Measuring outcomes from a peer-led social communication skills intervention for adults following acquired brain injury

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I, Susan Howell confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signed:
Abstract

**Background:** Reduced social competence and social integration following acquired brain injury (ABI) is well-documented. There is evidence that group social communication interventions for people with ABI and training for neurotypical communication partners can be more effective than training the person with ABI alone. This study explores the effectiveness of a peer-led group intervention based on claims that peer models are a more powerful mechanism for learning and behaviour change than interventions led by a clinician. A peer-led training model for social communication has not previously been tested in ABI.

**Method:** Twenty-four participants with severe ABI were recruited from a residential post-acute neurorehabilitation centre. An experimental parallel group design was used to compare a peer-led group intervention to a social activity group (usual care). A pilot study tested the feasibility of the approach followed by a main study. The groups ran for 8 weeks. A peer facilitator was trained in sixteen individual sessions over 4 weeks with a clinician. Behaviour was measured twice at baseline, after intervention and at maintenance. Four primary outcome measures, including the Adapted Measure of Participation in Conversation (MPC), and a newly devised measure of conversational interaction evaluated change in group communication behaviours.

**Results:** Groups did not differ in baseline behaviour. There were significant differences in the treated group on the MPC and the measure of conversational interaction post-intervention. The treated group showed a more balanced interaction post-intervention and at follow-up. However, outcome measures showed differential sensitivity.

**Conclusion:** There is preliminary evidence of advantage for peer-led groups in ABI intervention. The new conversational measure shows promise as a method to detect change in group communication behaviour.
Impact Statement

Acquired brain injury is a principal cause of life-long disability worldwide. Chronic cognitive and communication problems can follow injury, adversely impacting previous relationships and the ability to build new ones. Reduced social acceptance and social isolation are commonly reported problems. Intervention for social communication skills is recommended as a practice standard in programmes of rehabilitation, but the evidence of gain from more traditional models of intervention is mixed because the automatic transfer of skills learned in the training setting to everyday life cannot be assumed. Evidence for communication partner training for family and paid carers holds some promise but community re-integration entails the ability to build relationships with other people independently of family members and paid professionals. Access to prestigious discourse types, in which a person with ABI is able to play a valued social role, requires the ability to engage as an equal partner in conversation, and an ability to speak on your own behalf.

This investigation has taken a new approach, testing claims that peer models are a more effective mechanism for learning than clinician-led approaches. The intervention trained a peer with an ABI to facilitate communication between individuals with ABI in an expert discussion group. Outcomes were compared to a traditional staff-led social activity group. Previous measurement tools have evaluated change in paired conversations so, in addition to testing existing measures in a new group context, a new measurement tool was developed and tested to measure change in interactional participation between peers over time.

Findings from this exploratory study show that a peer-mediated intervention is feasible, and that a trained peer can successfully facilitate group interaction without direct support from a neurotypical communication partner. The intervention group showed an improved ability to socially connect and participate collaboratively over time. Conversely, there was no change over time in the staff-led group. The new measure impacts assessment practice by providing a means to directly assess change in social participation in groups over time. Overall, these findings show initial evidence of benefit for individuals with
communication problems following ABI in independent relationship-building within complex encounters and in new social networks with multiple communication partners, consistent with the communication demands of everyday life. This research has the potential to inform future clinical practice. It meets current recommendations for new interventions that address communication needs in real-world environments and for new tools to measure participation outcomes.
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# Glossary of Abbreviations

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<tr>
<td>ABI</td>
<td>Acquired brain injury</td>
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<tr>
<td>ASD</td>
<td>Autistic spectrum disorder</td>
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<tr>
<td>BRISS-R</td>
<td>Behaviorally Referenced Rating System of Intermediate Social Skills - Revised</td>
<td>(Farrell et al., 1985) (Flanagan et al., 1995) (Marsh and Knight, 1991)</td>
</tr>
<tr>
<td>CCD</td>
<td>Cognitive communication disorder</td>
<td></td>
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<tr>
<td>CONSORT</td>
<td>Consolidated Standards of Reporting Trials</td>
<td>(Moher et al., 2010)</td>
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<tr>
<td>FSIQ 4</td>
<td>Full Scale IQ on 4 subtests (from the WASI-II)</td>
<td>(Wechsler, 2011)</td>
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<td>FSS</td>
<td>Feature Summary Scales (from the PPIC)</td>
<td>(Linscott et al., 1996)</td>
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<td>GAS</td>
<td>Goal Attainment Scaling</td>
<td>(Kirusek and Sherman, 1968)</td>
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<td>GCS</td>
<td>Glasgow Coma Scale</td>
<td>(Teasdale and Jennett, 1974)</td>
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<tr>
<td>ICC</td>
<td>Intra-class correlations</td>
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<tr>
<td>INCOG</td>
<td>The international group of researchers and clinicians who developed recommendations for the management of cognition (2014)</td>
<td>(Togher et al., 2014)</td>
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<tr>
<td>INT</td>
<td>Interactional Network Tool</td>
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<td>IRR</td>
<td>Inter-rater reliability</td>
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<tr>
<td>LCQ</td>
<td>La Trobe Communication Questionnaire</td>
<td>(Douglas et al., 2014)</td>
</tr>
<tr>
<td>MPC</td>
<td>Measure of Participation in Conversation</td>
<td>(Togher et al., 2010)</td>
</tr>
<tr>
<td>MRC</td>
<td>Medical Research Council</td>
<td></td>
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<tr>
<td>nRCT</td>
<td>Non-randomised controlled trial</td>
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<tr>
<td>OCEBM</td>
<td>Oxford Centre for Evidence-Based Medicine</td>
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<tr>
<td>Acronym</td>
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<tr>
<td>PCSS</td>
<td>Personal Conversational Style Scale (from the BRISS-R)</td>
<td>Farrell et al., 1985</td>
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<td></td>
<td>(Flanagan et al., 1995)</td>
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<td></td>
<td></td>
<td>(Marsh and Knight, 1991)</td>
</tr>
<tr>
<td>PDBS</td>
<td>Person Directed Behavior Scale (from the BRISS-R)</td>
<td>Farrell et al., 1985</td>
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<td>(Flanagan et al., 1995)</td>
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<td></td>
<td></td>
<td>(Marsh and Knight, 1991)</td>
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<tr>
<td>PFIC</td>
<td>Profile of Functional Impairment in Communication</td>
<td>Linscott et al., 1996</td>
</tr>
<tr>
<td>PPIC</td>
<td>Profile of Pragmatic Impairment in Communication</td>
<td>Linscott et al., 1996</td>
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<tr>
<td>PRI</td>
<td>Perceptual Reasoning Index (from the WASI-II)</td>
<td>Wechsler, 2011</td>
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<tr>
<td>PTA</td>
<td>Post-traumatic amnesia</td>
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<tr>
<td>RCT</td>
<td>Randomised controlled trial</td>
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<tr>
<td>SBI</td>
<td>Specific Behaviour Items (scale from the PPIC)</td>
<td>Linscott et al., 1996</td>
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<tr>
<td>SLT</td>
<td>Speech and Language Therapist</td>
<td></td>
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<tr>
<td>SNA</td>
<td>Social Network Analysis</td>
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<tr>
<td>TA</td>
<td>Therapy Assistant</td>
<td></td>
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<tr>
<td>TASIT</td>
<td>Awareness of Social Inference Test</td>
<td>McDonald et al., 2002</td>
</tr>
<tr>
<td>TBI</td>
<td>Traumatic brain injury</td>
<td></td>
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<tr>
<td>TIDieR</td>
<td>Template for Intervention Description and Replication</td>
<td>Hoffman et al., 2014</td>
</tr>
<tr>
<td>ToM</td>
<td>Theory of Mind</td>
<td></td>
</tr>
<tr>
<td>VCI</td>
<td>Verbal Comprehension Index (from the WASI-II)</td>
<td>Wechsler, 2011</td>
</tr>
<tr>
<td>WASI-II</td>
<td>Wechsler Abbreviated Scale of Intelligence – second edition</td>
<td>Wechsler, 2011</td>
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Chapter 1 Introduction

There are at least one million people in the UK living with a long-term disability as a result of an acquired brain injury (The United Kingdom, Acquired Brain Injury Forum, 2018). The acquired brain injury (ABI) population is diverse, comprising those with traumatic and non-traumatic injuries. A traumatic brain injury (TBI) is a result of damage from an external blow to the head (either penetrating the skull or as a result of the brain hitting against the inside surfaces of the rotating skull). Common causes include road traffic accidents, falls, sports injuries and assaults. Non-traumatic injuries can occur as a result of a range of conditions such as anoxia, infections or haemorrhage, encephalitis and metabolic conditions. Depending on the nature, location and severity of the injury, the cognitive, behavioural, physical and psycho-social effects can be wide-ranging. Communication disturbances reflect a primary cognitive (versus a primary language) impairment and deficits in social competence are common (Togher, Wiseman-Hakes, Douglas, Stergiou-Kita, Ponsford, Teasell and Turkstra, 2014).

The aim of rehabilitation following ABI is to equip individuals with the skills to return to previous life roles and personally meaningful real-world activities (Martelli, Zasler and Tiernan, 2012). McColl, Carlson, Johnston, Minnes, Shue, Davies and Karlowits (1998) conducted a qualitative study to define the meaning of successful community integration for people with ABI, and participants identified social relationships as one of the most important features. However, previous research has identified an association between social communication skill deficits and poor social outcomes. Specifically, 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 (Sander, Clark and Pappadis, 2010; Struchen, Pappadis, Sander, Burrows and Myszka, 2011). 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 (Hoofien, Gilboa, Vakil and Donovick, 2001; Oddy, Coughlan, Tyerman and Jenkins, 1985; Thomsen, 1984).
Previous interventions for social communication impairment have trained discrete skills in individual or group settings using structured treatment programmes or more context-specific treatment approaches, and a range of outcome measures have evaluated post-treatment and follow-up changes in dyadic conversation. Despite this focus on dyadic outcome measurement, however, social communication commonly involves more than two people. The loss of group social interaction skills is likely to adversely affect relationship-building in family and friendship groups, leisure and vocational activities. There is an urgent need, therefore, to investigate new ways to train social communication for the real world and to measure the effects on social participation in groups. Recent studies have investigated the effects of the environment on social communication capability and shown successful outcomes from training usual neurotypical communication partners (such as family, friends and carers). The communication culture for individuals with severe ABI also includes ABI peers in rehabilitation settings, residential homes, activity groups, day centres and vocational environments. Peer-to-peer interactions following ABI have previously been identified as opportunities to practise normal conversation in contrast with more artificial encounters, such as those that routinely take place with rehabilitation professionals, that can be potentially disempowering (Togher, Hand and Code, 1997). Training for ABI peer partners has not previously taken place.

The aims of this investigation are as follows:

- To compare the effectiveness of a new peer-led intervention to a social activity group (usual care) in order to improve social participation skills following brain injury in a group setting
- To test the intervention for feasibility in a pilot study, followed by a main study phase
- To evaluate the sensitivity of existing outcome measures to changes in group interaction over time
- To test the sensitivity of a new measure of group social participation, developed for this study
- To determine participant satisfaction with this model of intervention

Chapter 2 reviews the literature on social communication impairments following
ABI and previous intervention approaches. Chapter 3 describes the peer-led intervention developed and tested in this study and its theoretical foundations. Chapter 4 reviews social network approaches and reports on the development of a new outcome measurement methodology for ABI groups. The method and results for the pilot and main studies are reported in Chapter 5 and Chapter 6. Chapter 7 presents a summary of findings and recommendations for future investigation.
Chapter 2 Literature Review

The purpose of this investigation was to compare the effectiveness of a new peer-led intervention to a social activity group (usual care) with the aim of improving social participation skills after ABI. The new intervention was delivered to individuals with severe ABI in a post-acute rehabilitation setting. The intervention drew on current theories and previous reports of group and individual interventions. This literature review evaluates classification and assessment of severe ABI (Section 2.1), social communication impairments following ABI (Section 2.2) and the impact of those impairments on social integration (Section 2.3). Group, individual and communication partner training interventions for social communication impairments following ABI are reviewed in Section 2.4. Section 2.5 examines peer-mediated social communication skills interventions. This chapter concludes with summary of findings (Section 2.6) in preparation for the conceptual framework for a peer-mediated approach to improving social interaction skills in ABI presented in Chapter 3.

