



## RESEARCH ARTICLE

# A preliminary randomized controlled study of the PEERS<sup>®</sup> program for Taiwanese autistic adolescents: The effectiveness on reducing school bullying and enhancing social function

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## Abstract

Individuals with autism spectrum disorder (ASD) often experience lifelong social communication challenges and are more vulnerable to school bullying. Addressing their social difficulties and school bullying requires evidence-based interventions. PEERS<sup>®</sup> (Program for the Education and Enrichment of Relational Skills) was adapted and translated for Taiwanese adolescents. This randomized controlled study aimed to examine the effectiveness of the Taiwanese version of PEERS<sup>®</sup> in reducing school bullying and enhancing social function among autistic adolescents. Twenty-one autistic adolescents (mean age  $14.29 \pm 1.67$  years; female  $n = 733.33\%$ ) were randomized to a treatment group (TG,  $n = 10$ ) or a delayed treatment control group (DTG,  $n = 11$ ). The outcome measures (school bullying, social challenges, social skills knowledge, and social skills performance) were assessed at baseline, post-treatment, and follow-up. The group and time interaction analyses revealed greater magnitudes of reduction in general school bullying ( $p < 0.001$ ), victimization ( $p < 0.001$ ), perpetration ( $p = 0.012$ ), social challenges ( $p = 0.001$ ), and peer conflicts ( $p < 0.001$ ), and improvement in social knowledge ( $p < 0.001$ ) in the TG group than the DTG group. The findings suggest that the PEERS<sup>®</sup> program tailored for Taiwanese adolescents is effective in reducing school bullying, decreasing social challenges, and enhancing social skills among autistic adolescents, with very large effect sizes (Cohen's  $d$  ranging from 1.19 to 2.88). Consequently, participation in the PEERS<sup>®</sup> program is recommended for adolescents with social difficulties to improve their social communication and interactions to offset school bullying and other social challenges related to adverse outcomes.

## Lay Summary

This study examined the effectiveness of the PEERS<sup>®</sup> program, adapted for Taiwanese autistic teenagers. The findings suggest that the program effectively improves social function and reduces the risk of bullying in school for these teens. Teenagers with social difficulties, especially those on the autism spectrum, should be encouraged to participate in the PEERS<sup>®</sup> program, which provides essential skills and strategies to cope with social difficulties and school bullying.

## KEYWORDS

adolescents, autism, school bullying, social skills, randomized clinical trial

## INTRODUCTION

Autism spectrum disorder (ASD) is a common (prevalence rate, 1%) neurodevelopmental disorder characterized by social communication and interaction impairments and the presence of restricted/repetitive behavior and interests (APA, 2013; Chen et al., 2019; Maenner et al., 2021; Zeidan et al., 2022). Social difficulties typically manifest in childhood, often continue to adolescence, and may worsen as autistic individuals age (Lord et al., 2022; McCauley et al., 2020; WHO, 2018). Autistic adolescents usually struggle with the complex social demands and rules accompanying their development (Lai et al., 2019; Ratto & Mesibov, 2015).

Mastering social skills is indispensable for effective interpersonal interactions (Jurevičienė et al., 2018; Matson, 2017), as they are crucial in promoting inclusion and participation in families, communities, and schools (Gresham & Elliott, 1984; Nangle et al., 2020). Social skill challenges can lead to isolation and hinder friendship formation among students (Barati et al., 2012; Bellini et al., 2007), potentially contributing to psychological and physical problems (Segrin, 2019; Segrin & Flora, 2006). Moreover, adolescents facing social difficulties may confront a widespread challenge in peer relationships, such as school bullying (Chou et al., 2019; Hsiao et al., 2022; Sterzing et al., 2012; van Roekel et al., 2010).

School bullying, including victimization, perpetration, or both (i.e., victimization–perpetration), is a repeated power-imbalanced behavior affecting the pediatric population psychologically, emotionally, and behaviorally (Hymel & Swearer, 2015; Jetelina et al., 2019; Olweus, 1993, 2013; Smith et al., 2016; Swearer & Hymel, 2015). Extensive research links social skill difficulties with bullying involvement (de Sousa et al., 2021; Fox & Boulton, 2005; Larke & Beran, 2006), while good social skills serve as a protective factor (D'Urso et al., 2022; Goldbaum et al., 2007; Hodges et al., 1999; Papamichalaki, 2021; Schwartz et al., 2000). Autistic students may be particularly vulnerable due to impaired social communication and interactions (Chou et al., 2020; Fredrick et al., 2022; Matthias et al., 2021; Park et al., 2020; van Roekel et al., 2010; Volkmar & Pete, 2021), with a US national study showing prevalence rates of 37.4% for victimization, 5.9% for perpetration, and 8.9% for victimization–perpetration (Sterzing et al., 2012). In Taiwan, a recent study found that 57% of autistic youths experienced pure victimization and 17.4% victimization–perpetration, with no cases of pure perpetration (Hsiao et al., 2022).

Stepped care has been introduced across the lifespan of autistic people to address their developmental challenges (Lord et al., 2022). Considering the prevalence of social skill difficulties and school bullying in autistic adolescents, targeted interventions are important for promoting their well-being (Nangle et al., 2020; Wong et al., 2015; Yao & Enright, 2021). Programs like the

Viennese Social Competence Training, the Olweus Bullying Prevention Program, and the KiVa anti-bullying program have shown effectiveness (Farrington & Tfofi, 2009; Le et al., 2021; McDaid et al., 2019). Nonetheless, most anti-bullying initiatives focus on schoolwide approaches rather than individual needs (Saarento et al., 2015; Swearer & Doll, 2001; Swearer & Espelage, 2004), and few are proven effective for typically developing students (Kõiv, 2012). Given their specific vulnerabilities, autistic adolescents need tailored, individual-level interventions that address both challenges in social function common to autistic youth and any co-occurring conditions (Holden et al., 2020).

Social skill difficulties can be ameliorated through systematic social skills training, which is an evidence-based practice designed to increase the knowledge and performance of social skills (Nangle et al., 2010; Nangle et al., 2020; Wilson, 2002; Wong et al., 2015; Yao & Enright, 2021). Furthermore, social skills training is available for a variety of populations with social challenges, delivered in individual or group formats across clinical or school settings (Barati et al., 2012; Gresham, 1981; Lai et al., 2020; Nangle et al., 2010). An accumulating body of meta-analyses continually supports social skills training as a viable approach for alleviating social difficulties in people with ASD at various developmental levels (Babb et al., 2020; Gates et al., 2017; Gilmore et al., 2022; Ke et al., 2017; Miller et al., 2014; Reichow et al., 2013; Wolstencroft et al., 2018; Wong et al., 2015). Reviews of existing programs show that group-based social skills training is commonly chosen for autistic adolescents to improve their social skills and well-being (Gates et al., 2017; Gilmore et al., 2022; Wolstencroft et al., 2018). Research conducted using PubMed and EBSCOhost databases has identified several interventions with proven effectiveness in improving social competence through rigorous study designs centered around the keywords “adolescents, autism, and social skills training” and limited to randomized controlled trials (RCTs) over the past 5 years. These notable programs include PEERS<sup>®</sup> (Laugeson et al., 2008; Moody & Laugeson, 2020; Nangle et al., 2020; Vuattoux et al., 2021; Zheng et al., 2021), SENSE Theatre<sup>®</sup> (Corbett et al., 2011; Corbett et al., 2016; Corbett et al., 2023), KONTAKT<sup>®</sup> (Afsharnejad et al., 2020; Afsharnejad et al., 2021; Herbrecht et al., 2009; Jonsson et al., 2019), and summerMAX (Lopata et al., 2013; Thomeer et al., 2019).

