., 2011; Shattuck et al., 2007; Tantam, 2003; Taylor & Seltzer, 2010), a range of other challenges and factors also make a significant contribution to the development of DLS. Executive functioning difficulties such as planning, following multi-step directions, time management, and getting started on tasks may lead to challenges in learning and mastering DLS (Hume et al., 2014; Pugliese et al., 2015, 2016; Wallace et al., 2016). DLS appear to be influenced by factors such as parental expectations, decreased fostering of independence, or being overly dependent on others (Drahota et al., 2011; Green & Carter, 2014; Hall & Graff, 2011; Hume et al., 2014; Kirby, 2016; Kraper et al., 2017; Tomanik et al., 2004). It is clear that the complex set of individual strengths, challenges, and ASD symptoms need to be considered when determining how to target DLS at home, school, and in the community.

There are a range of evidence-based strategies that have been identified for targeting adaptive behavior, including DLS, in adolescents with ASD utilizing various behavioral strategies (e.g., direct instruction, reinforcement, chaining, task analysis, prompting) and technology, visual supports, and video modeling (Bennett & Dukes, 2014; Flynn & Healy, 2012; Hume & Reynolds, 2010; Matson et al., 2012; Mechling et al., 2009; National Autism Center, 2015; Palmen et al., 2012; Wong et al., 2015). The literature has often focused more on supports and interventions that target DLS in children and younger adolescents with ASD or individuals with ASD with a comorbid ID (Bennett & Dukes, 2014). Thus, there is a clear gap for how best to build pivotal DLS in adolescents

with ASD without an ID (i.e., IQ ≥ 70) to facilitate successful outcomes in college, employment, and independent living. Further, there are no intervention programs that address the acquisition and mastery of DLS in adolescents with ASD. Therefore, our team sought to address this gap in the literature by developing an intervention package that implements the use of evidence-based treatment strategies to teach critical DLS in order to have a significant impact on both the current functioning and future adult outcome for adolescents with ASD without a comorbid ID.

A primary aim of this paper is to detail the iterative development of a DLS intervention specific to adolescents with ASD without a comorbid ID that includes the initial feasibility studies that demonstrate promising rates of efficacy and acceptability. Throughout its development and refinement, the DLS intervention has utilized evidence-based strategies that lead to acquisition and mastery of critical, age-appropriate DLS in adolescents with ASD and has incorporated components from existing evidence-based interventions for youth with ASD (Laugeson et al., 2012; Reaven et al., 2012; White et al., 2010). Another aim of this review is to provide in-depth information on the DLS intervention including content, structure, and use of specific treatment strategies as a way to further our understanding of not only how to teach DLS, but also the essential intervention components that appear to be meaningful, engaging, and successful for adolescents with ASD and their parent/caregiver. Thus, a comprehensive description of the development, refinement, and use of the DLS intervention may not only assist clinicians who are targeting these skills in various settings (e.g., outpatient clinic, school, or via telehealth), but may also provide insight to researchers who are developing interventions for adolescents with ASD to facilitate their transition to the adult world.

Surviving and Thriving in the Real World

Surviving and Thriving in the Real World (STRW) was developed through an iterative approach that sought to gain an understanding of how to develop a DLS intervention to best serve adolescents with ASD and their families. STRW was designed for the treatment of adolescents with ASD without an ID who have significant DLS deficits as reported by their parent. The overarching goal of STRW is to help teens with ASD develop the key life skills that will help them to not only survive, but to thrive in the real world.

Development of STRW

Parental Concerns During Adolescence

We developed a survey to gain an understanding of the concerns that parents of adolescents with ASD without an ID had and then conducted focus groups with both adolescents with ASD and their parents to get additional information about these concerns. Results from these two studies indicated that parents were concerned about their adolescent's ability to obtain the skills that would be necessary for them to live independently (Duncan et al., 2011, 2012). In fact, 78% of parents reported that they expected their adolescent with ASD without an ID to live at home or in a supported setting as an adult. Parents expressed the need for an intervention that would teach key life skills to their adolescent (e.g., cooking, waking up on time). The majority of adolescents with ASD confirmed that they had not mastered age-appropriate DLS such as laundry, using a checking account, and cooking for themselves.

Profile of DLS in Adolescents with ASD

We then sought out to further understand the profile of DLS strengths and challenges in adolescents with ASD (Duncan & Bishop, 2015). First, we conducted a secondary data analysis on over 400 adolescents with ASD without ID (IQs ≥ 85) and found that over 55% had a DLS deficit, defined as a DLS score on the Vineland at least one standard deviation below IQ. The results indicated the need to close the substantial gap between cognitive ability and actual life skills in order to facilitate a successful adult outcome. In our follow-up study of 75 parents of adolescents with ASD without ID, a detailed analysis of individual DLS items on the Vineland-II revealed significant weaknesses in areas such as preparing food, doing laundry, cleaning, taking medications, and budgeting and managing money (Duncan et al., 2014).

Development of STRW Intervention Components

With an understanding of the DLS deficits in adolescents with ASD from both a research and clinical perspective, our team created the STRW intervention, which utilized behavioral and developmental principles while also embedding in the individual profile of strengths, challenges, and characteristics of individuals with ASD. STRW was designed to target four core DLS areas (i.e., personal hygiene and self-care, laundry, cooking, and money management) that are impaired in most adolescents with ASD. These DLS areas were chosen because they are easy to teach (e.g., the steps of laundry using a task analysis), allow for the adolescent to practice evidence-based

strategies during the learning process, provide opportunities for the adolescent to achieve success and witness their own growth, initially require few social-communication skills, and are critical to independence in adolescence and adulthood. When determining how to foster acquisition, mastery, and generalization of the DLS areas, it was clear that evidence-based behavioral principles such as task analysis, prompting, modeling, scaffolding, and reinforcing would be likely be most successful because it is well established that a range of DLS can be successfully taught to adolescents with ASD using behavioral strategies (Bennett & Dukes, 2014; Palmen et al., 2012; Steinbrenner et al., 2020; Wong et al., 2015). Thus, our team sought to expose adolescents and their parents to a range of evidence-based behavioral strategies that could be used to build DLS both during and after the STRW intervention (see below section on 'Evidence-Based Strategies'). To facilitate the use of strategies, we incorporated a behavioral contract that would explicitly specify the DLS goal for the teen, list any strategies that they should use, and indicate the reward that they receive when they met their goal (see below section on 'Essential Treatment Components'). A developmental approach was used such that age-appropriate expectations and demands and parental involvement were taken into consideration when deciding what DLS to target in the STRW intervention (Reaven, 2011; Sze & Wood, 2008). All DLS targeted in STRW are skills that are expected of all teens by the time that they graduate high school. The STRW sessions normalized that some DLS were challenging for teens with ASD and then emphasized a collaborative approach to building skills both during session and out of session. This developmental perspective was also emphasized when working with parents when discussing how to foster age-appropriate independence for teens with ASD (e.g., doing their own load of laundry each week, packing their lunch as part of their morning routine, putting their money from a part-time job toward their cell phone bill, etc.) in an incremental, but challenging manner. Lastly, the needs of individuals with ASD and their parents was embedded into the STRW curriculum. For example, issues that may be more specific to adolescents with ASD such as sensory aversions (e.g., when brushing teeth, when doing laundry) or food preferences were discussed openly in sessions to identify solutions for these concerns. Parents were also encouraged to discuss any challenges that they have with their teen's emerging independence (e.g., overinvolvement in teen's DLS activities, decreased expectations about abilities).