2.1 Classification and assessment: defining severe ABI

The identification and development of efficacious treatments for individuals following severe ABI is impeded by the heterogeneity of injuries and patterns of presentation. Classification offers a means to study the mechanisms underpinning the condition, thereby shaping intervention strategies to improve outcomes. Saatman, Duhaime, Bullock, Maas, Valadka and Manley (2008) identify four methods of classification. The first is classification by severity (from mild to severe). Saatman et al., (2008) summarise these in a sequence moving from external scalp lacerations and skull fractures through internal haemorrhage in the meningeal spaces (epidural, subdural, subarachnoid, intraparenchymal), to cerebral contusions and lacerations, and axonal injury. The second method of classification is by further definition of injury type: by location (e.g. intracranial) and distribution (focal or diffuse). The third classification is the physical mechanism causing the injury (such as impact versus inertia loading injuries). The fourth classification by pathophysiology makes a distinction between primary
damage versus secondary damage caused, for example, by hypoxia, hydrocephalus or seizures.

In clinical research, ABI severity is commonly measured by the degree of altered consciousness at the point of injury (Teasell, Bayona, Marshall, Cullen, Bayley, Chundamala, Villamere, Mackie, Rees, Hartridge, Lippert, Hilditch, Welch-West, Weiser, Ferri, McCabe, Mc Cormick, Aubut, Comper, Salter, Van Reekum, Collins, Foley, Nowak, Jutai, Speechley, Hellings and Tu, 2007). There are a number of scoring systems that serve as severity measures and outcome predictors. The Glasgow Coma Scale (GCS) measures three aspects of behavioural consciousness (Teasdale and Jennett, 1974). Motor responses, verbal responses and eye opening are recorded on a scale of 1 – 5. These are then summed for a scoring range of 3 – 15. A summed score between 3 and 8 indicates severe injury. Studies have shown good inter- and intra-rater reliability when the GCS has been used as a measure of severity (Perrin, Niemeier, Mougeot, Vannoy, Hirsch, Watts, Rossman, Grafton, Guerrer, Pershad, Kingsbury, Bartel and Whitney, 2015). As a predictor of longer-term outcome, findings have been more variable. The accuracy of scores at the point of injury may be compromised by factors such as extracranial injuries, or by interventions such as intubation, sedation or other neuromuscular blocking agents (Friedland, 2013). Fluctuating consciousness may be further influenced by intoxication, for example, undermining the value of GCS as an outcome predictor (Balestreri, Czosnyka, Chatfield, Steiner, Schmidt, Smielewski, Matta and Pickard, 2004). These authors advise that the variable predictive values of the GCS require consideration in research selection protocols.

In cases of TBI, a measure of post-traumatic amnesia (PTA) is considered by some to be a reliable severity indicator and predictor of outcome (Sherer, Struchen, Yablon, Wang and Nick, 2008). PTA is defined as the period of time from the point of injury to full orientation to the present, such that the individual is able to form and recall new memories (Jennett, 1976). Using an established index of classification (Russell and Smith, 1961), a PTA duration of more than 1 day indicates a severe TBI. Variability in patterns of recovery continues to limit the predictive accuracy of PTA as an outcome measure (Walker, Ketchum,
Marwitz, Chen, Hammond, Sherer and Meythaler, 2010). A study investigating the relationship between the duration of PTA and outcome found that that 67% of individuals with a PTA of between 0 – 14 days returned to productivity within 1 year of injury, thereby associating a severe classification with a favourable outcome (Nakase-Richardson, Sherer, Seel, Hart, Hanks, Arango-Lasprilla, Yablon, Sander, Barnett, Walker and Hammond, 2011). However, the definition of productivity is not clearly specified.

The Mayo Classification System for TBI (Malec, Brown, Leibson, Testa Flaada, Mandrekar, Diehl and Perkins, 2007) uses multiple indicators to overcome the limitations of single criterion systems. A range of indicators avoids the problem of unclear or missing single indicators in the medical record. Diagnostic indicators for moderate to severe TBI include a loss of consciousness of 30 minutes or more; a period of PTA of 24 hours or more; a GCS score in the first 24 hours of less than 13 (unless invalidated by extracranial or other intervention outcomes); the presence of one or more of the following injuries: intracerebral haematoma, subdural haematoma, epidural haematoma, cerebral or haemorrhagic contusion, a dura-penetrating TBI, subarachnoid haemorrhage or brain stem injury. Friedland (2013) observes that the inclusion of multiple indicators represents an advancement on previous single indicator systems. While the inclusion of an injury profile enables more accurate classification for treatment planning, this method does not make a distinction between moderate and severe TBI, which has implications for functional outcome expectation.

The predictive value of these measures is limited by the diversity of the ABI population. Patterns of impairment and longer-term functional outcomes will vary according to injury type and severity, as well as age at the point of injury and other pre-morbid variables (Dikmen, Machamer, Winn and Temkin, 1995; Millis, Rosenthal, Novack, Sherer, Nick, Kreutzer, High and Ricker, 2001). The majority of individuals with a severe ABI have persisting neurological signs and a complex profile of functional support needs that reflect physical, emotional, behavioural and cognitive difficulties that will limit life roles. In their review of the literature examining the effects of TBI and cognitive impairment 6 or more months post-injury, Dikmen, Corrigan, Levin, Machamer, Stiers and Weisskopf
(2009) identified a clear association between severe injury and a broad spectrum of pervasive long-term cognitive deficits in both closed and penetrating injuries.

Although most studies in the field of ABI have been conducted with individuals with a TBI (Teasell et al., 2007), the clinical course for those with severe traumatic and non-traumatic injuries is broadly similar. Both groups sustain damage to brain structures that is either distributed and/or localised. Once stabilised, there is a period of early rehabilitation intervention in which it is expected that most gains will occur (Barnes, 1999). This stage is generally followed by a decline in the rate of improvement and subsequent plateau (Cullen, Park and Bayley, 2008). In a study of functional outcomes in 51 individuals following a severe TBI between 1 and 2 years post-injury, Lippert-Grüner, Lefering and Svestkova (2007) identified small functional gains, but the degree of improvement was variable. In order to maximise the opportunity for functional gains at the early stage of recovery and in a resource efficient way, individuals with severe traumatic and non-traumatic injuries are treated in the same rehabilitation facilities (Shah, Carayannopoulos, Burke and Al-Adawi, 2007). The profiles of social communication impairment that characterise the ABI population are reviewed in the next section.

2.2 Social communication impairments in ABI

Following a severe ABI, individuals present with a range of cognitive and behavioural impairments that impact social communication competence. A cognitive communication disorder (CCD) in ABI is a consequence of a primary cognitive disorder versus a primary language disorder (Togher, Wiseman-Hakes, et al., 2014). It has been estimated that some form of cognitive communication impairment is present in 80 – 100 percent of individuals suffering a brain injury (Sarno, 1980). A minority of individuals may present with aphasia (a specific language disorder affecting comprehension and production). The majority have a communication style that reflects altered patterns of thinking and behaviour. An impaired ability to express and recognise emotion is also observed (Babbage, Zupan, Neumann, Tomita and Willer, 2011). Commonly reported factors impacting social competence also include fatigue, reduced motivation and loss of drive (McKinlay, Brooks, Bond, Martinage and Marshall, 1981; Powell, Al-Adawi,
Morgan and Greenwood, 1996). These issues have the potential to preclude active engagement in established and new routines, including programmes of rehabilitation.

The frontal and temporal lobes, and the surrounding structures, are particularly vulnerable to injury from accelerating, decelerating and rotational forces (Adams, Graham, Murray and Scott, 1982; McAllister, 2011). Spikman, Timmerman, Milders, Veenstra and van der Naalt (2012) draw a distinction between the impact of general cognitive and social cognitive processes on social competence after severe injury to these regions of the brain. General cognitive impairments commonly refer to attention, concentration, memory, the capacity for new learning and executive skills (Dikmen, Machamer, Powell and Temkin, 2003). Social cognitive processes comprise emotion recognition, empathy and theory of mind (McDonald, 2013; Spikman et al. 2012).

The relationship between social and general cognitive impairment is a topic of debate, as investigations to uncover the complex relationships between these processes and their neural correlates are in their infancy. Salzman and Fusi (2010) propose a conceptual framework that views the pre-frontal areas of the brain (which includes the subcortical limbic system) as a dynamic network of structures that mediate both emotion and cognitive processes. Recent reviews consider social cognition and general cognition as dissociable constructs (e.g. McDonald, 2017). In a study comparing individuals with moderate-severe TBI (n=28) to a group of healthy controls (n=33) on a battery of social and non-social cognitive tests, Spikman et al. (2012) found the TBI group performed more poorly than the controls on all tests. However, the effect size was greatest on tests of emotion recognition. Spikman et al. (2012) found no correlation between social cognition scores and non-social cognitive tests, suggesting that the low scores on tests of emotion recognition were not a result of general cognitive impairment. This framework of general cognitive and social cognitive processes will be used to review the literature on social communication skills following ABI.
2.2.1 General cognitive impairment and social communication

Reduced speed of processing, poor concentration and attention difficulties are frequently observed in individuals following brain injury, and have been found in studies investigating neuropsychological impairment following severe injury after 1 year (Dikmen et al., 1995), 7 years (Oddy et al., 1985) and in reports by relatives (McKinlay et al., 1981). Struchen (2005) summarises the behavioural outcome of these deficits as difficulty keeping track of a conversation, problems switching between the roles of listener and speaker, and an inability to assimilate detail in conversation at a standard pace. Discourse analyses have been used to measure these irregularities within the conversation flow. Coelho, Youse and Le (2002) examined discourse patterns in a moderate to severe ABI group (n=32) and healthy controls (n=43) in conversation with a researcher. They recorded fewer initiations and comments from the ABI group. There was also an absence of shared responsibility for conversational flow in the ABI group, responses were not designed to facilitate further interaction and there was a reliance on the researcher to maintain conversational momentum.

Findings from discourse studies have not always been consistent. Coelho, Liles and Duffy (1991) found a greater number of speaking turns in a mild ABI group (n=5) compared to controls (n=5), and a higher number of turns was associated with utterances of shorter duration. By contrast, Dardier, Bernicot, Delanoe, Vanberten, Fayada, Chevignard, Delaye, Laurent-Vannier and Dubois (2011) found no significant differences in the number of speaking turns between a severe TBI group (n=11) and matched controls (n=11), but differences in the number of topic maintaining turns were significant, indicating that the TBI group were significantly less able to develop a conversational topic over several consecutive turns. Bond and Godfrey (1997) reported increased turn duration in a severe TBI group (n=62) compared to controls (n=25). These differences are likely due to the different measures used, individual variation in patterns of impairment and also differences in the conversational discourse task. Dardier et al. (2011) analysed the content of a structured interview where speaking turns are governed by rules, whereas Coelho, Liles and Duffy (1991) and Bond and Godfrey (1997) analysed unstructured conversation. The relationship with the
communication partner and their skill at interacting with the person with TBI is a further variable likely to influence outcome.

Problems with short-term memory may be evident in reduced detail in conversation, losing track of the ground covered, and repetition of information. In a meta-analysis of the cognitive correlates of pragmatic understanding, declarative memory (for facts and events) was strongly associated with the comprehension skills required for successful social interaction (Rowley, Rogish, Alexander and Riggs, 2017). Prospective memory deficits may be evident in the ability of the individual to remember what to do and when to do it (Shum, Levin and Chan, 2011). Autobiographical memory deficits may also undermine the quality of conversation with others. Knight and O’Hagan (2009) compared a group of people with severe TBI (at least 6 years post-injury) to healthy controls (n=19) matched by age, gender and occupation/education on a personal autobiographical memory task. Findings showed no difference between the groups on the ability to recollect a famous name, but recall of personal and specific information associated with that name was disrupted. The authors concluded that an inability to spontaneously draw on previous experiences and shared knowledge adversely impacted conversational interaction. Confabulation may also be evident as an individual unintentionally fabricates the detail of a past event (Demery, Hanlon and Bauer, 2001). The real-time monitoring and manipulation of information for cohesive conversation requires working memory capability. Functional brain imaging techniques have shown the neurobiological correlates of the working memory network to be widely distributed, and vulnerable to disruption following injury (Manktelow, Menon, Sahakian and Stamatakis, 2017). In a comparative study to investigate the effects of working memory capability on active listening tasks, Christodoulou, DeLuca, Ricker, Madigan, Bly, Lange, Kalnin, Liu, Steffener and Diamond (2001) reported more errors on tasks with high working memory demands in a moderate–severe TBI group (n=9) than in a group of healthy controls (n=7). An inability to monitor conversation is likely to result in disorganised content. In their analysis of cohesion in two monologic discourse tasks, Hartley and Jensen (1991) recorded significantly fewer cohesive ties in an ABI group compared to controls, and increased ambiguity made the discourse more difficult to follow.
Executive skills also contribute to social competence. They include the ability to deploy attention and working memory to effectively plan, organise, anticipate, initiate, coherently deliver and revise plans in the face of new information (Kim, Whyte, Hart, Vaccaro, Polansky and Branch Coslett, 2005). This requires sensitivity to the social nuances of a conversation, and the ability to employ devices appropriate for the social context and purpose. For example, conversational content and associated behaviours have been described as repetitive and stimulus-driven, rather than planned or coherently evolving within an exchange (Martin and McDonald, 2003). On a procedural discourse task, participants with severe TBI (n=2) demonstrated excessive or insufficient conversation behaviours that were ill-matched to listener needs compared to matched controls (n=12) (McDonald, 1993).