PEERS<sup>®</sup>, a parent-assisted program for cognitively able autistic adolescents, is widely used and targets both social skills and school bullying (Laugeson et al., 2012; Zheng et al., 2021). The young adult version of the PEERS<sup>®</sup> program, with cultural adaptations for Taiwanese individuals, has been validated as effective in enhancing social functioning among autistic young adults (Chien et al., 2021); however, these positive outcomes are not directly transferable to adolescents. The adolescent

version of PEERS<sup>®</sup> has been validated in various countries, including Asian nations (Shum et al., 2019; Sittanomai et al., 2021; Yamada et al., 2020; Yoo et al., 2014). However, its adaptation to Taiwanese culture is necessary due to the context-specific nature of social skills (Babb et al., 2020). Therefore, developing a culturally adapted Mandarin version of the adolescent PEERS<sup>®</sup> program in Taiwan is essential for enhancing social skills and reducing bullying among Taiwanese autistic adolescents.

The current study adapted the PEERS<sup>®</sup> program to Taiwanese culture and social norms and preliminarily assessed its efficacy in enhancing social skills and reducing school bullying among Taiwanese autistic adolescents using an RCT. The hypotheses were (1) the culturally adapted Taiwanese adolescent PEERS<sup>®</sup> program would be a feasible and acceptable intervention for Taiwanese autistic adolescents, (2) both the PEERS<sup>®</sup> program treatment group (TG) and the delayed treatment control group (DTG) would show significant improvements in reducing school bullying and social challenges, and increasing social knowledge and performance immediately after and 4 months following the intervention, and (3) the TG receiving this PEERS<sup>®</sup> program would show greater magnitudes of reducing school bullying and social challenges, and improving social skills compared with the DTG receiving treatment-as-usual (i.e., participants were able to seek or not seek any treatment).

## METHODS

### Participants

Adolescents meeting the following inclusion criteria were eligible to participate: (1) a clinical diagnosis of ASD by a child psychiatrist based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (American Psychiatric Association, 2013), confirmed by the Autism Diagnostic Interview-Revised (ADI-R) (Gau et al., 2011; Lord et al., 1994), and the Autism Diagnostic Observation Schedule (ADOS) (Chang et al., 2023; Lord et al., 1989), (2) age between 12 and 18 years, (3) enrollment in secondary education, (4) self-reported or parent-reported social difficulties, (5) experienced school bullying according to self-report or parent-report, (6) motivation to participate in the study, (7) a full-scale IQ >70 on the Wechsler Intelligence Scale for Children, Fourth edition (WISC-IV), (8) proficiency in Mandarin, and (9) having a parent fluent in Mandarin who was willing to participate as a social coach. Exclusion criteria were (1) a history of schizophrenia, mood disorders, or other major neuropsychiatric disorders or (2) any visual or hearing impairments that would hinder participation in the study.

Twenty-one adolescents (mean age  $14.29 \pm 1.67$  years; female  $n = 733.33\%$ ) were recruited from the Children's Mental Health Center of the National Taiwan University Hospital. None of the participants reported any harm from their involvement in the trial.

### Procedure

This study was approved by the Research Ethics Committee of the National Taiwan University Hospital before its implementation (NTUH-REC No. 201906022RIND) and was registered in ClinicalTrials.gov (NCT05341011). Written informed consent was obtained from all participants and their parents.

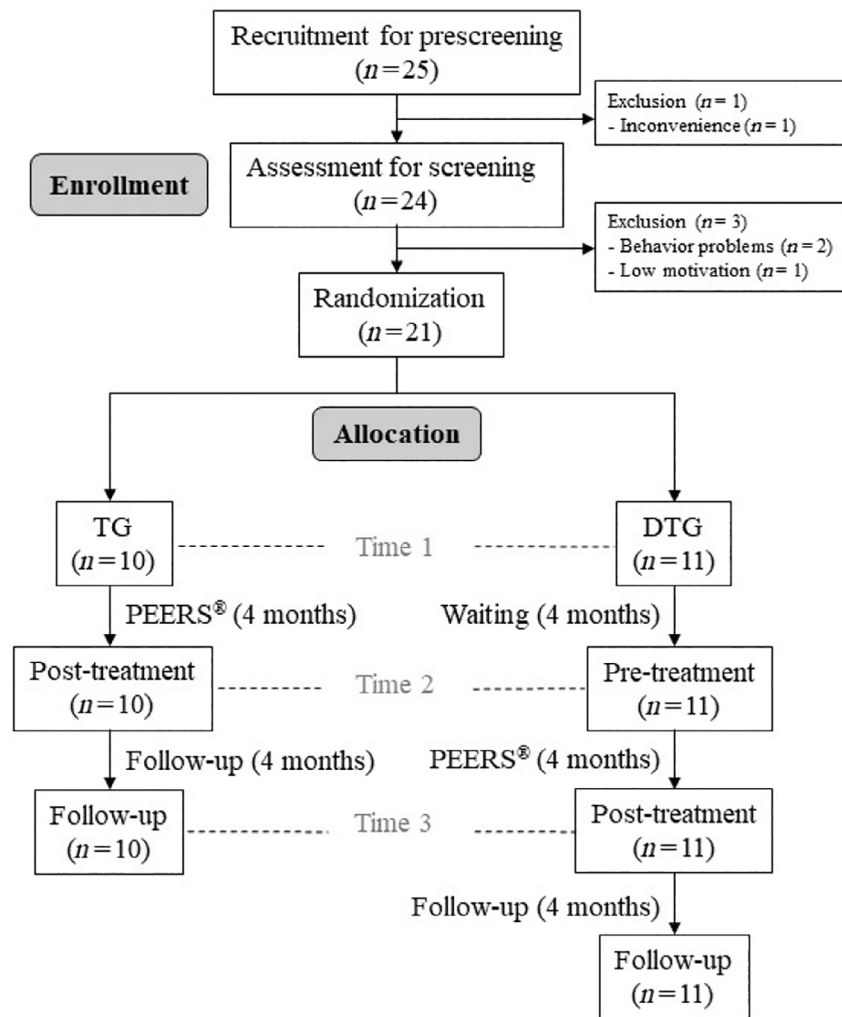
With a telephone screening to meet the inclusion and exclusion criteria, the potential participants and their caregivers (all parents) were invited to have a face-to-face evaluation and detailed explanation of the study objectives, procedures, adherence to the program, and volunteer participation (detailed in Supporting Information Method S1). They are also informed that whether or not they participate in this RCT will not influence their treatment at the hospital.