Iterative Feasibility Studies

We utilized the Obesity-Related Behavioral Intervention Trials (ORBIT) model of intervention development (Czajkowski et al., 2015) to rigorously develop and test STRW using the following phases: (1) define the basic elements of a DLS intervention and identify the best setting for delivery in both school ($N=3$) and clinical outpatient settings ($N=2$); (2) refine the core components of the STRW intervention (i.e., developing a STRW manual for delivery in a group setting with concurrent parent and adolescent sessions); and (3) conduct proof of concept studies through both a pre-post treatment design ($N=7$) and a small randomized clinical trial (RCT $N=12$) to examine initial acceptability and feasibility of STRW. The above phases in the ORBIT model built upon each other to refine the final intervention we are currently testing in a larger RCT of STRW as compared to an active control group.

Feasibility Study 1: School Setting

Our initial feasibility study examined intervention delivery in the school setting and at the individual level using a series of three single case interventions. While we anticipated that STRW would be best implemented as a group intervention, in this first iteration we conducted individual sessions to develop and refine the session content. A school setting was chosen for several reasons including the flexibility of working with school personnel to identify class periods (e.g., intervention classes, study hall) that would allow for the adolescent to be pulled out to work on DLS, access to a kitchen and laundry area to facilitate teaching and mastery of targeted DLS, and increased convenience for adolescents and families as the intervention would be delivered at a location that did not require extra travel as it could be delivered as part of the adolescent's school day. In weekly individual therapy sessions across three adolescents at one school, a licensed clinical psychologist taught adolescents the DLS identified as critical by the parents in our prior studies above including (1) developing a morning hygiene routine, (2) cooking in the microwave, stove, and oven, and (3) doing laundry. The structure of sessions involved direct instruction (e.g., didactic lessons, video modeling, hands-on activities, use of technology) followed by the opportunity to practice the DLS with feedback and support from the therapist (e.g., sorting and loading laundry into a washing machine). The therapist sent weekly email updates to parents that included a description of what occurred in each session and the adolescent's homework assignment to promote generalization of the DLS taught at school to home.

Through this iteration at the school, we found that parent involvement at a higher level than weekly communication would be critical to the intervention. The parents of our participants required significant support (e.g., uncertainty about how to hold teens accountable and build motivation to work on DLS, decreased confidence regarding use of strategies to teach specific DLS) via email or by phone as they worked to address the DLS at home with their teen. Thus, while there were clear advantages to conducting the treatment in the

school setting, a stronger parent component was necessary to provide support and coaching as the adolescent practiced DLS outside of sessions in order to master and generalize skills to the home environment. We explored whether parents could be incorporated into the treatment when delivered in the school setting. Unfortunately, parents' work schedules precluded them attending sessions delivered during the school day and schools could not remain open in the evenings to accommodate parents' schedules. Based on these findings, the next iteration was designed for an outpatient clinic setting.

Feasibility Study 2: Outpatient Setting

A licensed psychologist worked across two parent/teen dyads in weekly individual therapy sessions to teach core DLS (i.e., morning routine, cooking, and laundry). The sessions covered content related to building new DLS and focused on discussing the teen's progress and problem-solving how to increase motivation and practice DLS in the home environment. The adolescent and their parent identified specific DLS goals and an associated reward using a behavior contract and support was provided by the therapist (e.g., setting realistic expectations, negotiating rewards). As a homework assignment, the parent/adolescent dyads practiced newly learned DLS in their home (e.g., cooking in the microwave) because they were not able to practice it within session. Teens did appear to learn DLS that were taught in session and generalized it to the home with guidance from their parent. The reward provided by the behavior contract was clearly motivating for teens and incentivized them to practice DLS at home. Based on both parent feedback and the observations that parents clearly benefitted from the coaching and support provided by the therapist in individual sessions, we felt a group session format would allow for even more support from both the therapist and other parents (e.g., exposure to different strategies and approaches that target DLS based on adolescent's strengths and challenges, normalization of DLS challenges). Parents also noted that they felt their teen may be even more motivated to participate in treatment if they were able to practice DLS with other teens with ASD.

Feasibility Study 3: Refinement of the STRW Intervention for Delivery in the Outpatient Setting Using a Group Format

Our initial feasibility studies allowed us to identify core intervention components (e.g., the specific DLS to target) and refine the use of evidence-based strategies to effectively target DLS. For example, the use of a contract between the adolescent and parent would continue to remain a core component of STRW because it proved critical to maintaining

accountability to practice and master targeted DLS between sessions and to increase adolescent motivation through earning of rewards. A STRW intervention manual that included detailed directions, helpful tips, and all handouts was further refined to be used by all therapists facilitating STRW sessions. The initial feasibility studies indicated that the intervention would be more effectively delivered in an outpatient setting to allow for the involvement of parents. Further, while it was always our intent to deliver STRW in a group format, the initial feasibility studies confirmed the need for this structure. A separate parent group would not only provide direct instruction on how to effectively implement strategies to promote and prioritize the successful development of DLS, but would allow for the opportunity to discuss and troubleshoot issues such that parents could learn from the challenges and triumphs of other parents. A separate teen group would normalize DLS deficits and the learning of DLS in sessions for teens as they learned and practiced new skills with other peers with ASD. Thus, the next iteration of STRW was conducted in the outpatient setting with a concurrent parent group and an adolescent group. Several evidence-based group treatments have effectively utilized concurrent treatment to adolescents with ASD and their parents and typically enroll 4 to 10 participants in each group (Laugeson et al., 2012; Reaven et al., 2012).

Pre-post Treatment Design

Our team then conducted an initial feasibility study of the STRW group intervention in the outpatient setting with seven adolescents with ASD without an ID and their parents (Duncan et al., 2017) using a pre-post design. Adolescents were eligible to participate if they met the following criteria: (1) were enrolled in high school (9th to 12th grade); (2) had a diagnosis of ASD that was confirmed using the Autism Diagnostic Observation Schedules, 2nd Edition [ADOS-2; (Lord et al., 2012)]; (3) had an IQ ≥ 70; and (4) had a Vineland Adaptive Behavior Scales, 2nd Edition [Vineland-2; (Sparrow et al., 2005)] score on the DLS domain or subdomains that was at least 15 points below their IQ. STRW consisted of 12 weekly, 90-min, concurrent parent and adolescent sessions that targeted personal hygiene and self-care, laundry, kitchen safety and cooking in the microwave, stove, and oven, and basic money management skills. Adolescent sessions focused on direct instruction and practice of specific DLS and parent sessions targeted how to successfully implement a behavior contract to teach, practice, and master DLS at home (Duncan et al., 2017). One therapist facilitated the parent sessions, and two therapists facilitated the adolescent sessions. The primary outcome measures were the Vineland-2 and goal attainment scaling (GAS; Ruble et al., 2012, 2013). Rates of attendance were high, and parents and teens reported high rates of satisfaction. Results indicated that

adolescent participants made significant gains on the Vineland-II and GAS. Specifically, adolescents made gains of two–two and a half years of skills from baseline to 6-month follow-up on the Vineland-2 Domestic and Community subdomains. The parents expressed high rates of satisfaction with the separate parent group (via both anonymous satisfaction survey and during sessions) and cited the support and guidance that they received from both the therapist and the other parents. Parents also noted that their teens seemed to be more willing to practice DLS at home after learning how to do it within the adolescent group. As a result, our team kept the structure and delivery of STRW of the concurrent parent and adolescent groups.

Based on the learnings from this pilot, several refinements were made to the content of the STRW intervention based on feedback from parent and adolescent participants including (1) adding a session on grocery shopping; (2) incorporating money management content into each session instead of the sessions targeting this DLS to build money awareness and spending skills; and (3) adding a session on coping with the anxiety and stress due to the upcoming transition to adulthood.

