Measuring outcomes of a peer-led social communication skills intervention for adults with acquired brain injury: a pilot investigation

Neuropsychological Rehabilitation

Susan Howell, PhD,[a] Suzanne Beeke, PhD,[a] Tim Pring, PhD,[b] Rosemary Varley, PhD[a]

[a] Division of Psychology and Language Sciences, University College London

[b] Division of Language and Communication Science, City, University of London

Corresponding author: Susan Howell, Department of Language and Cognition, University College London, Chandler House, 2 Wakefield Street, London WC1N 1PF

Tel: +44 207 679 4001

Email: s.howell.12@ucl.ac.uk

Measuring outcomes of a peer-led social communication skills intervention for adults with acquired brain injury: a pilot investigation

Abstract

Reduced social competence following severe acquired brain injury (ABI) is well-documented. This pilot study investigated a peer-led group intervention based on the claim that peer models may be a more effective mechanism for behaviour change than clinician-led approaches. Twelve participants with severe ABI were recruited from a post-acute neurorehabilitation setting, and randomly assigned to either a peer-led intervention or a staff-led activity group (usual care) (Clinicaltrials.gov: NCT02211339). The groups met twice a week for 8 weeks. A peer was trained separately to facilitate interaction in the intervention group. Training comprised 16 individual sessions over 4 weeks. Group behaviour was measured twice at baseline, after intervention and at maintenance (4 weeks), using the Adapted Measure of Participation in Conversation (MPC) and the Interactional Network Tool (INT), a newly devised measure of group conversational interaction. Outcome measures showed differential sensitivity. The groups did not differ in baseline behaviour. Findings showed a significant improvement in the treated group on the MPC transaction scale post-intervention (p=.02). The intervention group showed more balanced interaction post-intervention on the INT and at follow-up. Findings show preliminary evidence of advantage for peer-led groups. The INT shows promise as a method to detect change in group communication behaviour.

Key Words: Brain injury; Communication; Rehabilitation; Social networks; Intervention, group

Acquired brain injury (ABI), including traumatic brain injury (TBI) is a leading cause of disability world-wide, with new cases of TBI estimated to exceed 50 million each year.[1] In the UK alone, there are at least one million people living with a long-term disability as a result of acquired brain injury[2]. The cognitive, behavioural, physical and psycho-social effects can be wide-ranging, and deficits in social competence are common[3]. Manifestation in social settings includes under-participation or dominance in conversation, repetitive or disorganised content, excessive or insufficient eye gaze, lack of restraint, insensitivity to others and to social nuance, and difficulties adapting behaviour to the context. Studies have shown that impaired social interaction skills can undermine the ability to make and sustain relationships at work, at home and in leisure routines, resulting in increased dependence on family and paid support teams to meet social interaction needs[4,5]. Findings from longer-term studies show that without the ability to independently build reciprocal relationships, individuals experience reduced social contact and an increase in social isolation over time[6,7,8].

Previous interventions for social communication have trained discrete skills (such as starting a conversation or managing conversation responses[9,10,11,12]). Training has taken place in individual or group settings using structured, manualised treatment programmes[13,14] (e.g. Improving First Impressions: A Step-by-Step Social Skills Program[15]; Group Interactive Structured Treatment for Social Competence[16]). Context-specific treatments have trained participation in the target environment[17]. Recent studies have shown successful outcomes with regard to enhanced communication skills in usual neurotypical conversation partners, such as family and friends[18], and carers[19]. Across these interventions, outcomes have typically been

measured in dyadic conversations. However, routinely, conversation partners also include ABI peers in rehabilitation settings, residential homes, activity groups, day centres and vocational environments. Further, social communication in many contexts commonly involves more than two people. Given that the aim of rehabilitation following ABI is to enable skills allowing return to previous life roles and personally meaningful real-world activities[20], there is a need to investigate new ways to train social communication for the real world and to measure the effects on social participation in groups.

The peer-led intervention was based on three social learning and development theories. First Vygotsky proposed that collaborative interaction with a more competent peer can facilitate learning[21]. Second, Bandura observed that learning occurs through observation of others thought to be similar to oneself[22]. These theories have typically been applied in child and adolescent education forums. Third, Lave and Wenger claimed that learning takes place incidentally through social participation rather than as a result of acquired propositional knowledge[23]. Typically, interactional skills are trained in interactions with therapists, while peer-to-peer interactions might be identified as opportunities to practise these skills in natural conversation[24,25]. However, encounters with therapists might be artificial[26] and the peer model may be a more effective mechanism for learning following ABI than therapist-led approaches.

The aim of the current investigation was to test the effectiveness of a novel peer-led intervention to improve group interaction skills. Outcomes were compared to a staff-led activity group. The latter are commonly used in post-acute and community

rehabilitation settings to develop group social interaction skills[27,28]. Two exploratory hypotheses underpinned the research question: first, the peer-led intervention would result in improved scores on measures of participation in conversation compared to the standard social activity; second, the peer-facilitated group would demonstrate a more balanced pattern of interaction over time, with all participants listening and talking in approximately equal measure, compared to the staff-led group.

Methods

Approval to conduct the study was granted by the local NHS health research ethics committee (reference 14/SC/0048). An experimental parallel group design was chosen to investigate whether a peer-led intervention was more effective than a staff-led group to improve social communication skills (ClinicalTrials.gov Protocol Registration and Results System: NCT02211339). Twelve participants were recruited between 1st and 15th April 2015 from a specialist residential centre for severe ABI. Inclusion criteria were either a severe TBI, measured by post-traumatic amnesia duration exceeding 24 hours (or other neurological evidence e.g. surgery to reduce intracranial swelling, persisting neurological signs), or a severe ABI with similar cognitive presentation to TBI (measured by a Glasgow Coma Scale score of less than 9 or other persisting neurological signs). Participants were aged between 18 and 70 years, at least 6 months post-onset of injury, with evidence of social communication impairment, judged by the treating clinical team. Other inclusion/exclusion criteria were ability to tolerate group activity (evidence from staff report), absence of significant aphasia (as judged by clinical opinion), severe depression or psychiatric disorder (as judged by medical opinion) and extensive cognitive impairment

preventing active involvement in programmes of rehabilitation (judged by clinical characteristics and presentation). Profiling tests (see Table 2) confirmed fit to criteria, and revealed similarity at baseline between the groups. Capacity to consent was established. Five participants were judged able to consent and seven participants were either without or had borderline capacity to consent. For the latter, consent was given by a consultee. Consecutive referrals meeting the eligibility criteria were invited to participate until target numbers were met. Participants were randomly assigned to either the intervention group (n=6) or the control group (n=6) through on-line randomisation by a researcher who was blind to case. A group size between 5 and 8 is typical for interventions in this field[13,14,29,30,31]. The peer facilitator was selected from the intervention group after randomisation and during the first 2 weeks of the group meetings. Criteria comprised recommendation by a knowledgeable other (ward manager, key worker, member of the clinical team) to confirm the ability to listen and follow a conversation, to show respect for other people and their opinions, to draw others into a conversation, to move a conversation forward, and understand and use metaphor. Selection was also dependent on video observation of these competencies in the group meetings during the baseline measurement period.

Demographic and profiling variables are presented in Table 1. All participants were at the chronic stage of recovery, but there was a difference between groups, with the control group displaying shorter time post-onset. The peer facilitator is highlighted in bold.