Out of 25 adolescents initially screened through phone interviews, one declined due to insufficient time to participate in this trial, and 24 proceeded to in-person interviews (Figure 1). Three of these 24 parent–autistic adolescent dyads were excluded from the study for not meeting the inclusion criteria, resulting in a final sample of 21 adolescents and their parents eligible for the intervention.

### Design: Randomized clinical trial

Adolescent participants were randomly assigned to either the TG ( $n = 10$ ) or DTG ( $n = 11$ ) using a computer-generated list by an uninvolved research assistant. The DTG began the Taiwanese adolescent PEERS<sup>®</sup> program after TG participants completed the program, with their waiting period coinciding with TG's treatment (see Figure 1). The intervention was free for all participants.

After screening, baseline assessments were conducted within a week. Outcome measures were taken 1 week before, 1 week after, and 4 months after the PEERS<sup>®</sup> intervention. The DTG began their intervention after the DG had completed the 4-month PEERS<sup>®</sup> intervention. During the 4-month PEERS<sup>®</sup> intervention, social skills and bullying experience were assessed in the middle phase. Additionally, an observer-rated scale was employed to quantify changes in the participants' social communicative behaviors during each session, although this was not the primary focus of the study.



**FIGURE 1** Flowchart of the sampling and trial procedure following Consolidated Standards of Reporting Trials (CONSORT) guidelines.

## The Taiwanese adolescent PEERS<sup>®</sup> program

The Taiwanese adolescent PEERS<sup>®</sup> program was translated and adapted from the original treatment manual for the UCLA PEERS<sup>®</sup> for Adolescents program in English (Laugeson & Frankel, 2010) and the Hong Kong version in Cantonese-Chinese into Traditional-Chinese (detailed in Supporting Information Method S2).

The adolescent group was led by a registered occupational therapist with experience treating autistic children and certification in the PEERS<sup>®</sup> for Adolescents program. The social coach group was facilitated by a special educator trained in ASD intervention and parenting skills. Two behavioral coaches, a child psychiatrist, and an occupational therapist, supported the adolescent group, while a social worker observed the social coach group. These coaches conducted role-play demonstrations, provided feedback during behavioral rehearsal exercises, managed behaviors as needed, and ensured adherence to the treatment protocol to maintain the integrity of the Taiwanese adolescent PEERS<sup>®</sup> program.

The Taiwanese adolescent PEERS<sup>®</sup> program, a structured parent-assisted social skills training, includes

fourteen 90-min sessions based on the original PEERS<sup>®</sup> Treatment Manual (Laugeson & Frankel, 2010) with concurrent but separate sessions for adolescents and parents. The program's format comprises didactic instructions, role-play demonstrations, behavioral rehearsal exercises, performance feedback, homework assignments, and a reunion of the adolescents and their parents to discuss homework plans.

Adolescent sessions in the PEERS<sup>®</sup> program are not just about the adolescents. They begin with a collaborative review of homework and addressing challenges, followed by a lesson on skills like conversation, friendships, humor, sportsmanship, and conflict resolution using concrete rules and steps with role-play demonstrations. Participants practice these skills in behavioral rehearsal exercises, receive feedback from coaches, and are assigned homework to generalize social skill practice and usage. The role of parents is equally important, as parent sessions similarly review homework, guiding parents in supporting their teens' homework completion, and fostering independence. Parents are taught to assist with skill practice between sessions for better skill generalization. Sessions conclude with a joint adolescent–parent review

of skills and homework assignments, reinforcing the collaborative nature of the program. Individual checkouts in the last 10 min of each session ensure practical plans for upcoming assignments (detailed in Supporting Information Method S3).

The fidelity of intervention was maintained through detailed lesson plans derived from the manual and comprehensive process guides. Team meetings and clinical case conferences before and after each session ensured consistent administration fidelity. In pre-session meetings, the adolescent group leader provided instructions and role-play training, while post-session discussions focused on evaluating participants' performance and addressing challenges. Intervention adherence was actively monitored, including session attendance and homework completion, allowing a maximum of two session absences and two missed homework assignments. Such meticulous monitoring, combined with continuous support and feedback, ensured adherence to protocols and provided participants with the necessary support for positive outcomes.

## Measures

### Measurement of school bullying

#### *The Chinese version of the School Bullying Experience Questionnaire (C-SBEQ)*

C-SBEQ was used to evaluate recent school bullying experiences using 16 items on a 4-point Likert scale (0 = "never," 1 = "just a bit," 2 = "often," 3 = "all the time") (Kim et al., 2001; Yen et al., 2012). This scale includes four subscales, each with four items, to evaluate victimization (i.e., items 1–8) and perpetration (i.e., items 9–16) in both passive bullying and active bullying, respectively. A score of 2 or 3 on any item indicated bullying involvement reported by parents. The C-SBEQ is reliable and valid (Yen et al., 2012). The C-SBEQ has been used to measure school bullying among autistic adolescents in Taiwan (Chou et al., 2019; Chou et al., 2020). This study used parent-report C-SBEQ total scores, victimization subscale scores, and perpetration subscale scores to measure bullying severity. The subscales showed acceptable internal consistency with Cronbach alphas of 0.727 for victimization and 0.753 for perpetration. The intraclass correlation coefficients ranged from 0.742 to 0.813 for the four subscales, indicating moderate to high 1-month test–retest reliability (Yen et al., 2012).

### Measurement of social function

#### *The Social Responsiveness Scale (SRS)*

The SRS is a 65-item self-reported scale of autistic-like social challenges in natural settings (Constantino & Gruber, 2005). Higher total raw scores indicate more

severe social impairments. The SRS has been demonstrated to have good internal consistency, construct validity, inter-rater reliability, test–retest reliability, and discriminative validity in prior research (Constantino & Gruber, 2005). The Chinese version of the SRS was prepared with culture-relevant expressions and two-way translation by the Taiwan Autism Study Group, led by Drs. Gau and Wu, and was officially approved by Dr. Constantino in 2008. Given that the exploratory and confirmatory factor analyses indicated that the Chinese version of the SRS, after removing five items, has a four-factor structure (social communication, stereotyped behaviors/interest, social awareness, and social emotion) but is better conceptualized as a one-factor model (Gau et al., 2013; Lin et al., 2023; Tung et al., 2021), we used the SRS total score in the analyses as a general index of autistic social deficits. High internal consistency was found for the four subscales (Cronbach's  $\alpha$  0.94–0.95) and the total scale (Cronbach's  $\alpha$  0.95) in our ASD cohort. With excellent psychometric properties, the Chinese SRS is widely used to assess the severity of overall social challenges in Taiwan (Gau et al., 2013).

