Journal of Autism and Developmental Disorders (2024) 54:2108–2123
https://doi.org/10.1007/s10803-023-05962-3

ORIGINAL PAPER

Adapting the Tackling Teenage Training Sex Education Program for Autistic Adults in the US: A Pilot Study

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Accepted: 8 March 2023 / Published online: 12 April 2023

Abstract

Despite the established need for sexuality and relationship programming for autistic adults, there are extremely limited curricula for this population. This pilot study used an evidence-based sexuality and relationship education program for autistic adolescents (Tackling Teenage Training) as the basis for an adult-focused virtual psychoeducational group. Qualitative feedback, quantitative ratings of the programming, and behavioral surveys from participants were collected. Nine participants completed the program, and corresponding pre and post measures. Highly rated topics, for example gender identity and online dating, were consistent with previous research on what autistic adults want from a sexuality and relationship education program. Future programming should incorporate increased attention to themes and topics highlighted by participants, and should utilize the teaching tools (e.g., role play, peer discussions) identified as useful by the participants.

Keywords Autism · Adult · Sex education · Romantic relationships · Identity · Internet · United States

The fact that over 97% percent of adults have sex during their lifetime is directly at odds with the fact that there are remarkably few adult-centered sexuality and relationship education (SRE) programs or even settings in which to discuss sexuality (Chandra et al., 2013; Dudek et al., 2021; Solomon et al., 2019). SRE offers important protective benefits, including decreased risk of sexual abuse and later age of first sexual experience, with higher ratings of how pleasant that experience was (Iddings & Wadsworth, 2021; Nurgitz et al., 2021). Autistic adults, unfortunately, have inconsistent access to comprehensive SRE, an issue that has been highlighted by self-advocates, researchers, and family members (Autistic Self Advocacy Network, 2011, 2015; Ballan, 2012; Crehan et al., 2021). Not just autistic adults, also autistic teens are less likely to receive SRE than neurotypical peers (Graham Holmes et al., 2022) and even when they do, the formatting is often inaccessible, due to lack of consideration for sensory or social communication profiles (Barnett & Maticka-Tyndale, 2015). This could imply that some autistic adults may have received no or very limited sexual and relationship education, with limited opportunity to fill in this gap later in life.

For autistic adults who missed SRE in adolescence, adult-focused programs are few and far between (Mackin et al., 2016; Solomon et al., 2019). Critically, autistic adults

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also have specific learning needs that demand considered and tailored programming decisions. For instance, gender diversity is more common and more fluid for autistic adults (Dewinter et al., 2017; George & Stokes, 2018), yet the majority of SRE programs in the U.S. focus exclusively and overwhelmingly (e.g., over 80%) on heterosexual relationships between cisgender people (Kosciw et al., 2014). Autistic adults identify assertiveness and consent as areas in which they want more psychoeducation (Crehan et al., 2023), yet these topics are less likely to be covered in typical SRE programs. Instead, information such as contraception, abstinence, and sexually transmitted infections tend to be priorities of school-based programming in the United States (Landry et al., 2003). Particularly for adults above the age of 35–40, many virtual relationship tools (e.g., internet dating, pornography websites, sexting) were not available when they may have first received SRE, creating an additional knowledge gap based on age, not to mention increased vulnerability (Chiner et al., 2021; Klettke et al., 2014).

There are many calls to increase SRE resources and programming for autistic individuals (e.g., Gerhardt, Cauchi, & Gravino, 2022; Wilczynski, Sundberg, Miller, & Johnson, 2022) yet there are a limited number of evidence-based SRE curricula for autistic individuals. Many studies are small but the conclusions are generally promising; that autism-specific SRE results in positive psychosexual outcomes (Pask et al., 2016; Tissot, 2009). One of these is the Tackling Teenage Training (TTT; Dekker et al., 2015; Visser et al., 2017), which was shown in a randomized control trial to improve psychosexual functioning for autistic teens using parent and self-report. The original TTT development was rooted in two models; Haracopos and Pederson's (1992), work on the rights of autistic people to their own sexuality, and an adaptation of Mesibov's (1984) social skills training hierarchy by Hellemans (1996), who mapped the hierarchy onto SRE domains. From this foundation, the content of the sections was based on research identifying learning needs (e.g., more time on social communication), and the structure of the sessions (didactics, behavioral rehearsal/knowledge quizzes, reinforcement outside of session via homework/parent support) was designed to match best practices for education in autism (McNeill, 2019).

Even with an evidence-based curriculum available, SRE is difficult to access for autistic individuals. Barriers to disseminating programming to the autistic community have been previously characterized, including lack of resources, lack of training, and lack of time (Barry et al., 2020). Each of these barriers have been identified as even more acutely problematic within the SRE space (Buston et al., 2002; Cappello, 2000; Curtiss & Ebata, 2016; Harris, 2017). The original TTT was developed and tested as a one-on-one psychoeducational program. A limitation of this model is the number of participants who can access the program. Further limiting accessibility is availability of people to lead such programming. In the US in particular, sexuality carries more stigma compared to the Netherlands, and professionals including medical providers, teachers, and therapists all report feeling underprepared to discuss sexuality and relationship information with autistic individuals (Ballan, 2012; Curtiss, 2013.; Marshall et al., 2020; Shindel et al., 2010). Despite the high risk of not offering SRE (e.g., less access to positive outcomes and higher risk of sexual abuse), SRE too often is viewed as an extra learning experience and not included in typical educational offerings. The TTT is a long program (18 weeks) but comprehensive; by shifting to a group format the number of individuals impacted within the same time frame would increase dramatically. Additionally, a group model capitalizes on having less providers/professionals available to provide specialized services, a consistent problem in the autism care space (Nicolaidis et al., 2013).

The long history of stigma surrounding sexuality and disability means that evidence-based programming and facilitators of such programming has not developed as it should to meet the needs and wants of autistic adults. For many autistic adults, the service cliff means that there is less access to programming, such as SRE, as they enter their 20s and beyond. In an effort to address this gap, we adapted an evidence-based SRE program for autistic teens (the TTT), for adults (more detailed information about the TTT and its adaptations can be found in the method). By building on an evidence-based program, the goal was to capitalize on the lessons learned previously. Prior work on adapting interventions for group formats has shown that fewer resources can reach further, which would be helpful in an autism-centered program (Movsisyan et al., 2019). To more efficiently deliver high-demand programming to more individuals, the curriculum was adapted to a group format. Additionally, much sexuality and relationship learning comes from peers, and the group format allows this peer-based learning to take place.