Small Randomized Clinical Trial (RCT) with a Waitlist Control Design

In order to further evaluate efficacy and feasibility, our team completed a small feasibility RCT with 12 adolescents with ASD without an ID who were randomized to STRW ($n=6$) or a waitlist control group ($n=6$; (Duncan et al., 2021). A wait list control design was utilized to test whether the improvements in DLS following STRW were due to the passage of time and exposure adolescents would typically have to DLS as part of their daily life. Inclusion criteria was the same as the pre-post feasibility study (see above) with the exception that the Vineland Adaptive Behavior Scales, 3rd Edition [Vineland-3; (Sparrow et al., 2016)] was used because this newer version added additional items to the DLS domain to allow for a more comprehensive assessment of DLS. Four out of six participants from the waitlist control group crossed over and completed the STRW intervention. STRW consisted of 14 weekly, 90-min concurrent parent and adolescent sessions that included the modifications from the pre-post feasibility pilot study. Primary outcome measures were the Vineland-3 and GAS. Rates of attendance and satisfaction were high for parent and teen participants. Results indicated that the STRW treatment group made significant gains on the Vineland-3 DLS domain compared to the waitlist control group. These findings were replicated for the waitlist control group participants who crossed over and completed STRW as they too made significant gains on the Vineland-3 domain and subdomains and all GAS areas from post-waitlist to post-treatment. When the treatment and waitlist control group participants who completed STRW were combined, significant gains on all primary outcome measures were found. Specifically, the adolescents gained 4 to 7 years of skills on the Vineland-3 DLS subdomains from baseline to 6-month follow-up (Duncan et al., 2021). Further, these adolescents closed the gap such that the mean Vineland-DLS standard score was now in the average range after a mean increase of 15 points.

While this study indicated that the core structure, format, and content of STRW appeared to be beneficial, several refinements were made to the STRW protocol based on adolescent feedback about how to improve the adolescent sessions including: (1) adding in additional interactive group activities and games to build skills (e.g., Price is Right© games to work on money skills); (2) increasing use of video clips to teach DLS in adolescent sessions (e.g., video on how to measure dry and wet ingredients); and (3) using technology to build DLS (e.g., using reminders on a phone or smart speaker). Additional refinements were made based on parent feedback including removing the session on coping skills because it distracted both parents and teens from their DLS goals.

RCT of Final STRW Intervention

Our research team is currently conducting a RCT of STRW (delivered both in-person and later adapted to telehealth due to COVID-19) to determine its efficacy on improving DLS compared to a social skills intervention. We anticipate enrolling over 100 adolescents with ASD without an ID between the ages of 14 and 18. Inclusion criteria for the current study is identical to our previous efficacy studies (Duncan et al., 2017; 2021). Our primary aim is to determine if adolescents with ASD make significant DLS gains as assessed by both the Vineland-3 and GAS when compared to an intervention targeting social skills. This will allow us to collect data on STRW compared to an active intervention delivered in the same format and with the same number of sessions but targeting a different outcome. Further, we will be able to explore if certain adolescent factors (e.g., executive functioning, age, cognitive abilities, internalizing and externalizing behaviors) or family characteristics (e.g., parenting style, maternal education, and income) affect DLS gains in STRW.

Structure of STRW

In its current iteration that incorporates changes from the pre-post feasibility study and the small RCT described above, the STRW intervention consists of 14 weekly, 90-min concurrent adolescent and parent group sessions that target hygiene and self-care, laundry, cooking and kitchen skills,

and money management. STRW groups typically consist of four to eight adolescents with ASD without ID and their caregiver/parent. There are separate therapists for the parent and adolescent groups. The adolescent group also typically includes two to three graduate student trainees who assist with implementation. All therapists receive training on STRW by attending a 3-h overview of STRW, reviewing the manual, watching previously taped STRW sessions, and attending a 1-h weekly group supervision. The structure, core content, evidence-based strategies, and essential treatment components of STRW are discussed in detail below (see Fig. 1).

Parent Group Sessions

Each week parents receive instruction (e.g., didactics, practice, role play), detailed information (e.g., handouts, online and print resources), and feedback through large group discussions on how to utilize evidence-based strategies to teach and then generalize target DLS for their adolescent with ASD. The content and activities of the adolescent sessions are discussed in detail and parents are provided with all of the handouts and resources that teens use in their group session. Beginning in Session 4, the therapist reviews the progress that each teen made on the goals listed on their DLS contract. The therapist in the parent group sessions also discusses barriers (e.g., addressing decreased motivation from the teen, developing parental skills to foster independence with DLS, identifying rewards to increase the likelihood of continued skill development) and assists in problem-solving these barriers. Parents' skill acquisition and implementation

are further facilitated by the group process of sharing successes, use of beneficial strategies and supports, and problem-solving with one another. Parents complete satisfaction forms at the end of each session. Beginning in Session 4, parents fill out a weekly form that tracks the completion of goals being targeted on the contract. Parents join the adolescent session for the last 5 to 10 min to get an update on the content that was covered and specific information on their teen's performance in the session. This provides an opportunity for an adolescent session therapist to discuss any issues regarding completion of homework assignments, upcoming homework assignments, and any behavioral issues (e.g., participation level, motivation, etc.) with the parent/teen dyad.

Adolescent Group Sessions

Each week specific DLS are targeted. Through didactics, demonstration, role plays, small group activities, and direct teaching and modeling, adolescent therapists break down target DLSs into manageable steps and then assist the teen in practicing the DLS. Multiple evidence-based strategies are used in each adolescent group session to increase skill acquisition. Adolescents work with therapists to learn and practice each of the skills in session. Many activities are done with partners or in small groups with the support of a therapist. For example, for the session targeting cooking on the stovetop, therapists utilize visual strategies (e.g., following a recipe with both written directions and pictures of each step), technology (e.g., viewing a video of how to cook scrambled eggs using a phone app that has both recipes and accompanying videos that demonstrate
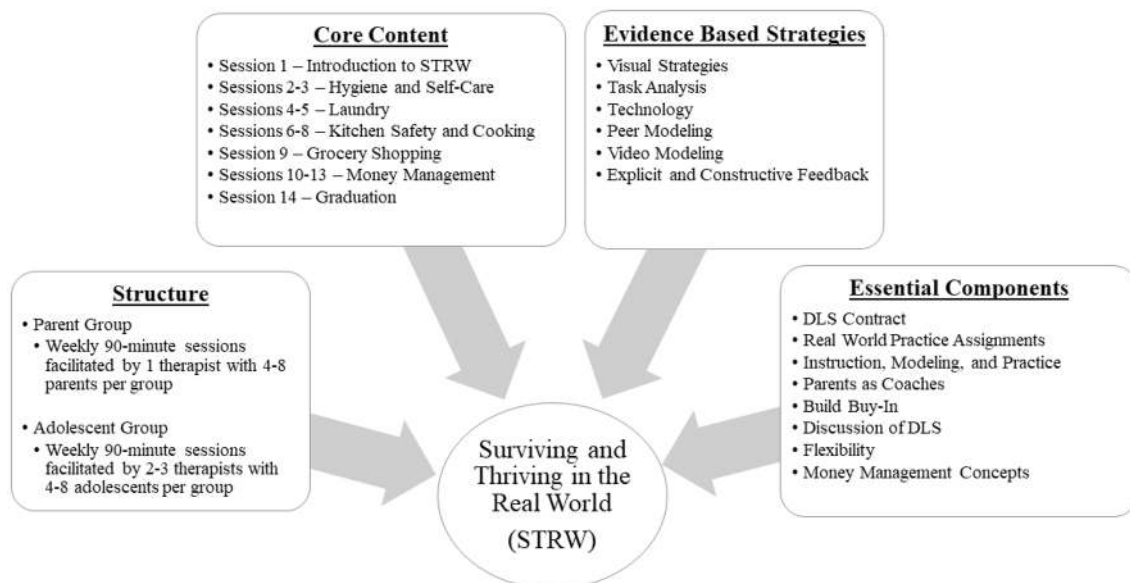

Fig. 1 Elements of the STRW intervention

how to cook the recipe), and direct instruction and feedback as each adolescent participant prepares, cooks one to two items, and cleans up the kitchen area. While not directly targeted, appropriate social skills are modeled and discussed when relevant (e.g., listening to others, offering appropriate advice to other teens). Adolescents complete satisfaction surveys at the end of each session. Beginning in Session 4, adolescents fill out a weekly form that tracks the completion of goals being targeted on the contract.

