

ORIGINAL ARTICLE

Program for the Education and Enrichment of Relational Skills for adolescents with an acquired brain injury: A randomized controlled trial

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Aim: To test the efficacy of a group social skills intervention on social functioning in adolescents with a brain injury.

Method: Thirty-six adolescents (mean age 14y, SD 1y 8mo, age range 12y 1mo–16y 3mo; 17 females) with acquired brain injury (ABI; ≥ 12 mo postintervention; $n=19$) or cerebral palsy ($n=17$) were randomly allocated to the Program for the Education in Enrichment of Relational Skills (PEERS) or usual care. The primary outcome was the Social Skills Improvement System-Rating Scales (SSIS-RS). Secondary outcomes were scores derived from the Test of Adolescent Social Skills Knowledge-Revised (TASSK-R), Social Responsiveness Scale, Second Edition, and Quality of Socialization Questionnaire. Between-group differences postintervention and at the 26-week retention time point were compared using linear mixed modelling for continuous outcomes and Poisson regression for count data.

Results: There were no between-group differences on the primary outcome (SSIS-RS). Regarding the secondary outcomes, the PEERS-exposed group achieved significantly greater improvements on the TASSK-R (mean difference [MD]=6.8, 95% confidence interval [CI]=4.8–8.8, $p<0.001$), which were maintained at the 26-week retention time point (MD=8.1, 95% CI=6.0–10.2, $p<0.001$). PEERS was also associated with a significant increase in parent-reported invited get-togethers at 26 weeks (incidence rate ratio=4.0, 95% CI=1.0–16.0, $p=0.05$).

Interpretation: Adolescents with brain injury who completed the PEERS learned and retained social knowledge and increased social participation.

Abbreviations: ABI, acquired brain injury; ASD, autism spectrum disorder; GSSI, group social skills intervention; PEERS, Program for the Education in Enrichment of Relation Skills; QSQ, Quality of Socialization Questionnaire; RCT, randomized controlled trial; SRS-2, Social Responsiveness Scale, Second Edition; SSIS-RS, Social Skills Improvement System-Rating Scales; TASSK-R, Test of Adolescent Social Skills Knowledge-Revised.

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Adolescents with an acquired brain injury (ABI) or cerebral palsy (CP) can experience challenges with many aspects of social functioning, such as social problem-solving, pragmatic language and speech difficulties, interpreting the emotions of others, and regulating their own emotional responses.¹⁻³ These difficulties, along with often reduced social opportunities, motor and sensory impairments, and persisting physical symptoms, such as pain and fatigue, can result in social isolation, reduced social participation, or rejection by peers.³ Prevalence rates for difficulties with social functioning in these populations are emerging with studies reporting 23% to 50% of children with traumatic brain injury⁴⁻⁶ and 33% to 45% of children with CP^{3,7} experiencing problems with social functioning, which can increase over time and persist into adulthood.^{3,7,8}

Several systematic reviews of group social skills interventions (GSSIs) exist for adolescents with autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD).⁹⁻¹³ A recent systematic review and meta-analysis of GSSIs for adolescents with congenital, acquired, or developmental disabilities included 16 randomized controlled trials (RCTs) of seven social skills programmes (Gilmore et al., forthcoming). Of the 16 RCTs, 15 comprised adolescents with ASD and one focused on brain tumour survivors.¹⁴ Meta-analyses found that GSSIs compared to waiting list/care as usual led to significantly improved social responsiveness, social skills, social functioning, and social knowledge (Gilmore et al., forthcoming). The most commonly evaluated group social skills programme was the Program for the Education in Enrichment of Relational Skills (PEERS).¹⁵ There is evidence that PEERS may be effective for young people with other diagnoses, such as ADHD.¹⁶ Since both ADHD and ASD are common among adolescents with brain injury, PEERS might be an effective intervention to improve social functioning in this group.