Table 1: Demographic variables: intervention and control groups. I5 (in bold) was the peer facilitator

Participant	Age (years)	Male/ female	Education (years)	Time post onset (years)	Injury severity/clinical characteristics
Intervention group					
I1	39	F	10	24	TBI: RTA. Comatose for several months. Severe cognitive impairment.
I2	45	F	16	6	ABI: Hydracephalic ischemia (intracranial mass lesion). Severe cognitive impairment.
I3	53	M	12	0.7	ABI: Severe bilateral HSV encephalitis. Severe cognitive impairment.
I4	57	M	15	1.1	ABI: Hypoxia (multi-organ failure; cardiac arrest). Severe cognitive impairment.
I5	**50**	**M**	**11**	**5**	**ABI: ICH (ruptured AVM). Severe cognitive impairment/behavioural issues**
I6	31	M	11	9.0	TBI: RTA. GCS:6 Severe cognitive impairment
Mean (SD)	45.8 (9.60)	4/2	12.5 (2.43)	7.63 (8.60)	TBI/ABI: 2/4
Control group					
C1	62	M	12	0.5	TBI: SAH and SDH (falls). Severe cognitive impairment
C2	43	F	15	1	ABI: SAH (Grade 5). Severe cognitive impairment
C3	49	M	11	1	ABI: Obstructive hydrocephalus. Severe cognitive impairment
C4	68	F	16	1	ABI: Hypoxia (cardiac arrest). Severe cognitive impairment
C5	33	M	13	2	TBI: SAH; intracerebral haemorrhage (fall). Severe cognitive impairment
C6	57	M	13	3	TBI: SDH (fall). Severe cognitive impairment
Mean (SD)	52.0 (12.91)	4/2	13.33 (1.86)	1.42 (0.92)	TBI/ABI: 3/3

RTA= road traffic accident; SAH= subarachnoid haemorrhage; SDH= subdural haematoma;ICH=intracranial haemorrhage; HSV = herpes simplex virus
AVM= arteriovenous malformation; GCS= Glasgow Coma Scale

Participants were assessed using a battery of standardised tests to establish baseline cognitive and communication profiles. The Wechsler Abbreviated Scale for Intelligence – second edition (WASI II)[32] measured verbal and non-verbal cognitive ability. A semantic fluency test[33] measured lexical-semantic knowledge and executive control. The La Trobe Communication Questionnaire (LCQ)[34] determined perceived social communication impairment (self-report and other-report versions) and The Awareness of Social Inference Test (TASIT) Part 1[35] evaluated ability to interpret emotional intention from facial expression, tone of voice and gesture. Profiling was completed prior to randomisation so that the assessor was blind to allocation. Group scores on the standardised profiling tests confirmed cognitive and communication deficits (between 1.5 and 7 standard deviations below the normative mean) across both groups (Table 2).

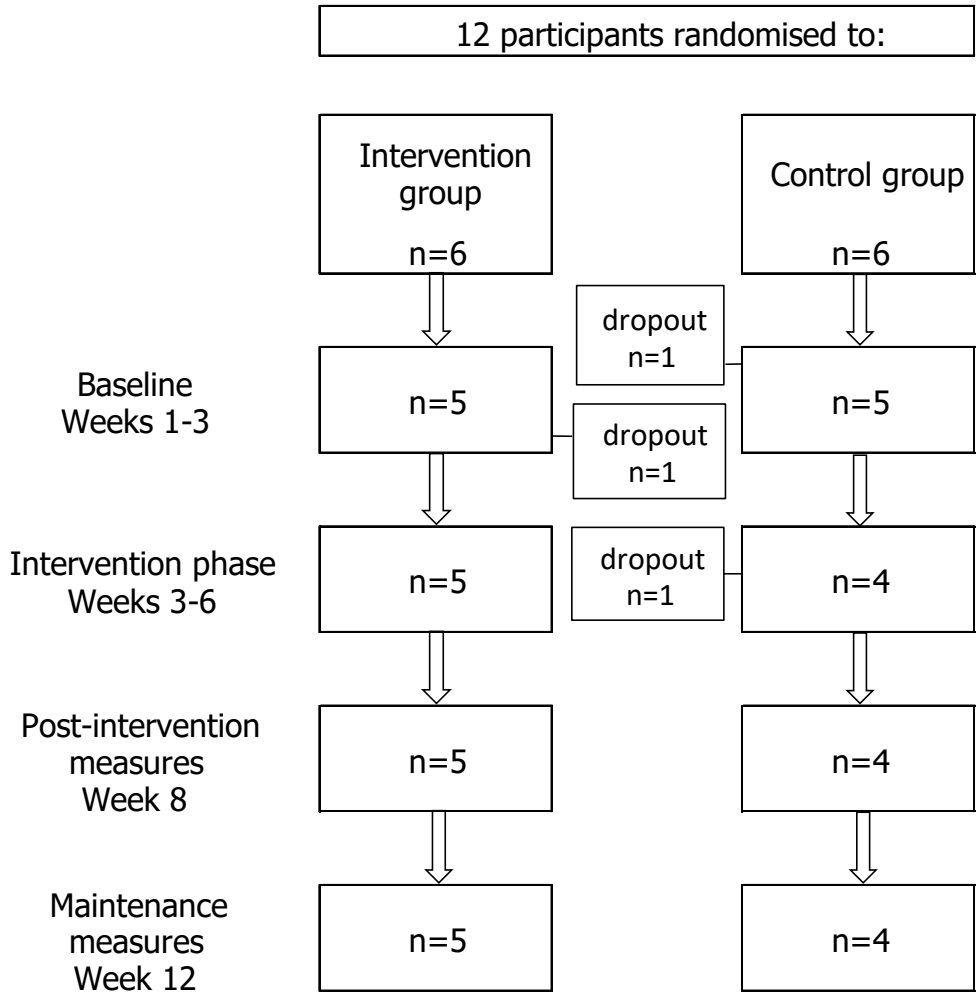
Table 2: Profiling variables: intervention and control groups

Participant	LCQ-self	LCQ-other	Semantic fluency	TASIT Part 1	WASI-II VCI	WASI-II PRI	WASI-II FSIQ 4
Intervention group							
Score range (low-high)	120-30	120-30	0-28+	0-28	45-160	45-160	40-160
					Composite scores		
I1	46	57	11	23	86	86	84
I2	36	66	10	10	56	55	52
I3	46	64	14	17	99	83	90
I4	58	69	10	13	81	51	65
I5	**36**	**56**	**14**	**13**	**75**	**65**	**68**
I6	33	53	7	11	63	70	64
Mean	42.50	60.83	11.00	14.50	76.67	68.33	70.50
(SD)	(9.38)	(6.37)	(2.68)	(4.80)	(15.63)	(14.28)	(14.02)
Control group							
C1	43	73	7	16	105	82	93
C2	37	58	10	22	85	81	81
C3	48	64	3	9	49	52	47
C4	46	80	16	14	102	58	79
C5	39	78	9	16	56	71	62
C6	35	40	11	20	95	100	97
Mean	41.33	65.5	9.33	16.17	82.00	74.00	76.50
(SD)	(5.16)	(15.04)	(4.32)	(4.58)	(23.87)	(17.54)	(18.97)

Abbreviations: WASI-II Wechsler Abbreviated Scale for Intelligence (second edition); VCI Verbal Comprehension Index; PRI Perceptual Reasoning Index; FSIQ 4 – Full Scale IQ on 4 subtests; LCQ La Trobe Communication Questionnaire; TASIT The Awareness of Social Inference Test

Participant progression through the study is presented in a CONSORT diagram (Figure 1). Three participants withdrew from the study (one from the intervention group during the baseline period, and two from the control group due to unexpected surgical procedures).

Figure 1: CONSORT diagram showing participant allocation and progression



Measures

There were two baseline measures of behaviour and two post-intervention probes – one at the end of intervention and a second maintenance measure 4 weeks after the withdrawal of intervention (Figure 1). Two primary outcome measures were employed to evaluate intervention effects. The Measure of Participation in Conversation (MPC)[37] measures conversation participation, comprising two sub-scales: 'interaction' measures the degree to which verbal and non-verbal contributions are shared in conversation; 'transaction' measures the ability to exchange and request information. Both sub-scales are scored on a 9 point Likert scale (0-4 with half point scoring options) where four indicates full and zero indicates no participation. See Togher et al. (2010)[37] for further information on scoring procedures and psychometric data.