Methods

Summary of TTT

The Tackling Teenage Training (TTT) curriculum, an evidence-based SRE program originally developed for autistic teens, was adapted for use with adults (Visser et al., 2017). The program can be implemented for both intervention and prevention purposes to satisfy the needs of autistic individuals' psychosexual development. The original curriculum was

an 18-week program that has demonstrated its impacts on autistic individuals' satisfaction and outcomes, including knowledge, social connectedness, social reciprocity, appropriate boundaries and sexual behaviors. It consists of both the manual for providers and workbook for autistic individuals. The manual for providers has protocols and instructions for each session and the workbook included quizzes, texts, exercises, illustrations and homework, including the participation of parents, for autistic teens.

Outcomes from an RCT with an intervention and waitlist control condition of the original TTT showed improvements on a psychosexual knowledge test (Dekker et al., 2015). The program showed a significant increase in psychosexual knowledge by both self and parent report, and awareness of interpersonal boundaries, based on parent-report. Results showed that the program did not have an impact on self-reported romantic relationships skills, or self- or parent-report inappropriate sexual behaviors.

Content of Adult Group Program

In guidelines developed based on a systematic review, Movsisyan et al. (2019) outline the steps to adapting an intervention for new contexts. For this project, age cohort and group format were the two planned changes in context, and a virtual format ended up as an additional change in context. Here, we outline our approach based on the four phases in the guidelines; Exploration, Preparation, Implementation, Sustainment. The Exploration Phase, during which interventions are explored and selected, is where we identified the TTT as the curriculum to adapt. Given the development of these materials specifically for autistic participants and the existing evidence base for such programming, the TTT was a promising template on which to build. For the Preparation phase (e.g., identifying potential mismatches, developing model, establishing capacity), our clinical research team examined the content of weekly sessions and assessed the content for age appropriateness and format fit. For instance, some topics, such as puberty, were removed to better serve an adult audience (these changes resulted in the program length shortening from 18 to 16 sessions). Caregiver participation became voluntary, to fit developmentally with an adult cohort. Topics relating to LGBTQ + identity and assertiveness were augmented, based on research highlighting the relevance as well as desire to include such topics in SRE. Additional and supplementary materials including videos and websites were also used to cover themes that are not discussed in the original TTT (e.g., intersex, gender fluidity, communication between two partners). There were not materials about Online dating in the original pilot. Given how common online dating has become, this module was built out by group leaders, who utilized examples from the participants to generate examples and discussion. For instance, the group generated ideas about why someone would generate a fake social media profile, and what some signs of "catfishing" might be. The group also reviewed actual dating profiles to identify what they liked and disliked about profiles, in order to inform their own use of these sites.

The final session was used to review any remaining questions and to discuss how group members wanted to continue, as some had expressed wanting to learn more or to stay connected with each other.

For time purposes moving from an individual to group format, not all of the exercises were included, particularly ones that were rote review of didactic material. Exercises relating to social application of concepts and information were kept to cover during group. In some lessons, exercises became handouts or homework for autistic adults to complete individually outside the program (e.g., masturbation). Table 1 provides a comprehensive description of pieces kept from the original TTT, as well as pieces that were added. Overall, the number of exercises was reduced, and quizzes were removed. The group of participants in the current study constitute the pilot testing phase, as part of the Implementation phase. The TTI and qualitative feedback were collected to evaluate and, in the future, revise the materials. The Sustainment phase is briefly described in the "Future Directions" section.

The main adaptation for a virtual format was incorporating breakout rooms to allow for discussion of homework in smaller groups, rather than a large group discussion which can be challenging in a virtual space.

Groups were led by a trained clinical psychologist with experience leading SRE groups for autistic people, and a postdoctoral trainee. After the first two weeks, participants requested more time to consult with peers regarding sex and dating. Thus, a consult portion was added for the last 15 min of each group in which group members were encouraged to bring in questions for each other. Of note, as the group continued and participants became more comfortable with each other, these consults were incorporated throughout the session, rather than a specified time at the end of the session.

Two optional caregiver sessions were included (40-minute long sessions). Caregivers were informed that specifics regarding their young adult's participation would not be discussed without formal consent from the participant. Rather, the intent of the caregiver sessions was to provide information on topics covered in the group and provide strategies for supporting their young adult at home. Per the request of caregivers, a brief syllabus was provided with topics covered throughout the course of the

Table 1 Summary of included TTT materials

Name of sessions	Included TTT materials	Added components
Week 1: Introductions & Who Do We Talk to?	Lesson 1 Talking about Puberty · Open illustration · Introduction to TTT · Homework, symbols, and veto cards explained · Exercise #1-4 · Homework	
Week 2: Sexual Anatomy & Puberty, Session 1	Lesson 4 What do you call that? · Exercise #3-5 Lesson 5 The Changes in puberty in boys · Exercise #1-2	
Week 3: Sexual Anatomy & Puberty, Session 2	Lesson 4 What do you call that · Picture 4.4 Lesson 5 The Changes in puberty in boys · Exercise #3-6 Lesson 6 The Changes in puberty in girls · Exercise #1-2	Slang terms video activity
Week 4: Sexual Anatomy & Puberty, Session 3	Lesson 6 The Changes in puberty in girls · Exercise #3, 5-6	Introduction to intersex Gender unicorn Peer consultation time
Week 5: Gender Unicorn: Gender Identity, Gender Expression, Sexual attraction, Romantic Attraction, Session 1	Lesson 10 Doubts and confusion during puberty · Exercise #1 (Modified)	Peer consultation time
Week 6: Gender identity; Begin Appearance, Impressions, & Self-Expression, Session 2	Lesson 10 Doubts and confusion during puberty · Exercise #3-4	Gender identity terms How to explore sexuality safely with limited in-person opportunity Peer consultation time
Week 7: Masturbation, Session 1	Lesson 2 This is me · Exercise #4 Lesson 3 A good first Impression · Exercise #2 (Part of) Lesson 7 Masturbation · Exercise #8	Media and masturbation activity
Week 8: Masturbation, Session 2	Lesson 7 Masturbation · Exercise #1-5, 7	Legal and illegal aspects of porn Masturbation myths
Week 9: Sex with Partner, Session 1	Lesson 12 Safe sex · Exercise # 2 Lesson 13 The 'first time' · Exercise #1-2	"Things not seen in mainstream porn" discussion Group activity establishing a definition of "sex"
Week 10: Sex with Partner, Session 2	Lesson 13 The 'first time' · Exercise #4	Communication about sex, especially when things go wrong Peer consultation time
Week 11: Sex with Partner, Session 3	Lesson 12 Safe sex · Exercise # 4 Lesson 13 The 'first time' · Exercise #5, 7 Lesson 14 Pregnancy · Illustration	Peer consultation time
Week 12: Personal Boundaries & Safety, Session 1	Lesson 15 Where do you draw the line? · Exercise #2	How to discuss safer sex Handout on emotional vs physical safety Expressing sensory experiences and boundaries
Week 13: Personal Boundaries & Safety, Session 2 & Dating, Session 1	Lesson 11 Being in love and dating · Exercise #6 Lesson 16 Personal Boundaries and Others' Boundaries · Exercise #2	Where to meet others Peer consultation time
Week 14: Dating, Session 2 & Online Safety	Lesson 17 Internet and making contact · Table 17.1	Role play asking, accepting, and refusing dates