The aim of this RCT was to determine the efficacy of PEERS to improve the social competence and friendship skills of adolescents with a brain injury. We hypothesized that adolescents receiving PEERS would achieve significantly greater gains in self- and caregiver-reported social skills, improved social knowledge, a reduction in caregiver-reported social impairments, and an increase in social participation compared to waiting list/care as usual.

METHOD

The study design for this waiting list RCT has been described in the study protocol.¹⁷ The study took place in Brisbane and Sydney between August 2017 and December 2019. Ethical approval was granted by the Medical Research Ethics Committee of The University of Queensland (no. 2017000864), the Children's Health Queensland Hospital and Health Service Human Research Ethics Committee (no. HREC/17/QRCH/87), and the Cerebral Palsy Alliance Ethics

What this paper adds

- Adolescents with a brain injury can learn and retain social knowledge.
- The Program for the Education in Enrichment of Relational Skills (PEERS) can improve social participation in adolescents with brain injury.
- PEERS can be adapted for Australian adolescents with brain injury.

Committee (no. 20170802/HREC:EC00402). Informed written consent was obtained from caregivers and verbal assent was given by all adolescent participants. The trial was registered with the Australian New Zealand Clinical Trial Registry (no. ACTRN12617000723381).

Participants

Adolescents aged 11 to 17 years with a diagnosis of ABI (at least 12mo postinjury) or CP and self- and caregiver-reported difficulty in making and keeping friends were invited to participate. To be eligible for inclusion, participants were required to: (1) be enrolled in high school (home schooling included); (2) be motivated to improve friendship skills; (3) be able to attend a 14-week group programme including homework tasks; (4) have a verbal IQ >70 measured on the Wechsler Abbreviated Scale of Intelligence, Second Edition; and (5) be able to verbally communicate in English and complete pre- and postintervention assessments. Caregivers were also required to be able to verbally communicate in English, commit to participation in the 14-week group programme, and support homework completion. Adolescents were excluded if they had uncontrolled epilepsy, severe visual or auditory impairments, or were non-verbal. Including a mix of young people with CP and ABI was decided based on research evidence, the authors' clinical and research experience with both groups, and the similarities in presentation of social functioning difficulties that often occur.

Study procedure

Participants were randomly allocated to the 14-week PEERS intervention or waiting list/care as usual. Allocation was conducted by a statistician not involved with conducting the intervention, with access only to a participant's identification number and (for balancing purposes) site, sex, and diagnosis. Opaque envelopes were used to conceal group allocation until baseline assessments were completed. Blinding of participants and therapists was not possible due to the nature of the group programme.

Intervention and comparison

The intervention consisted of a 90-minute group session per week for adolescent participants and a separate 90-minute group session per week for their caregivers (conducted simultaneously) over a 14-week period. Group sessions consisted of four to six participants. Sessions were conducted at the Centre for Children's Health Research in Brisbane and the Cerebral Palsy Alliance in Sydney. Sessions were led by occupational therapists, speech pathologists, clinical/neuropsychologists, social workers, and youth workers experienced in facilitating groups. Two group leaders conducted the adolescent group and one facilitator led the caregiver group. A social coach who had lived experience assisted in the adolescent group. At least one group leader was a certified PEERS instructor who had completed the 3-day training programme. Group leaders not trained in the programme used the treatment manual and received guidance by certified practitioners to assist in running the groups. Both the treatment and waiting list groups continued with usual care throughout the programme, which included a range of therapies, such as physiotherapy, occupational therapy, speech pathology, and psychology. A full description of the PEERS intervention, including the intake procedures is detailed in the protocol paper.¹⁷