The Interactional Network Tool (INT)[38] is a new digital measure developed for this study to capture group interaction patterns based on social network analysis. A 14-item coding scheme (see Table 3) records verbal initiations and responses to one or more participants, and non-verbal initiations and responses (including gesture, eye gaze, body movement and facial expression). These are tallied for each individual in the interaction, as well as the interlocutor(s) to whom they are directed. The definition of initiation and response behaviours is deliberately broad. For example, interaction code 1 (verbal initiation to one other) is intended to capture all verbal initiation behaviours, and would include both questions and statements. Frequency data are entered into the INT software and transformed into a matrix of interactive connections between participants. Sociograms are then generated to illustrate

patterns of interaction within the group.

Table 3: INT Coding Scheme

Initiation behaviours	**Code**
Verbal initiation: to one other	1
Verbal initiation: to group	2
Non-verbal initiation: eye gaze (people)	3
Non-verbal initiation: eye gaze (objects)	4
Non-verbal initiation: pointing/reaching	5
Non-verbal initiation: facial expression	6
Response behaviours	
Verbal response: (1word) to one other	7
Verbal response (1 word) to group	8
Verbal response: (more than 1 word) to one other	9
Verbal response: (more than 1 word) to group	10
Non-verbal response: head nod/shake	11
Non-verbal response: pointing/reaching/gesturing	12
Non-verbal response: facial expression	13
Other vocal response: laughter, scream, singing, fillers e.g. "um"	14

Two secondary outcome measures were also employed. The LCQ questionnaires (self and other report) were repeated immediately post-intervention to measure perceived change in social communication skills.

Acceptability of the intervention was evaluated from attendance rates, and through an informal feedback questionnaire administered within a few days of the final group meeting by a person unrelated to the study to guard against bias. Opinions were directly sought from the peer facilitator in the treated group, the other group

members and participants in the control group. All participants were asked to rate four statements on a five point Likert scale. The four statements were:

- Group purpose: it is important for the residents across campus to have the opportunity to meet together socially
- Communication: I have been able to confidently share my opinions in this group
- Participation: we have all worked well together in this group
- Satisfaction: I have enjoyed being part of this group

Procedure

The groups met twice a week for 8 consecutive weeks, commencing 22nd April 2015. A project-based approach[39] was chosen to enable the intervention group to work collaboratively on a meaningful common goal. They worked as an expert committee and discussed 18 pre-selected topics associated with their rehabilitation. Members of staff were not present. A peer was trained separately to facilitate the group discussion. Training was delivered concurrently with the group meetings in 16 one-to-one sessions with a speech and language therapist (SLT) over 4 weeks, using principles of self-coaching[41], a network of prompts, opportunities for rehearsal and video for reflection and feedback. Video plus verbal feedback has previously been shown to improve skills in individuals with impaired awareness following ABI[42]. Control group meetings comprised social activity supported by trained therapy assistants (usual care in this setting). Participants collectively chose a quiz group and therapy assistants were encouraged to set each quiz into a themed discussion topic

(e.g. current affairs) to facilitate opinion sharing. Further details are available in the supplementary appendix.

Group meetings were filmed according to a pre-determined protocol using four tripod mounted camcorders in order to capture the group interaction from multiple angles (see the TIDieR checklist in appendix 1 for equipment and procedures). Ten minute clips were extracted for analysis. Each clip presented three-way views of the participant interacting with the rest of the group on one screen. Standard sampling protocols to guard against sample selection bias were followed[43], commencing at 5 minutes into the conversation[44]. Three raters blind to the intervention, allocation, phase of the intervention and to other raters' scores, independently evaluated the video clips using the primary outcome measures at baseline, post-intervention and maintenance measurement points. Raters received approximately 2.5 hours training using video clips unconnected to this study and supplemented by homework tasks to consolidate the classroom training.

Data analyses

Inter-rater reliability was calculated using intra-class correlations type 3,1[45]. On pre-intervention analyses, means, standard deviations and (in some analyses) non-parametric methods were applied to determine difference between groups. Analyses of intervention effects were conducted using descriptive statistics and conventional significance tests on MPC data, where scores were measured on a continuous scale. Parametric tests were conducted where data were normally distributed. INT data are

relational, they express the connections between a group of participants and are not suitable for inferential statistical analyses. A statistical innovation, a normalised Herfindahl-Hirschman index (NHHI) was employed to evaluate equality of participation. The application of the NHHI to the INT data acknowledges the observation from previous researchers that context-dependent frequency counts follow a scale free distribution[46] (i.e. a balanced group interaction requires some participants to increase and others to decrease the frequency of their contributions). We believe this is its first application to clinical outcome research (Howell et al., in preparation).

Method for managing missing data following losses

Data collection for the primary outcome measures took place within the group meetings. Measures were not observed independently of the setting. Given the exploratory nature of this investigation and the small sample size, conventional procedures for listwise deletion were applied to the interval-level data generated by the MPC. INT data are relational, expressing the interactive connections between group participants in situ. Lost participants were therefore not included in the evaluation.

Preliminary analyses

Rater reliability was calculated on scores from two raters. Rater 1 evaluated 35 films and Rater 2 evaluated four randomly selected films, giving a sampling rate of 11%. Each film was rated on the MPC interaction and transaction scales (both 9 point Likert scales), and frequencies recorded on the 14 communication behaviours specified by the INT (see Table 3). ICCs were high for the MPC interaction scale

(ICC=0.86) indicating excellent agreement. ICCs for the transaction scale (ICC=0.58) indicated fair agreement. ICCs were high for INT initiations and responses (ICC=0.97, 0.86) indicating excellent agreement.

There were no significant differences between groups at baseline on the primary outcome measures, although sample sizes reduced power to detect difference. The first baseline measure was used in subsequent post-intervention and maintenance comparisons as the peer facilitator attended a planned training session at the second baseline measurement point.

Results

MPC

Table 4 presents mean scores and standards deviations on the interaction and transaction sub-scales across assessment points.

Table 4: Mean scores on the MPC for the intervention and control groups*

	Intervention Group (n=5)			Control Group (n=4)		
Outcome measure	Baseline Mean (SD)	Post-intervention Mean (SD)	Maintenance Mean(SD)	Baseline Mean (SD)	Post-intervention Mean (SD)	Maintenance Mean (SD)
MPC						
Interaction	1.90 (1.52)	2.50 (1.06)	3.10 (0.42)	2.25 (1.76)	2.00 (1.58)	2.13 (1.43)
Transaction	2.00 (1.54)	2.80 (1.15)	3.30 (0.57)	2.25 (1.76)	2.00 (1.78)	1.88 (1.65)

Abbreviations: MPC Adapted Measure of Participation in Conversation

*Raw data available: DOI 10.17605/OSF.IO/Y5CGD

Mean scores from baseline to post-intervention on the MPC scales increased for the intervention group and decreased for the control group. Two factor mixed ANOVAs were conducted to examine the effects of time and group on MPC interaction and transaction scale scores. The alpha level was set at 0.05. As Mauchly's test was significant in these analyses, a Greenhouse-Geisser correction was applied.

The main effects in the analyses were not significant. On the interaction scale, the interaction of group by time from baseline to maintenance was not significant ($F=1.69$; $df=1.12, 7.88$, $p=.23$). On the transaction scale, the interaction of group by time from baseline to maintenance did not reach significance ($F=3.39$, $df=1.12, 7.87$, $p=.1$); However, when only the pre and post scores were analysed, a significant interaction was obtained ($F=8.37$, $df=1,7$, $p=.02$), indicating increased gains over time for the treated group initiating and responding to shared conversation content compared to the control group, whose scores declined.