Content of STRW

Introduction to STRW

Session 1 of STRW is held with parent/teen dyads together as to provide an introduction to the STRW intervention and allow for parents and teens to get to know one another. Each parent/teen dyad identifies several short-term and long-term life goals and then describes the essential life skills that are needed to reach future goals, which are discussed through both partner-based and large group activities. The rationale, logistics, and commitments for STRW are reviewed as a group to increase understanding of the intervention goals and increase the likelihood of motivation and investment in the process.

Hygiene and Self-care

Sessions 2 and 3 are focused on building skills in the area of personal hygiene and self-care that typically occur in the context of a morning or nighttime routine. Parents are encouraged to begin with targeting the morning routine because it consists of skills and behaviors that consistently occur between the time a teen wakes up and the time a teen goes to school. In the teen group, the importance of hygiene is discussed and the teens identify their own personal hygiene activities (e.g., showering, wearing deodorant, shaving, washing face, etc.) and discuss rules for how often they should be completing these tasks (e.g., daily, weekly, monthly). The task analysis (see Fig. 2) is introduced as a strategy that can be used to break down complex skills into more manageable steps. Real World Practice assignments for these sessions include creating a task analysis for the steps of their morning routine, determining the teen's level of independence with morning routine steps, and then identifying what strategies/supports could help the teen become more independent. Parents and teens begin using the DLS contract (see Fig. 3) to work on their morning routine beginning in Session 3.

Laundry

Sessions 4 and 5 target the skills of sorting laundry, using the washing machine and dryer, and folding/ putting clothing away. A laundry room is not available for use in our clinic space, so a large cutout of a washing machine and dryer are used for the various activities. Teens are given explicit rules for completing laundry and also get practice through partner and large group activities (e.g., sorting laundry, identifying the appropriate washing machine cycle to wash clothing items, and folding shirts using a folding board). Teens create a task analysis of the entire laundry process and discuss strategies to increase the likelihood of their success. Real World Practice assignments include adding a laundry goal to their DLS contract and discussing how their family may do laundry differently from what was discussed in session.

Kitchen Safety and Cooking

All kitchen safety and cooking sessions are conducted in a kitchen with a stovetop, oven, and microwave to provide an opportunity to demonstrate and practice skills. Teens are also taught kitchen safety concepts and these are practiced and modeled (e.g., cleaning up a spill). Session 6 focuses on kitchen safety (e.g., knife skills, fire safety), making no-cook recipes (e.g., bagel and cream cheese, peanut butter and jelly sandwich), and microwaving recipes (e.g., macaroni and cheese, soup, and popcorn). Session 7 targets mixing and measuring dry and liquid ingredients and cooking in the oven (e.g., pizza, chocolate chip cookies). Session 8 addresses cooking on the stovetop (e.g., grilled cheese, spaghetti and sauce, and scrambled eggs) and cleaning up the kitchen (e.g., using a kitchen cleaning checklist). Throughout these three sessions, teens are exposed to and/or practice a variety of skills including how to use a can opener, operate a toaster, use potholders to take items out of the oven, etc. Real World Practice assignments include adding the goal of cooking in the microwave, oven, and stovetop to the DLS contract while also adhering to kitchen safety and cleaning checklists.

Grocery Shopping

Session 9 serves as a transition from the sessions on cooking to future sessions on money management by focusing on how to make and use a list for purchasing grocery items, navigating the various aisles and sections of a grocery store, purchasing items (self-checkout and regular checkout), and putting items away at home. The Real World Practice assignment can be individualized to the teen's experience and may include making a list of items needed at the grocery store, finding the items, purchasing the items, and putting the items away.

Task Analysis Worksheet

Skill: ___Morning Routine___

Step	Can you do this step independently?	What could you do to become more independent?
1. Wake up on my own	Rarely (2 out of 5 days) Requires parent prompt	Set the alarm on my alarm clock to wake me up Monday through Friday at 6:00am and again at 6:10am. Place alarm clock on my desk, so I have to get out of bed to turn it off.
2. Take a shower	Often (4 out of 5 days) Requires parent prompt	Use my notes phone app to make a checklist of morning routine steps. Refer to list in the morning and check off each item on the list as I complete it. Sync checklist with my parent's phone to make sure that I have done everything.
3. Put on clean clothes	Always (5 out of 5 days)	
4. Use a face wipe to wash face.	Rarely (1 out of 5 days)	Keep morning routine items in a basket on bathroom counter. Use the checklist on the notes phone app.
5. Brush my teeth	Sometimes (3 out of 5 days)	Keep morning routine items in a basket on bathroom counter. Use the checklist on the notes phone app
6. Put on deodorant	Sometimes (3 out of 5 days)	Keep morning routine items in a basket on bathroom counter. Use the checklist on the notes phone app
7. Comb hair	Always (5 out of 5 days)	
8. Eat breakfast	Always (5 out of 5 days)	
9. Pack my backpack (books, notebooks, laptop, charger, wallet, phone)	Never (0 out of 5 days)	Put a checklist by the hook where I keep my backpack so I know what to pack. Have parent double-check packing of backpack.
10. Take medication and vitamin	Never (0 out of 5 days – requires prompting from parent)	Have medication sorted in a daily pill box for Monday. Set a reminder on smart speaker in the kitchen for 6:45am to take medication.

Fig. 2 Example task analysis of morning routine

Money Management

The goal of the four money management sessions is to build financial literacy skills in the areas of spending, saving, and budgeting. Session 10 focuses on identifying the teens' understanding of basic money concepts, discussing how to be a smart spender, and examining the main features of and differences between a checking account, savings account, and a credit card. Session 11 emphasizes the importance of opening a checking account and walks

Fig. 3 Example DLS contract

through the steps of how to apply for and use an online checking account (e.g., transferring money between savings and checking accounts, checking balance, and confirming purchases). This same session also discusses how to make a plan to save up for short-term and long-term purchases, how to use a money diary to track spending habits, and how to keep personal information safe. Session 12 focuses on the steps for developing a monthly budget supported by several realistic examples so that the teens gain experience with creating a budget that includes income, fixed expenses, and variable expenses. Building on the concepts covered in the money management sessions, in Session 13, the teens are given the task of budgeting for their graduation session. Specifically, teens are provided a set amount of money to plan for the final graduation session that will include a party with pizza, snacks, dessert, drinks, and miscellaneous supplies. Teens identify the items that need to be purchased (based on number attending, food preferences, etc.) and then work together to budget for the party. Due to the fact that teens have both varying money management skills and opportunities to practice spending and saving (e.g., part-time job vs. weekly allowance), Real World Practice assignments are more individualized than for previous sessions. Parents and teens are given a range of options that include opening up a savings account, making a purchase with a debit card, tracking weekly spending with a money diary, budgeting

for an upcoming activity or event, and/or budgeting for ingredients to cook a meal.

Graduation

The final session is focused on celebrating the successes of the parent and teen as they have targeted their specific goals on the DLS contract. The first half of the session is spent eating the food that the teens planned and budgeted for in the previous session. The second half includes self-reflection of achievements and challenges, discussion of lessons learned, identifying what DLS goals the parent/teen dyads hope to achieve in the future (e.g., 3 to 6 months), and presenting the graduation certification of achievement to the teens.