The commercially available PEERS treatment manual was used to guide treatment sessions and included topics such as conversational skills, electronic communication, choosing appropriate friends, using humour, entering and exiting conversations, hosting and attending get-togethers, good sportsmanship, handling teasing and embarrassing feedback and bullying, changing a bad reputation and handling disagreements, rumours, and gossip. Each adolescent session included a homework review, didactic lesson with modelling, role playing, and behavioural rehearsal and socialization activities. The caregiver group comprised problem-solving regarding social coaching of adolescents, review of adolescents' didactic lessons for the week, homework assignment, and reunification with the adolescents. Minor tailoring of weekly sessions to adjust content for adolescents with brain injury incorporated provision of written cue cards to support working memory and learning of new social rules and behaviours. The session focusing on choosing appropriate friends was adjusted to include social groups relevant to Australian adolescents and some minor wording changes were adjusted to suit the cultural context. Fidelity checklists were completed after each session ensuring that all manual content was covered each week.

Screening and outcome measures

Data were collected at baseline (T1), immediately postintervention at 14 weeks (T2), and at 26 weeks for 3-month retention (T3). A neuropsychologist at each site administered the Wechsler Abbreviated Scale of Intelligence, Second Edition¹⁸ screener, with the verbal composite score used to determine

eligibility for the trial. The Behaviour Rating Inventory of Executive Function, First Edition¹⁹ and Conners 3²⁰ were completed by caregivers at the screening assessment to assess executive function behaviours. Primary outcome measures of social competence were the social and problem behaviour subscales of the Social Skills Improvement System-Rating Scales (SSIS-RS),²¹ which were completed separately by adolescents and caregivers. Standard scores were obtained, with higher scores reflecting increased frequency of behaviour (mean=100, SD=15). Secondary outcomes, for which the study was not powered, included the Quality of Socialization Questionnaire²² (QSQ), which measured the frequency (count data) of hosted and invited get-togethers in the previous month and was completed independently by caregivers and adolescents. This study reported separate results for hosted and invited get-togethers. The conflict score was not calculated because many adolescents could not complete this part of the assessment due to not attending or hosting any get-togethers in the previous month. Social impairment was measured by the caregiver-reported Social Responsiveness Scale, Second Edition²³ (SRS-2), with higher scores indicating increased levels of social impairment. Raw scores were used for the SRS-2 in keeping with recommendations for research.²³ The Test of Adolescent Social Skills Knowledge-Revised²⁴ (TASSK-R) is a 30-item questionnaire completed by adolescents to assess social knowledge (see the protocol paper for a full description of measures, including validity and reliability data).¹⁷

Statistical analysis

A sample size of 38 participants was estimated to give 80% power based on data from previous PEERS studies to detect a 10-point mean difference (MD) on the parent-reported SSIS-RS (assuming an SD of 10.5 and $\alpha=0.05$).²⁵ Linear mixed modelling, adjusting for baseline, sex, and diagnosis, on an intention-to-treat basis was used to analyse between-group differences on the continuous outcomes: SSIS-RS, TASSK, and SRS-2. STATA v16.1 (College Station, TX, USA) was used to analyse the results with the significance level set at $p<0.05$ for all outcome measures. No adjustment for multiple comparisons was performed.²⁶ Poisson regression was used to analyse the count data generated by the QSQ. Pre/postintervention data from the intervention and waiting list group participants who completed PEERS were pooled and analysed using paired *t*-tests.

RESULTS

Thirty-six adolescent-caregiver dyads consented to participate in the study and were randomized into the PEERS intervention ($n=18$) or waiting list/care as usual group ($n=18$). Baseline characteristics are presented in Table 1, with a mean age of the sample of 14 years (SD 1y 8mo; age range 12y 1mo–16y 3mo) and an almost even sex divide. Several subscales

TABLE 1 Demographic and screening variables for the treatment and waiting list control groups