Table 1 (continued)

Name of sessions	Included TTT materials	Added components
Week 15: Online Dating & Meeting people online	No TTT material	"Why would others make fake profiles" Generated list of safe behaviors for online interactions, list of red flags How to spot a fake dating profile/review of real profiles What to include in a dating profile
Week 16: Wrapping It All Up	No TTT material	Reactions to group, planning for next steps

16-week group. Feedback from caregivers was generally positive, with requests for additional supports for their young adults. Caregivers additionally asked questions about supporting their young adults—e.g., how to talk to resistant young adults, problem solving potential socially problematic behaviors, resources for continued education. Eight caregivers attended the first session; no data were collected about attendance for the second session.

Participants

Eleven participants enrolled in a virtual, 16-week SRE program. Ten had a previous diagnosis of autism spectrum disorder and one participant had prior diagnoses of ADHD and Developmental Delay (who was not included in final analysis as they did not complete final surveys). Another individual dropped out of the group after 9 weeks due to personal reasons (unrelated to group); we do not have post data available for this participant. For the remaining participants, two participants missed 1 week, and one participant missed 2 weeks. Six participants had perfect attendance across the 16 weeks. Demographic information for the nine participants who completed the program and surveys is presented in Table 2.

Circulated flyers stated that the group was intended for neurodivergent adults with average to above average language and cognitive skills. A diagnosis of autism spectrum disorder was not necessary for group participation, although all participants in the final analyses had a diagnosis of autism spectrum disorder. No exclusionary criteria were included regarding comorbid diagnoses. In an effort to best determine fit for the group and maximize attendance, a brief consultation was completed via telehealth with the primary group leader and the interested participant. During this time, the group leader explained the purpose of the group, answered any questions from potential participants, and assessed fit for group (e.g., desire to enhance sexual identity and development, motivation to attend, ability access materials). Caregivers were only included in this meeting if the adult participant provided consent.

Recruitment

Group members were recruited through The Help Group, a nonprofit organization in the Los Angeles area that serves youth and young adults with neurodevelopmental disabilities via specialized day schools, community mental health

Table 2 Participant demographics

	M		*SD*
Age	21.11 [19-23]		1.69
		n	%
Sex assigned at birth			
Female		1	11
Male		8	89
Gender			
Woman		1	11
Man		8	89
Sexual orientation			
Bisexual		1	11
Gay		2	22
Straight (Heterosexual)		5	56
Straight (Heterosexual), questioning or unsure		1	11
Race			
Black or African American		1	11
Hispanic or Latino, White		1	11
White		7	78
Diagnoses[a]			
Autism		9	100
ADHD/ADD		4	44
Anxiety disorder		1	11
Depression		1	11
Developmental delay		3	33
Learning disability		3	33
Mental retardation[b]		1	11
OCD		3	33

[a]Diagnoses were provided by participants, and some participants indicated multiple diagnoses

[b]This description was provided by a participant

clinics, as well as various supports and programs. Information regarding the group was sent via email to a listserv for more general events by The Help Group (12,500 subscribers) as well as a listserv for the Help Group's Advance LA program that specifically serves transition age youth and young adults (5,800 subscribers). Subscribers include current or past clients or students of The Help Group, mental health care providers, as well as individuals interested in hearing about programming by The Help Group. Information regarding the group was also on The Help Group and Advance LA's website as well as social media pages.

Measures

Demographics form was completed at baseline and included questions about age, race, and gender.

Autism Quotient-10

The AQ-10 is a brief version of the full 50-item AQ (Booth et al., 2013). Designed for healthcare professionals to use as a screening tool, the measure was completed here to briefly characterize the participant in place of full diagnostic history. This was administered at the beginning of the program to serve as a descriptive measure of autism. The questionnaire has been used previously to measure autistic traits in a large sample ($N = 44{,}722$) and has a Cronbach alpha of 0.85 (Allison et al., 2012; Lundin et al., 2019).

All but one of the participants had a self-reported diagnosis of ASD.[1] In the adult world in particular, an evaluation for ASD can be difficult to obtain. Using a tool such as the AQ-10 to describe self-identified autistic adults rather than necessitate diagnostic history is one way to ensure that our participant pool is representative of autistic adults out in the world; it should be stated however that there are identified limitations to using the AQ-10, such usage in groups with average intelligence, sex-bias and potential limited discriminative power between clinical samples (Booth et al., 2013).

Weekly Ratings

Each week, participants were asked to rate three statements: (1) This topic was relevant to me; (2) I learned something new about this topic in today's group; and (3) I would be interested in hearing more about this topic. Ratings were made on a five-point scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree). Participants were also able to leave open ended feedback about their experience with the topic.

At the end of the program, participants were asked to rate their overall experience using ten questions (six using the same five-point rating scale as the weekly ratings, four open ended questions).