#### *The Chinese version of the Test of Adolescent Social Skills Knowledge (TASSK)*

The TASSK is a 26-item measure based on the 13 didactic lessons of PEERS<sup>®</sup> to assess adolescents' understanding of specific social skills knowledge taught during the intervention (Laugeson & Frankel, 2010). Adolescents select the best of two options to complete each sentence stem, with correct answers scoring one point each and a maximum score of 26, indicating a better grasp of social etiquette. Previous studies have demonstrated the TASSK's sensitivity to treatment effects (Laugeson et al., 2012; Schohl et al., 2014; Yoo et al., 2014). The test–retest reliability Pearson correlation was 0.73 ( $p < 0.001$ ). Cronbach's alpha coefficient was 0.43, indicating relatively low internal consistency, comparable to the English version ( $\alpha = 0.56$ ) and the Hong Kong Chinese version ( $\alpha = 0.50$ ) (Shum et al., 2019). This reliability level of the TASSK is deemed acceptable, similar to previous studies (Laugeson et al., 2012; Mandelberg et al., 2014; Schohl et al., 2014), given the scale's diverse question range, where high internal consistency is not expected (Laugeson et al., 2008).

#### *The Chinese version of the Quality of Socialization Questionnaire–Parent (QSQ-P)*

The QSQ-P is a 12-item questionnaire completed by parents, including two items on recent peer get-together frequency and a 10-item Conflict Scale for assessing conflict levels during the last get-together (Laugeson & Frankel, 2010). This study focused on the Conflict Scale, where higher scores indicate more observed conflict. The QSQ-P, translated into Chinese (Shum et al., 2019), was used to evaluate social skill performance improvements,

consistent with previous research (Laugeson et al., 2012; Laugeson et al., 2014; Schohl et al., 2014; Yoo et al., 2014). The test–retest reliability Pearson Correlation for the Conflict Scale was 0.86 ( $p < 0.001$ ). Cronbach's alpha coefficient for the QSQ-P was 0.69, indicating a similar level of internal consistency to the English version's 0.87 and the Hong-Kong Chinese version's 0.72 (Shum et al., 2019).

## Measurement of acceptability and feasibility

The intervention delivery quality was assessed using the following measures. Attendance of teenagers and their parents in the Taiwanese adolescent PEERS<sup>®</sup> was monitored and recorded for each session. Participants also gave feedback and rated their program satisfaction after each session using the self-administrated 100-point scale to express their satisfaction with the intervention (100 being the highest satisfaction). Homework completion rates were assessed by the number of weekly homework assignments completed by adolescent participants and their parents, with a maximum of 13 assignments.

## Statistical analysis

Statistical analyses were performed using IBM SPSS 20.0 Statistics version 26 (SPSS, Inc., Chicago, IL). A significance was set at  $p < 0.05$  level. Sample size determination was based on a review of previous RCTs on the PEERS<sup>®</sup> program for autistic adolescents using the same outcome measures (Laugeson et al., 2012; Shum et al., 2019; Yamada et al., 2020; Yoo et al., 2014). Power analyses using G\*Power 3.1 indicated a minimum sample size of 21 participants. The intention-to-treat principle was applied to compare pre-intervention, post-intervention, and 4-month follow-up between the TG and DTG groups. Basic demographics were compared using Chi-square tests for categorical data and two-sided independent  $t$ -tests for continuous variables.

To assess the feasibility and acceptability of the Taiwanese adolescent PEERS<sup>®</sup> program by autistic adolescents and their parents, average attendance rate, satisfaction score, and homework completion rates were calculated. Group differences at the same time points were analyzed using independent  $t$ -tests, while paired  $t$ -tests examined the time differences in the effectiveness of the TG and DTG. The group-by-time interaction was tested with repeated measures analysis of variance (ANOVA) and a generalized estimating equation (GEE) model controlling the effects of adolescent age, gender, and IQ. Effect sizes were calculated using Cohen's  $d$  (Cohen, 1988).

Data from both TG and DTG were analyzed across three time points (pre-PEERS<sup>®</sup>, post-PEERS<sup>®</sup>, and 4-month follow-up) to compare changes in bullying

experiences, social challenges, and social skills. The comparisons of these changes were evaluated using paired  $t$ -tests and repeated measures ANOVA for continuous variables and with the Friedman test for categorical variables. Changes in social skills and bullying experiences during the intervention were analyzed using repeated measures ANOVA.

## RESULTS

### Demographics and baseline variables

The descriptive statistics of baseline characteristics of adolescents and their parents for the TG and DTG groups are presented in Table 1. There were no statistically significant differences in the demographic and clinical variables or the baseline assessments of all outcome measures (QSQ-P, TASSK, C-SBEQ, and SRS) between the TG and DTG. There were no significant group differences in the autistic symptom severity assessed by the ADOS (module 3) and the current ADI-R (full version in Table S1).

### Acceptability and feasibility

During the PEERS<sup>®</sup> intervention, there were no dropouts in either the TG or DTG. Participants attended at least 12 of the 14 sessions, with an average attendance rate of 96.26% for adolescents and 97.28% for parents (Table S2). Average satisfaction scores per session and combined all 14 sessions were about 94 out of 100 (Adolescents:  $94.34 \pm 4.91$ ; Parents:  $93.54 \pm 3.94$ ) and 97 out of 100 (Adolescents:  $97.57 \pm 3.97$ ; Parents:  $96.90 \pm 3.70$ ), respectively, suggesting high satisfaction levels. Overall, the satisfaction levels reported by both adolescents and parents were high. Moreover, the homework completion rate was 96.34% (detailed in Supporting Information Result S1).