Variable	Group	
	PEERS <i>n</i> =18	Waiting list control <i>n</i> =18
Mean age (SD), y:mo	14:0 (1:10)	13:11 (1:6)
Diagnosis ABI, <i>n</i> (%)	9 (50)	8 (44)
Diagnosis CP, <i>n</i> (%)	9 (50)	10 (56)
Male, <i>n</i> (%)	9 (50)	10 (56)
School grade (SD)	8.8 (1.8)	8.6 (1.4)
English main language, <i>n</i> (%)	17 (94)	18 (100)
Participating parent mother, <i>n</i> (%)	16 (89)	16 (89)
Comorbidities, <i>n</i> (%)		
Autism spectrum disorder	2 (11)	2 (11)
Attention-deficit/hyperactivity disorder	7 (39)	1 (6)
Epilepsy	4 (22)	1 (6)
School type, <i>n</i> (%)		
Mainstream	18 (100)	15 (83)
Distance education	–	2 (11)
Home schooling	–	1 (6)
WASI-II verbal composite, mean (SD)	91.8 (15.1)	93.0 (17.3)
BRIEF global executive composite, mean (SD)	68.8 (11.0)	63.3 (9.4)
Conners 3, mean (SD)		
Inattention (T score)	75.0 (14.0)	63.4 (9.4)
Hyperactivity/impulsivity (T score)	69.4 (15.1)	58.2 (14.5)
Learning problems (T score)	67.8 (14.2)	67.4 (14.9)
Executive functioning (T score)	66.5 (13.9)	62.1 (10.9)
Defiance/aggression (T score)	57.8 (11.2)	51.6 (12.9)
Peer relations (T score)	85.3 (10.0)	81.6 (12.6)
Annual income, <i>n</i> (%)		
<A\$50 000	2 (12)	2 (11)
A\$50 000–100 000	7 (41)	2 (11)
A\$100 000–150 000	2 (12)	4 (22)
>A\$150 000	6 (35)	10 (56)

Abbreviations: ABI, acquired brain injury; BRIEF, Behaviour Rating Inventory of Executive Function; CP, cerebral palsy; PEERS, Program for the Education in Enrichment of Relation Skills; WASI-II, Wechsler Abbreviated Scale of Intelligence, Second Edition.

on the Behaviour Rating Inventory of Executive Function (Table S1) and Conners 3 were elevated in our sample, indicating more difficulties with attention, working memory, executive functioning, and learning than published normative data from age-matched peers. Scores for peer relation difficulties on the Conners 3 were particularly elevated.

Groups were similar at baseline for demographic and baseline measures (Table 1) for most variables. Exceptions were a higher number of caregiver-reported hosted get-togethers

in the waiting list control group (median=1, interquartile range [IQR]=0–2.0) than the intervention group (median=0, IQR=0–0.8) and the intervention group reporting a higher number of adolescents with a co-occurring diagnosis of ADHD (*n*=7, 39%) and epilepsy (*n*=4, 22%) than the waiting list control group (ADHD *n*=1, 6%; epilepsy *n*=1, 6%). Fourteen of the waiting list control caregivers reported an annual income greater than A\$100 000 compared to eight of the intervention group. The higher number of adolescents with a co-occurring diagnosis in the intervention group, along with fewer family financial resources in this group, were imbalances that occurred by chance. If they had any impact on the outcomes, they could potentially contribute to an underestimation of the effect of the intervention. Adjusting for high income (>A\$100 000) in the linear mixed model made a negligible difference to the intervention effect for every outcome.

One hundred per cent of the intervention group completed the programme and were reassessed at 14 weeks (T2; Fig. S1). Three dyads from the waiting list/care as usual group withdrew before T2 as they no longer wished to participate. At the 3 months' retention (T3), 17 dyads from the intervention group (94%) and 12 from the waiting list/care as usual group (67%) completed the outcome measures. Ten dyads from the waiting list/care as usual group went on to complete PEERS. Average attendance for the intervention group was 82%. Fidelity checklists confirmed 100% compliance with delivery of the content of PEERS. No significant adverse events were reported during the trial.