Teen Transition Inventory

The primary clinical outcome measure for this pilot was the Teen Transition Inventory (TTI) [2](Dekker et al., 2017), which measures three domains of psychosexual functioning: *Psychosexual Socialization, Psychosexual Selfhood, and Sexual/Intimate Behavior*, by means of various subscales and individual items (please see Table 3 for full list). The TTI was originally developed for use with teens and has been used previously with adults (Crehan et al., 2021). The 123-item TTI self-report version (there is also a parent-report version, not used here) was used in this study; item responses are averaged by scale, with higher scores indicating more knowledge/better functioning. The Cronbach's alpha among the autistic group across all scales is approximately 0.74 (Dekker et al., 2017). Scores on items range from one to three and scaled scores were calculated by averaging all items. Most between-scale correlations were low and non-significant.

A reliable change index (RCI) was calculated for each participant on each subscale to assess whether observed individual change was clinically meaningful. Although large scale conclusions are significantly limited by the small sample size, the RCI metric requires a large cutoff to indicate meaningful change, and here would identify promising domains and topics to assess in future work.

Given the adult population and trends relating to SRE assessment in prior work, we hypothesized that the program would positively impact (e.g., increase scores), implying an increase in knowledge, skills, and positive experiences, across the following seven subscales: within the *Psychosexual Socialization* domain, 'Perceived Romantic Competence,' and 'Personal Openness about Intimacy;' within the *Psychosexual Selfhood* domain 'Romantic desires' and 'Self-Esteem;' within the *Sexual/Intimate Behavior* domain 'Types of Intimate Behavior and Experiences,' 'Amount of Inappropriate Sexualized Behavior,' and 'Online Sexual

[1] Autism diagnosis was confirmed by a provider.

[2] Studies have shown that autistic young adults often do not score significantly differently on sex education knowledge quizzes compared to neurotypical peers (Hannah & Stagg, 2016; Ousley & Mesibov, 1991). Group differences emerge, however, when concepts such as attitudes toward SRE and need to access more SRE (e.g., through discussions with others/resources), or social applications of sexuality and relationship topics (Mehzabin & Stokes, 2011). The TTI was not used as an outcome in the original TTT RCT. However, the TTI was utilized here due to the relevance of the subscales to prior findings of SRE experiences for autistic adults (e.g., assessing attitudes, access, and social behaviors).

Table 3 TTI pre- and post-intervention scores by overall domain and subscale

	Pre-intervention			Post-intervention		
	n	*M*	*SD*	*n*	*M*	*SD*
Psychosexual socialization domain	9	2.14	0.29	9	2.17	0.16
Friendship skills	9	2.54	0.28	9	2.60	0.19
Social acceptance by peers	9	2.44	0.53	9	2.31	0.35
Perceived romantic competence	5	1.47	0.38	5	1.47	0.51
Personal openness about intimacy	9	1.78	0.47	9	2.00	0.58
Psychosexual selfhood domain	9	2.23	0.15	9	2.22	0.16
Sexual preference*	5	1.63	0.22	5	1.67	0.20
Body image*	9	2.50	0.50	9	2.56	0.46
Perceived social competence	9	2.28	0.15	9	2.17	0.19
Social desires	9	2.15	0.43	9	2.06	0.41
Romantic desires	9	2.40	0.27	9	2.33	0.29
Amount of sexual desires	7	1.74	0.64	7	1.89	0.66
Self-esteem	9	2.52	0.23	9	2.47	0.24
Sexual-intimate behavior domain	9	0.96	0.22	9	0.93	0.21
Amount of sexual behavior*	9	1.29	0.33	9	1.27	0.33
Types of intimate or sexual behavior and experiences*	5	1.76	0.25	5	1.70	0.15
Amount of inappropriate sexualized behavior	9	1.06	0.17	9	1.00	0.00
Online sexual activity	9	0.18	0.06	9	0.19	0.08

*Changes on these scales reflect *differences* in responses across time points but the directionality is not interpretable

Activity'. All other scales were predicted to remain steady between the pre and post time points.

Analyses

For the TTI, pre and post domain and subscale means are summarized but not compared statistically, due to the small sample size. Weekly ratings and overall ratings are summarized as well, with an eye toward improvements and changes to make to future iterations of this curriculum.

Results

Overall, findings reflect that participants enjoyed the program and that engagement was high. Data collection by week allowed for immediate feedback on which topics would benefit from increased attention in further programming; patterns from these findings reflected expected patterns, including participants wanting more information about online dating, LGBTQ + topics, and less emphasis on physical development. Outcomes from the TTI showed that the curriculum positively impacted how participants thought about sexuality and relationships personally and in discussion with others, and had some important impact on online behavior.

Weekly Rating

Overall, weekly ratings were high (Table 4). Online dating and Masturbation I resulted in the highest relevance ratings. Sexual anatomy I & II and Sex with a partner II were rated as least relevant (although were still above "neutral"). Participant ratings on whether they learned something new were highest for Online dating, Sexual anatomy and puberty II, and Gender Identity. The initial introduction session and Sexual anatomy and puberty I had the lowest ratings for learning something new. Participants were particularly interested in hearing more about Online dating, and Masturbation I, and least interested in Sexual anatomy and puberty II and Sex with a partner II.

These are relative comparisons; overall, ratings of relevance, novelty, and interest in learning more were high for this group across the 16 sessions.