### Comparisons between the two groups: TG and DTG

To evaluate the effectiveness of the PEERS<sup>®</sup> intervention, repeated-measure ANOVA analyzed the interaction between group (TG vs. DTG) and time (Time 1 vs. Time 2) effects on outcome measures. Significant interactions were found in SRS total scores ( $p = 0.001$ ) and TASSK total scores by adolescents ( $p < 0.001$ ), as well as QSQ-P Conflict Scale scores ( $p < 0.001$ ), C-SBEQ total scores ( $p < 0.001$ ), C-SBEQ victimization subscale scores ( $p < 0.001$ ), and perpetration subscale scores ( $p = 0.012$ ) by parents, indicating marked improvements with PEERS<sup>®</sup> intervention with very large effect sizes (Cohen's  $d$ s  $> 1.00$ ) (Table 2 and Figure 2). Further, using

**TABLE 1** Group comparison on background demographics and baseline variables.

	TG ( <i>n</i> = 10)		DTG ( <i>n</i> = 11)		Statistics	
	Mean or <i>n</i>	SD or (%)	Mean or <i>n</i>	SD or (%)	<i>t</i> or $\chi^2$ or Fisher's exact test	<i>p</i>
Adolescents						
Adolescent age	13.7	1.52	14.5	1.70	-1.08	0.30
Adolescent sex (Female)	3	30.00%	4	36.36%		1.00
Full-scale IQ	109.5	13.48	110.0	16.61	-0.08	0.94
Education						
Middle school	8	80.00%	7	63.64%		0.64
High school	2	20.00%	4	36.36%		
Self-reported						
SRS total scores	98.90	22.11	97.18	29.25	0.15	0.88
TASSK total scores	15.50	3.24	15.18	2.14	0.27	0.79
Parents						
Parent age	47.76	2.92	45.29	4.19	1.55	0.14
Parent sex (female)	10	100%	8	72.70%		0.21
Asian	10	100%	11	100%		
Education						
High school or less	0	0%	2	18.18%		0.48
College or above	10	100%	9	81.82%		
Family income						
Low	3	30.00%	3	27.27%		0.86
Middle	4	40.00%	6	54.55%		
High	3	30.00%	2	18.18%		
Parent-reported						
QSQ-P Conflict Scale scores	5.50	2.80	5.36	2.87	0.11	0.91
Numbers above C-SBEQ cutoff	10	100%	11	100%		
C-SBEQ total scores	12.40	5.87	9.82	5.04	1.08	0.29
C-SBEQ victimization	8.90	3.41	6.64	3.61	1.48	0.16
C-SBEQ perpetration	3.50	3.31	3.18	2.04	0.27	0.80

Abbreviations: C-SBEQ, Chinese version of the School Bullying Experience Questionnaire; DTG, delayed treatment control group; QSQ-P, Quality of Socialization Questionnaire-Parent; SRS, Social Responsiveness Scale; TASSK, Test of Adolescent Social Skills Knowledge; TG, treatment group.

GEE to control for age, gender, and IQ, significant PEERS<sup>®</sup> intervention effects were observed across all measures ( $p \leq 0.005$ ). However, adolescent age negatively influenced QSQ-P Conflict Scale scores ( $p < 0.01$ ), and IQ had a negative effect on C-SBEQ total scores and victimization subscale ( $p < 0.05$ ) (Table S3).

### Comparisons between the three timepoints: Pre-PEERS<sup>®</sup>, Post-PEERS<sup>®</sup>, and 4-month follow-up

Comparisons of combined data from TG and DTG pre-treatment, post-treatment, and 4 months following treatment showed significant improvements (Table 3). Parent-reported C-SBEQ total scores and subscale scores showed significant reductions in overall bullying ( $p < 0.001$ ), victimization ( $p < 0.001$ ), and perpetration ( $p < 0.05$ ). Adolescent-reported SRS total scores also

decreased, indicating milder social challenges ( $p < 0.001$ ). Additionally, there were significant improvements in parent-reported QSQ-P Conflict Scale scores and adolescent-reported TASSK total scores ( $p < 0.001$ ). Figure 3 visually illustrates these changes across the three time points of intervention: pre-treatment, post-treatment, and follow-up.

The Friedman test, applied to TG and DTG combined data on the C-SBEQ, showed a significant decrease in the proportion of participants with scores of 2 and above ( $n = 21$  to 10 then to 5 in overall bullying involvement,  $p < 0.001$ ), with both victimization and perpetration rates dropping after the PEERS<sup>®</sup> intervention ( $p < 0.001$  and  $p < 0.05$ , respectively). Bullying involvement reduced from 100% at pre-intervention to under 50% at post-test and below 25% at the 4-month follow-up (Detailed in Table S4, Figures S1 and S2). For detailed results of changes in bullying experiences and social skills during the intervention, refer to Table S5 and Figure S3.

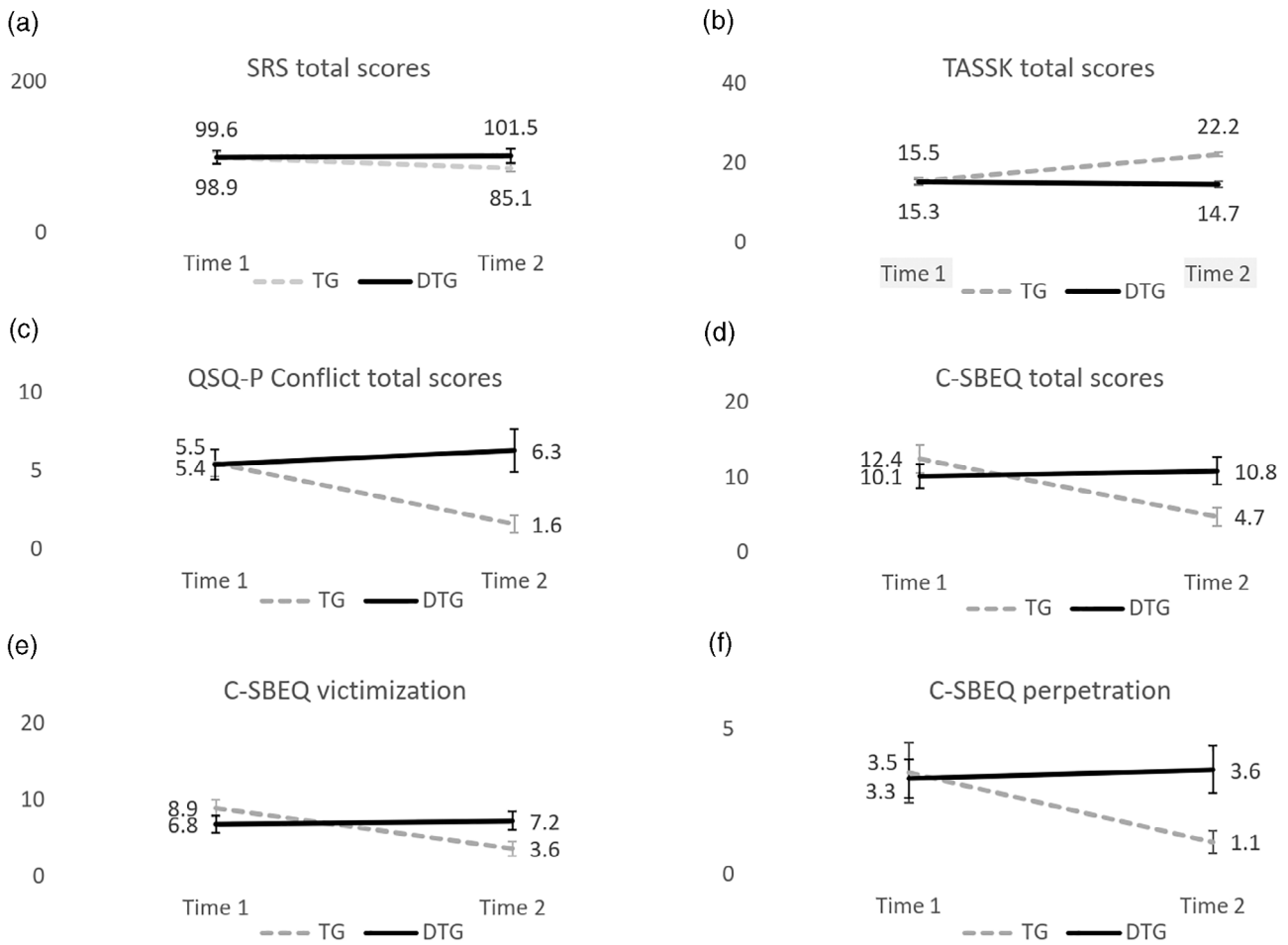
**TABLE 2** Group comparison of bullying experiences, social deficits, and social skills pre- and post-treatment between PEERS® Treatment Group (TG) and the Delayed Treatment Group (DTG).