General cognitive domains provide a framework to consider common behavioural changes associated with social communication impairments but they do not fully account for or describe the impact of these subtle changes on social relationships. Indeed, the weak relationship between neuropsychological test scores and functional communication performance is well-documented (Coelho, Ylvisaker and Turkstra, 2005). Research studies have used discourse analysis methodologies to measure functional outcomes, but it is clear that knowledge of the discourse task, the context and the relationship between conversation participants is required for accurate interpretation of findings (Togher, McDonald, Coelho and Byom, 2014). The ecological validity of the test environment holds particular challenges because everyday conversation is unpredictable and subject to fluctuating conditions. Successful social relationships depend on the ability to respond adaptively whilst also adhering to social rules. Individuals may be unaware of the impact of their behaviour on others as a result of an inability to recognise, monitor and adapt in response to external cues (Prigatano, 1991). Self-awareness of communication skills has been identified as a predictor for social integration (Struchen, Clark, Sander, Mills, Evans and Kurtz, 2008) and is inextricably linked to social cognitive processes, which are discussed in the next section.
2.2.2 Social cognitive processes and social communication

Social cognition has been defined as the processes through which individuals make sense of themselves and others in their social world (Fiske and Taylor, 2013). The ability to predict patterns of behaviour in others depends on both recognition and accurate interpretation of social cues. McDonald (2013) draws a distinction between ‘hot’ processes (the ability to recognise and identify with emotions of others) and ‘cold’ processes (the ability to take another’s perspective). This modular approach is based on claims of independent neural systems involvement in emotion processing and cognitive capacities such as theory of mind (ToM). This perspective of social cognition mediated by separate brain structures is controversial. McDonald (2013) argues that the debate can be explained in part by different levels of social cognitive processing, of which some components are shared while others are specialised. For example, the perception of social signals is specialised and specific to social cognition, but response regulation is mediated by cognitive processes which are probably shared. Williams and Wood (2017) describe a simpler perspective, in which social cognitive processes are mediated by the social context. This approach characterises adaptive social behaviour as incorporating both an accurate perception of sensory inputs and a response that is proportionate to the context. The potential sensory inputs available in a given social exchange are broad. Adolphs (2010) provides a model of social information processing that includes perception of biological motion, social touch and pheromones (although the evidence for this in human interactions is not strong) in addition to face and speech perception.

The ability to perceive feelings or emotions from facial expressions is an essential component of social competence, and a link between severe TBI and impaired emotion recognition from static photographs is now well established (Yassin, Callahan, Ubukata, Sugihara, Murai and Ueda, 2017). Babbage et al. (2011) conducted a meta-analysis of 13 studies between 1980 and 2009 comparing facial affect recognition from static images in individuals with a moderate to severe TBI (n=296) versus matched controls (n=296). Mean scores for the TBI group were 1.1 standard deviations below that of the neuro-typical group. The
authors estimated that between 13% and 39% of people with a moderate to severe TBI have an impaired ability to perceive emotion from static images. However, assessment using dynamic stimuli is more representative of social encounters where individuals need to perceive overt and tacit messages from ever changing facial expressions and respond accordingly.

Knox and Douglas (2009) compared facial expression perception skills in both static and dynamic presentations in a group of individuals with severe TBI (n=13) to a non-injured control group (n=13). The TBI group were more impaired on both tasks than the control group, and the TBI group had more difficulty interpreting emotion in dynamic than static displays. Conversely, McDonald and Saunders (2005) compared a severe TBI group (n=34) to a non-injured group (n=28) and found that the TBI group were more impaired on static than dynamic displays. Contradictory findings on gender differences are also reported. Zupan, Babbage, Neumann and Willer (2017) investigated the ability to interpret emotion from static stimuli in a severe TBI group, and found no difference between males (n=116) and females (n=44). Rigon, Turkstra, Mutlu and Duff (2016) also found no gender difference in a moderate-severe TBI group on a static task of emotion recognition, but there was a significant gender difference on dynamic tasks, with females (n=25) performing better than males (n=28). There was no gender difference on the same tasks in a group of matched controls (female=27; male=22). Other studies of neuro-typical groups demonstrate an advantage for females in processing facial expressions under certain conditions (Hong, Yoon and Peaco, 2015). Gender may therefore be a potential confound in findings from some studies.

Other task-related confounds include response mode (Knox and Douglas, 2009) whereby the task potentially becomes one of word retrieval if verbal responses are required. Turkstra, Kraning and Riedeman (2017) have questioned the ecological validity of test materials that use forced-choice labelling of isolated faces, rather than open-choice labelling of faces within scenes from everyday life, which they argue is more representative of the real-world task demand. Further, differential neural pathway activation in static versus dynamic displays (Kilts, Egan, Gideon, Ely and Hoffman, 2003) may potentially disadvantage individuals.
with impaired general cognitive skills as accurate interpretation of information from dynamic displays is reliant on intact attention, working memory and information processing capability (Knox and Douglas, 2009; McDonald and Saunders, 2005; McDonald, 2013).

Impaired recognition of emotion in speech has also been documented (McDonald and Saunders, 2005; Dimoska, McDonald, Pell, Tate and James, 2010; Ietswaart, Milders, Crawford, Currie and Scott, 2008). Information on vocal emotion is derived from the acoustic-perceptual properties of speech, carried by prosodic cues such as loudness, tempo, intonation and pitch (Pell and Kotz, 2011). Dimoska et al. (2010) compared the performance of a moderate-severe TBI group (n=18) to a non-injured control group (n=18) on two vocal emotion perception tasks presented with semantic information (e.g. ‘That car just splashed me!’) and without (e.g. ‘Someone migged the pazing’). The inclusion of a semantic condition was designed to control for the potential confound of perceiving the emotion carried in speech content versus perceiving emotion from prosodic features alone. The TBI group were significantly more impaired than the control group in both conditions. Moreover, there was no difference in performance between the two conditions for the TBI group, suggesting impaired recognition of emotion from prosodic features irrespective of speech content.

McDonald and Saunders (2005) also found a TBI group to be more impaired than non-injured controls on a task of emotion perception that was reliant on auditory skills alone. Gender differences are also evident. In a study comparing men (n=116) and women (n=44) with severe TBI, Zupan et al. (2017) found speech affect recognition to be less impaired in females.

In the light of these findings, it is perhaps unsurprising that studies investigating the simultaneous perception of both facial and vocal emotion from audio-visual presentations show impaired performance in the TBI population compared to neuro-typical groups (Ietswaart et al., 2008; McDonald and Saunders, 2005; Milders, Fuchs and Crawford, 2003). Ietswaart et al. (2008) compared a TBI group (n=30) across the spectrum of severity to a neuro-typical control group (n=32) on impairments of facial and vocal emotion shortly after injury and 1 year later. Assessments showed the TBI group were more impaired than the control
group on visual and auditory emotion processing tasks. The authors conclude that these deficits were a direct effect of injury as repeat tests after 1 year showed no significant change.

In addition to the ability to perceive emotion from facial expression and tone of voice and adaptively respond to that information, social communication requires the ability to attribute mental states (such as thoughts, beliefs and intentions) to others. Investigators have posited that acquired ToM impairments may underlie social communication deficits following brain injury (Milders, Fuchs and Crawford, 2003). Martín-Rodríguez and León-Carrión (2010) conducted a meta-analysis of 26 studies (between 1995 and 2008) comparing ABI groups to healthy controls across four developmental ToM tasks. These comprised first order ToM tasks, to assess the ability to recognise true or false beliefs in others (i.e. he thinks that...), second order belief tasks, to assess the ability to correctly attribute one person’s belief regarding the belief of another (i.e. she thinks that he thinks that...), indirect speech tasks to assess the ability to understand sarcasm, irony, metaphor and jokes, and a faux pas detection task. Effect sizes showed severe impairment in understanding indirect speech (es=0.87) and faux pas recognition (es=0.70), and moderate impairments in the second order (es=0.60) and first order (es=0.52) belief tests. Overall, these findings indicate a moderate to large effect size for cognitive ToM impairments in the ABI population. The range of task presentations (verbally delivered stories, non-verbal static presentations using pictures or cartoons, dynamic presentations using video) introduced confounding variables. It is therefore difficult to disassociate interference from general cognitive impairments (e.g. visual attention, working memory and other executive skills) on tests of mental state judgments of varying complexity (McDonald, Honan, Kelly, Byom and Rushby, 2014).

Cognitive empathy and emotional empathy are related constructs (McDonald et al., 2014), defined as the ability to understand a different perspective and empathise with the feelings of others (Neumann, Zupan, Malec and Hammond, 2014). Both are requisite skills for a successful interpersonal interaction. Neumann et al. (2014) examined differences in a moderate to severe TBI group (n=60) and matched controls (n=60). Cognitive and emotional empathy skills
were significantly lower in the TBI group, replicating findings from earlier studies (Williams and Wood, 2010; de Sousa, McDonald and Rushby, 2011). Differences in alexithymia (the ability to acknowledge and describe one’s own emotional state) and facial and vocal affect recognition were also investigated. Findings showed significant differences between the groups. In the TBI group, cognitive empathy variance was significantly explained by alexithymia and affect recognition, indicating that individuals with difficulty acknowledging their own emotional state are more likely to have difficulty recognising emotion in others and taking their perspective.

Social cognition is a complex construct. The incidence of impairment is not yet well established likely due to multiple skill components and their differential representation within the ABI population (Cassel, McDonald and Togher, 2016). Further, it is difficult to separate general cognitive skills from social cognitive processes in order to determine skill needs. Spikman et al. (2012) recommend the inclusion of emotion recognition assessments in addition to a general cognitive test battery for more accurate profiling in clinical practice.

2.3 Social communication skills and community integration

Given the pervasive nature of social communication impairment in ABI, there is an inevitable impact on community integration where interpersonal relationships are frequently cited as important for a sense of community belonging (Sander, Clark and Pappadis, 2010; McColl et al., 1998; Struchen et al., 2011). Definitions of community integration comprise some common themes including social relationships, social activity and employment/vocational opportunity (McColl et al., 1998).

2.3.1 Social communication skills and social relationships

The loss or deterioration of pre-injury social relationships following brain injury is well documented (Kozloff, 1987; Olver, Ponsford and Curran, 1996; Temkin, Corrigan, Dikmen and Machamer, 2009; Wagner, Williams and Long, 1990). Studies of long-term sequelae have examined the relationship between social network size and satisfaction with social relationships. In a study measuring
psychosocial outcomes in a severe TBI population (n=7; mean years post-injury=14.1), Hoofien et al. (2001) reported participant evaluations of social functioning to be low and family member estimates confirmed these reports. Thirty one percent reported no friends outside of their immediate family group and 8% reported being socially isolated. The average number of friends was 2.7. Social functioning was significantly related to psychiatric status. Impaired social communication skills are likely to contribute to this reduction in social networks (Galski, Tompkins and Johnston, 1998; Hartley, 1995). Using global measures of communication behaviour, TBI conversations have been identified as less socially reinforcing and rated as less rewarding, less appropriate, less interesting and more effortful than conversations with matched controls (Bond and Godfrey, 1997).

Some studies have directly explored associations between social communication skills and social integration outcomes. Struchen et al. (2011) identified an association between social communication abilities, emotional and behavioural function and social integration outcomes. Dahlberg et al. (2006) found an association between self-reported social communication skills deficits and reduced social participation and integration. At a discourse level, Galski, Tompkins and Johnston (1998) compared discourse samples from a mild TBI group (n=30) to matched neurotypical controls (n=10) and identified a correlation between a number of discourse variables and poorer social integration in the TBI group. These included an increased length of time to complete discourse tasks, increased wordiness, the inclusion of multiple topics into narrative tasks, slower response times, inability to repair or revise errors and reduced discourse organisation and cohesion. Such an interpersonal profile is likely to negatively affect relationships.