Evidence-Based Strategies

A range of evidence-based strategies are utilized throughout STRW to help adolescents acquire specific DLS in session and then master and generalize these skills to the home and the community. These strategies have been shown to be an effective way for individuals with ASD to learn adaptive behavior skills (Bennett & Dukes, 2014; Flynn & Healy, 2012; Palmen et al., 2012) as well as skills in other domains (Hume et al., 2014; National Autism Center, 2015; Reichow & Volkmar, 2010; Steinbrenner et al., 2020). The strategies

listed below are utilized throughout STRW sessions and in the Real World Practice assignments, though some strategies are used more frequently than others. Parents and teens are encouraged to identify the strategies that are effective in helping them develop DLS at home and in the community.

Visual Supports

In adolescent group sessions, a visual schedule is presented and briefly discussed at the beginning of each session so that teens are aware of all of the activities that will be covered (Hume & Odom, 2007; Hume et al., 2012; Krantz et al., 1993). Visual supports such as creating a checklist of steps (e.g., the hygiene tasks that need to be completed as part of one's morning routine) are taught to increase skill acquisition. By posting these checklists in the area that the targeted DLS will occur (e.g., kitchen, bathroom, laundry room), it serves as a reminder of what teens need to do without the parents providing any support or prompts. Parent/teen dyads are also encouraged to post their DLS contract somewhere in the house so that it can serve as a visual reminder of the teen's goals, expectations, and rewards.

Task Analysis

A task analysis (see Fig. 2) is the process of breaking down a complex skill or activity into smaller, more manageable steps (Hume & Odom, 2007; Hume et al., 2012). This is the first strategy taught in STRW as adolescents work on breaking down the steps of their morning routine so that they can follow and complete the skills independently. It serves the dual purpose of clearly outlining all of the steps of a task, but also allows for the parent/teen dyad to discuss what steps the teens are doing independently and develop a plan for teaching any steps that they have not mastered. Task analysis is also used for DLS such as completing an evening hygiene routine, doing laundry, using a recipe to cook, and cleaning the kitchen. Once a task analysis is developed for a skill, it is easy to then transfer the steps to a paper or electronic checklist. Parents are also provided instruction on how to utilize the task analysis to determine how to approach skill acquisition over time, such as how many steps the teens should be required to do independently on their contract to earn a reward. As teens master the steps on a task analysis, parents will increase their expectations.

Technology

During adolescent sessions, various technology platforms are used to solidify newly taught concepts (e.g., online Kahoot quiz to review kitchen safety rules. Apps for smartphones (e.g., money management app to assist with tracking expenses, grocery store app to help with making lists or finding items, cooking app with videos of recipes) are used because these have been shown to be an effective way to understand and learn targeted skills in other areas of functioning and increase motivation for learning new skills in individuals with ASD (Burton et al., 2013; Satriale et al., 2009). Teens are encouraged to use various technology (e.g., phone, tablet, smart speakers such as Amazon Echo, smartwatch) at home to remember to complete DLS goals without support or prompts from parents (e.g., setting an alarm to wake up on one's phone, using a calendar app to schedule reminders, using the notes or memo phone feature to write down and save a task analysis for laundry, using the Amazon Echo to remind teen to pack his lunch each morning).

Modeling

Modeling, which is particularly effective in social skills interventions for adolescents with ASD (Laugeson & Park, 2014; Reichow & Volkmar, 2010), is used throughout STRW as a way to supplement direct instruction of DLS so that the teens are able to actually see how each step of a task needs to be done. *Peer modeling* is used when teens demonstrate and teach specific skills in session to other teens. At home, parents can use other family members or friends as peer models for demonstrating how to complete various DLS goals (e.g., older brother demonstrating how he uses his checking account to make sure he is staying on budget each month). *Video modeling* is another evidence-based strategy in which the teen watches a video that demonstrates how to complete DLS such as doing laundry from start to finish, folding a shirt, making scrambled eggs, navigating a grocery store, and using self-checkout at a grocery store (Hume et al., 2009). Teens can film themselves or another peer or adult completing a skill so that they can then watch it as needed. In particular, parents and teens are encouraged to utilize video modeling when learning to cook a new recipe because many cooking websites not only list the recipes with ingredients, but also include a video demonstration of how to follow the steps of the corresponding recipe. Some teens are highly motivated by video modeling, and the parent group therapist shares a variety of videos via a shared YouTube page that can be utilized to further teach or generalize DLS at home.

Explicit and Constructive Feedback

During each session, teens are given explicit and constructive feedback from the therapists as they learn and practice new skills (e.g., how to identify fixed vs. variable expenses when creating a budget, how to measure flour for a cookie recipe). Specifically, a variety of behavioral techniques are utilized (e.g., reinforcement, chaining, prompting, etc.) when providing feedback about DLS. In parent sessions, the therapist discusses the importance of giving teens direct and

supportive feedback about the goals that they are working on at home, in a format that does not criticize, but instead emphasizes how the teen could improve (Laugeson & Frankel, 2011; Laugeson et al., 2012). Parents provide this feedback during the weekly review of the contract with their teen, but also throughout the week as teens work on their various goals. Parents are coached to give feedback on completion of a goal, level of independence, use of strategies, and quality. If needed, parents may role play with the parent therapist how to give feedback to their teen or negotiate a new goal or expectation on the contract.

Essential Treatment Components

DLS Contract

The DLS contract is the most critical treatment component because it is used to specify the goals that teens will be working on each week and the reward that they will earn (see Fig. 3). For both parents and teens, the DLS contract specifies the goal, the expectations of the goal (e.g., when, what day(s), how often, how many prompts, use of strategies, etc.), and the reward that will be earned if the goal is met. It is critical that parents involve the teens in the development and modification of the DLS contract. This allows teens to be involved in the active discussion, negotiation, and compromise around what their goals are, how they are progressing, and what rewards they will earn. During Session 3, the rationale for the DLS contract is discussed. Parents and teens have an opportunity to discuss questions and concerns and role play how to develop the DLS contract in their group sessions. Parent/teen dyads complete the first goal to be targeted on their DLS contract as a Real World Practice assignment. Notably, parents and teens modify the DLS contract after each group session, altering current goals and adding new goals. Thus, by the end of STRW, most teens have four to five goals on their DLS contract.

In Session 3, incentives or rewards for the DLS contract are also discussed. Rewards are utilized, as opposed to punishment, in order to positively reinforce skills as they are developed and then mastered. It is critical to identify rewards that are motivating to teens to increase the likelihood that they will be motivated to learn the new DLS. Thus, parents and teens work together to identify rewards that are of low, medium, and high value so that the rewards are tailored to the targeted daily living skill. Rewards should be varied and tied to each goal on the DLS contract. Some examples of rewards include extra screen time, money, picking out a favorite dessert, getting a coffee, playing a favorite board game with the family, playing a video game with an older sibling, choosing what take-out to get for dinner, 30 min to practice driving, etc. Oftentimes, especially for older teens,

they are intrinsically motivated to learn these skills so that they are more likely to succeed in college, work, or when living independently. While some teens may initially be difficult to motivate for a variety of reasons (e.g., lack of motivation or interest in building DLS), we have always been able to help the adolescent identify a reward by encouraging them to think about what would motivate them to build their skills. It is likely also helpful that teens are exposed to why it is important to build their DLS (see 'Essential Treatment Components') and to other teens discussing their progress and working on building their DLS within the adolescent session. Both parents and teens find it very helpful to hear what is rewarding for other teens as well. Importantly, punishments or the removal of privileges are not utilized in the current intervention. We have found that teens are more likely to learn a new skill when they are provided a reward that they are motivated to earn.