Primary and secondary outcomes

Primary and secondary outcomes are reported in Table 2. No between-group differences on the caregiver or adolescent SSIS-RS (social skills or problem behaviour subscales) were detected immediately postintervention or at the 3-month follow-up after controlling for baseline, sex, and diagnosis. Immediately postintervention, the PEERS group had increased social knowledge on the TASSK-R compared to the waiting list control group (MD=6.8, 95% CI=4.8–8.8, $p<0.001$) and this was maintained at 26 weeks (MD=8.1, 95% CI=6.0–10.2, $p<0.001$). No significant differences were detected in caregiver-reported invited get-togethers on the QSQ immediately postintervention; however, compared to the control group, the PEERS group had a borderline significant increase in caregiver-reported invited get-togethers on the QSQ at 26 weeks (incidence rate ratio=4.0, 95% CI=1.0–16.0, $p=0.05$). There were no statistically significant between-group differences in the adolescent-reported invited and hosted get-togethers on the QSQ or the caregiver-reported SRS-2.

Post hoc analyses

For each outcome, post hoc analyses were conducted on the pooled pre- and postintervention data (preintervention: T1

TABLE 2 Results and analysis of the primary and secondary outcomes

Outcome measure	Intervention group Mean (SD)			Waiting list control group Mean (SD)			Adjusted ^a between-group difference (intervention/ control) at follow-up		
	Baseline (T1)	Immediately postintervention (T2)	3-mo follow-up (T3)	Baseline (T1)	(T2)	3-mo follow-up (T3)	T2 Mean difference (95% CI), <i>p</i>	T3 Mean difference (95% CI), <i>p</i>	
SSIS-RS ^b	<i>n</i> =18 83.4 (15.1)	<i>n</i> =18 89.7 (15.6)	<i>n</i> =17 89.8 (15.7)	<i>n</i> =18 85.5 (13.1)	<i>n</i> =15 86.7 (12.4)	<i>n</i> =12 91.2 (12.9)	3.5 (-2.7 to 9.8), <i>p</i> =0.26	1.8 (-4.8 to 8.4), <i>p</i> =0.59	
Caregiver-reported social skills	120.9 (13.6)	116.3 (15.6)	118.1 (17.8)	118.5 (16.9)	120.0 (18.4)	116.3 (14.1)	-3.3 (-10.4 to 3.8), <i>p</i> =0.36	0.1 (-7.5 to 7.6), <i>p</i> =0.99	
Caregiver-reported problem behaviours ^c	94.4 (16.2)	98.1 (15.3)	100.9 (12.8)	97.1 (16.4)	94.5 (16.3)	103.5 (15.0)	6.2 (-1.3 to 13.7), <i>p</i> =0.10	-2.8 (-10.8 to 5.2), <i>p</i> =0.49	
Adolescent-reported social skills	107.6 (13.9)	105.7 (11.0)	101.8 (11.3)	105.4 (10.4)	106.3 (9.9)	103.4 (7.9)	-1.1 (-6.3 to 4.1), <i>p</i> =0.68	-3.8 (-9.5 to 1.8), <i>p</i> =0.18	
Adolescent-reported problem behaviours ^c	14.8 (1.8)	21.5 (3.8)	22.6 (3.0)	14.0 (3.3)	14.4 (2.7)	14.3 (3.2)	6.8 (4.8 to 8.8), <i>p</i> <0.001	8.1 (6.0-10.2), <i>p</i> <0.001	
TASSK-R ^b	86.0 (28.9)	74.6 (33.3)	76.9 (34.9)	75.2 (27.3)	79.1 (23.1)	72.6 (25.4)	-7.7 (-19.3 to 3.9), <i>p</i> =0.19	-2.6 (-15.0 to 9.7), <i>p</i> =0.67	
SRS-2 ^{b,c}	Median (IQR)						IRR (95% CI), <i>p</i>		
Caregiver-hosted	0 (0-0.8)	2.0 (0.3-2.8)	0 (0-1.0)	1.0 (0-2.0)	1.0 (0-1.5)	0 (0-1.3)	1.9 (0.8-4.2), <i>p</i> =0.11	1.1 (0.4-3.1), <i>p</i> =0.79	
Caregiver-invited	0 (0-1.0)	1.0 (0-1.8)	1.0 (0-1.0)	1.0 (0-2.0)	0 (0-1.0)	0 (0-0.3)	2.2 (0.9-5.5), <i>p</i> =0.09	4.0 (1.0-16.0), <i>p</i> =0.05	
Adolescent-hosted	0 (0)	1.0 (0.3-2.0)	1.0 (0-2.0)	0.5 (0-1.8)	0 (0-1.0)	0.5 (0-2.0)	2.4 (0.9-6.0), <i>p</i> =0.07	2.0 (0.8-4.9), <i>p</i> =0.13	
Adolescent-invited	0 (0-0.8)	1.0 (0-1.0)	1.0 (0-2)	0 (0-1.0)	1.0 (0-1.0)	0 (0)	1.2 (0.5-3.1), <i>p</i> =0.69	1.6 (0.6-4.8), <i>p</i> =0.39	