As the individual’s social network retracts there is increased dependence on family members for support (Humphreys, Wood, Phillips and Macey, 2013; Kozloff, 1987). Predictors of burden and distress on families and caregivers include cognitive and behavioural changes (Knight, Devereux and Godfrey, 1998; Kreutzer, Gervasio and Camplair, 1994; Manskow, Sigurdardottir, Roe, Andelic, Skandsen, Damsgard, Elmstahl and Anke, 2015). The individual’s lack of social
contact has also been identified as a source of caregiver distress over time (Marsh, Kersel, Havill and Sleigh, 2002), as has a reduction in the caregiver’s own social support network (Manskow et al., 2015). Vangel, Rapport and Hanks (2011) report a reciprocal relationship between the well-being of the person with brain injury and the social supports available to caregivers.

Studies investigating partner relations largely report on marital relationships, and findings are variable. In a review of the literature between 2001 and 2011 on marital stability, Godwin, Kreutzer, Arango-Lasprilla and Lehan (2011) report breakdown rates that range from 15% to 45%. Bracy and Douglas (2005) investigated interpersonal communication skills in married couples where the husband had sustained a severe TBI, and those of a matched control group. The TBI dyads reported more communication difficulties than the control group, with TBI partners reporting avoidance of demanding conversation.

In addition to the adverse effects of injury on the ability to maintain pre-existing friendships and personal relationships, impaired social communication skills affect the ability to make new contacts and form new social relationships outside the home. Participation in meaningful leisure activities provides opportunities to meet other like-minded people and make reciprocal friendships, but outcome studies document reduced opportunities for social contact (Olver, Ponsford and Curran, 1996). In part, this may be due to difficulties establishing new social activity routines, as discussed in the next section.

2.3.2 Social communication skills and participation in social activity

Studies indicate that following ABI, many individuals do not return to pre-injury levels of participation in social activity, either in the short-term or at later stages following injury. A within-group study to compare patterns of social activity pre-injury and 1 year post-injury in moderate to severe TBI (n=160) found participants engaging in fewer social leisure pursuits post-injury (Wise, Mathews-Dalton, Dikmen, Temkin, Machamer, Bell and Powell, 2010). Reduced engagement in leisure and social activity can then persist into the medium to long term. This has been reported in studies of people with TBI and subarachnoid haemorrhage between 1 and 4 years post-injury (Eriksson, Tham
and Borg, 2006), moderate to severe TBI between 3 and 5 years post-injury (Dikmen et al., 2003), severe TBI between 2 and 7 years post-injury (Oddy et al., 1985) and moderate-severe TBI between 7 and 24 years post-injury (Devitt, Colantonio, Dawson, Teare, Ratcliffe and Chase, 2006). In addition to environmental barriers to participation, studies identify increased injury severity and reduced cognitive and physical function as predictors for less favourable outcomes in the medium and long-term (Devitt et al., 2006; Dikmen et al., 2003; Doninger, Heinemann, Bode, Sokol, Corrigan and Moore, 2003). Fleming, Braithwaite, Gustafsson, Griffin, Collier and Fletcher (2011) suggest that interventions to meet social participation goals during the rehabilitation phase may facilitate more positive social integration outcomes at later stages following discharge.

There is a relationship between social activity and quality of life for people with TBI. Cicerone and Azulay (2007) reported a correlation between satisfaction with leisure and social activity and general life satisfaction. In their systematic review of the literature on leisure/social activity interventions following TBI, Tate, Wakim and Genders (2015) reported improved psychological well-being from regular and active engagement in recreational programmes. However, the number of studies showing sufficient scientific rigour for valid evaluation was small. Effects were largely measured on well-being and quality of life scales and investigators recommend the inclusion of measures that show more intervention-specific outcomes to enable a more rigorous evaluation of efficacy. Treatment effects also appeared to be dependent on regular involvement in activity programmes running over months in order to establish new routines and friendships. For example, Douglas, Dyson and Foreman (2006) reported statistically significant improvements in social integration and well-being from regular attendance (over 6 months) in an assisted community participation programme for severe TBI (n=20; mean years post-injury=10). These studies indicate that long-term support is required to facilitate participation through social activity following severe ABI. Another means of rekindling pre-existing friendships and making new ones within a regular routine is through work. This is discussed in the next section.
2.3.3 Social communication skills and return to work

For many individuals with ABI, a return to work is the primary goal and the most salient measure of rehabilitation success. However, outcome studies document reduced employment opportunities following brain injury (Wehman, Targett, West and Kregel, 2005) and estimates of return to work vary widely. In a systematic review of the evidence between 1992 and 2008, van Velzen, van Bennekom, Edelaar, Sluiter and Frings-Dresen (2009) reported a return to work rate of 30 – 65% after traumatic and non-traumatic ABI (mild, moderate and severe injury). From a review of the TBI literature, Shames, Treger, Ring and Giaquinto (2007) estimated a return rate of 12 – 70%. According to Wehman et al. (2005), the range of assessment protocols, indicators of participant severity and definitions of employment (paid employment versus voluntary placements versus supported vocational initiatives) impedes reliable data interpretation.

The ability to remain in employment is arguably a more meaningful measure of outcome than simply a return to work (Bahadur, McRann and McGilloway, 2017). In a longitudinal study to record employment rates at 1, 2 and 3 years post-injury in a moderate-severe TBI group (n=236), Ponsford and Spitz (2015) found that 44% of their study population were employed at each measurement point, with evidence of substantial movement in and out of work between time points. A recent study of employment outcomes at 4 years post severe TBI (n=133) found 38% of people to be in employment (Ruet, Jourdan, Bayen, Darnoux, Sahridj, Ghout, Azerad, Pradat Diehl, Aegerter, Charanton, Vallat Azouvi and Azouvi, 2017). In a longitudinal study of employment rates in a mild – severe TBI group (n=141), Ponsford, Downing, Olver, Ponsford, Acher, Carty and Spitz (2014) reported a 40% return to some form of employment at 2 years post-injury, and this did not change significantly at 5 and 10 years. Some studies acknowledge the influence of environmental factors such as the state of the economy on these statistics, where a downturn influences both availability of supported positions and tolerance for lower productivity or interpersonal relationship issues (Grigorovich, Stergiou-Kita, Damianakis, Le Dorze, Lemskey, Hebert, 2017; Olver, Ponsford and Curran, 1996).
Longitudinal studies also enable analysis of predictors of employment stability. Results are largely consistent. Adverse factors include older age at the point of injury, low educational level, pre-injury unemployment, low pre-injury employment skills, single person status, increased injury severity, longer length of stay in acute/rehabilitation settings, functional dependence on discharge, more severe cognitive impairment, behavioural changes (such as inappropriate social behaviour) and low self-awareness (Wehman et al., 2005; Ponsford and Spitz, 2015; Ruet et al., 2017; Scaratti, Leonardi, Sattin, Schiavolin, Willems and Raggi, 2017; Brooks, McKinlay, Symington, Beattie and Campsie, 1987; Sherer, Bergloff, Levin, High, Oden and Nick, 1998). Ruet et al. (2017) identified functional status at 1 year post-injury as a predictor of return to work. In this study, participants who were dependent on assistance with routine activities of daily living 1 year post-injury remained unemployed at the 4 year review. Communication-specific parameters have largely been omitted from these studies of employment stability (Snow, Douglas and Ponsford, 1998) or subsumed under the umbrella of behavioural changes, such as personality or emotion outcomes (Struchen et al., 2011). However, Brooks et al. (1987) identified conversation skills as a predictor of failure to return to work, along with cognitive and behavioural issues, and personality change.

Qualitative studies enable identification and analysis of the barriers and opportunities that influence participation by people with ABI in working life across a range of contexts (Bush, Hux, Guetterman and McKelvey, 2016). Sale, West, Sherron and Wehman (1991) investigated the causes of failed placements on a supported employment initiative for individuals with moderate – severe TBI (n=29). Forty eight percent of placements ended prematurely; interpersonal relationship difficulties were cited as the cause of failure in 45% of cases. These were described as misinterpretation of social cues, conflicts with colleagues and supervisors, and verbally inappropriate comments to customers and colleagues.

Social communication skills play a vital role in successful reintegration into previous roles at home and in the wider community, and to the maintenance of previous friendships and the formation of new ones. The specific impact of ABI on potential employment, social activity and relationship-building requires a
rehabilitation ethos that facilitates social communication behaviour change in order to enhance participation. The next section examines empirical investigations into interventions to remediate social communication skills, where a distinction can be drawn between interventions targeting the restoration of discrete social communication skills versus a context-sensitive approach designed to facilitate social participation in everyday life.

2.4 Interventions for social communication impairments in ABI

Given the breadth and consistency of reports over the past 40 years documenting the negative impact of impaired social communication skills on social integration in community settings, the number of empirical investigations into interventions is limited. There have been three systematic reviews of the evidence published in the past 10 years. Cicerone, Langenbahn, Braden, Malec, Kalmar, Fraas, Felicetti, Laatsch, Harley, Bergquist, Azulay, Cantor and Ashman (2011) conducted a review of the literature on cognitive rehabilitation in ABI published between 2003 and 2008. Citing evidence from four group studies, they concluded that there was sufficient evidence for interventions for social communication skills to be delivered as a practice standard in programmes of rehabilitation. Finch, Copley, Cornwell and Kelly (2016) conducted a search of all peer-reviewed TBI interventions for social communication skills published up until October 2013. Of the 15 studies of varying scientific rigour that met their criteria, they concluded that interventions for impaired social communication skills were generally beneficial, but the evidence for context-sensitive group interventions was strongest. Wiltshire and Ehrlich (2014) conducted a systematic review of the evidence for effectiveness of communication partner training interventions for participants with TBI between 2004 and 2014. From the four studies in their review, they concluded that while there is some evidence of benefit, the research is limited and insufficient for confident recommendations.

As these systematic reviews are relatively recent, the present review offers a more qualitative perspective and selection bias cannot therefore be excluded. The peer-reviewed interventions were drawn from a search of Psych Info, Medline and Cinahl databases between 1980 and October 2013, and Psych Info, Pub Med, Cinahl and Speechbite databases up to September 2017. Combinations
of the following terms were used to identify interventions for impaired social communication skills following ABI: *social communication, social skills, cognitive, communication, intervention, therapy, treatment, rehabilitation, participation, brain injury, acquired brain injury, traumatic brain injury, adult*. Additional reports were identified from a review of the reference sections of journal articles generated by the database search as well as additional papers known to this author. The following exclusions were applied: non-peer reviewed papers, book chapters, theoretical or conceptual papers, and interventions with paediatric and adolescent populations. This search generated 28 peer-reviewed reports. See Table 2.1 for a summary. The interventions fall into three categories: group treatments for ABI/TBI, individual treatments for ABI/TBI and communication partner training, and are grouped in this way in Table 2.1.
Table 2.1 Interventions for social communication impairments for adults following ABI