Overall Ratings

Overall, most participants rated the group as relevant, that it enhanced their understanding of sex, they would take away something to use in everyday life, and that the information was presented in a way they understood (Table 5). All participants either agreed or strongly agreed that the group leaders were competent. Internet dating/safe internet use were most commonly mentioned ($N = 3$) in response to the question

Table 4 Weekly lesson ratings

Week number and topic		Topic was relevant	Learned something new	Interested in hearing more
1	Intro and who do we talk to	M = 4.33 (SD = 0.50) [range 4–5]	3.78 (0.97) [2–5]	3.67 (0.87) [3–5]
2	Sexual anatomy and puberty, part I	4.11 (0.60) [3–5]	3.78 (1.20) [2–5]	3.78 (0.83) [3–5]
3	Sexual anatomy and puberty, part II	3.67 (1.23) [1–5]	3.78 (0.97) [2–5]	3.33 (1.12) [1–5]
4	Sexual anatomy and puberty, part III	4.11 (1.05) [1–5]	4.67 (0.50) [4–5]	3.89 (0.93) [3–5]
5	Gender identity, expression, sexual attraction, romantic attraction	4.44 (0.73) [3–5]	4.44 (0.73) [3–5]	4.22 (0.67) [3–5]
6	Gender identity: begin appearance, impressions, and self expression	4.33 (0.71) [3–5]	4.67 (0.71) [3–5]	4.11 (0.93) [3–5]
7	Masturbation I	4.63 (0.52) [4–5]	4.50 (0.76) [3–5]	4.38 (0.74) [3–5]
8	Masturbation II	4.22 (0.67) [3–5]	4.33 (0.50) [4–5]	4.11 (0.60) [3–5]
9	Sex with a partner I	4.11 (1.36) [1–5]	4.22 (0.83) [3–5]	3.78 (1.30) [3–5]
10	Sex with a partner II	4.00 (1.41) [1–5]	4.25 (1.39) [1–5]	3.50 (1.31) [1–5]
11	Sex with a partner III	4.11 (1.36) [1–5]	4.00 (1.32) [1–5]	3.89 (1.36) [1–5]
12	Personal boundaries and safety	4.00 (1.41) [1–5]	4.56 (0.53) [4–5]	3.67 (1.32) [1–5]
13	Personal boundaries II and Dating	4.22 (0.83) [3–5]	4.56 (0.53) [4–5]	4.11 (0.93) [3–5]
14	Dating II and online safety	4.00 (1.31) [1–5]	3.87 (1.46) [1–5]	3.75 (1.39) [1–5]
15	Online dating and meeting people online	4.63 (0.52) [4–5]	4.75 (0.46) [4–5]	4.38 (0.74) [3–5]

Table 5 Overall ratings

Question	Mean (SD)	Range
1. Overall, I found this group relevant to me	4.56 (0.73)	3–5
2. Overall, I felt this group enhanced my understanding of sexuality and relationships	4.44 (0.53)	4–5
3. I will away something from group to be used in my everyday life	4.33 (0.71)	3–5
4. Overall, I thought the group leaders were competent	4.78 (0.44)	4–5
5. Overall, I enjoyed participating in this group	4.67 (0.50)	4–5
6. The information was presented in a way I understood	4.56 (0.73)	3–5

"One thing I learned", followed by gender/sexuality ($N = 2$). Activities which required engaging with the material and each other, such as through role plays and discussions, were identified as a favorite part of group by half the participants ($N = 5$). Consistent with this, increased participation from all group members and more role plays were identified as a way to improve group in the future ($N = 4$). Qualitative reactions to weekly topics are listed in Table 6.

Most enjoyed aspects of the training were "role-playing" and "hearing different perspectives/discussions." Participants identified discussion of peer pressure and emotions in relationships as additional topics they would like to see covered. As described previously, attendance was very consistent for this group, further reflecting the positive experience of participants.

TTI

Domain and subscale scores are summarized in Table 3, and a visual of domain scores by participant is in Fig. 1. Table 7 summarizes significant RCI findings for scales where change would be meaningful, similar to the approach in Table 3. Overall, the TTI reflected mixed trends in the pre-post comparisons. Three subscales within the *Psychosexual Socialization* domain, 'Friendship Skills,' 'Perceived Romantic Competence/Romantic Ability,' and 'Personal Openness about Intimacy,' all improved compared to the pre-program assessment but inspection of the RCI reflects both improvements, deteriorations, or no change by participant. Taken as an aggregate, the fourth scale within that domain, 'Social Acceptance by Peers,' got worse over the course of the program. The RCIs show that scores improved for two participants, worsened for three, and did not change for four participants. Within the *Psychosexual Selfhood* domain, 'Body Image' and 'Amount of Sexual Desires' changed over the course of the program in a positive direction, with all other scores decreasing. Across subscales, most of the RCIs within this domain reflected no significant change. Within the *Sexual/Intimate Behavior* domain, 'Amount of Inappropriate Sexualized Behavior' worsened and 'Online Sexual

Table 6 Qualitative responses by week

Week number & topic		Examples of qualitative responses
1	Intro and who do we talk to	Advice on how to be less nervous or anxious expressing my feelings with my girlfriend and her parents
2	Sexual anatomy and puberty, part I	New terms of various subjects, slang or not, is important and enlightening to the other experiences of my fellow students
3	Sexual anatomy and puberty, part II	A bit strange learning about females since I'm not attracted to them sexually
4	Sexual anatomy and puberty, part III	I'm into males so that is the only reason I didn't feel it was relevant; info about intersex was particularly intriguing, the subject of intersex is a fascinating topic, as well as how society and families handle it
5	Gender identity, expression, sexual attraction, romantic attraction	It's just that i didn't understand it at all; it's always nice to know that so many people are so accepting of any different sexuality; i have heard about gender identity and am pretty familiar with it
6	Gender identity: begin appearance, impressions, and self expression	Transgender and transsexual comparison
7	Masturbation I	This was more relevant to my specific situation than some of the other subject matter, this was a very important thing to discuss because it happens to EVERYBDOY; it's always nice to get new perspectives on things like this
8	Masturbation II	I knew about the male side of things, the further information given about masturbation was quite apt for this subject
9	Sex with a partner I	More relevant to the information I'm looking to learn more about; that photo with all of those actions warrants further study if you ask me; very interesting to see all of the different perspectives here today
10	Sex with a partner II	I was aware of most of the things that I have experience with; the scissoring detail and clip were quite informative, in the grand scheme of things
11	Sex with a partner III	Interesting discussion about the Big Mouth, but the hypothetical solutions were far better, yes; more about relationships and safety this time that is more my area of interest; the scenario part of this session was the most engaging part of an already engaging time together
12	Personal boundaries and safety	The scenarios have nuance and that was quite nice; there were quite a few things that i wasn't aware of
13	Personal boundaries II and dating	I seriously recommend talking about the trappings of online dating, figurately and literally
14	Dating II and online safety	Everybody's role playing was strong not because of any acting, but because it all felt natural; I feel that RP is always a great way to get us learning, what better [way[to be informed than to be in the moment, in a sense
15	Online dating and meeting people online	Online dating has many nuances, remember, be transparent

Activity' slightly improved overall. Specific item responses provide important context to the variability in this small participant pool.