Abbreviations: CI, confidence interval; IQR, interquartile range; IRR, incidence rate ratio; QSQ, Quality of Socialization Questionnaire; SRS-2, Social Responsiveness Scale, Second Edition; SSIS-RS, Social Skills Improvement System Rating Scales; TASSK-R, Test of Adolescent Social Skills Knowledge-Revised.

^aAdjusted for baseline, sex, and diagnosis.

^bLinear mixed modelling analyses.

^cLower scores indicate improvement.

^dLinear regression analyses.

for the intervention group and T3 for the control group; postintervention: T2 for the intervention group and T4 for the control group [Table 3]). Significant changes from baseline were found on the primary outcome measure of the SSIS-RS caregiver-reported social subscale (MD=4.5, 95% CI=0.5–8.6, $p=0.03$) and the secondary outcome measures of the TASSK-R (MD=7.5, 95% CI=5.8–9.1, $p<0.001$), SRS-2 (MD=-12.1, 95% CI=-20.9 to -3.3, $p=0.009$), QSQ adolescent-reported invited get-togethers (MD=0.7, 95% CI=0.2–1.2, $p=0.009$), QSQ caregiver-reported invited get-togethers (MD=0.6, 95% CI=0.2–1.1, $p=0.004$), and QSQ caregiver-reported hosted get-togethers (MD=0.9, 95% CI=0.4–1.5, $p=0.002$). Some changes were found for the SSIS-RS caregiver-reported problem behaviour subscale, adolescent-reported SSIS-RS social and problem behaviour subscales, and QSQ hosted get-togethers but none were statistically significant.

DISCUSSION

This study found no difference between PEERS and waiting list groups on caregiver- or adolescent-reported social competence. Secondary outcome measures demonstrated that adolescents with ABI and CP who participated in PEERS gained social knowledge and were able to retain this new knowledge 3 months after completion of the programme, despite reported functional challenges with working memory and learning. Improved social participation was also seen, with an increased number of invited get-togethers at the 3-month follow-up. Caregiver-reported hosted get-togethers, adolescent-reported hosted and invited get-togethers, and caregiver-reported social impairment did

not show significant between-group differences. Analysis of pooled pre/postintervention data from all adolescents who completed PEERS found significant improvements in caregiver-reported social skills, adolescent social knowledge, adolescent-reported invited get-togethers, caregiver-reported invited and hosted get-togethers, and reduced caregiver-reported social impairment.