	TG (n = 10)			DTG (n = 11)			Group differences			Group × time		
	Time 2–Time 1			Time 2–Time 1			Time 2			Time 2–Time 1		
	Mean (SD)	t	p	Mean (SD)	t	p	Mean (SD)	t	p	F	p	Cohen's d
<b>Self-reported</b>												
SRS total scores	-13.80 (13.25)	-3.29	0.009**	1.55 (2.21)	2.32	0.043*	-1.29	0.213	0.57	14.39	0.001**	1.62
TASSK total scores	6.70 (3.09)	6.85	<0.001***	-0.64 (1.86)	-1.14	0.283	0.06	<0.001***	3.92	44.40	<0.001***	2.88
<b>Parent-reported</b>												
QSQ-P Conflict Scale scores	-3.90 (2.13)	-5.79	<0.001***	0.91 (2.07)	1.46	0.176	-3.28	0.004**	1.45	27.46	<0.001***	2.29
C-SBEQ total scores	-7.70 (6.33)	-3.85	0.004**	1.18 (2.09)	1.88	0.090	-3.00	0.007**	1.32	19.45	<0.001***	1.88
C-SBEQ victimization	-5.30 (3.71)	-4.51	0.001**	0.73 (1.35)	1.79	0.104	-2.60	0.018*	1.14	25.41	<0.001***	2.16
C-SBEQ perpetration	-2.40 (3.17)	-2.39	<0.001***	0.45 (1.21)	1.24	0.242	-3.05	0.008**	1.31	7.71	0.012*	1.19

Abbreviations: C-SBEQ, Chinese version of the School Bullying Experience Questionnaire; DTG, delayed treatment control group; QSQ-P, Quality of Socialization Questionnaire-Parent; SRS, Social Responsiveness Scale; TASSK, Test of Adolescent Social Skills Knowledge; TG, treatment group.

\*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001.





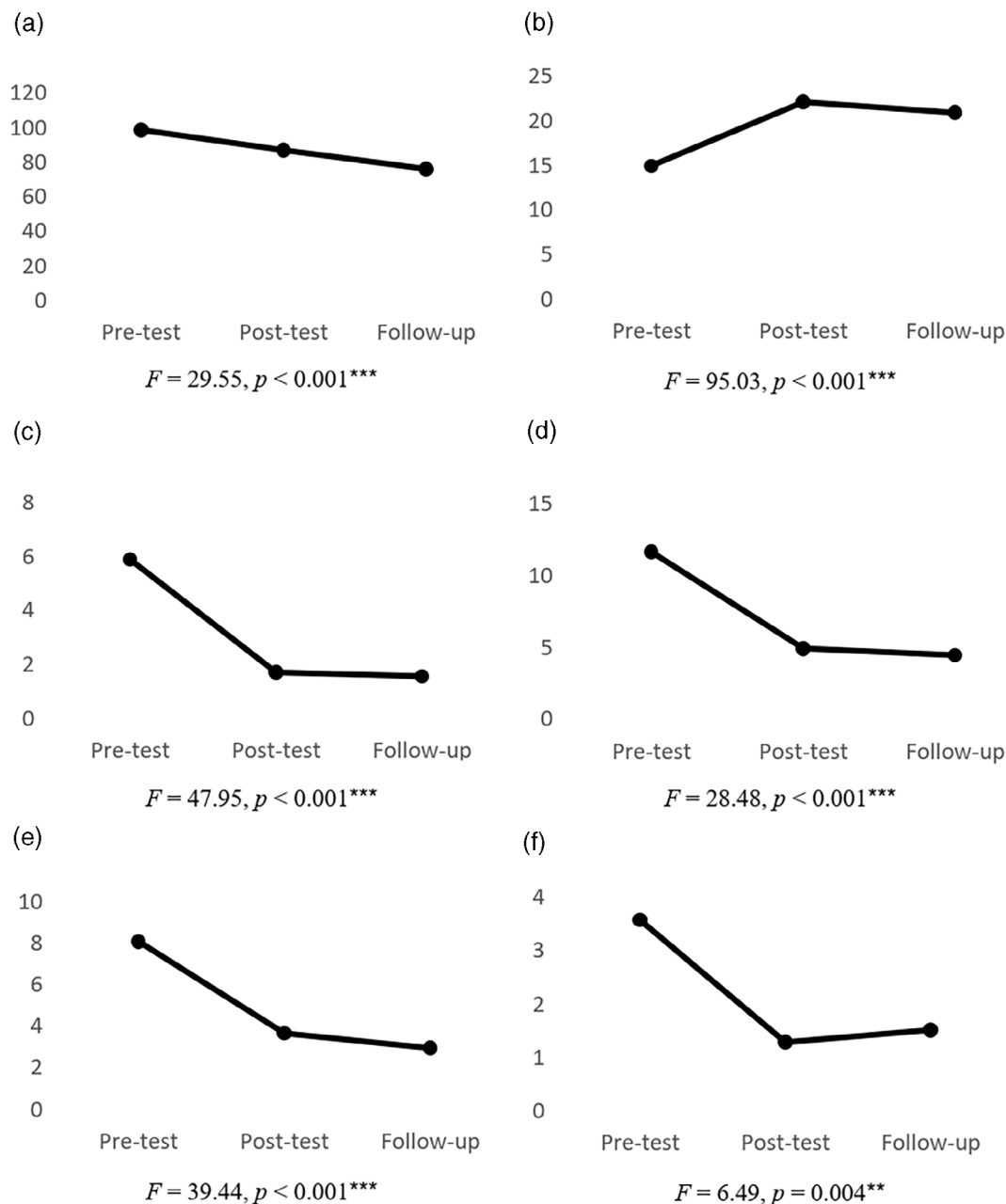
**FIGURE 2** Line graphs showing the changes before and after PEERS® treatment between two groups. (a) SRS total scores. (b) TASSK total scores. (c) QSQ-P Conflict Scale scores. (d) C-SBEQ total scores. (e) C-SBEQ victimization. (f) C-SBEQ perpetration. C-SBEQ, Chinese version of the School Bullying Experience Questionnaire; QSQ-P, Quality of Socialization Questionnaire-Parent; SRS, Social Responsiveness Scale; TASSK, Test of Adolescent Social Skills Knowledge.