Specific Item Responses

Closer examination of the response data on two subscales illustrated some important points to consider for implications and future iterations of this program. Item-level responses are described here to provide more detailed explanation of scale ratings of clinical interest, although changes do not reflect statistically significant differences. One group of questions asks about discussing sexuality and intimacy with others ('Personal Openness'). Participants discussed these topics with parents or friends the same amount or more at the end of the program compared to the beginning (one participant began discussing with parents, three more participants consulted with friends). For family members, three more participants discussed topics with siblings or family members, while one reported less discussions. And one individual reported more discussions with a therapist, while another reported less (all others remained the same).

Results from specific 'Online Sexual Activity' scale items showed that some participants may have benefitted from the TTT. For instance, three participants reported less times contacting people they do not know through the internet, and one person reported a drop in showing themselves naked on a webcam. All other participants reported no change.

Figure 2 displays the total scores (not means) by participant on these two subscales that were further examined.

Discussion

Overall Conclusions

In this pilot study, the Tackling Teenage Training was adapted for an adult audience and qualitative feedback,

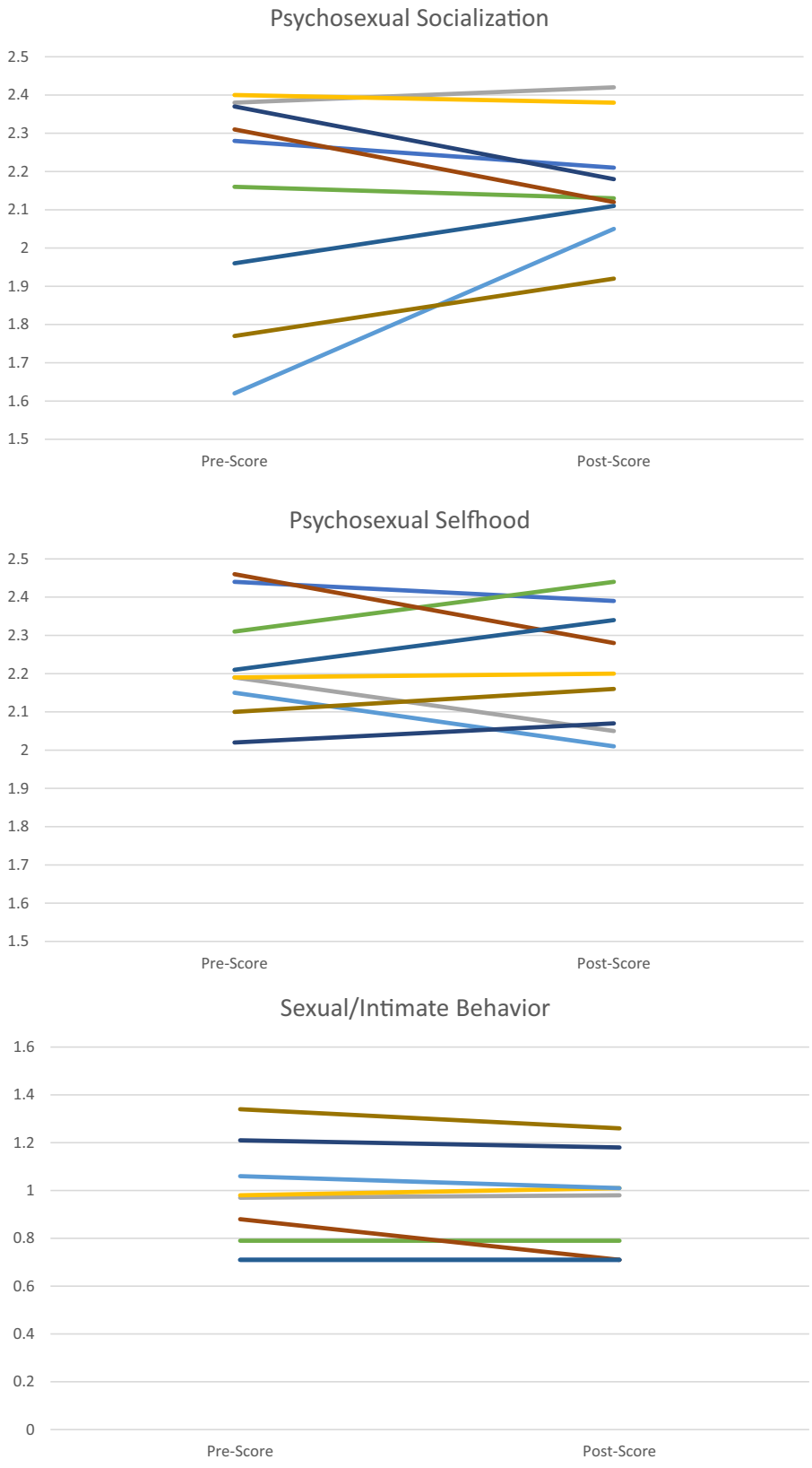

Fig. 1 Individual pre and post scores on the three domains of the TTI

Table 7 Number of participants with significant Reliable Change Index (> 1.96) results by TTI subscale[a]

Psychosexual socialization domain				
	Friendship skills	Social acceptance	Perceived romantic competence[b]	Personal openness about intimacy
Significant improvement	3	2	1	0
Significant deterioration	1	3	0	0
No significant change	5	4	4	9

Psychosexual selfhood domain						
	Perceived social xompetence	Social desires	Romantic desires	Amount of sexual desires[b]	Self-esteem	Body image
Significant improvement	1	0	0	0	0	0
Significant deterioration	3	1	0	0	0	0
No significant change	5	8	9	4	9	9

Sexual-intimate behavior domain		
	Amount inappropriate sexual behavior	Online sexual behavior
Significant improvement	0	0
Significant deterioration	1	0
No significant change	8	9

[a]Only scales where a change would be clinically meaningful were included here

[b]Indicates scales with missing participants

quantitative ratings and behavioral surveys were collected from nine participants. TTI results show mixed results for participants. Item-by-item examination demonstrated that experiences relating to increased communication about sexuality and intimacy, hopes for the future, and internet use had a neutral or positive effect for most participants. Future work should explore whether observed improvements in scores persist in larger groups. The utility of the TTI as an outcome measure for this group might also be worth exploring. Increased awareness of a topic could result in subsequent lower ratings (e.g., a respondent might believe they are interacting with others appropriately but then after learning about dating rules, they may know more about dating that results in lower ratings of their interactions). Although some items targeted areas in need of programming (e.g., internet dating, masturbation), some domains would not be hypothesized to be impacted as a result of this program. The authors echo the call for gold-standard outcomes to improve the study and dissemination of evidence for SRE.