In order to facilitate successful implementation of the DLS contract at home, each parent typically spends 5 to 10 min in the parent group session discussing their teen's progress. The therapist leading the parent group assists parents with problem-solving challenges or barriers to their teen's completion of each goal including modifying a reward to ensure it is motivating and implementing various strategies to build the teen's independence. As goals are added each week, the therapist also discusses how to incorporate goals into everyday life to make skill development and mastery practical in terms of time and effort (e.g., help the parent cut up vegetables needed for the family's dinner, put all of the family's towels in the washing machine, pack their own lunch for school, etc.). As the parents become increasingly comfortable with each other, they often provide appropriate suggestions to other parents on how to target goals. In the teen group, the teens also briefly discuss the progress they are making on the DLS contracts at the beginning of each session. If the teens report any issues, the teen therapists discuss this with the parent/teen dyad at the reunification that occurs at the end of the parent and teen sessions.

Throughout STRW, the therapist in the parent group discusses the necessity of providing a consistent reward to teens until a goal is truly mastered (i.e., being done independently without support from a parent 90% of the time). For many teens, this means that they will be working on a goal for at least 2 to 3 months before the concept of fading the reward is discussed and then enacted on their DLS contract. Rewards for daily goals (e.g., making oatmeal for breakfast, completing morning hygiene routine) are typically faded faster than weekly goals (e.g., doing own laundry, purchasing items at the grocery store) because there are more opportunities for the teen to practice these skills. Parents and teens should also talk about the reasons for fading a reward (e.g., the teen is demonstrating mastery of the skill, increased independence, increased responsibility) and when fading will occur. This

is also an opportunity to discuss if any additional goals will be added to the contract. Although discussed throughout, it is re-emphasized in Session 13, where the concept of fading rewards is explicitly reviewed in the parent group so that individual questions can be addressed. Typically, at least one to two parents have already started fading rewards with their teen by that session and are also able to share their experience.

Real World Practice Assignments

Each week, the teens are given Real World Practice assignments to complete before the next session. Many assignments are goals that are added to the teen's DLS contract. The goal of these assignments is to generalize skills taught in sessions to the home or community environments. Parents are encouraged to be highly involved in the Real World Practice assignments so that they can act as DLS coaches by providing support and constructive feedback. Importantly, the assignments are not referred to as "homework" because these assignments are skills needed to survive and thrive in the real world. A review of the Real World Practice assignments is completed at the beginning of every session in each of the parent and teen groups.

Instruction, Modeling, and Practice

Acquisition of DLS in teen sessions is targeted through instruction, modeling, and practice using diverse resources and evidence-based strategies. Specifically, the teen therapists begin teaching a DLS by providing explicit, detailed instruction (e.g., the rules for sorting dirty laundry, how to choose settings on a washing machine). Then, the skill is modeled by other teens or therapists (e.g., teens demonstrate how to sort clothes into dark and light piles, therapists demonstrate what cycle to choose for washing common clothing items). Finally, the teens also have an opportunity to practice these same skills in session. Generalization of the skills occurs when teens practice a skill at home or in the community as part of a Real World Practice assignment (e.g., sorting and washing their own clothing on their specific washing machine).

Parents as Coaches

The role of parents is to further build and generalize the skills that are taught and practiced in the teen sessions to their home or community. During the review of the Real World Practice assignments and discussion of progress on the DLS contract, parents are given ideas for and constructive feedback on how to best serve as a coach to build their teen's DLS. For example, a therapist may have a parent walk through how to fade back prompts and supports as their teen

gets ready for school in the morning. Various techniques such as role playing, behavioral rehearsal, constructive feedback, video modeling, etc. are discussed to help parents become effective coaches. Parents are encouraged to bring any questions to the parent group to get feedback and/or support on how to be an effective coach from the therapist and other parent group members. Notably, on weekly satisfaction surveys, parents often report that the support that they receive from others not only provides motivation as a parent to work on these DLS, but also increases their accountability as a coach to implement the strategies and ideas suggested by others.

Build Buy-In

The first two sessions of STRW are focused on building parents' and teens' investment or buy-in to work on DLS. Specifically, when the parent/teen dyads meet as a large group in Session 1, clinicians emphasize the importance of DLS for meeting future goals (e.g., getting a job, living in a college dorm, etc.). During Session 2, the therapist discusses the following concepts with the parent group: (1) DLS are impaired in adolescents with ASD; (2) explicit instruction and practice is needed to master age-appropriate DLS; and (3) DLS are linked to a successful adult outcome in areas such as college, getting a job, and living independently. Building upon this foundation, during Session 3, both parents and teens are separately introduced to the concept of using a contract to not only build DLS, but to increase independence and the likelihood of a successful transition to adulthood. If teens are not intrinsically motivated to work on these skills, the external rewards that are built into the contract typically lead to buy-in and motivation to work on DLS. Parents have also provided feedback via satisfaction surveys that their teen seems to have more buy-in due to the other teens participating in the group and observing that other teens have similar DLS deficits and are invested in working on the goals outlined in their DLS contract.

Parent Discussion of DLS

Within the first three sessions of STRW in particular, parents are encouraged to discuss the various DLS challenges that their teen experiences and what strategies and supports have/ have not worked. By creating an open dialog about these challenges, parents tend to be honest and upfront in reporting how the goals on the DLS contract are progressing and what obstacles they may be facing. For example, many parents report that they are over involved in their teen's DLS and need to step back and evaluate how to foster their teen's independence. Due to the group setting, there are typically other parents who have faced or are facing similar struggles. By normalizing the challenges and also openly discussing

how to address and refine the strategies to build mastery and independence, parents feel supported as they become DLS coaches for their teens.

Teen Discussion of DLS

Throughout STRW sessions, teens are encouraged to discuss the specific DLS that are challenging for them, which serves to normalize these difficulties. The therapists facilitate open conversations regarding how to build the specific DLS and also have teens discuss the strategies that may be successful for them (e.g., how to navigate sensory aversions when showering or brushing teeth). Further, if teens are particularly skilled in an area, they are given the opportunity to take on a leadership role (e.g., demonstrate how to make grilled cheese). Lastly, therapists candidly discuss that it is not necessarily fun or motivating to work on DLS goals, but that there are many benefits to meeting the goals specified on their DLS contract (e.g., less nagging from parents, increased independence, external reward, increased trust from parents, etc.).

Flexibility

There is flexibility built into all sessions that allow for individualization of the content for adolescents and parent participants. The group format encourages social interaction among participants and creates naturalistic teaching experiences (e.g., parents discussing successful use of rewards, teens discussing successful hygiene routines). Further, utilizing a range of strategies allow for parents and teens to determine what strategies are most effective for them (e.g., using a paper checklist vs. a checklist on a smartphone).

Money Management Concepts

Our team has found that many teens have a minimal understanding of what various items cost (e.g., food that their family typically purchases at the grocery store, personal care items they use on a regular basis). This lack of awareness often makes it difficult to work on goals related to spending and saving. Thus, various money management games and Real World Practice assignments are included in each session. A *Price is Right*© game is played in each STRW session in which the teens have to guess the cost of various items (e.g., how much detergent and fabric softener costs during the sessions focused on laundry). Building on this, parent/teen dyads are given a weekly Real World Practice Assignment to target skills related to money management concepts, such as comparing the prices of cereal when grocery shopping, determining what deodorant to buy while evaluating brand and price, purchasing groceries with a parent's debit card, and researching the best price before purchasing a new video game. Parents are highly encouraged to include their teen in activities that will expose them to spending and saving money.