The effect sizes for the interaction scale ($d=1.0$) and the transaction scale ($d=1.22$) were large at the maintenance assessment. The intervention group scores at maintenance were close to the ceiling on the MPC assessment and reduced the ability to detect further improvement by the treated participants. A power calculation using these effects sizes found that only ten participants per condition were required to give an 80% chance of obtaining a significant result. However, we accept that this sample size may be misleading due to the ceiling effect in the data.

INT

Communication behaviour frequency data for all interactors in each group were entered into the INT at each measurement stage. Subsequent analysis showed the proportion of the total interaction attributable to each participant (including staff). A within and between group comparison of initiation and response proportions was calculated from the INT matrix data table. The NHHI was calculated as a measure of equality of participation in conversation (i.e. as a function of the number of participants and the degree of participation in the interaction). Results for both groups are shown in Table 5. Change of over time is illustrated in Figure 2. The NHHI uses proportional share to determine the balance of the interaction across a participant group. Interpretation guidelines[47] suggest a value below 0.1 reflects balance; a value between 0.1 and below 0.2 indicates moderate balance; 0.2-0.6 indicates domination by a minority and a value above 0.6 indicates domination by one participant.

Table 5: Interaction proportions and NHHI scores for intervention and control groups. I5 (in bold) was the peer facilitator

Herfindahl-Hirschman Index (range 0-1)						
Intervention group						
	Baseline n=6		Post-intervention n=5		Maintenance n=5	
	Initiations and responses	NHHI	Initiations and responses	NHHI	Initiations and responses	NHHI
	Proportion		Proportion		Proportion	
I1	0.07		0.24		0.04	
I2	0.01		0.08		0.24	
I3	0.40	**0.15**	0.20	**0.08**	0.43	**0.12**
I4	0.03		0.08		0.06	
I5	**0.31**		**0.39**		**0.22**	
I6	0.18					
Control group						
	Baseline n=7		Post-intervention n=6		Maintenance n=6	
	Initiations and responses	NHHI	Initiations and responses	NHHI	Initiations and responses	NHHI
	Proportion		Proportion		Proportion	
C2	0.01		0.11		0.08	
C3	0.09		0.02		0.03	
C4	0.11		0.14		0.17	
C5	0.02	**0.14**	0.02	**0.42**	0.07	**0.33**
C6	0.22					
TA1	0.45		0.71		0.65	
TA2						

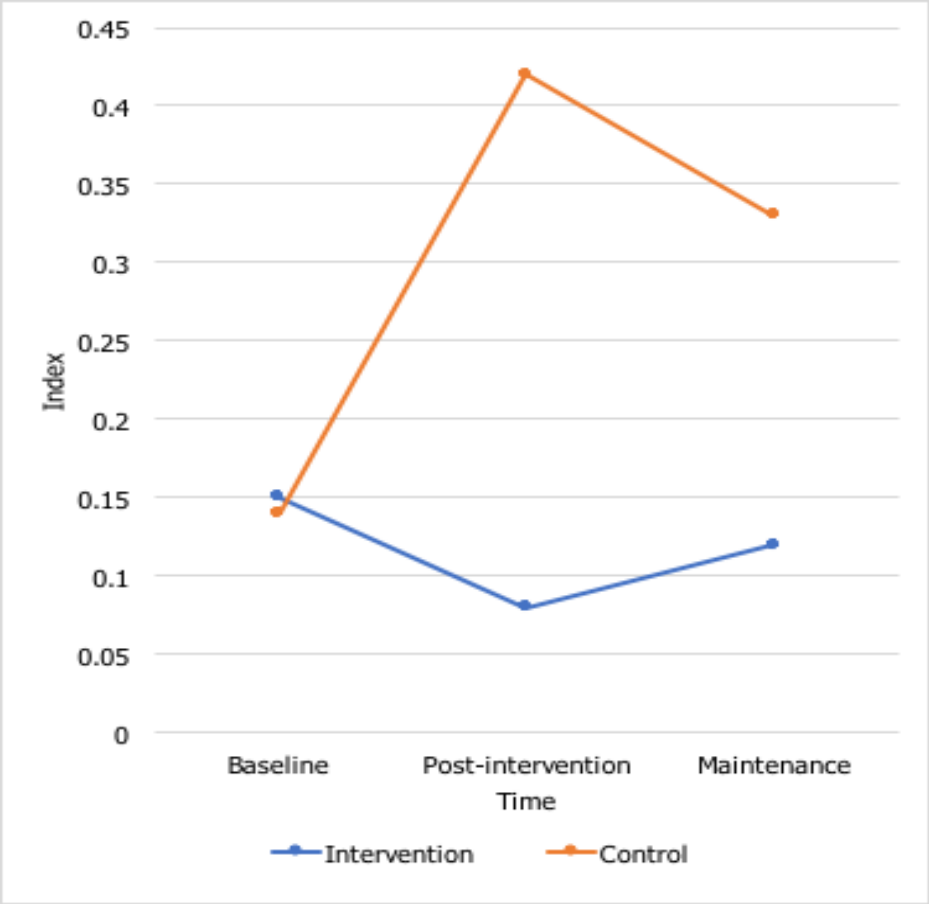
Abbreviation: TA therapy assistant

The formula for calculating a normalized HHI is as follows:

$$NHHI = \frac{(HHI - \frac{1}{n})}{1 - \frac{1}{n}}$$

NHHI interpretation guidelines [47]
< 0.1 indicates balance; 0.1- <0.2 indicates moderate balance; 0.2-0.6 indicates domination by a minority; >0.6 indicates domination by one.