The adolescents with brain injury in our study had difficulties with executive functioning, in line with the extensive literature indicating executive difficulties after childhood brain injury.^{27,28} Despite these difficulties in executive functioning, improvements in social knowledge were comparable with other trials of PEERS (Gilmore et al., forthcoming). The current study's increase of 6.8 (95% CI=4.8–8.8) is in keeping with a recent meta-analysis of five studies that demonstrated improved social knowledge on the TASSK-R with an MD of 7.4 points (95% CI=5.4–9.5) compared to the waiting list control group (Gilmore et al., forthcoming). These results suggest that adolescents with brain injury can make similar gains with adequate support.

PEERS was designed for adolescents with ASD and without intellectual impairment. Although our sample had an average verbal IQ, adjustments were made to support difficulties in executive functioning associated with brain injury. Social rule cards listing the rules related to the weekly topic were provided to each participant. These cards were intended to provide explicit scaffolding of the information, prompt memory, and assist with rehearsal of homework tasks before performing tasks in the home and school environment. The core components of role playing, repetition, and homework in PEERS also provided structure to enhance new learning and memory. Clinically, PEERS is now delivered over 16 weeks at the University of California, Los Angeles, where the

TABLE 3 Post hoc results of primary and secondary outcomes

Outcome measure	Preintervention Mean (SD)	Postintervention Mean (SD)	Difference (post/preintervention) ^a Mean (95% CI), p
SSIS-RS	$n=28$	$n=28$	
Parent-reported social skills	86.6 (15.0)	91.1 (15.9)	4.5 (0.47–8.53), $p=0.03$
Parent-reported problem behaviours	118.7 (13.1)	115.0 (15.1)	-3.7 (-7.8 to 0.4), $p=0.08$
Adolescent-reported social skills	97.6 (16.6)	99.1 (15.8)	1.5 (-2.6 to 5.6), $p=0.46$
Adolescent-reported problem behaviours	105.8 (12.4) ^b	105.8 (11.2)	-0.5 (-4.2 to 3.1), $p=0.77$
TASSK-R	14.3 (2.3)	21.7 (3.7) ^c	7.5 (5.8–9.1), $p<0.001$
SRS-2	80.5 (28.9)	68.5 (31.7)	-12.1 (-20.9 to -3.3), $p=0.009$
QSQ	Median (IQR)		
Parent-hosted	0 (0–1.0)	2 (0–2.3)	0.9 (0.4–1.5), $p=0.002$
Parent-invited	0 (0–1.0)	1.0 (0–2.0)	0.6 (0.2–1.1), $p=0.004$
Adolescent-hosted	0 (0–1.0)	1.0 (0–2.0) ^b	0.5 (-0.1 to 1.1), $p=0.12$
Adolescent-invited	0 (0) ^b	1.0 (0–1.0)	0.7 (0.2–1.2), $p=0.009$

Abbreviations: CI, confidence interval; IQR, interquartile range; QSQ, Quality of Socialization Questionnaire; SRS-2, Social Responsiveness Scale, Second Edition; SSIS-RS, Social Skills Improvement System-Rating Scales; TASSK-R, Test of Adolescent Social Skills Knowledge-Revised.

^aPaired t -test.

^b $n=27$.

^c $n=26$.

programme originated.²⁹ Other GSSIs, such as KONTAKT, have been delivered over 16 to 24 weeks with large effect sizes for the longer intervention.³⁰ A longer PEERS programme for adolescents with brain injury would offer more opportunity for repetition and reinforcing of new learning potentially increasing the effectiveness of the intervention. However, this would need to be balanced against the feasibility of a longer course for participants and health service providers. To the authors' knowledge, no head-to-head comparisons of longer and shorter programmes of any GSSIs in an RCT have been conducted, few studies have explored the feasibility and acceptability of participation, and no health economic evaluation has detailed the costs involved.