Unexpected Iteration: Transition to STRW-Telehealth

The COVID-19 global pandemic necessitated the in-person STRW intervention groups to be indefinitely suspended. Adapting STRW to be delivered via telehealth (STRW-telehealth) in the midst of COVID-19 was a shift from in-person STRW that ushered in another phase in the iterative development and refinement of its content and approach, and it also provided an opportunity to enhance the current STRW protocol in several key ways while maintaining essential treatment components. Notably, the use of telehealth treatment was not as widely used in clinical care during the development and initial evaluations of STRW. However, recent literature reviews on telehealth in individuals with ASD and other neurodevelopmental disabilities indicate that treatment via telehealth has both high rates of parents satisfaction and engagement despite the technology challenges that may arise during delivery (Sutherland et al., 2018; Valentine et al., 2021). There appears to be emerging evidence for telehealth to have similar rates of efficacy for treating individuals with ASD and their families with interventions that utilize behavioral and cognitive-behavioral strategies (Bearss et al., 2018; Marino et al., 2020; McCrae et al., 2020). The COVID-19 pandemic has provided adolescents with ASD and their parents with additional exposure to telehealth services, which makes it more likely that they may be interested in pursuing treatment in this manner in the future (Solomon & Soares, 2020).

We felt the group format was applicable via telehealth for parents. However, while the adolescent group format provided benefits such as increased buy-in and normalization of DLS challenges, it was not the ideal format for providing instruction and practice of key DLS via telehealth for a variety of reasons (e.g., need for an adult to be present to coach and provide individualized support to the adolescent, challenges with teaching DLS such as cooking and laundry). Therefore, as our team began adapting STRW to be delivered via telehealth, we expanded the role of parents as DLS coaches such that they would be assisting in the initial teaching of new DLS during sessions as well as the practice and mastery of DLS between sessions through the implementation of the DLS contract. In this design, it was hypothesized that parents would continue to benefit from the parent group sessions by being able to discuss challenges and effective strategies, receive support from the parent therapist and

other parent participants, increase accountability for working on goals on the DLS contract, and engage in problem-solving. The adolescents would continue to receive in vivo guidance in acquiring new DLS through telehealth sessions delivered individually to parent/teen dyads. Therefore, the *90-min weekly parent group session* was upheld in STRW-telehealth and had similar content, structure, and treatment components as the in-person STRW sessions. A *60-min weekly, individual parent-adolescent dyad session with an individual therapist* was initiated, replacing the STRW adolescent group, because it would allow for the adolescents with ASD to benefit from essential treatment components such as explicit instruction followed by hands-on practice of DLS with individualized feedback, use of a DLS contract to target goals, and completion of Real World Practice assignments to further build and generalize skills.

In STRW-telehealth, the parent/teen dyad and an individual therapist met each week for 14 weeks to discuss the following: (1) Real World Practice assignment check-in; (2) DLS contract check-in (e.g., progress on goals targeted); (3) instruction and practice of DLS; and (4) discussion on new DLS goals to add to the contract and new Real World Practice assignments. In these new dyad sessions, the parent took the lead on teaching and modeling a new skill before providing coaching to the teen as they practiced a new skill in the home environment. The individual therapist provided live feedback on teaching, modeling, and coaching and also demonstrated how to address challenging issues (e.g., negotiating for a reward on the DLS contract, fading back prompts for a goal). Thus, the new structure of the dyad sessions increased direct parental involvement in teaching DLS to their teen and the therapist provided individualized support. To ensure that the parents were prepared to take an active role and support skill acquisition during each dyad session, the content for the dyad sessions were discussed in detail in each weekly parent group session, prior to the dyad session.

Based on anecdotal reports from the therapists, the change to individual sessions with adolescents in their own home with their parents as coaches appears to have several advantages to the acquisition and generalization of DLS. Specifically, this format allows the adolescent to learn and practice in their own home, which may increase applicability and generalizability. For example, the change to telehealth has allowed adolescents to learn to cook in their own kitchen, using their family's utensils and materials (e.g., knives, pots, pans) and kitchen appliances (e.g., toaster ovens, air fryers, stand-up mixers, microwaves, as well as stovetop and oven). The dyad sessions have also allowed the adolescents to cook recipes that are typical for their family and that the teens enjoy, rather than the standardized recipes (e.g., scrambled eggs, macaroni and cheese) outlined in the in-person STRW manual. Anecdotally, the individualization of recipes was

particularly beneficial for teens with sensory aversions or challenges or for teens who had restricted diets. Further, we noticed that when parents see their teens demonstrating a skill such as cutting up a vegetable in the dyad sessions, they appear to be more comfortable allowing them to cook independently or assist with meals that the parents were preparing (e.g., cutting up vegetables for fajitas) between sessions. Telehealth has also allowed teens to learn how to do laundry using their own washing machine and dryer, as well as use their own clothing. During dyad sessions, parents witnessed firsthand their teen's abilities and progress, which allowed for a deeper understanding of what DLS to target on the contract and how much support or guidance their teen may need. For example, one parent expressed doubt that her teen actually needed to learn how to complete his morning routine or do laundry, as she believed he had a comprehensive grasp on this skill. However, during dyad sessions, it became clear that the teen was reliant on multiple prompts (e.g., verbal reminders, text messages, etc.) to complete this DLS. The parent reported that she had not realized how much direct and indirect prompting was being provided until the therapists pointed it out in both dyad and parent group sessions. The parent and teen were then able to develop a system that provided the teen with structure (e.g., reminders on his phone, checklist of steps) without the parent being as involved. With the change to a telehealth format, the STRW content appears to be more adaptable to individualized teaching, meeting the teens at their own skill level, while also providing support and coaching for their parents.

Overall, the content for STRW in-person and STRW-telehealth sessions remained very similar (see Table 1). Specifically, the only major changes to content related to increased individualization based on the teen's current skill level and adapting to utilization of their home environment as opposed to outpatient setting (e.g., putting their clothing away in their own room as opposed to folding a shirt on a table in the therapy room). The largest change was adapting the group content and activities to be delivered via telehealth rather than in an in-person adolescent group session. Instead of emphasizing direct instruction, teen discussion, group activities and games, and completion of handouts to learn new content, all materials from STRW teen group session were converted to a PowerPoint slideshow for ease of use and consistency. A HIPAA compliant video conferencing program (i.e., Zoom) was used for all parent group sessions and dyad sessions. Thus, resources (e.g., videos, websites, files) were consolidated in a PowerPoint slideshow that was shared with dyads on their screen. Notably, with a shift to telehealth, therapists relied on the use of different technology resources during dyad sessions, which were presented through screen sharing (e.g., session PowerPoint presentations, Excel worksheets for budgeting activities, YouTube videos for video modeling, various websites for instruction, etc.). Anecdotally,

Table 1 Adaptations made from the in-person adolescent group sessions to the telehealth parent/teen dyad sessions

Session	Telehealth adaptation
1 Introduction to STRW	• Discuss short-term and long-term goals with dyad • Address individual parent/teen issues around motivation, buy-in, and commitment to STRW
2 Hygiene and Self-Care Skills	• Self-reflection of current DLS is done with dyad • Detailed discussion around how to support personal hygiene skills that are challenging for teens
3 Morning Routine	• Teen demonstrates morning routine steps in dyad • Teen and parent receive instruction and feedback on how to develop their DLS contract (e.g., compromise, negotiation, identify specific goals and reward)
4 Sorting Laundry and Using the Washing Machine	• Instruction and practice is done with dyad's clothing items, laundry products, and washing machine
5 Using the Dryer and Folding and Putting Clothing Away	• Instruction and practice is done with dyad's clothing items, laundry products, and dryer • Teen demonstrates how to fold and put clothing away in their own room
6 Kitchen Safety and Cooking in the Microwave	• Discuss and demonstrate safety concepts in dyad's kitchen • Teen chooses and then cooks preferred no-cook and microwave recipes
7 Measuring Ingredients and Cooking in the Oven	• Teen chooses and cooks preferred oven recipes • Teen practices mixing and measuring with recipe chosen by dyad
8 Cleaning up the Kitchen and Cooking on the Stovetop	• Teen chooses and cooks preferred stovetop recipes • Discuss and demonstrate how to clean up the kitchen at home using a checklist
9 Grocery Shopping	• Dyad engages in applied instruction and practice using the grocery store(s) • Discuss and practice the procedure for putting groceries away
10 Understanding the Cost of Items and Purchasing Items	• Individualized instruction and practice to teen's experience with buying items
11 Using a Checking and Savings Account	• Dyad discusses how to open and use a checking account • Individualized instruction and practice on using a money diary and savings contract
12 Budgeting	• Individualized instruction and practice around creating a budget
13 Budgeting for an Event	• Individualized instruction and practice around an activity/event that the teen needs to budget for
14 Graduation	• Self-reflection of progress the teen has made within the dyad session • Individualized planning for next steps for targeting DLS post STRW

this appears to have increased investment and interest from teens who seemed to enjoy the various technology resources. Therapists also utilized the video conferencing program's tools, such as annotating a teen's responses directly onto a shared PDF file or entering their expenses for a budget into an Excel sheet. Parents were given access to all handouts, resources, and videos via a shared online folder. Blank DLS contracts and task analysis worksheets were mailed to all families at the start of STRW-telehealth to increase accessibility, and parents were encouraged to request paper copies of additional handouts, which could be mailed to their home.