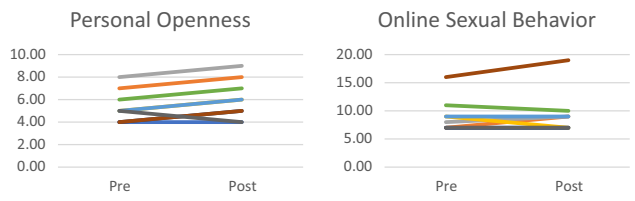

Fig. 2 Individual pre and post scores on the two subscales with specific items of interest

The adult curriculum was well received, well attended, and interesting to the participants in this pilot group. We believe this, in combination with how useful participants found the information, the most clinically interesting outcome of this work. Whether or not participants are satisfied is a key component of building an effective psychoeducational program, especially for an adult audience (Carlson & Gabriel, 2001; Trotter, 2008). Recent literature has clearly established a scientific need for greater resources and study of autism sexuality programming (Autistic Self Advocacy Network, 2011, 2015; Ballan, 2012; Crehan et al., 2021). The high rate of engagement even within this small participant pool reflects in real time the drive that autistic adults have to participate in relevant clinical programming. By collecting feedback on their experiences and reactions to group materials, we can expand upon which aspects of the group helped drive success.

Group Content

With the limited literature on SRE programming for autistic adults, the buy-in from participants is crucial at this early stage of psychoeducational development. The lesson on Online dating and meeting people online had the highest

ratings across each of the weekly rating scales (topic was relevant to me, learned something new, interested in hearing more). Additionally, specific items on the relevant scale of the TTI reflected that programming may positively impact online behavior for participants. Support for online sexual behaviors, both increasing positive ones (e.g., dating) and decreasing negative ones (e.g., illegal activity), is very limited for self-advocates and educators/clinicians working with autistic individuals. The speed at which online dating platforms and the corresponding social rules are changing has negatively impacted resources available to help individuals navigate these virtual worlds. Online dating is one of the primary ways individuals meet romantic partners (Rosenfeld & Thomas, 2012). Unfortunately, this method of meeting others is laden with challenges, ranging from virtual matches exaggerating or lying about personal characteristics, to sexual predators accessing dating sites to intentionally do harm (Couch et al., 2012; Mishna et al., 2009; Scannell, 2019; Sharabi & Caughlin, 2019). Even in less dangerous situations, studies are finding that small things like use of language can impact how attractive a potential mate might find a match (Van der Zanden et al., 2020). For individuals with social communication challenges, the online dating world has many unknowns. Complicating the landscape further is that technology for dating platforms and the associated social norms emerge and develop quickly. Guidance for anyone navigating such sites is limited and by the time research can be conducted, oftentimes out of date. Online dating represents an increasingly large part of the adult romantic relationship scene, especially for autistic adults. Over half of autistic adults have tried online dating and, compared to neurotypical adults, use online dating platforms at higher rates (Gavin et al., 2019; Roth & Gillis, 2015). In fact, autistic people use online dating methods more frequently than the neurotypical population. Participant ratings reflect how important it is to include information about online interactions in SRE programs. Future work could integrate promising studies on how to safely navigate such sites (Zytko et al., 2018).

Gender identity was also rated highly by participants as relevant to them, they state they learned something new, and are interested in hearing more. Gender identity and sexual orientation are chronically under addressed in school-based SRE programs, with over 80% of programs focusing exclusively on heterosexual relationships between cisgender people (Kosciw et al., 2014). LGBTQ + identities seem to be more prevalent in the autistic community compared to the neurotypical community (Dewinter et al., 2017; George & Stokes, 2018; van der Miesen et al., 2018). In combination with reduced access to identity-appropriate SRE, it is unsurprising that this topic was rated so highly. Interestingly, sexual anatomy was split across two lessons; the session discussing intersex was highly rated where the topic with background information about men and women was not rated as highly, comparatively. Including information on gender identity in an adult SRE program is recommended. However, in an ideal world, this topic would be covered earlier in the lifespan, as identities are forming (de Melker, 2015).

Personal boundaries and safety sessions received high ratings as well. This is consistent with prior studies of autistic individuals, where assertiveness and consent are identified as areas in need of more attention (Crehan et al., 2023). Existing programs that address these topics might augment the curriculum in its current format to more fully address this area (Haley et al., 2019; Sayyadi et al., 2019; Widman et al., 2018). Specific findings around increasing openness of self-reflection and discussing SRE with others are related to personal boundaries and safety. Communication about and comfort with SRE contributes to safety in recognizing unsafe relationships or romantic behaviors (Wurtele & Kenny, 2011).

Generally, ratings of relevance, 'learned something new', and 'interested in hearing more' were fairly high. The lowest rated sessions focused on sexual anatomy and group introductions; moving forward, we may condense this information into one session. Topics such as anatomy are more traditionally covered in SRE programs, and as adults, many may have learned the key details through lived experience. The slightly lower ratings on these topics in contrast to more socially-demanding topics (e.g., gender identity, personal boundaries, and safety) were unsurprising given recent surveys of autistic adults (Crehan et al., 2023).

Significant interpretation of the TTI findings is limited by the sample size. However, item-level responses show that this program tapped into areas that have previously been identified as important in SRE in the current day, including online activities and involving and supporting autistic individuals in discussing their goals for the future (Autistic Self Advocacy Network, 2015; Gillespie-Lynch et al., 2017). As with any intervention, some participants improved in areas that others stayed the same or stepped backwards in terms of their knowledge. Identifying which factors (e.g., teaching materials, participant profile) are related to success in different domains can help providers tailor information to best support a learner.