**TABLE 3** Comparisons between the three timepoints: pre-PEERS®, post-PEERS®, and 4-month follow-up.

	Intervention stage			Paired <i>t</i> -test		Pre-test to follow-up		Repeated measures ANOVA		
	Pre-test <i>M</i> ( <i>SD</i> )	Post-test <i>M</i> ( <i>SD</i> )	Follow-up <i>M</i> ( <i>SD</i> )	<i>t</i>	<i>p</i>	<i>t</i>	<i>p</i>	<i>F</i>	<i>p</i>	$\eta^2$
<b>(<i>n</i> = 21)</b>										
Self-reported										
SRS total scores	98.81 (25.57)	87.00 (23.21)	76.19 (20.85)	5.26	<0.001***	5.99	<0.001***	29.55	<0.001***	0.60
TASSK total scores	15.00 (2.80)	22.10 (1.70)	20.90 (1.97)	-11.29	<0.001***	-9.18	<0.001***	95.03	<0.001***	0.83
Parent measures										
QSQ-P Conflict Scale scores	5.90 (3.51)	1.71 (1.62)	1.57 (1.66)	7.23	<0.001***	7.10	<0.001***	47.95	<0.001***	0.71
C-SBEQ total scores	11.67 (5.59)	4.95 (4.30)	4.48 (5.36)	6.31	<0.001***	5.68	<0.001***	28.48	<0.001***	0.59
C-SBEQ victimization	8.10 (3.52)	3.67 (3.17)	2.95 (2.94)	6.98	<0.001***	7.06	<0.001***	39.44	<0.001***	0.66
C-SBEQ perpetration	3.57 (2.82)	1.29 (1.62)	1.52 (3.49)	4.24	<0.001***	2.41	0.026*	6.49	0.007**	0.25

Abbreviations: C-SBEQ, Chinese version of the School Bullying Experience Questionnaire; DTG, delayed treatment control group; QSQ-P, Quality of Socialization Questionnaire-Parent; SRS, Social Responsiveness Scale; TASSK, Test of Adolescent Social Skills Knowledge; TG, treatment group.

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001.



**FIGURE 3** Line graphs showing the changes between the three timepoints. (a) SRS total scores. (b) TASSK total scores. (c) QSQ-P Conflict Scale scores. (d) C-SBEQ total scores. (e) C-SBEQ victimization. (f) C-SBEQ perpetration. C-SBEQ, Chinese version of the School Bullying Experience Questionnaire; QSQ-P, Quality of Socialization Questionnaire-Parent; SRS, Social Responsiveness Scale; TASSK, Test of Adolescent Social Skills Knowledge.

## DISCUSSION

As the first study in ethnic Chinese to investigate the effectiveness of the PEERS<sup>®</sup> program for adolescents in Mandarin, our findings indicate that the Taiwanese adolescent PEERS<sup>®</sup> program effectively reduces the risk of school bullying, decreases social challenges, and enhances social skills in autistic adolescents. The program's feasibility was demonstrated by high attendance (96%), overall satisfaction (97%), and homework completion rate (96%). The absence of dropouts further

highlights its feasibility and acceptability among Taiwanese adolescents. After treatment, there were significant reductions in general bullying involvement, victimization, and perpetration (assessed by parents), along with a significant reduction in social challenges (assessed by adolescent participants), as well as significant improvements in social skills knowledge (assessed by adolescent participants) and social skills performance (assessed by parents). These intervention gains were generally maintained at 4-month follow-up assessments.

There was a significant decrease in bullying among autistic adolescents after the intervention, as reported by their parents. Additionally, a clinically significant shift from bullying involvement to non-involvement was demonstrated by more than half of the adolescents (10 out of 21). More specifically, it showed a decrease in the severity of bullying victimization and perpetration, indicating that the PEERS<sup>®</sup> intervention successfully reduced the occurrence of various types of school bullying and their severity. The findings suggested the impact of PEERS<sup>®</sup> was expanded notably beyond its original and primary focus on social functioning. The significant improvements in social skills knowledge and social skills performance replicated previous findings in autistic adolescents from other cultural backgrounds (Idris et al., 2022; Laugeson et al., 2008; Sittanomai et al., 2021; Yamada et al., 2020; Yoo et al., 2014). Apart from social skills, the significant reduction in social challenges after treatment confirms previous findings showing a significant decrease in severity related to social impairments (Idris et al., 2020; Laugeson et al., 2012). The current findings unequivocally highlight the broader impact of the PEERS<sup>®</sup> program, extending beyond social skills enhancement to encompass a significant reduction in school bullying.

Furthermore, the improvement in bullying involvement and social function remained statistically significant after controlling for age, sex, and IQ. These results further support the efficacy of the PEERS<sup>®</sup> program in benefiting autistic adolescents across different developmental stages (such as junior or senior high school age), different sexes, and cognitive abilities (i.e., IQ at or above average). Notably, sex was not correlated with any changes resulting from the intervention, consistent with previous findings that gender did not significantly influence the effects of the PEERS<sup>®</sup> intervention effect (Hong et al., 2019; Yoo et al., 2014). Conversely, age was only correlated with improvements in social performance, not in social knowledge or different domains of improvement. Our finding suggests that older participants may be more effective than younger participants in applying newly acquired social knowledge during peer interactions. This finding aligns with previous research on PEERS<sup>®</sup>, which also did not identify a clear impact of age on social functioning outcomes (Chang et al., 2014; Hong et al., 2019). Additionally, as the first study to investigate the effectiveness of the PEERS<sup>®</sup> intervention on school bullying, we found that full-scale IQ was correlated with social functioning outcomes. While participants with both average and above-average full-scale IQ demonstrated the abilities to acquire social skills knowledge and learn social skills performance, those with higher IQ scores notably exhibited a greater reduction in bullying involvement, indicating a more significant translation of acquired skills into practical use.