<table>
<thead>
<tr>
<th>Group Studies</th>
<th>Participants</th>
<th>Design</th>
<th>Intervention</th>
<th>Primary Outcome Measures</th>
<th>Findings</th>
<th>Follow-up</th>
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<tbody>
<tr>
<td>Dahlberg et al., 2007</td>
<td>n=52 TBI</td>
<td>RCT</td>
<td>Manualised treatment programme (18 hours over 12 weeks)</td>
<td>• Profile of Functional Impairment in Communication</td>
<td>Improvements on 9 of the 10 PFIC summary scales, SSQA, GAS and SWLS</td>
<td>At 6 months follow-up: improvements maintained on 6 of the ten PFIC scales, SSQA, GAS and SWLS</td>
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<td></td>
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<td></td>
<td>Deferred treatment control group</td>
<td>• Social Communication Skills Questionnaire-Adapted (SCSQ-A)</td>
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<td>• Goal Attainment Scaling (GAS)</td>
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<td>• Satisfaction With Life Scale (SWLS)</td>
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<td>• Craig Handicap Assessment (CHART-SF)</td>
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<td>• Community Integration Questionnaire (CIQ)</td>
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<tr>
<td>McDonald, Tate et al., 2008</td>
<td>n=51 severe acquired brain injury</td>
<td>RCT</td>
<td>Manualised treatment programme (48 hours over 12 weeks)</td>
<td>• BRISS-R: Partner directed behaviour scale (PDBS)</td>
<td>Improvements in treatment group on PDBS only.</td>
<td>No follow-up</td>
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<td></td>
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<td>Control groups: social activity and deferred treatment</td>
<td>• BRISS-R: Personal conversational style scale (PCSS)</td>
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<td>• The Assessment of Social Inference Test</td>
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<td></td>
<td>• Depression Anxiety Stress Scales</td>
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<tr>
<td>Bornhofen and McDonald, 2008a</td>
<td>n=12 severe TBI</td>
<td>RCT</td>
<td>25 hours (8 week) treatment programme to remediate emotion perception</td>
<td>• Emotion perception tasks</td>
<td>Improvements in emotion judgments and on TASIT</td>
<td>Gains maintained at 1 month follow-up</td>
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<td>Control group: deferred treatment</td>
<td>• The Assessment of Social Inference Test (TASIT)</td>
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<td></td>
<td>• Sydney Psychosocial Re-integration Scale</td>
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<td>Group Studies</td>
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| Bornhofen and McDonald, 2008b | n=18 TBI     | RCT     | 25 hours (10 week) treatment programme comparing errorless learning (EL) versus self-instructional (SIT) approaches Control group: deferred treatment | • Emotion perception tasks
• Awareness of Social Inference Test (TASIT)
• Sydney Psychosocial Re-integration Scale
• Depression Anxiety Stress Scales                                                                 | EL and SIT improvements in emotion perception (SIT more efficacious)
SIT gain on one test of TASIT.                                                                 | Discrimination and matching task gains maintained at 1 month follow-up. Social inference gains not maintained at follow-up. |
| McDonald et al., 2013         | n=20 severe ABI | RCT     | Manualised treatment programme to recognise prosodic emotion cues (6 hours over 3 weeks) for treatment group Control group: deferred treatment | • The Awareness of Social Inference Test (TASIT)
• Prosodic Emotion Labelling Task
• Self and relative communication questionnaires                                                                 | No statistically significant gains                                                                 | 1 month follow-up                                                                                   |
| Appleton et al., 2011         | n=7 mild-severe ABI | Cohort study | Modified version of manualised treatment programme (from McDonald et al., 2008) with extra psychosocial content (12 hours over 4 weeks). | • Bedside Evaluation Screening Test
• La Trobe Communication Questionnaire
• Correct Information Unit analysis
• Hospital Anxiety and Depression Scale
• Mini International Neuropsychiatric Interview
• Coping Self-Efficacy Scale
• WHO Quality of Life Assessment                                                                 | Raw test scores reported. Improvements for some participants on the following parameters: efficiency of connected speech, more informative content and reduced anxiety | 3 month follow-up                                                                                   |
<table>
<thead>
<tr>
<th>Group Studies</th>
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<tbody>
<tr>
<td>Braden et al., 2010</td>
<td>n=30 TBI and TBI+ neuro/psych condition</td>
<td>Cohort study</td>
<td>Manualised training for TBI and TBI plus participants (19.5 hours) over 13 weeks.</td>
<td>• The Profile of Pragmatic Impairment in Communication (PPIC)</td>
<td>Gains on GAS and SCSQ-A (subjective ratings).</td>
<td>Gains maintained at 6 month follow-up.</td>
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<td>• Social Communication Skills Questionnaire-Adapted (SCSQ-A)</td>
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<td>• Goal Attainment Scaling (GAS)</td>
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<tr>
<td>Ehrlich and Sipes, 1985</td>
<td>n=6 TBI (severity unspecified)</td>
<td>Cohort study</td>
<td>Four pragmatic communication modules (36 hours) over 12 weeks</td>
<td>• Communication Performance Scale (adapted from the Pragmatic Protocol)</td>
<td>Pragmatic communication gains on non-validated adapted scale</td>
<td>No follow-up.</td>
</tr>
<tr>
<td>Finch et al., 2017</td>
<td>n=8 moderate-severe TBI</td>
<td>Cohort study</td>
<td>Manualised metacognitive strategy intervention (16 hours over 8 weeks)</td>
<td>• Profile of Pragmatic Impairment in Communication (PPIC)</td>
<td>Significant gains on GAS scores. Variable change on PPIC scales. Non-significant findings on the LCQ</td>
<td>Maintained at 4 week follow-up (PPIC)</td>
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<td>• Goal Attainment Scaling (GAS)</td>
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<td></td>
<td>• La Trobe Communication Questionnaire (LCQ)</td>
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<tr>
<td>Goldblum et al., 2001</td>
<td>n=6 severe TBI</td>
<td>Cohort study</td>
<td>Conversation group (1.5 hours weekly) to practise pragmatic skills (over 2 years)</td>
<td>• Pragmatic Protocol</td>
<td>Plateau in pragmatic skills over time. Perceived quality of life gains</td>
<td>No follow-up.</td>
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<td>• Quality of Life Scale</td>
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<td>Group Studies</td>
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</tbody>
</table>
| Johnson and Newton, 1987      | n=10 severe TBI  | Cohort study               | Group intervention to reflect on and practice social performance issues with peer and therapist feedback (1.5 hours weekly for 1 year) Control groups:  
  • Psychiatric outpatients  
  • Non-clinical controls  | • Katz Adjustment Scale (KAS-R)  
  • Social Performance rating scale  
  • Questionnaire of Social and Evaluative Anxiety  
  • Rosenberg Self-esteem Scale  
  • Neurophysical Scale  | No significant difference between the groups on outcome measures. Individual examples change on measures of social performance. Relative reports of increased social activity | No follow-up                                                                                       |
| Ownsworth et al., 2000        | n=21 mild-severe ABI | Cohort study               | Support programme for psychosocial and self-awareness needs (24 hours over 16 weeks)                                                          | • Self-awareness Deficits Interview  
  • Head-injury Behaviour Scale  
  • Self-regulation Skills Interview  
  • Sickness Impact Profile  | Improved self-regulation and psychosocial function                                                                                                     | Maintained at 6 month follow-up                                                                                                                        |
<p>| Braunling-Morrow et al., 1986 | n=3 severe TBI   | Single case series         | Social interaction skills programme using a group game format (total 16 games – 2/3 group meetings for 30-60 minutes)                        | • Game format scores  | Improved social skills demonstrated in game scores and functionally (mealtime setting)                                                                | Maintained at 12 day follow-up                                                                                                                |</p>
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<tr>
<th>Group Studies</th>
<th>Participants</th>
<th>Design</th>
<th>Intervention</th>
<th>Primary Outcome Measures</th>
<th>Findings</th>
<th>Follow-up</th>
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<tbody>
<tr>
<td>Gajar et al., 1984</td>
<td>n=2 severity unspecified</td>
<td>Single case series</td>
<td>Group conversation behaviour treatment using +/- feedback from individual coloured lights (over 20 sessions)</td>
<td>Positive behaviour frequencies</td>
<td>Increase in positive communication behaviours. Generalised to client lounge.</td>
<td>No follow-up</td>
</tr>
<tr>
<td>Individual (i.e. non-group) Studies</td>
<td>Participants</td>
<td>Design</td>
<td>Intervention</td>
<td>Primary Outcome Measures</td>
<td>Findings</td>
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<tr>
<td>Helffenstein and Wechsler, 1982</td>
<td>n=16 non-progressive brain injury</td>
<td>RCT</td>
<td>Interpersonal process recall training (20 hours) Active control group: ‘non-therapeutic’ attention</td>
<td>• Strait-Trait Anxiety Scale • Tennessee Self-concept scale • Interpersonal Communication Inventory • Interpersonal Relationship Rating Scale • Independent Observer Report Scale • Videotape Analysis</td>
<td>Reduction of trait anxiety Improved self-concept Improved interpersonal and communication skills Increased frequency of specified communication behaviours No change on video analysis</td>
<td>1 month Gains maintained on limited follow-up sample (n=6)</td>
</tr>
<tr>
<td>Radice Neumann et al., 2009</td>
<td>n=19</td>
<td>RCT</td>
<td>Facial Affect Recognition (FAR) compared to Stories of Emotional Inference (SEI) to treat impaired emotion processing (3 hours per week for 2/3 weeks)</td>
<td>• Levels of emotion scale (LEAS) • Diagnostic Analysis of Non-verbal Accuracy scale (DANVA) • Emotion Evaluation Test (EET) from the TASIT • Brock Adaptive Functioning Questionnaire</td>
<td>FAR group improved on the LEAS and the DANVA (facial affect scale).</td>
<td>2 weeks FAR group gains maintained on the DANVA but not the LEAS. SEI group gain on the LEAS.</td>
</tr>
<tr>
<td>Brotherton et al., 1988</td>
<td>n=4 (severe TBI)</td>
<td>Case series (multiple baseline)</td>
<td>Structured social skills programme (twice weekly sessions for 1 hour)</td>
<td>Three point social behaviour rating scale</td>
<td>Gains reported for three participants post-intervention</td>
<td>Some training effects evident at 1 year follow-up</td>
</tr>
<tr>
<td>Individual (i.e. non-group) Studies</td>
<td>Participants</td>
<td>Design</td>
<td>Intervention</td>
<td>Primary Outcome Measures</td>
<td>Findings</td>
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</table>
| Douglas et al., 2014              | n=2 (severe TBI) | Single case (multiple baseline) | Structured intervention to improve communication-specific coping skills (12 hours over 6 weeks) | • The Discourse Coping Scale-Clinician Rating (DCS-CR)  
• The Communication-specific Coping Scale – research version (CommSpecCS)  
• La Trobe Communication Questionnaire  
• The Depression Anxiety Stress Scales-21 | Participant reported reduction in frequency of non-productive strategies (CommSpecCs self-report)  
Significant effects reported for participants on the DCS-CR  
Improved scores on DASS-21 for one participant  
Improved scores on LCQ | Gains maintained at 3 month follow-up |
| Douglas et al., 2016              | n=13 (severe TBI) | Case series (multiple baseline) | Structured intervention to improve communication-specific coping skills (12 hours over 6 weeks) | • The Discourse Coping Scale-Clinician Rating (DCS-CR)  
• The Communication-specific Coping Scale – research version (CommSpecCS)  
• La Trobe Communication Questionnaire (LCQ)  
• The Depression Anxiety Stress Scales-21 | Significant reduction in use of non-productive comprehension coping strategies (CommSpecCS self-report)  
Significant increase in use of productive expressive coping strategies (close other-report)  
Significant improvements on DCS-CR ratings  
Reduction on DASS-21 stress scale | Gains maintained at 3 months  
Significantly improved scores on LCQ self-reports at 3 months |
<p>| Giles et al., 1988                | n=1 (severe TBI) | Single case | Cognitive behavioural treatment to reduce verbosity (5 half hour sessions per week over 4 weeks) | Mean words per minute in response to structured, semi-structured and unstructured question types | Significant reduction in mean number of inappropriate words across all question types | Maintained at 2 month follow-up |</p>
<table>
<thead>
<tr>
<th>Individual (i.e. non-group) Studies</th>
<th>Participants</th>
<th>Design</th>
<th>Intervention</th>
<th>Primary Outcome Measures</th>
<th>Findings</th>
<th>Follow-up</th>
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<tbody>
<tr>
<td>Kirsch et al., 2004 n=1 (severe TBI)</td>
<td>Single case</td>
<td>Use of Personal Digital Assistant (PDA) to provide feedback on verbosity (B-A-B design: PDA in place for 5 weeks – withdrawn for 7 weeks – in place for 6 weeks)</td>
<td>Total length of utterance</td>
<td>Reduced length of utterance but generalised skills not evaluated</td>
<td>No follow-up</td>
<td></td>
</tr>
<tr>
<td>Lewis et al., 1988 n=1 (severe ABI)</td>
<td>Single case</td>
<td>Conversation therapy to reduce inappropriate comments using three behavioural feedback types (5 times per day/4 days per week)</td>
<td>Behavioural frequency counts (appropriate/inappropriate talk)</td>
<td>Ignoring and attention/interest were less effective strategies than correction at reducing inappropriate talk</td>
<td>Continued success with correction contingency at 6 month follow-up (anecdotal report)</td>
<td></td>
</tr>
<tr>
<td>O'Reilly et al., 2000 n=2 (severe TBI)</td>
<td>Single case series (multiple baseline)</td>
<td>Social communication skills problem-solving intervention in the workplace (twice weekly sessions for 1 hour)</td>
<td>Task analysis (of general verbal, nonverbal and specific verbal components) ratings completed by observers/job coaches</td>
<td>Improvements in targeted work-related social skills</td>
<td>Workplace gains maintained at 6 week follow-up</td>
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</tr>
<tr>
<td>Sladyk 1992 n=1 (severe TBI)</td>
<td>Single case</td>
<td>Pro-social skills programme comprising daily meetings in a rehabilitation facility to review behaviour (3 times per week for 58 days)</td>
<td>No formal evaluation</td>
<td>Descriptive reports of a reduction in negative behaviour and appropriate skills with staff and peers</td>
<td>No follow-up</td>
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<tr>
<td>Communication partner treatments</td>
<td>Participants</td>
<td>Design</td>
<td>Intervention</td>
<td>Primary Outcome Measures</td>
<td>Findings</td>
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<td>Togher et al., 2004</td>
<td>n=20 TBI</td>
<td>RCT</td>
<td>Training programme for police officers dealing with TBI in service encounters (12 hours) Control group: deferred treatment</td>
<td>Manual interaction analysis using generic structure potential analysis</td>
<td>More efficient service interactions in the training group</td>
<td>No follow-up</td>
</tr>
<tr>
<td>Goldblum and Alant, 2009</td>
<td>(n=64) Customer service managers, customer care assistants and sales assistants from a national supermarket chain</td>
<td>RCT</td>
<td>Video training programme delivered in one session (4 hours) Control group: deferred training programme delivered in one session (1.5 hours)</td>
<td>• Pre/post questionnaires formulated for the study</td>
<td>Comparison of knowledge and confidence constructs showed increased gains for trained group compared to controls</td>
<td>No follow-up</td>
</tr>
<tr>
<td>Togher et al., 2013</td>
<td>n=44 severe TBI (and partners)</td>
<td>Non-RCT</td>
<td>Manualised communication partner training (35 hours) for: • TBI and communication partner (JOINT) • TBI only (SOLO) • deferred treatment group (CONTROL)</td>
<td>• Adapted Measure of Participation in Conversation (MPC)</td>
<td>Gains for JOINT group relative to TBI SOLO and CONTROL group</td>
<td>Maintained at 6 month follow-up</td>
</tr>
<tr>
<td>Behn et al., 2012</td>
<td>n=10 paid carers</td>
<td>RCT</td>
<td>Manualised training for paid carers (17 hours over 8 weeks) in structured and casual conversations with severe TBI. Control group: deferred treatment</td>
<td>• Adapted Measure of Support in Conversation (MSC) • Adapted Measure of Participation in Conversation (MPC) • Global Impression Scales</td>
<td>Improvements in structured conversations only on MSC and appropriate, interesting and rewarding Global Impression sub-scales</td>
<td>Gains maintained at 6 month follow-up.</td>
</tr>
</tbody>
</table>
2.4.1 Group treatments