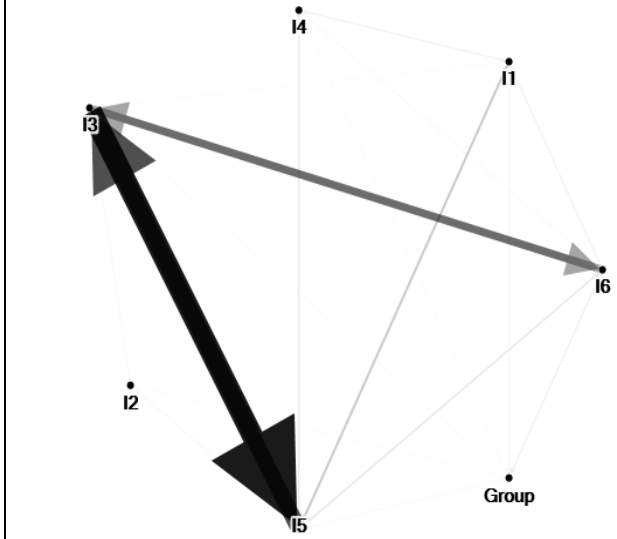
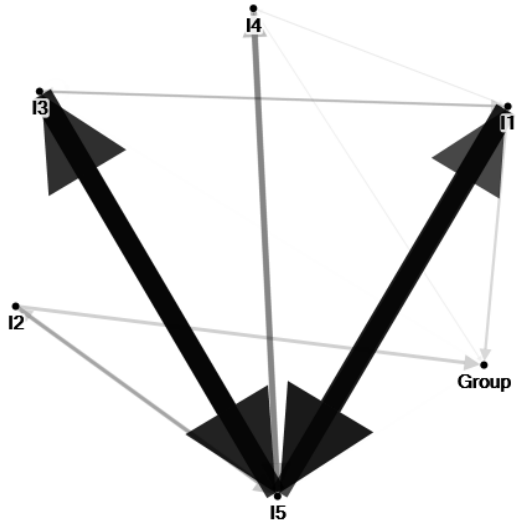
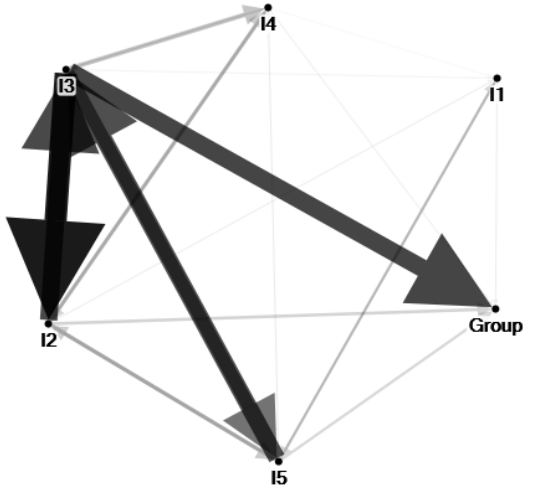
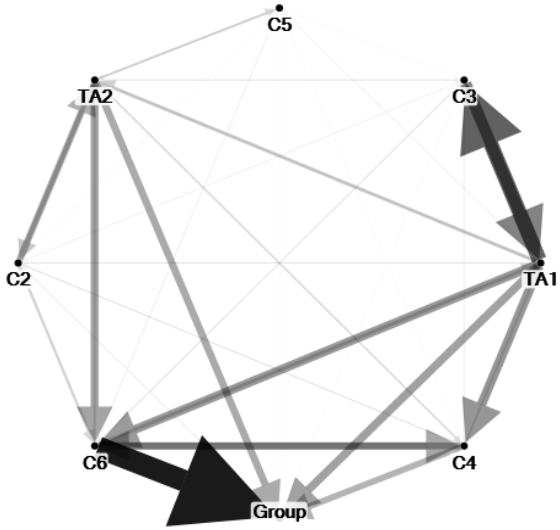
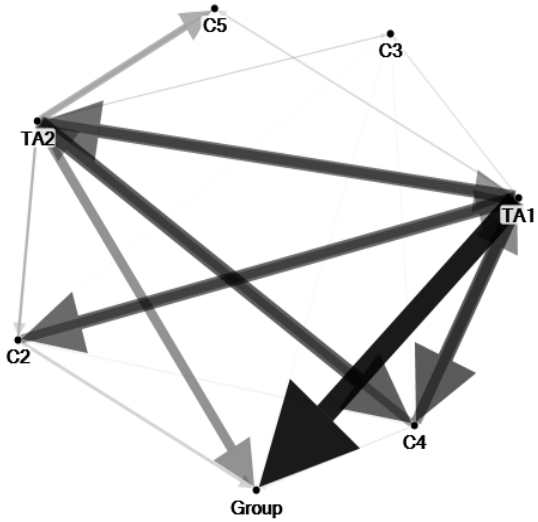
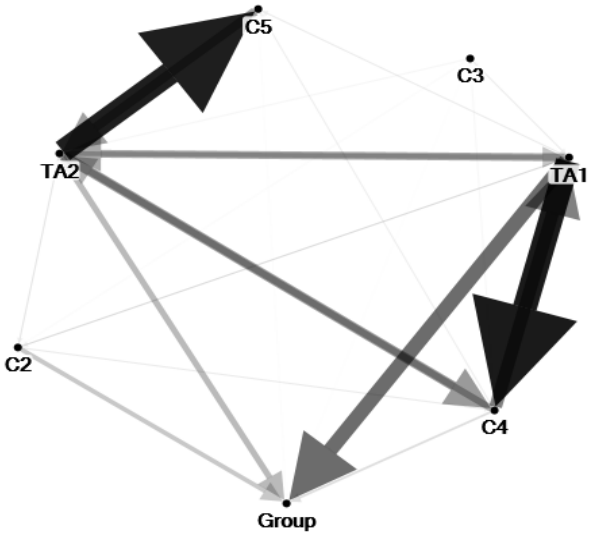
Figure 2: NHHI at baseline, post-intervention and maintenance for the intervention and control groups



NHHI values for the intervention group showed a more equal distribution of verbal and non-verbal initiations and responses across participants over time. By contrast, the control group showed interaction was increasingly dominated by a small sub-group. The INT sociograms display the weight of each participant's contribution in the group interaction (Figure 3). The line arrows indicate direction. As the number of interactions increases, the lines connecting participants become thicker and more colour dense. In the intervention group, I3 and I5 dominated the interaction at baseline, and I2 was a conversation isolate. However, over time the pattern of connections between participants became more widely distributed, suggesting a more balanced and inclusive conversation. The sociograms for the control group

show a distribution of paired interactions involving each therapy assistant and participant. Furthermore, the sociograms reveal that the contribution from therapy assistants increased over time.

Figure 3: INT sociograms showing pooled interaction profiles by group

Intervention group: Baseline	Intervention group: Post-intervention	Intervention group: Maintenance
		
Control group: Baseline	**Control group: Post-Intervention**	**Control group: Maintenance**
		

Abbreviations: TA therapy assistant

Secondary outcome measures

There was little change in mean scores for the intervention group on the LCQ-self questionnaire, and mean scores declined for the control group. Mean scores improved on the LCQ-other questionnaire for both groups (Table 6).

Table 6: LCQ change over time by group

	Intervention Group (n=5)		Control Group (n=4)	
Outcome measure	Pre Mean (SD)	Post Mean(SD)	Pre Mean (SD)	Post Mean (SD)
LCQ: Self	44.40 (9.10)	40.00 (5.61)	42.50 (5.32)	48.75 (10.63)
LCQ: Other	62.40 (5.68)	55.00 (10.61)	70.00 (10.71)	50.25 (23.80)

Intervention acceptability

Intervention and control group attendance was high, indicating that this model of intervention was acceptable to participants. The peer facilitator attended 100% of the individual training sessions. Three participants in the intervention group and one participant in the control group attended 94% of the sessions (i.e. each absent for 1 of 18 meetings). One participant in the intervention group attended 89% of the group meetings (i.e. absent for 2 of 18 meetings).

On the satisfaction questionnaire, the peer facilitator gave positive responses to all four probes. Statistical comparison of responses of the remaining members of the treated and control groups was not possible due to small numbers (n=4 in each case). Overall, members of the control group were more positive than respondents in the peer-led group.

Discussion

This pilot investigation tested the effectiveness of a new peer-led social communication skills intervention for people with severe ABI using an experimental, parallel group design. It also investigated standard inferential and novel network comparisons to evaluate outcomes. Two exploratory hypotheses underpinned our research. The first, that the peer intervention would result in greater improvement than control on the MPC scales, was partially supported. There was an increase in mean scores for the intervention group across all time points and a decrease for the control group, indicating an improved ability by members of the intervention group to respond to shared content in conversation. Maintenance measures did not reach statistical significance, but ceiling effects reduced the ability to detect difference. The second hypothesis, that participants in the peer-facilitated group would demonstrate a more equal pattern of verbal and non-verbal initiations and responses over time, was supported with NHHI/INT data showing a more balanced distribution over time for participants in the intervention group. NHHI values for the control group declined between baseline and post-intervention, reflecting a pattern of increased contribution by the therapy assistants. Values increased at maintenance but the profile indicated domination by a minority. These preliminary findings show evidence of advantage for peer-led groups and demonstrate that a peer with severe ABI can be trained to facilitate participation in a group interaction without staff present.

This novel intervention trained a peer with an ABI to facilitate communication using a project-based learning approach, meeting current recommendations for learning to

take place through naturally-facilitated practice in the target setting[3]. In contrast with previous interventions facilitated by staff, the expert discussion group enabled independent participation to achieve a shared meaningful goal in which group members were able to speak as equal partners and on their own behalf. The opportunity to practise skills independently within an empowering social role is not routinely provided in a rehabilitation setting. The peer model offers a framework to develop social learning and independence, through collaborative and active participation mediated by a more competent peer. Specifically, the intervention enables relationship-building skills to be trained within complex encounters and in new social networks with multiple communication partners, independently of family members and professionals.