Translation of social knowledge into gains with social functioning in an adolescent's own community is a key goal of GSSIs. The primary outcomes of caregiver- and adolescent-rated social skills and problem behaviours on the SSIS-RS in the current study did not capture translation of knowledge into social functioning. This contrasts with data from previous RCTs of PEERS with adolescents with ASD that have largely shown significant between-group differences on the caregiver-rated SSIS-RS.^{31,32} Few studies have reported adolescent self-rated SSIS-RS and previous systematic reviews of outcome measures have highlighted concerns about the validity of these results in relation to an adolescent's potential vulnerability to social desirability and dependence on an individual's ability to follow instructions.³³ Similar concerns have been raised by authors in the brain injury field, recommending that self-report should not be used as a primary approach to measurement.³⁴ Findings from our study support this recommendation with adolescents rating themselves in the average range for social skills and problem behaviours, which contrasted with caregivers' ratings of increased difficulties with social skills and problem behaviours. While reduced insight may account for a lack of change on adolescent ratings, failure to detect change on the parent primary outcome measures may reflect a lack of power, a real absence of treatment effect, or indicate that the measure itself may not have captured change in individual goals, such as whether they had a friend to sit with at lunch at school. Adding an individualized goal-setting measure to the outcome measures, such as the Goal Attainment Scale,³⁵ may better capture change in what is most important to adolescents and their caregivers in their own home, school, and community.

The results of this study must be interpreted with consideration of design limitations. Three participants in the waiting list group did not complete the postintervention assessments as they no longer wished to participate in the trial. A further two waiting list participants dropped out before the 26-week retention time point and one was lost to follow-up. Although common in longer trials of GSSIs, with large time commitments involved from families and difficulties with conflicting schedules impacting participation in trials, this loss of information may have influenced results. Lack of information on minimal important change for any of the questionnaire measures makes interpreting the results

difficult. In addition, all outcome measures were self- or caregiver-reported, introducing potential bias through lack of blinding to the intervention. The absence of an individualized goal-setting outcome measure is also acknowledged. The potential for differing outcomes in adolescents with ABI and CP after participation in PEERS is acknowledged; however, this study is probably too small to determine these effects.

Research testing the efficacy of GSSIs with adolescents with brain injury is in its early stages, with many questions to explore in future research. High-quality clinical trials testing different programmes with validated and reliable measures sensitive to change is of key importance. Future studies should consider adding other established and emerging assessments to provide more objective measures of social skills, such as the Contextual Assessment of Social Skills,³² the Paediatric Evaluation of Emotions, Relationships, and Socialization,³⁶ and a means of measuring individualized social participating goals.³⁵ Additionally, embedding a qualitative evaluation would provide more in-depth understanding of the impact of these studies on social functioning in this population. Focus group data collected during the current study will be analysed and contribute to knowledge regarding the acceptability and feasibility of the intervention. Ensuring input from teenagers and families with lived experience in the planning stage of future trials will also help focus studies on outcomes that are important to participants. Homework compliance was not formally measured in this study and so it is unknown whether homework completion was a potential mediator of translation of social knowledge to changes in social functioning.

CONCLUSION

This first RCT using PEERS in adolescents with brain injury showed that with minor adjustments to the manualized intervention, adolescents were able to gain and retain social knowledge in a similar way to adolescents with ASD. Increases in invited get-togethers with friends at follow-up was also an encouraging indication of the potential for this programme to increase social participation. No evidence of change to social competence on parent- and adolescent-reported questionnaire data was found. Future research is required to test the efficacy of PEERS in a larger sample of adolescents with brain injury and needs to consider additional measures of individual social participation goals as well as objective observational measures of change in social skills. Other options, such as peer support and increasing the length of the intervention, could also be considered. Further exploration of the acceptability and feasibility of this intervention is crucial during this initial testing of efficacy in this population.

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CONFLICT OF INTEREST


Elizabeth Laugeson receives book royalties from Taylor and Francis.

DATA AVAILABILITY STATEMENT

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

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SUPPORTING INFORMATION

The following additional material may be found online:

Figure S1: Participant flow diagram.

Table S1: BRIEF Score Summary Table for whole sample.

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