Group Structure

Oftentimes, and in the original RCT, SRE programs are split for at least some topics according to a gender binary (girls/women and boys/men). In this group and others, we have moved away from this practice for a few reasons. The first is that we spend time in this program discussing gender, and gender fluidity, and moving beyond a binary model of gender; thus, relying on a two-gender split for some topics is not consistent with our teaching methods, or with what we know about gender. Second, is that by focusing on body parts

instead of gender identity, we aim to be more inclusive. For instance, information for best hygiene practices for a vagina would be necessary for a cisgender woman and a transgender man who has not undergone gender affirming surgeries. Keeping everyone "in the room" for all sections can facilitate access to personally relevant information without demanding that a participant "out" themselves. And finally, knowing how different body parts function, even if they are not your own, can be particularly useful if a partner might have those parts. In a 2021 study of postgraduate educational science students, over 2/3 of survey respondents did not label the clitoris on a very detailed image (Ampatzidis et al., 2021).

The group format, instead of individual meetings, appears to be a strength of this pilot group. Multiple group members mentioned that discussions with others were enjoyable and helped their learning. One expressed wanting to continue to group for the support they found there. Role play was a specific pedagogical tool that group participants enjoyed. Peer learning oftentimes augments SRE programs (Strange et al., 2002). This effect may also have been heightened as data collection took place during the COVID19 pandemic, when opportunities for social interaction were more limited. A group format for a highly-sought after type of programming would more quickly deliver important information to its intended audience. Both as a pedagogical choice and a dissemination facilitator, the group format is something we intend to continue with moving forward. Revision of the curriculum to reflect results and feedback here will reflect the final stage in the adaptation process proposed by Movsisyan et al. (2019), the Sustainment phase.

Limitations

Clearly, this sample size here is too small to make any statistical claims about changes in behavior or knowledge. However, the positive quantitative and qualitative results even on a small scale offer promising future directions for this curriculum. Especially for an area where evidence-based resources are extremely limited, this initial phase suggests that further exploration of this program is appropriate. The valuable feedback from ratings, qualitative responses, and measure outcomes will inform improvements to the curriculum ahead of larger scale study.

While based on the TTT and using many of the pieces, there are pieces that were excluded from the original TTT. It is possible that omitted sections may have significantly contributed to the impact of the original program. Analyzing the impact of each individual module would allow for a comprehensive understanding of which aspects of the TTT are critical for its success. Decisions about materials here were rooted in past experiences with this program and in offering similar programming to autistic adults, and reflecting the developmental needs of an adult population, vs. an adolescent one. With more participants in the future, we will be able to investigate how each piece may contribute to knowledge change. Additionally, the RCT of the original TTT found that younger adolescents demonstrated greater improvements in knowledge over the course of the program; larger studies will allow examination of how age is related to outcomes.

A perpetual challenge in the sexuality and relationship education world is lack of standardized measurement tools to measure progress, knowledge, and behavior change. Most programs, including this one, have relied on tools designed to fit that particular curriculum. This does allow us to compare these results to previous trials but makes generalization across programs challenging. The development of broadly accessible tools to compare SRE programming, as well as sexual behaviors, risk of sexual abuse, and changing sexuality needs over time is critical to further progress in this area.

Future Directions

This work reflects research priorities identified by self-advocates, researchers, and clinicians; sexuality and relationship education across the lifespan needs increased attention and resources (Barnett & Maticka-Tyndale, 2015; Dewinter et al., 2020). We will continue using this curriculum and measuring the impact on the knowledge of autistic adults. Follow up will help assess whether this training program has a long term impact. Although this study is focused on the needs of autistic adults, we also believe that some of these topics (e.g., boundaries, internet safety), may be useful for a range of adults, with or without a developmental disability. Sexuality and relationship development are lifelong processes. Just as studies have shown that an earlier introduction to SRE topics (such as beginning to discuss consent in kindergarten) can help facilitate learning more complicated nuances in adolescence, it is likely that additional SRE resources for adults would be well received. Topics covered in this curriculum such as gender identity, pornography, and internet safety are ones that need more resources and attention in SRE curricula (Dudek et al., 2021; Gallagher, 2011; Kosciw et al., 2014).

These clinical groups offered a way for autistic adults to connect about relationships, identity, and connection. The qualitative aspect of the group experience was not measured here and this should be explored in future work. Knowledge and behavior are straightforward to measure but connection and belongingness, both of which have tremendous implications for mental health (Botha, 2020), was observed to be a beautiful byproduct of this SRE-focused program. Building a safe space with individuals with at least one shared identity to discuss highly personal information resulted in a cohesion that warrants study over longer periods of time.

Based on feedback provided by participants, future clinical and research groups may be strengthened by removing some of the information relating to Sexual anatomy and Sex with a partner (or perhaps to make it available in other ways) to leave more time for topics such as Gender Identity. Incorporating ways for adults to consult with each other if a group leader is not also autistic is recommended. Additional topics are not included here, such as how to have discussions about whether or not you want children, how to approach issues with fertility, and how to communicate with a long-term romantic partner would be good options to explore in future work.

The positive reactions to these topics in our pilot are promising for larger dissemination. Larger scale trials with a similar curriculum that reflects the suggestions made in this round will be an important next step in determining whether this training is a good evidence-based option for SRE for autistic adults. Potential collaborators are encouraged to contact the author.

Author Contributions Original material development was performed by LD and KGL. Adapted materials and data collection tools were developed by EC, JB and LS. Data collection was performed by JB. Analyses were performed by EC, XY, and SD. The first draft of this manuscript was written by EC, XY, SD, and JB. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Declarations

Conflict of interest Drs. Crehan, Barstein, & Stephens have no conflicts to report. Ms. Dufresne and Ms. Yang have no conflicts to report. Drs. Dekker & Greaves-Lord developed the original TTT materials, for which they receive no renumeration; they have no conflicts to report. Dr. Dekker's time was partially supported by the KNAW Ter Meulen Grant/KNAW Medical Sciences Fund, Royal Netherlands Academy of Arts & Sciences. No other funds, grants, or other support was received.

Ethical Approval This research study was conducted retrospectively from data obtained for clinical purposes. We consulted extensively with the IRB of Tufts University who determined that our study did not need ethical approval. An IRB official waiver of ethical approval was granted from the Tufts SBER (STUDY00002117) on November 3, 2021.

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