According to Sohlberg and Mateer (1989) the group format holds many benefits for individuals with ABI, including opportunities for more natural conversation between peers, overlearning through multiple practice repetitions with different communication partners in situ, and opportunity to promote generalisation of skills (Elman, 2007). It also offers resource benefits for service providers. The published evidence for social communication interventions is currently strongest for group (versus individual) treatments (Togher, Wiseman-Hakes, et al., 2014). The group studies selected for evaluation in this review comprise randomised controlled trials, cohort studies and case series designs.

Cicerone et al., (2011) cite evidence from four RCTs which, presented in a systematic review, represent Level 1, the highest level of evidence in the Oxford Centre for Evidence-Based Medicine (OCEBM) hierarchy (Howick, Chalmers, Glasziou, Greenhalgh, Heneghan, Liberati, Moschetti, Phillips and Thornton, 2011). Each of these studies (Dahlberg, Cusick, Hawley, Newman, Morey, Harrison-Felix and Whiteneck, 2007; McDonald, Tate, Togher, Bornhofen, Long, Gertler and Bowen, 2008; Bornhofen and McDonald, 2008a; Bornhofen and McDonald, 2008b) test the efficacy of a different social communication skills treatment package delivered to groups of individuals with ABI. Three of these four RCTs were cited in the systematic review of social communication interventions for adults with TBI conducted by Finch et al. (2016). A fifth and more recent RCT (McDonald, Togher, Tate, Randall, English and Gowland, 2013), investigated the effectiveness of an intervention for emotion perception deficits in a mixed ABI group (and therefore did not meet the criteria of Finch et al., 2016), but has been included to further illustrate the benefits and challenges associated with delivering group interventions to the ABI population. The content and duration of the programmes differ, but each is based on principles of behaviour modification to shape social competence. Cicerone et al. (2011) conclude that timing and dosage are two issues that require continued investigation in order to determine treatment efficacy. These interventions will now be comparatively reviewed.
Dahlberg et al. (2007) conducted an investigation into the efficacy of a group social skills intervention devised for individuals with a moderate to severe TBI (n=52; mean years post-injury=9.7). Participants were recruited in four waves over 20 months and randomly assigned to either a training group or deferred treatment group using a computer-generated list. Allocation was not concealed. The manualised programme, Group Interactive Structured Treatment for Social Competence (GIST), comprised a mix of social behaviour, cognitive skill and pragmatic language training for successful social encounters. It was delivered by a speech and language therapist (SLT) and a social worker. Tasks included tailored goal setting and self-assessment, as well as strategy practice for generalisation, involving home practice and input from close others. Improved social skills were reported following 12 weekly sessions (18 hours of training). Gains were recorded on six (of 10) subscales of the Profile of Functional Impairment in Communication (PFIC, Linscott, Knight and Godfrey, 1996), a social skills questionnaire, Goal Attainment Scaling (GAS, Kirusek and Sherman, 1968) and quality of life reports at a 6 month follow-up. The authors propose group leadership, individual goal setting, group interaction, group feedback, mutual support and tailored strategies for generalisation as strengths of the intervention. They also suggest that stringent inclusion/exclusion criteria were a limitation as broader criteria would have provided a study sample more representative of the population encountered in clinical practice. Methodological strengths of this study include the randomised design, but allocation was not concealed. Raters were fully blinded on the PFIC assessments, but the remaining measures were subjective questionnaires completed by participants and close others, and GAS scores were completed by the group leaders. These limitations potentially impact the generalisability of findings.

McDonald, Tate et al. (2008) tested the effectiveness of a different manualised social skills training package, Improving First Impressions: A Step-by-Step Social Skills Program (McDonald, Bornhofen, Togher, Flanagan, Gertler and Bowen, 2008). The intervention comprised group and individual sessions. The study design incorporated two control arms, a social activity group and a wait list group. Their inclusion criteria were wider than those of Dahlberg et al. (2007),
and included individuals with severe ABI (defined as TBI plus those with a similar cognitive communication presentation). The treatment, delivered by an SLT and a clinical psychologist, comprised 24 hours of social behaviour training over 12 weeks. This training was delivered to groups of three to five participants (n=51; mean years post-injury=4.95) recruited in three waves at three rehabilitation centres. The treatment targeted a range of social competencies, such as greeting people, beginning a conversation, choosing a topic and dealing with disagreements. It also encompassed a further 12 hours of social perception training and 12 individual sessions to address adjustment issues. Three primary outcome measures recorded post-intervention change in social behaviour, social perception and emotional adjustment. Intervention group gains were reported on one social behaviour scale of the Behaviorally Referenced Rating System of Intermediate Social Skills – Revised (BRISS-R) (Farrell, Rabinowitz, Wallander and Curran, 1985), indicating an improved ability to adapt to the conversational needs of others post-intervention. Maintenance measures were not taken.

Overall, outcomes indicated a modest gain following intervention, but findings were tempered by several serious methodological limitations. Participant attrition exceeded expectation. An intention-to-treat analysis was not employed, and per protocol analyses excluded lost participants and the adjusted sample size did not meet power requirements. Further, participants were reassigned between the treatment and control arms, violating the principle of random assignment. The absence of maintenance measures prevented an evaluation of the sustainability of effects.

Finch et al. (2016) describe these two RCTs as context-sensitive in approach. However, this contrasts with an alternative definition of a context-sensitive intervention as taking place in a real-world setting that is meaningful to the participant (Ylvisaker et al., 2003). Outcomes in both studies were measured in a clinic setting with each participant in conversation with an unfamiliar research assistant. Change on wider measures of social participation were not recorded in either study. These studies also illustrate differences in dosage and intensity over a treatment length of 12 weeks. Dahlberg et al. (2007) demonstrated increased gains despite a lower dosage and lower treatment intensity (18 hours)
delivered in weekly group meetings of 1.5 hours; McDonald, Tate et al. (2008) delivered a weekly group meeting of 3 hours plus a weekly individual meeting of 1 hour (48 hours in total). Differences in the study designs include the participant profiles (moderate–severe TBI versus severe ABI), the components of the treatment programmes, different outcome measures and their respective abilities to capture change, and the number of control arms (a waitlist versus a waitlist and a social activity group). In both studies, the mean number of years post-injury indicates that participants were at a chronic stage of recovery. McDonald, Tate et al. (2008) refer to findings from an earlier study (Helffenstein and Wechsler, 1982) and suggest that treatment effects following social communication interventions may be greater for those with less severe injuries at an earlier stage of recovery.

Dahlberg et al. (2007) acknowledged that the narrow inclusion criteria rendered the sample unrepresentative. McDonald et al. (2013) reported that stringent exclusion criteria reduced the number of potential participants, limiting the power of the study. In both studies, attrition rates exceeded pre-treatment estimates. Dahlberg et al. (2007) recorded a 25% loss over the course of the treatment and follow-up phases, and McDonald, Tate et al. (2008) experienced a 24% loss. Both studies recruited community-dwelling individuals and these findings perhaps reflect difficulties securing commitment from this clinical population to long and complex intervention programmes.

Cicerone et al. (2011) also cite evidence from two further RCTs in support of their practice recommendation for social skills interventions following injury. Both investigate one aspect of social communication: impaired emotion perception following TBI. Bornhofen and McDonald (2008a) used a hierarchy of practice tasks designed in a game format, to maximise motivation and opportunities for repetition. Twelve participants with severe TBI were recruited and randomised to a training or waitlist group (mean years post-injury = 7.8). The training was delivered for 25 hours over 8 weeks. Gains in the treatment group were recorded on labelling emotion in dynamic video displays on The Awareness of Social Inference Test (TASIT, Part 1) and understanding social
inference based on emotional demeanor in video sequences (TASIT, Part 2), but not judging emotion from static photographs. Transfer of gains into day to day interactions was not significant. The second study (Bornhofen and McDonald, 2008b) compared errorless learning versus self-instructional approaches to improve emotional perception deficits in severe TBI (n=18; mean years post-injury=24). The errorless learning group repeatedly practised the identification of patterns associated with line drawings of emotions (e.g. open mouth, wide eyes, raised eyebrows showing surprise). The self-instruction group were taught an acronym as a framework to enable independent sourcing of the same information. A total of 25 hours of treatment was delivered over 10 weeks to groups of six participants. Modest gains were recorded on facial expression judgement and the ability to draw social inferences for both groups. The authors concluded that self-instructional approaches were more efficacious than errorless learning approaches. However, this finding requires a cautious interpretation given the low participant numbers limiting the validity of findings. There was limited evidence of transfer of gain into everyday life, measured using questionnaires to capture participant and relative reports. The authors hypothesise that questionnaire insensitivity to the nuances of change post-treatment accounted for differences in empirical versus anecdotal evaluation of transfer effects.

The final and most recent RCT investigating emotion perception (McDonald et al., 2013) delivered a manualised treatment programme to improve recognition of prosodic emotion cues in ABI (n=20; mean years post-injury=9.4). Six hours of treatment were delivered over 3 weeks to groups of two participants. One therapist delivered the treatments to all groups. Effects between the treatment and waiting list group did not reach statistical significance. However full compliance was achieved, which the authors attribute to fewer treatment sessions.

One methodological limitation common to Bornhofen and McDonald (2008a; 2008b) and McDonald et al. (2013) is the small sample size, increasing the margin of error and compromising confidence in the conclusions. All three
studies have a strong impairment focus. Although this runs counter to models of learning in context for those with ABI, where contextual understanding and motivation are hypothesized to underpin effective skill transfer, treatments to address impaired receptive social communication skills are a relatively recent development. Given the proliferation of reports of difficulty in social understanding and reading social cues following ABI, they may hold promise as a means to improve socially skilled behaviour in everyday environments. Replication to evaluate findings from larger samples would be beneficial.

Evidence from four single arm group cohort studies of social communication interventions (Braden, Hawley, Newman, Morey, Gerber and Harrison-Felix, 2010; Ehrlich and Sipes, 1985; Goldblum, Mulder and von Gruenewaldt, 2001; Ownsworth, Mcfarland and Young, 2000) were also included in the review by Finch et al. (2016). Findings from a more recent single arm cohort study (Finch, Cornwell, Copley, Doig and Fleming, 2017), a group cohort study with a comparison arm (Johnson and Newton, 1987) and a single arm cohort study conducted in an ABI in-patient setting (Appleton, Browne, Ciccone, Fong, Hankey, Lund, Miles, Wainstein, Zach and Yee, 2011) are also reviewed. Using the OECBM classification (Howick et al., 2011), these cohort-designed investigations represent Level 3 evidence (or Level 4 evidence where the study quality is poor).