Measurement of change in group interaction is a new field of investigation, and existing measures such as the MPC have been designed for dyadic conversation, typically between the person with ABI and their neuro-typical conversation partner. Findings showed restricted range at the upper end of the MPC scales, indicating insensitivity to changes in peer group participation. The INT represents a new approach to outcome evaluation, enabling group interactions to be measured and visualised. Findings showed a more balanced distribution of initiations and responses over time in the intervention group, indicating positive change in capacity to adapt conversation behaviour in response to the behaviour of others. This innovation may have considerable clinical value in profiling interaction in social settings typical of everyday life.

In common with previous studies[13,19,31], there was no significant improvement on

the LCQ self-report questionnaire. Social interaction is a complex construct and the LCQ is not designed to directly measure group interaction. In common with Finch et al.[31], findings suggest an insensitivity to the construct under investigation. Findings on the LCQ other-report questionnaire showed a perception of improved skills for both groups, although bias cannot be excluded as raters (all familiar communication partners) were aware of the phase of intervention.

There are a number of challenges in designing methods to collect acceptability judgements where cognitive impairment is severe. This study used a post-intervention participant questionnaire. The complexity of questionnaire completion for this clinical group has previously been described[50]. It places demands on declarative and working memory, and requires the integration of examples from past experience to form a judgement. Future studies could trial an alternative feedback methodology (e.g. to rate satisfaction after each training session or group meeting) in order to increase the salience of the task for participants and provide more informative feedback as the meetings progress.

Study Limitations

This was a pilot study of a novel intervention. The sample size was small, and the follow-up period was relatively short at 4 weeks. Intention-to-treat analyses were not applied. A future study with an increased sample size and a longer maintenance period is warranted. However, there were issues with both measures that impeded sample size estimation. On the MPC, the small standard deviations for the intervention group distorted the effect size as a result of a ceiling effect. The INT data follow a scale-free distribution, and conventional statistical procedures to

determine effect sizes were not suitable to use with these data. The application of the NHHI was exploratory and further research is required to determine its reliability as an index of conversation share. Finally, participant selection was biased to severe cases. It would be useful to explore effectiveness with individuals with mild and moderate impairment.

Conclusion

These preliminary findings show that a peer-facilitated intervention can result in an improved ability to participate collaboratively in discussions without staff present. This has important implications for clinical practice, where the goal of rehabilitation is community integration, requiring skills to independently build rapport and social bonds in valued social roles. The peer-led intervention and the INT offer a new approach to the rehabilitation and measurement of real-world social communication for individuals with ABI. Replication within a bigger study is now indicated in order to increase confidence in these findings.

Acknowledgements:

The authors would like to thank Adam Searle of TGC Consulting Ltd for support with the INT, and Anthony Geffen and the team at Atlantic Productions for advising on the filming protocol. Susan Howell is supported by a postdoctoral award from the Economic and Social Research Council [grant reference ES/T008504/1].

ORCID

Susan Howell https://orcid.org/0000-0002-8329-7529

Suzanne Beeke https://orcid.org/0000-0002-6772-2820

Tim Pring https://orcid.org/0000-0002-3671-7471

Rosemary Varley https://orcid.org/0000-0002-1278-0601

References

1. Maas AIR, Menon DK, Adelson PD, Andelic N, Bell MJ, Belli A, et al. Traumatic brain injury: integrated approaches to improve prevention, clinical care, and research. *Lancet Neurol*. (2017) 16:987–1048. doi: 10.1016/S1474-4422(17)30371-X
2. United Kingdom Aquired Brain Injury Forum, 2018. Available from: http://www.ukabif.org.uk. [Accessed 1 March 2019]
3. Togher, L., Wiseman-Hakes, C., Douglas, J., Stergiou-Kita, M., Ponsford, J., Teasell, R., Bayley, M. and Turkstra, L.S. (2014). INCOG recommendations for management of cognition following traumatic brain injury, part IV: cognitive communication. Journal of Head Trauma Rehabilitation, 29(4), pp. 353–368. doi: 10.1097/HTR.0000000000000071.
4. Sander, A.M., Clark, A. and Pappadis, M.R. (2010). What is community integration anyway? Defining meaning following traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, 25(2), pp. 121–127. doi: 10.1097/HTR.0b013e3181cd1635.
5. Struchen, M.A., Pappadis, M.R., Sander, A.M., Burrows, C.S. and Myszka, K.A. (2011). Examining the contribution of social communication abilities and affective/behavioral functioning to social integration outcomes for adults with traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, 26(1), pp. 30–42. doi: 10.1097/htr.0b013e3182048f7c.
6. Hoofien, D., Gilboa, A., Vakils, E. and Donovick, P.J. (2001). Traumatic brain injury (TBI) 10-20 years later: a comprehensive outcome study of psychiatric

symptomatology , cognitive abilities and psychosocial functioning. *Brain Injury*, 15(3), pp. 189-209. doi: 10.1080/026990501300005659.

7. Oddy, M., Coughlan, T., Tyerman, A. and Jenkins, D. (1985). Social adjustment after closed head injury: a further follow-up seven years after injury. *Journal of Neurology, Neurosurgery and Psychiatry*, 48, pp. 564–568. doi:10.11.36/jnnp.48.6.564
8. Thomsen, I. V. (1984). Late outcome of very severe blunt head trauma: A 10-15 year second follow-up. *Journal of Neurology Neurosurgery and Psychiatry*, 47(3), pp. 260–268. doi: 10.1136/jnnp.47.3.260.
9. Brotherton F.A., Thomas, L.L., Wisotzek, I.E. and Milan, M.A. (1988). Social skills training in the rehabilitation of patients with traumatic closed head injury. *Archives of Physical Medicine and Rehabilitation*, 69, pp. 827–832.
10. Giles, G., Fussey, I. and Burgess, P. (1988). The behavioural treatment of verbal interaction skills following severe head injury: a single case study. *Brain Injury*, 2(1), pp. 75–79.
11. Johnson, D. A. and Newton, A. (1987). Social adjustment and interaction after severe head injury: II. Rationale and bases for intervention. *British Journal of Clinical Psychology*, 26 (4), pp. 289–298. doi: 10.1111/j.2044-8260.1987.tb01362.x.
12. O'Reilly, M. F., Lancioni, G. E. and O'Kane, N. (2000) Using a problem-solving approach to teach social skills to workers with brain injuries in supported employment settings. *Journal of Vocational Rehabilitation*, 14(3), pp. 187–194.
13. McDonald, S., Tate, R., Togher, L., Bornhofen, C., Long, E., Gertler, P. and Bowen, R. (2008). Social skills treatment for people with severe, chronic

acquired brain injuries: a multicenter trial. *Archives of Physical Medicine and Rehabilitation*, 89(9), pp. 1648–1659. doi: 10.1016/j.apmr.2008.02.029.

14. Dahlberg, C. A., Cusick, C.P., Hawley, L.A., Newman, J.K., Morey, C.E., Harrison-Felix, C.L. and Whiteneck, G.G. (2007). Treatment efficacy of social communication skills training after traumatic brain injury: a randomized treatment and deferred treatment controlled trial. *Archives of Physical Medicine and Rehabilitation*, 88(12), 1561–1573. doi: 10.1016/j.apmr.2007.07.033.
15. McDonald, S., Bornhofen, C., Togher, L., Flanagan, S., Gertler, P. and Bowen, R. (2008). *Improving First Impressions: A Step-by-Step Social Skills Program*. Sydney: University of New South Wales, School of Psychology. Available from: http://www.assbi.com.au.
16. Hawley L, Newman J. Group Interactive Structured Treatment – GIST: For social competence. Denver, CO: 2008. Available from: http://www.braininjurysocialcompetence.com
17. Behn, N., Marshall, J., Togher, L., Cruice, M. (2019). Feasibility and initial efficacy of project-based treatment for people with ABI. *International Journal of Language & Communication Disorders*, 54(3), pp465-478. doi: 10.1111/1460-6984.12452
18. Togher, L., McDonald, S., Tate, R., Power, E. and Rietdijk, R. (2013). Training communication partners of people with severe traumatic brain injury improves everyday conversations: a multicenter single blind clinical trial. *Journal of Rehabilitation Medicine*, 45(7), pp. 637–645. doi: 10.2340/16501977-1173.