The current study indicates that the culturally adapted PEERS<sup>®</sup> intervention were feasible and

acceptable for autistic adolescents and their parents in Taiwan. The Taiwanese adolescent PEERS<sup>®</sup> program effectively reduced social challenges and improved social skills knowledge and social skills performance, aligning with previous similar PEERS<sup>®</sup> intervention studies in other cultural contexts across America (Laugeson et al., 2012; Veytsman et al., 2023), Europe (Idris et al., 2020), and Asia (Shum et al., 2019; Sittanomai et al., 2021; Yamada et al., 2020; Yoo et al., 2014) using a variety of objective and subjective measures. Through social skill training, participants gradually learned various social skills, such as conversation, humor, sportsmanship, organizing, getting invited, and hosting get-togethers. Additionally, the PEERS<sup>®</sup> intervention showed unexpected benefits in reducing bullying involvement. Given that social difficulties increase the risk of school bullying (Park et al., 2020), the comprehensive training provided by the PEERS<sup>®</sup> intervention, including strategies to address bullying, may help autistic students avoid bullying situations.

The following implications can be drawn from this study. First, autistic adolescents experience significantly more peer rejection and social isolation than their typically developing peers. Group-based social skills training can be beneficial for those with ASD, as it allows participants to learn and practice newly acquired skills together within the supportive environment of a neurodivergent peer group. Tailoring intervention strategies to the specific needs of autistic adolescents, such as providing clear rules and steps to offering real-life practice as homework, and involving parental support as social coaches, can lead to improvements in social skills. Having parents act as social coaches can help reinforce and generalize these skills in real-life situations. Finally, it is noteworthy that adolescents who have recently experienced school bullying may benefit from this social skills training, which includes topics related to bullying without requiring personal disclosure of bullying experience. While the program is not designed to address the emotional aspects of bullying, it encourages teens to develop effective coping strategies to minimize future victimization. Moreover, as the salient social challenges associated with ASD ameliorated with the growth of social skills, risk factors of bullying involvement decreased. The impact of social skills on general interpersonal and school bullying topics requires further investigation.

The results of this preliminary RCT are promising, but several limitations need to be addressed. First, the small sample size of this pilot study limits the generalization of findings. Although PEERS<sup>®</sup> showed large effect sizes across all outcome measures in this study (Cohen's  $d > 1.00$ ), a larger sample could provide stronger evidence for treatment effects. Second, the study excluded adolescents with major psychiatric disorders, such as schizophrenia, anxiety disorder, and major depression. Considering the prevalence of co-occurring psychiatric conditions among autistic individuals (Hossain et al., 2020), future studies

might consider including individuals on the spectrum with these conditions to expand PEERS<sup>®</sup>. Third, the participants are limited to motivated adolescents without intellectual disabilities, reducing generalizability to broader populations of autistic adolescents with higher support needs. Further research could explore the effectiveness of PEERS<sup>®</sup> for low-motivated participants or those with delayed cognitive abilities using a simplified version of the program. Fourth, similar to most prior studies on PEERS<sup>®</sup>, this study used a waiting list condition for comparison instead of an active treatment control group. Future research should compare PEERS<sup>®</sup> to an active treatment control group to ensure its effectiveness beyond general effects. Fifth, the outcome measures in the present study were mainly reported by the participants and their parents, potentially introducing bias as they were all active participants. There were no objective measures on proximal and distal treatment effects by naïve raters, which may limit the robustness of our findings. Future studies should include direct observations of improvement in real-life situations and outcomes measured by independent third-party assessors such as teachers or caregivers unaffiliated with the program. Moreover, the observed benefits in reducing bullying involvement are mainly based on parents' perceptions rather than autistic adolescents' perspectives, while parents would often not instantly observe and may not always accurately reflect their kids' social interactions. Future research should incorporate the perspectives of autistic adolescents themselves to provide a more comprehensive understanding of the intervention's impact on bullying involvement. Sixth, despite the small sample size and homogeneity of our sample, the large effect size observed in our study suggests a significant impact of the PEERS<sup>®</sup> intervention on improving social functioning and reducing bullying. However, it is important to acknowledge that these findings should be interpreted with caution, given the limitations of our study design and small sample size. Future research with larger and more diverse samples is needed to validate and extend our findings. Finally, long-term follow-up on effectiveness in bullying will provide valuable information regarding the maintenance of findings beyond 4-months. A long-term follow-up study is underway to assess the maintenance of the treatment gains after intervention. Future studies with larger sample sizes, using subjective and objective measures, including follow-up assessments, would further elucidate the effectiveness of the PEERS<sup>®</sup> intervention.

Despite its limitations, this study demonstrates the feasibility and acceptability of the PEERS<sup>®</sup> intervention among Taiwanese autistic adolescents and their parents, as evidenced by no dropouts, high attendance rate, high satisfaction scores, and high homework completion support. This study provides further evidence that PEERS<sup>®</sup> treatment effects are generalizable across cultures. It also

employed standardized diagnostic measures, such as the ADOS and the ADI-R, before the intervention and assessed multiple domains of school bullying and social functioning after the intervention. The Taiwanese adolescent PEERS<sup>®</sup> program was consistently reported by various informants to significantly improve social challenges, social knowledge, and social performance. Moreover, participation in the PEERS<sup>®</sup> intervention led to enhanced social function and reduced bullying involvement. Another strength of this study is its RCT design, which provides a robust methodology for evaluating the effectiveness of the PEERS<sup>®</sup> intervention. The efficacy of the PEERS<sup>®</sup> on school bullying and social function among autistic adolescents was further confirmed by controlling for sex, age, and IQ. These findings may provide valuable evidence for future practice.

## CONCLUSION

The current study offers strong evidence for the effectiveness of the PEERS<sup>®</sup> program as a social skills training intervention with anti-bullying components for cognitively able autistic adolescents.

Notably, this work extends beyond examining the treatment effects of social skill training on enhancing social abilities to explore the actual experiences of school bullying. In summary, our findings indicate that PEERS<sup>®</sup> provides autistic adolescents and their parents with the necessary knowledge and strategies to increase social engagement and reduce bullying involvement. Highlighting the program's positive impact, a teenage participant from the Taiwanese adolescent PEERS<sup>®</sup> program shared, "For the first time in my life, I have started to look forward to making genuine friendships. It just feels like the beginning of a promising future." This feedback exemplifies the transformative effect PEERS<sup>®</sup> can have on autistic adolescents.

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## CONFLICT OF INTEREST STATEMENT

All authors declared no conflict of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## ETHICS STATEMENT

This study was approved by the National Taiwan University Hospital Ethics Committee (NTUH-REC No. 201906022RIND), registered on [ClinicalTrials.gov](https://clinicaltrials.gov) (NCT05341011), and conducted in accordance with the Declaration of Helsinki. Before the study's implementation, written informed consent was obtained from all participants and their parents.

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## SUPPORTING INFORMATION

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