Braden et al. (2010) used a cohort design without a control arm to replicate the programme GIST to improve social communication skills (see Dahlberg et al., 2007). Inclusion criteria were widened for a more representative sample to include mixed severity TBI with dual diagnoses, including mental health and/or a substance abuse history. The study comprised four treatment groups (n=30; mean years post-injury=7.85), organised by injury profile. Two groups required the presence of a close other in the treatment sessions. Statistically significant gains were reported on the two questionnaires completed by the participant/support person/clinician and the GAS scores completed by the participant/clinician. These gains were maintained at a 6 month follow-up. Gains on the PPIC, an objective measure of social communication impairment,
assessed by a blind rater, were not significant. The investigators reported an attrition rate of 43%, with losses to follow-up biasing results. This is likely to reflect the challenges of securing commitment from a more complex participant population at a chronic stage of recovery. Although this study suggests that treatments for a TBI population with additional complex diagnoses are potentially feasible, measurement methods require consideration. There is a need for measurement tools that are both objective and sufficiently sensitive to communication behaviour change.

Four early studies used a cohort design to evaluate the effects of wide-ranging interventions for social communication skills. Ehrlich and Sipes (1985) conducted a single cohort exploratory study to investigate effects of a group intervention for pragmatic impairment following TBI (n=6; time post-onset= ≥1 year). This SLT-led programme comprised four communication modules: non-verbal communication, communication in context, message repair and narrative cohesion. Practice and feedback opportunities were provided using role play and video review. Three 60 minute weekly sessions were delivered over 12 weeks. Significant improvements were reported on pre/post-intervention outcomes measured on an adapted and non-standardised version of the Pragmatic Protocol (Prutting and Kirchner, 1987) by the treating clinicians. Goldblum et al. (2001) reported on outcomes from a weekly conversation group (1.5 hours) led by speech and language therapy students, under supervision. The group ran for 6 years in total, but outcomes from six participants attending for 2 years were reported. Findings indicate perceived change on the Pragmatic Protocol (Prutting and Kirchner, 1987) and a quality of life scale developed by the authors. Ownsworth, Mcfarland and Young (2000) conducted a cohort study without a control arm to investigate the effects of a therapist-led group support programme to address self-awareness and psychosocial needs in two mild – severe ABI groups (n=21; mean years post-injury=8.6). One 90 minute session was delivered weekly over 16 weeks. The content drew on cognitive rehabilitation, cognitive behavioural therapy and social skills training approaches. Results for the two groups were pooled. Findings indicated improved self-regulation and psychosocial functioning on standardised measures post-
intervention. These were maintained at a 6 month follow-up. Measures of intellectual self-awareness showed a significant improvement on relative reports but not participant reports (measured by pre/post questionnaire). Johnson and Newton (1987) investigated a therapist-led group treatment for severe TBI (n=10; mean years post-injury=5.6). The weekly group sessions ran for 1 year and comprised social skills discussion topics, practice opportunities and feedback (peer and therapist). Social interaction scores were compared to data from a psychiatric group and a neurotypical population. No significant changes in group behaviours were recorded on social performance ratings using standardised measures by blind assessors or on self/close other behaviour scales. Generalisation was reportedly encouraged (e.g. to attend available social activities) but not tested. Close others reported increased engagement in social activity by the end of the treatment.

These early studies are of variable methodological quality and range from a descriptive study (Goldblum et al., 2001) to an investigation with a control arm using established outcome measures and blind raters (Johnson and Newton, 1987). Methodological limitations include rating bias, limited measures of skill transfer, treatment replication difficulties and statistical issues. Ehrlich and Sipes (1985) and Goldblum et al. (2001) reported ratings from clinicians involved in the treatment which introduces the possibility of bias. More subjective measures (including participant/relative or clinician ratings where the phase of intervention is known) also increases the chance of rating bias. Three studies did not address generalisation (Ehrlich and Sipes, 1985; Goldblum et al., 2001; Johnson and Newton, 1987). Two of the studies examined lengthy interventions that may not be a replicable model in some settings (Goldblum et al., 2001, reported findings from group attendance over 2 years; Johnson and Newton, 1987, reported on a 1 year intervention). In the case of Goldblum et al. (2001), the conversation group was run without an intervention protocol. Statistical issues include small sample sizes (Ehrlich and Sipes, 1985; Goldblum et al., 2001; Johnson and Newton, 1987) and the application of multiple t-tests without adjustment for the family-wise error rate (Johnson and Newton, 1987; Ownsworth, Mcfarland and Young, 2000).
More recently, Finch, Cornwell, Copley, Doig and Fleming (2017) conducted a pilot study to investigate the effects of a manualised, goal-driven metacognitive strategy intervention to improve social communication following moderate to severe TBI (n=8), comprising both individual therapy and group practice sessions, practice opportunities and mechanisms for feedback and reflection. Metacognitive strategy training has been shown to improve self-awareness and self-monitoring and is a practice recommendation for cognitive communication disorders following TBI (Togher, Wiseman-Hakes, et al., 2014). An SLT delivered two 60 minute sessions each week for 8 weeks (one individual session and one group session for strategy practice). Results were significant for GAS post-intervention. Results were variable on the PPIC (a standardised and objective measure of social communication skills, assessed by a blind rater) and the La Trobe Communication Questionnaire (LCQ) (a measure of perceived change on the part of the participant and a familiar communication partner), post-intervention and at follow-up. The investigators suggest that a higher dosage may have been beneficial to enable participants to accrue sufficient practice repetitions to demonstrate gains. Methodological limitations (including a small sample size) are tempered by the exploratory nature of this pilot study. The authors comment on possible outcome measurement insensitivity and suggest that future replication should include the use of more objective measures (to reduce reliance on self-report) that also measure participation effects.

In contrast to these studies of community-dwelling individuals, Appleton et al. (2011) conducted a single arm pilot investigation into a modified version of the Improving First Impressions programme (McDonald, Bornhofen, et al., 2008), with additional psychosocial content, in an ABI in-patient setting (n=7; mean time post injury=34.5 weeks). Participants with stroke were also included. The intervention was previously tested in an RCT of community-dwelling individuals by McDonald, Tate et al. (2008). The programme was reduced in length from 36 to 12 hours, to accommodate length of in-patient stay, and delivered over 4 weeks. Baseline, post-intervention and 3 month follow-up measures of change on individual raw scores on a range of communication, psycho-social and quality
of life scales showed an increase for some participants on some measures. Inferential statistical analyses were not applied. Losses from baseline assessments to 3 month follow-up were 54%.

There were a number of methodological problems in this study making it difficult to draw conclusions. These included a small sample size and the use of raw test scores to report difference over time. The authors also acknowledge that findings were not always easy to interpret in the absence of information on clinical thresholds. Two participants were less than 6 months post-injury and so change as a result of spontaneous recovery cannot be excluded. However, this was a pilot investigation, and the setting and participant profiles were well-characterised and representative of an in-patient ABI facility. Although the study replicated aspects of a manualised programme (McDonald, Bornhofen, et al., 2008), there were no direct, objective measures of social communication to determine intervention effectiveness. The LCQ was used to determine participant and relative perceptions of change, but as with Finch et al. (2017) the response rate of the LCQ-other questionnaire was too low to enable meaningful reporting. The authors question the use of the LCQ-self questionnaire as an outcome measure, where severe cognitive impairment and low insight potentially undermine the validity of the responses. Overall, this report suggests that social communication interventions in a manualised format are a feasible inclusion in an in-patient rehabilitation setting, and that this model of intervention warrants further investigation.

Overall, these cohort studies are of varying methodological quality. They targeted a broad spectrum of social communication constructs, from self-regulation and psychosocial functioning (Ownsworth, Mcfarland and Young, 2000) to general conversation skills (Goldblum et al., 2001), which precludes comparison. The studies also used a wide range of outcome measures, and measurement insensitivity was a common concern. Only one study employed a control arm (Johnson and Newton, 1987). Most of the studies were described as exploratory, but the absence of a control group means that it is difficult to
determine whether findings are a result of therapeutic effects that are not intervention-specific (such as time or practice effects or participant expectation).

Finch et al. (2016) cite evidence from two case series designs. Using the OCEBM classification of levels of evidence (Howick et al., 2011), these studies represent Level 4 evidence, which puts them low down in the hierarchy because of the increased probability of bias. However, these were early studies using designs of lower level evidence quality to investigate innovative research questions for that time. Braunling-McMorrow, Lloyd and Fralish (1986) conducted a small group investigation into a social skills training programme for severe TBI (n=3; mean years post injury=2.6) in a residential rehabilitation setting. Results were reported as a case series. The training comprised an adapted interactional skills programme for learning disability and an adapted board game. Progress around the board required correct answers to social communication skills scenarios. One clinical psychologist facilitated a total of 16 games. These were delivered 2-3 times weekly for 30-60 minutes. Outcomes, measured by game scores and generalisation measures (12 days post-training) in a group mealtime setting, indicated improved skills. Gajar, Schloss, Schloss and Thompson (1984) used a multiple baseline design to evaluate self-monitoring and feedback effects on conversation behaviours in a group of four people with an SLT facilitator. Two participants had a TBI of non-specified severity. Two additional individuals with communication deficits of non-specified origin also participated in the group. Data were reported on the TBI participants only. This impairment-level intervention was conducted over 20 sessions, and tested the efficacy of a novel method of behavioural feedback. Light units in front of the participants displayed feedback via a green/red light for positive/negative conversation behaviours, as rated by students located in a one-way observation room. Reverse procedures were trialled to train self-monitoring skills, with clients coding their own behaviours via red/green lights shown on units in the observation room. Clients were given training in both the feedback and self-monitoring conditions. Outcomes were calculated to derive the percentage change in positive responses and compared to a non-injured group of college students. Data indicated an increase in positive conversation behaviours. Positive generalisation of gains was
recorded in a group meeting held in a different location (client lounge) led by two staff facilitators.

2.4.2 Individual (i.e. non-group) treatments

Finch et al. (2016) cite evidence from five individual treatment studies in their systematic review (Brotherton, Wisotzek and Milan, 1988; Giles, Fussey and Burgess, 1988; Kirsch, Shenton, Spirl, Simpson, LoPresti and Schreckenghost, 2004; O’Reilly, Lancioni and O’Kane, 2000; Sladyk, 1992). These are older studies comprising investigation into one-to-one therapy approaches that are impairment-directed. Five further individual treatment studies are also reported (Douglas, Knox, De Maio and Bridge, 2015; Douglas, Knox, De Maio, Bridge, Drummond and Whiteoak, 2016; Helffenstein and Wechsler, 1982; Radice-Neumann, Zupan, Tomita and Willer, 2009; Lewis, Nelson, Nelson and Reusink, 1988). Together, these studies tested a range of feedback techniques and strategies to achieve behaviour change. The two more recent studies (Douglas et al., 2015; Douglas et al., 2016) used a context-sensitive approach.

Helffenstein and Wechsler (1982) designed an RCT to investigate the efficacy of an interpersonal process recall approach (IPR). Sixteen recently injured participants (maximum years post-injury=2) were recruited in a hospital setting and randomly assigned to the intervention and control conditions. The structured intervention (20 hours) comprised video observation, immediate feedback, modelling and rehearsal, and required two clinicians to work with one patient (one as the communication partner and the second as an observer). The control intervention was described as individual sessions of ‘non-therapeutic attention’ in which feedback was not provided. In this study, the intervention was implemented by three clinical psychologists, one SLT and two counsellors. Independent assessors, blind to group, rated the participants from video samples using the Independent Observer Report Scale, developed for the study. The authors reported gains in communication skills and self-concept and a reduction in anxiety. There was no change in participant self-ratings of communication skills. These gains were maintained at follow-up (1 month). The investigators concluded that the quality of the feedback was the main strength of this
approach. A second study using video as a feedback tool in one-to-one therapy was conducted by Brotherton, Wisotzek and Milan (1988). These investigators used a single case series design (n=4; mean years post-injury=6) to test the efficacy of a social skills programme for severe TBI. The multiple baseline design comprised 32 individual baseline and intervention sessions delivered twice weekly for 1 hour. The intervention was structured, and delivery mechanisms comprised identification and modelling of target behaviours, opportunities for rehearsal, video feedback, homework and social reinforcement from family members. Behaviours were rated on a 3-point scale. Three participants demonstrated clear gains and maintained these at 1 year follow-up. The authors suggest that video feedback was a powerful ingredient of the intervention. Together, the strength of the evidence from these two early studies suggests that video feedback is a potent component of individually delivered therapy for impaired social communication skills.