19. Behn, N., Togher, L., Power, E. and Heard, R. (2012). Evaluating communication training for paid carers of people with traumatic brain injury. *Brain Injury*, 26(13–14), pp. 1702–1715. doi: 10.3109/02699052.2012.722258.
20. Martelli, M.F., Zasler, N.D. and Tiernan, P. (2012). Community based rehabilitation: special issues. *NeuroRehabilitation*, 31(1), pp. 3–18. doi: 10.3233/NRE-2012-0770.
21. Vygotsky, L.S. (1978). *Mind in Society: the Development of Higher Psychological Processes.* Cambridge, Massachusetts: Harvard University Press.
22. Bandura, A. (1962). Social learning through imitation. In: Jones, M.R. (ed.), *Nebraska Symposium on Motivation,* pp. 211–274. Oxford, England: University of Nebraska Press.
23. Lave, J. and Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press. doi: 10.2307/2804509.
24. Sohlberg, M.M. and Mateer, C.A. (1989). *Introduction to Cognitive Rehabilitation: Theory and Practice.* New York: Guilford Press.
25. Perna, R.B., Bubier, J., Oken, M., Snyder, R. and Rousselle, A. (2004). Brain injury rehabilitation: activity based and thematic group treatment. *Journal of Cognitive Rehabilitation*, 22(3), pp. 20–24.
26. Togher, L., Hand, L. and Code, C. (1997). Analysing discourse in the traumatic brain injury population: telephone interactions with different communication partners. *Brain Injury*, 11(3), pp. 169–189. doi: 10.1080/026990597123629.
27. Hammond, F., Barrett, R., Dijkers, M.P., Zanca, J.M., Horn, S.D., Smout, R.J., Guerrier, T., Hauser, E. and Dunning, M.R. (2015). Group therapy use and its impact on the outomes of inpatient rehabilitation following traumatic brain injury.

Archives of Physical Medicine and Rehabilitation, 96(80), pp. S282-292. doi: 10.3109/10641955.2015.1046604.

28. Keegan, L.C., Murdock, M., Suger, C., Togher, L. (2019). Improving natural social interaction: Group rehabilitation after Traumatic Brain Injury. *Neuropsychological Rehabilitation*. doi: 10.1080/09602011.2019.1591464.
29. Ehrlich, J. and Sipes, A. (1985). Group treatment of communication skills for head trauma patients. *Cognitive Rehabilitation*, 3, pp. 32–37.
30. Braden, C., Hawley, L., Newman, J., Morey, C., Gerber, D. and Harrison-Felix, C. (2010). Social communication skills group treatment: a feasibility study for persons with traumatic brain injury and comorbid conditions. *Brain Injury*, 24(11), pp. 1298–1310. doi: 10.3109/02699052.2010.506859.
31. Finch, E., Cornwell, P, Copley, A., Doig, E. and Fleming, J. (2017). Remediation of social communication impairments following traumatic brain injury using metacognitive strategy intervention: a pilot study. *Brain Injury*, 31(13–14), pp. 1830–1839. doi: 10.1080/02699052.2017.1346284.
32. Wechsler, D. (2011). *Wechsler Abbreviated Scale of Intelligence (WASI-II)*, 2nd ed. San Antonio, Tx: NCS Pearson.
33. Strauss, E.H., Sherman, E.M.S. and Spreen, O. (2006). *A Compendium of Neuropsychological Tests: Administration, Norms, and Commentary* (3rd ed.). New York: Oxford University Press.
34. Douglas, J. M., O'Flaherty, C. and Snow, P. C. (2000). Measuring perception of communicative ability: the development and evaluation of the La Trobe communication questionnaire. *Aphasiology*, 14(3), pp. 251–268. doi: 10.1080/026870300401469.

35. McDonald, S., Flanagan, S. and Rollins, J. (2002). *The Awareness of Social Inference Test (TASIT): Manual*. London: Pearson.

36. Douglas, J. M., O'Flaherty, C. and Snow, P. C. (2000). Measuring perception of communicative ability: the development and evaluation of the La Trobe communication questionnaire. *Aphasiology*, 14(3), pp. 251–268. doi: 10.1080/026870300401469.

37. Togher, L., Power, E., Tate, R., McDonald, S. and Rietdijk, R. (2010). Measuring the social interactions of people with traumatic brain injury and their communication partners: the adapted Kagan scales. *Aphasiology*, 24 (6-8), pp. 914–927. doi: 10.1080/02687030903422478.

38. Howell, S. (2018). Measuring outcomes from a peer-led social communication skills intervention for adults following acquired brain injury. Thesis (PhD), UCL (University College London). https://discovery.ucl.ac.uk/id/eprint/10059713

39. Ylvisaker, M., Feeney, T. and Capo, M. (2007). Long-term community supports for individuals with co-occurring disabilities after traumatic brain injury: cost effectiveness and project-based intervention. *Brain Impairment*, 8(03), pp. 276–292. doi: 10.1375/brim.8.3.276.

40. Hoffmann, T. C., Glasziou, P., Boutron, I., Milne, R., Perera, R., Moher, D., Altman, D., Barbour, V., Macdonald, H., Johnston, M., Lamb, S., Dixon-Woods, M., McCulloch, P., Wyatt, J., Chan, A. and Michie, S. (2014). Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *BMJ,* 348. doi: 10.1136/bmj.g1687.

41. Ylvisaker, M. (2006). Self coaching: a context-senstive, person-centred approach to social communication after traumatic brain injury. *Brain Impairment*, 7(3), pp. 246–258. doi: 10.1375/brim.7.3.246

42. Schmidt, J., Fleming, J., Ownsworth, T. and Lannin, N.A. (2012). Video feedback on functional task performance improves self-awareness after traumatic brain injury: a randomized controlled trial. *Neurorehabilitation and Neural Repair*, 27(4), pp. 316–324. doi: 10.1177/1545968312469838.

43. Correll, A., van Steenbrugge, W. and Scholten, I. (2010). Judging conversation: how much is enough?. *Aphasiology*, 24(5), pp. 612–622. doi: 10.1080/02687030902732752.

44. Best, W., Maxim, J., Heilemann, C., Beckley, F., Johnson, F., Edwards, S.I., Howard, D. and Beeke, S. (2016). Conversation therapy with people with aphasia and conversation partners using video feedback: a group and case series investigation of changes in interaction. *Frontiers in Human Neuroscience*, 7(10), p. 562. doi: 10.3389/fnhum.2016.00562.

45. Shrout, P. E. and Fleiss, J. L. (1979). Intraclass correlations: uses in assessing rater reliability. *Psychological Bulletin*, 86(2), pp. 420–428. doi: 10.1037/0033-2909.86.2.420.

46. Sim, P., Power, E. and Togher, L. (2013). Describing conversations between individuals with traumatic brain injury (TBI) and communication partners following communication partner training: using exchange structure analysis. *Brain Injury*, 27(6), pp. 717–742. doi: 10.3109/02699052.2013.775485.

47. Liston-Heyes, C. and Pilkington, A. (2004). Inventive concentration in the production of green technology: a comparative analysis of fuel cell patents. *Science and Public Policy*, 31(1), pp. 15–25. doi: 10.3152/147154304781780190.