Benefits of STRW-Telehealth

The STRW-telehealth adaptation appears to have numerous benefits. The change in format emphasized a more prominent parent-coaching model, such that parents were central to their teen's development of DLS and invested in their adolescent's successes. Parents were coached on how to teach and practice targeted DLS while also addressing any

challenges or obstacles as their teen worked to achieve their goals on the DLS contract. The individualized parent coaching appeared to be particularly beneficial for parents who expressed difficulties finding ways to motivate their teens, were unaware of how much prompting or assistance they may have been providing their teen or struggled to identify which evidence-based strategies they should utilize to increase independence in their teen. During dyad sessions, the therapist was able to observe parent/teen interactions (e.g., discuss how to give feedback and praise when teaching a skill, comment on the amount of prompts a parent gave when a teen practiced a skill), view the environment in which a goal was being targeted (e.g., discussing how to utilize alarm clocks and/or checklists to help a teen get up and complete a morning hygiene routine), and model and/or provide feedback on how to discuss motivation, buy-in, and rewards for goals with teens and their parent.

With the shift to dyad sessions, instead of an adolescent group, the content was increasingly individualized to the teen's particular skill area in that domain (e.g., cooking

recipes that can be used to eventually cook a family dinner once per week). Importantly, providing STRW over a virtual format has its advantages and may be preferential for specific teens and families (e.g., teens with limited availability, families who are not able to travel to an outpatient setting, teens whose social skills or behaviors prevent them from being successful in a group setting). Finally, as the sessions occurred in the adolescent's home environment, there was greater uptake and generalizability of concepts to their day-to-day lives following STRW because it eliminated the step of learning the skills in the clinic setting and then practicing and mastering them at home.

Challenges and Limitations of STRW-Telehealth

Despite these numerous benefits of STRW-telehealth, a few limitations became apparent, especially around use of technology. An initial challenge was choosing a secure and reliable video conferencing platform that promoted easy, reliable access for parents and teens, and had capabilities that allowed for interactive sessions (e.g., sharing screens, annotating on screen, showing videos). Another limitation of STRW-telehealth was that technology was not always reliable, which then affected the ability of parents and teens to attend or get the most out of group or dyad sessions (e.g., unstable internet connection). The evolution of technology also required therapists to keep up with various resources, apps, and video conference programs.

Finally, telehealth delivery to individual parent-teen dyads and a parent group is more resource and time intensive for both families and therapists as compared to the in-person concurrent adolescent and parent STRW groups. For parents and teens in STRW-telehealth, the time commitment increased from 90 to 150 min per week, which can be difficult for families to manage while also working to find time to practice the targeted skills on the DLS contract each week.

While we have anecdotal evidence of some of the benefits of STRW-telehealth, data collected on the in-person and telehealth iterations will be critical to understanding the optimal delivery model. For example, the individualized delivery of STRW via telehealth prevents the normalization of DLS deficits for adolescents with ASD that we initially hypothesized would be a benefit of group treatment.

Limitations

There are several limitations inherent in the current review of the STRW intervention. First, early studies were focused on feasibility and conducted with a small sample which limits our ability to interpret findings more broadly. The current RCT is ongoing and due to the COVID-19 pandemic will result in a smaller sample size due to the unexpected change

to telehealth and over half the sample receiving different delivery models. This will require that we test the resulting delivery model (in-person or telehealth) in a future trial that is fully powered to test the single delivery mode. Another limitation is that the participants enrolling in STRW may be highly motivated to address DLS challenges, which may make it more likely to see improvement in DLS. The current RCT should address this as we are actively recruiting participants from not only clinical settings, but also from schools, community providers, and outreach organizations to have a sample that is more representative of the general population and we are comparing to another active treatment with a different target (i.e., social skills). The in-person STRW sessions do require equipment for the adolescent groups (e.g., a kitchen with a stove and oven). We recognize that this may be a barrier to providing the intervention and we are currently working on modifications (e.g., adapting the three cooking sessions so that they are done via telehealth with parent/teen dyads so that teens can cook in their own kitchen). Further, due to the nature of hands-on instruction and modeling that is done during the adolescent group sessions, we typically have one lead adolescent therapist and one to three graduate student trainees staffing each group. We recognize that this may not be feasible for outpatient settings and are working on alternative solutions. For example, it would be possible to decrease staff if groups were run with four to five adolescents with ASD. In addition, a hybrid format that utilizes a combination of in-person visits (e.g., Sessions 1 to 3) and telehealth (e.g., cooking and laundry sessions) would likely be feasible with one lead adolescent therapist. In terms of staffing, STRW-telehealth may be more feasible to implement because it could easily be conducted by one therapist who facilitated the parent group session and then also led each parent/teen dyad session over the course of a week. Future work is needed to not only evaluate the efficacy of in-person STRW and STRW-telehealth, but to also determine how to disseminate the intervention more widely.

Conclusions and Implications

Adolescents with ASD who do not have a comorbid ID have DLS deficits that are significantly behind their peers and affect their ability to make a successful transition from high school to the adult world. The current review described the need, development and evaluation, and the structure, content, evidence-based strategies, and essential treatment components of the STRW intervention that targets acquisition and mastery of DLS in adolescents with ASD. The STRW intervention fills a gap as there are no intervention packages that address DLS deficits. Early pilot studies indicate that adolescents with ASD who complete STRW make significant DLS

gains as assessed by both the Vineland Adaptive Behavior Scales and goal attainment scaling. In our most recent pilot study (Duncan et al., 2021), results indicated that many adolescents gained 4 to 7 years of DLS such that they "closed the gap" between their DLS and chronological age. Our team is currently conducting a RCT comparing STRW to a social skills intervention in acquisition and mastery of DLS. Due to the pandemic and the need to adapt STRW to telehealth, we will have data on how the format of STRW affects DLS gains and this will guide the design of our future studies. Future research on STRW will also examine how to disseminate the intervention more broadly in order to facilitate the ability of adolescents with ASD to thrive in the adult world.

Authors' contributions All authors contributed to the current article on the development of an intervention. Dr. AD had the idea for the article and Drs. ML and LS assisted with drafting and reviewing the article. The first draft of the manuscript was written by AD and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Availability of data and materials Some of the data from this study have been shared on the National Database for Autism Research (NDAR) in accordance with National Institutes of Health (NIH) guidelines.

Declarations

Conflict of interest The authors have no conflicts of interest to disclose.

Ethical approval The studies were approved by the Cincinnati Children's Hospital Medical Center Institutional Review Board (IRB).

Consent to participate All youth assented and parents consented to participate prior to study procedures.

Consent for publication All authors agreed with the content of the current manuscript and gave explicit consent to submit. Specifically, all authors made substantial contributions, drafted or revised the manuscript, approved the version to be published, and agree to be accountable for all aspects of the work.

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