48. Hoepner, J. K. and Turkstra, L. S. (2013). Video-based administration of the La Trobe Communication Questionnaire for adults with traumatic brain injury and their communication partners. *Brain Injury*, 27 (4), pp. 464–472. doi: 10.3109/02699052.2013.765600.

49. Ylvisaker, M., Jacobs, H.E. and Feeney, T. (2003). Positive supports for people who experience behavioral and cognitive disability after brain injury. *Journal of Head Trauma Rehabilitation*, 18(1), pp. 7–32. doi: 10.1097/00001199-200301000-00005.

50. Ylvisaker, M., Sellars, C.W. and Edelman, L. (1998). Rehabilitation after traumatic brain injury in preschoolers. In: Ylvisaker, M. (ed.). *Traumatic Brain Injury Rehabilitation: Children and Adolescents*. Newton MA: Butterworth-Heinemann, pp. 303-329).

51. Ylvisaker, M. and Feeney, T. (2000). Reconstruction of identity after brain injury. *Brain Impairment*, 1(01), pp. 12–28. doi: 10.1375/brim.1.1.12.

52. Sohlberg, M.M. and Turkstra, L.S. (2011). *Optimizing Cognitive Rehabilitation*. New York: Guilford Press.

53. Ylvisaker, M., McPherson, K., Kayes, N. and Pellett, E. (2008). Metaphoric identity mapping: facilitating goal setting and engagement in rehabilitation after traumatic brain injury. *Neuropsychological Rehabilitation*, 18 (5-6), pp.713-741. doi: 10.1080/09602010802201832.

Appendix : TIDieR[42] checklist

TIDieR template item	Description	Reference
Name/description (Item 1)	A peer-mediated intervention for social communication skills in ABI. The aim is to enable a peer to successfully facilitate an ABI group discussion in order to improve the social communication skills of the group participants	
Rationale and content: (Item 2)	The rationale and content draw on a range of well-documented therapeutic approaches. The components and rationale for the **peer facilitator training** and the **group meetings** are specified separately:	
• Group meetings	Set up for an executive-style committee to discuss issues associated with brain injury rehabilitation The rationale draws on a project approach, defined as a meaningful project-style activity that provides opportunity for social interaction with peers, requires commitment to an expert role and takes time to complete Modifications to the environment provided positive behaviour supports to shape target behaviours (see Item 3 equipment/materials)	**Ylvisaker, Feeney and Capo (2007)**[39] **Ylvisaker, Jacobs and Feeney (2003)**[49]
• Peer facilitator selection and training	Selection of the peer facilitator based on observation of positive social behaviours (e.g. a confident communicator, respectful of others' opinions); understanding of metaphor; recommendation from a knowledgeable other The rationale for a peer facilitator draws on Vygotsky's theories of learning with peers: where a more skilled peer provides a scaffolded learning opportunity to a less able peer, and where learning takes place in a 'zone of proximal development.'	**Ylvisaker, Sellars and Edelman (1998)**[50] **Vygotsky (1978)**[21]

	Training requires an interaction style between therapist and the peer facilitator characterised as conversational and collaborative. The purpose of this approach is to jointly develop a framework of supports for thought and language organization	**Ylvisaker, Feeney and Capo (2007)**[39]
	Training uses metaphor to establish a positive role identity that matches the individual's perceived sense of self	**Ylvisaker (2006)**[41]
	The multiple facets of the role are drawn together into one metaphor as a means to improve thinking efficiency and develop strategies to support independent regulation of behaviours	**Ylvisaker and Feeney (2000)**[52]
	Strategy design and development for the training is based on the individual profile of cognitive-linguistic, physical and sensory capabilities, and psychological status	**Sohlberg and Turkstra (2011)**[52]
	Use of video to set goals, test strategies and provide feedback. Video plus verbal feedback has been shown to improve skills in individuals with ABI where awareness is impaired, and without an associated decline in emotional well-being	**Schmidt et al. (2012)**[42]
	Use of self-talk strategies, scripts and role play for rehearsal	**Ylvisaker (2006)**[41]
• Core principles and procedures of the peer facilitator training:		
Sessions 1 – 4	**Elicitation of a personally compelling metaphor** The use of meaningful metaphor requires the identification of symbols, or role models whose personal qualities or achievements encapsulate the positive characteristics of the role of facilitator as a means to successfully mediate discussion in the group. Examples include historical, literary or media figures, or admired individuals known to them through family, friends or work. Strategies to facilitate discussion in the group become aligned to the characteristics or symbols explored in the metaphor	**See Ylvisaker, McPherson, Kayes and Pellett (2008)**[53] **for a full explanation and worked example of metaphor creation**

Sessions 5 – 8	**Review of selected film clips; strategy identification and rehearsal** • Film clips from group meetings to be pre-selected by the SLT to illustrate target learning points, and prepared using Final Cut Pro editing software* • Goal setting: peer facilitator and SLT to agree the goal, based on observed needs identified in the film clip; reference chosen metaphors to determine the goals that might be identified if you were that person • Strategy development: SLT to follow procedures for collaborative and elaborative working • Practice using self-talk strategies, scripts and repeated rehearsal * No more than 1 or 2 learning points to be evaluated or practised in each training session	**See Ylvisaker, Sellars & Edelman (1998) (pp310-311)**[52] **for procedures** **See Ylvisaker (2006)**[41] **for procedures**
Sessions 9 – 16	**Use of video footage for self-evaluation, strategy review and refinement and to set new goals** Film clips to be selected and prepared by the SLT (as above) for feedback and to set new goals (as above)	
Materials and Processes (Item 3)	Group administration procedures and equipment and materials requirements are specified separately	
• Administration processes: Prior to commencement Weekly	Administrative procedures for the intervention and control groups: • Meeting rooms booked and confirmed • Meeting dates to be recorded in all ward/unit/home diaries • Alert wards, units, homes to group meetings • Ensure meetings are entered onto participant timetables/calendars/diaries	

Previous evening Morning of groups	• Remind wards/units/homes of group timings for the following day • Offer support to accompany participants to meetings if staff unavailable • Prompt staff to orientate participants to group meetings the following day • Phone all wards/units/homes to check feasibility of group timings • Camera/equipment and meeting room set-up, as per protocol • Provide support to accompany to meetings, if required	**See Howell (2018) (pp 311)**[38] **for filming protocol**
Post-groups	• Dismantle all equipment following meeting • Record attendance in clinical notes	
• Equipment for intervention group	Materials for an executive-style committee: • Camera set-up (as per protocol) • Equipment in place for staff observation/monitoring via video link • Call bell prominently placed on table for participant use • Written meeting agenda/discussion points • High quality stationery (note pads and pens) • Name plates • Individual bottles of mineral water and premium plastic tumblers (with the clarity/quality of glass) • Small selection of biscuits, if appropriate • Individual risk assessments/care plans in place • Correct ratio of staff available for emergency assistance, as per site-specific policy	**See Howell (2018) (pp309)**[38]**for intervention group discussion topics**

Additional activities and processes (Item 4)	Staff support outside of the group meetings for • Participant orientation and recall of group meetings • To ensure readiness and accompany participants to meetings, where required • Management of pacing across the day • Peer facilitator home practice activities • Psychological/emotional support needs, as required	**See Ylvisaker et al. (2007)**[39] **for examples of positive behaviour interventions and supports (PBIS)**
Intervention provider (Item 5)	It is recommended that this treatment is delivered by an SLT or clinician familiar with the core concepts and procedures for each of the intervention components, specified in this template	
Tailoring (Item 9)	The peer-facilitator's profile of cognitive strength and need, including insight and degree of motivation or engagement, determines the training content and learning approach	**See Ylvisaker (2006)**[41] **for procedures for delivering tailored and context-sensitive treatments** **See Sohlberg and Turkstra (2011)**[52] **for procedures for individual training plans for strategy learning in cognitive rehabilitation**