Two further studies report on the benefits of video feedback in individualised therapy to address communication breakdown following severe TBI. Douglas et al. (2015) and Douglas et al. (2016) investigated the efficacy of a structured intervention for community-dwelling individuals to improve communication-specific coping skills (CommCope-I). The 12 hour individualised treatment programme was delivered by clinicians over 6 weeks. Delivery mechanisms comprised targeted strategy development, video feedback, involvement of close others and practice opportunities in context. Douglas et al. (2015) published evidence for single case efficacy (n=2). Douglas et al. (2016) employed a multiple baseline design to test the intervention on a larger group of individuals with severe TBI (n=13; average years post injury=7.6) and close others (n=7). Outcome measures comprised self-report and close other ratings of change on the LCQ, Communication-Specific Coping Scale-research version (CommSpecCS) and self-report ratings on the stress subscale of the DASS-21. An objective measure of strategy use was taken by an independent assessor using the Discourse Coping Scale, developed for this intervention. Douglas et al. (2015) reported excellent inter-rater reliability using this tool. Findings showed a significant improvement in communication strategy use, reported functional
communication skills and a reduction in reported stress. Gains were maintained at a 3 month follow-up. Video feedback was highlighted by participants and close others as a strength of the study, along with individualised strategy development and real-world practice opportunity with everyday communication partners. Although numbers were small and there was no control arm, this study demonstrated a number of methodological strengths. Four clinicians attended one 3 hour training programme prior to treatment delivery. A 6 week pre-intervention phase enabled identification of a stable baseline, increasing confidence in the attribution of change to treatment rather than chance. Independent assessors evaluated change on an objective outcome measure. Post-intervention, 1 month and 3 month follow-up measures followed the 6 week intervention period, and statistical analyses were well-documented.

Four early single case studies examined a range of face-to-face feedback strategies to improve social communication skills. Lewis et al. (1988) trialled three forms of behavioural feedback to address socially inappropriate comments with one participant with severe ABI (2 years post injury). This intensive therapy was delivered five times each day over 4 days each week for 2 minutes in unstructured conversations by three therapists. The authors found that corrective feedback was more effective than systematically ignoring the inappropriate comments. The third strategy, attention and interest, was least effective. Sladyk (1992) reported observed improvements in pro-social skills following a 58 day treatment programme for TBI (n=1). The programme comprised structured feedback from peers and staff in daily meetings at a rehabilitation facility, and therapeutic practice opportunities in small structured groups scheduled three times weekly. Outcomes were reported in a descriptive style, without formal evaluation or follow-up. Two studies investigated interventions for verbosity. Kirsch et al. (2004) employed a Personal Digital Assistant (PDA) to deliver a pre-recorded cue, ‘be brief’ (Kirsch et al., 2004 pp. 371), at 15 minute intervals to reduce verbosity following a moderate-severe TBI. This was a B-A-B single case design. The PDA cue was in place for 5 weeks, withdrawn for 7 weeks and in place for a further 6 weeks. Length of utterance was reduced but generalised behaviour change was not evaluated. Giles et al.
(1988) conducted an intensive intervention, spanning five 30 minute sessions per week over 1 month in a single case study of verbose speech in severe TBI. Multiple practice opportunities for over-learning and positive behavioural reinforcement were cited as key strategies in reducing the mean number of inappropriate words per minute in response to three different question forms. Gains were maintained at a 2 month follow-up, but transferability of gains outside the treatment setting was not assessed. These single case reports suggest that structured and corrective feedback, comprising prompts and positive reinforcement may be effective in remediating impairments, but methodological quality is variable and findings require a cautious interpretation.

O'Reilly, Lancioni and O'Kane (2000) employed a multiple-base line study to investigate the effectiveness of a problem-solving intervention to improve social communication skills in the workplace following TBI (n=2). One hour sessions were delivered twice weekly for an unspecified length of time by a psychology student. Two skills were targeted for each participant. The therapist modelled target behaviours and practice was provided through role plays between the participant and the therapist. Specific feedback was provided by the therapist. Generalisation probes were conducted by members of staff serving as job coaches. Improvements in selected skills were recorded for both participants. Gains were maintained in the workplace at the 6 week follow-up. However, generalisation effects need to be interpreted cautiously as the probes in the workplace were infrequent and assessors were not independent.

Radice-Neumann et al. (2009) conducted an experimental parallel group design to compare two interventions to address impaired emotion processing following severe ABI (n=19). The Facial Affect Recognition (FAR) intervention was delivered in two parts. Part I used a computer programme to train attention to visual features. Part II included individual sessions with a therapist to discuss emotional event scenarios. The Stories of Emotional Inference (SEI) intervention used social stories to train attention to contextual information. Both interventions were delivered for 1 hour, 3 times each week by trained therapists and completed in 6 – 9 sessions. Outcomes demonstrated improved skills in
both groups, with greater improvement reported from the FAR intervention. FAR participants showed improved emotion recognition from faces and an improved ability to infer emotion in hypothetical situations. SEI participants showed an improved ability to infer how they (but not others) would feel in a hypothetical context. These findings show that individuals with impaired receptive social communication skills can show improvements post-treatment but maintenance of skills and generalisation to different environments is untested.

In summary, this review of group and individual treatments indicates that, overall, gains in social communication skills can be achieved following intervention but the number of Level 1 studies is low. Previous authors have noted the remarkable consistency of these positive findings, despite the range of intervention content and approaches employed (Cassel, McDonald, Kelly and Togher, 2016). More recent studies target the context of the interaction and the provision of supports to modify the communication environment and thereby enhance communicative effectiveness through communication partner interventions. These will be reviewed in the next section.

2.4.3 Communication partner training

There have been a number of investigations into training for communication partners of people with ABI in recent years, comprising family, friends, carers and other professional groups. Wiltshire and Ehrlich (2014) cite evidence from four studies in their review of interventions to train conversation partners of people with TBI (Goldblum and Alant, 2009; Togher, Power, Rietdijk, McDonald and Tate, 2012; Togher, McDonald, Tate, Power and Rietdijk, 2013; Sim, Power and Togher, 2013). Wiltshire and Ehrlich (2014) acknowledge that Togher et al. (2012), Sim, Power and Togher (2013) and Togher et al. (2013) are all reports of findings from the same study, and evaluate the same participants and intervention. Only the primary study (Togher et al., 2013) has been included in this review. Two additional studies of communication partner training following TBI (Togher, McDonald, Code and Grant, 2004; Behn, Togher, Power and Heard, 2012) have also been included as examples of training for professional groups to facilitate the communication exchange.
Togher, McDonald, Code and Grant (2004) developed a training programme for police officers, designed to improve the quality of information exchanged in telephone service encounters with brain-injured individuals (n=20). This RCT compared the service encounters between trained and untrained police officers in conversation with individuals with TBI, and used a crossover design to control for the effects of familiarity. Training methods included multiple practice opportunities and role plays. The training was conducted over 12 hours (six weekly 2 hour sessions). A manual interaction analysis tool (Generic Structure Potential) was used to measure outcomes, and interaction transcripts were analysed by an assessor blind to group allocation. The outcomes demonstrated that training for the communication partners improved the structure and flow of the conversation, enabling the person with TBI to stay on track. Training with these components enabled information to be exchanged in a more efficient and effective manner.

Goldblum and Alant (2009) also investigated the efficacy of a service encounter training programme. This one-off training programme was designed to enable staff in a retail supermarket chain to identify the barriers and facilitators to service interactions where the customer has a communication impairment as a result of a TBI. Staff were randomised to a training group (n=31) and an untrained group (n=33). The 4 hour training intervention was delivered by an SLT, with assistance from a second SLT and a person with TBI. Questionnaires were used to compare findings from the groups. Results showed increased knowledge and confidence in the trained group. There were a number of methodological limitations to this study, including the use of an unvalidated questionnaire as the primary outcome measure. Further, there was no testing of reported knowledge or confidence in actual service encounters with people with TBI, or any follow-up evaluation.

Togher, McDonald, Tate, Power, Ylvisaker and Rietdijk (2010) developed TBI Express, a training programme for everyday communication partners, drawing on theoretical approaches in collaborative and elaborative interaction styles from the
work of Ylvisaker, Feeney and Urbanczyk (1993) and Ylvisaker, Sellars and Edelman (1998) and also social development learning theories. Togher et al. (2013) tested the efficacy of TBI Express in a non-randomised controlled trial (nRCT) across three conditions: groups of individuals with TBI and their communication partners; groups of TBI individuals only and a deferred treatment condition (n=44). The programme comprised a combination of group and individual sessions delivered weekly over 10 weeks (35 hours training in total). It followed a manualised training format, incorporating strategy practice, home practice and feedback. Outcomes were measured by blind ratings on the Adapted Measure of Participation in Conversation (MPC). Outcomes showed that a programme with these components more effectively demonstrated the competence of the person with TBI when they were trained with their communication partner than when they were trained alone. Results were maintained at a 6 month follow-up. A further RCT conducted by the same team (Behn, Togher, Power and Heard, 2012) investigated the benefits of similar training for paid carers and people with TBI in a long-term residential setting. Ten carers were randomised to a trained (n=5) or untrained (n=5) condition. The content was adapted from TBI Express (Togher et al., 2010), and delivered for a total of 17 hours over 8 weeks. Findings showed improved interactions between carers and individuals with TBI in structured, but not casual, conversations that were maintained at a 6 month follow-up. The results must be interpreted cautiously given the small number of carers trained. These studies suggest that training communication partners can potentially circumvent some of the difficulties encountered directly training individuals with impaired learning and self-regulatory capability following ABI, and is consistent with increasing participation in everyday social life.

2.4.4 Summary of findings

Overall, these group, individual and communication partner intervention studies for ABI/TBI show evidence of some benefit post-intervention but evidence of maintained gains is variable. Evaluation of skill transfer to environments outside of treatment settings was also variable and without this evidence, treatment effects are unclear. More fundamentally, social communication is a complex
construct and the interventions targeted a wide range of variables represented by the construct. At one end of the spectrum, interventions targeted a general profile of commonly experienced social communication impairments, as documented in their respective manualised social skills programmes (Appleton et al., 2011; Braden et al., 2010; Braunling-McMorrow, Lloyd and Fralish, 1986; Dahlberg et al., 2007; Finch et al., 2017; McDonald, Tate, et al., 2008; Togher et al., 2013). Two further studies targeted individualised communication coping skills (Douglas et al., 2015; Douglas et al., 2016). Didactic (versus interactional) training for pragmatic impairment (Ehrlich and Sipes, 1985), general conversation skills (Gajar et al., 1984; Goldblum et al., 2001; Sladyk, 1992) and workplace-specific social communication skills (O'Reilly, Lancioni and O'Kane, 2000) were also targeted. Togher et al. (2013) and Behn et al. (2012) investigated improved participation in conversation through training for everyday communication partners, and Togher et al. (2004) and Goldblum and Alant (2009) tested training programmes to improve participation in service encounters. Interventions for more specific expressive impairments targeted verbosity (Giles, Fussey and Burgess, 1988; Kirsch et al., 2004) and socially inappropriate comments (Lewis et al., 1988). Investigations into receptive impairments included emotion perception training (Bornhofen and McDonald, 2008a; Bornhofen and McDonald, 2008b; McDonald et al., 2013; Radice-Neumann et al., 2009). Two studies investigated combinations of intervention targets. These included self-regulation, psychosocial functioning and social communication skills (Ownsworth, Mcfarland and Young, 2000) and emotion perception and social communication skills (McDonald, Tate, et al., 2008). Further, treatment duration and numbers of sessions varied widely. Interventions were delivered in as few as 6 hours (McDonald et al., 2013) to as many as 48 hours (McDonald, Tate, et al., 2008). The delivery span ranged from 3 weeks (McDonald et al., 2013) to 16 weeks (Ownsworth, Mcfarland and Young, 2000). Sessions varied in intensity from one to five sessions each week.

A range of measures were employed to evaluate outcomes. Finch et al. (2016) speculate that this may reflect representation from the different health professions involved in the investigations. Outcome measures comprised
established, adapted, task-specific and home-grown pragmatic communication or social communication scales and questionnaires. In addition, measures of self-awareness (Braden et al., 2010; Ownsworth, Mcfarland and Young, 2000), psychosocial outcomes (Douglas et al., 2015; Douglas et al., 2016; McDonald, Tate, et al., 2008; Ownsworth, Mcfarland and Young, 2000), social integration (Dahlberg et al., 2007) and quality of life (Dahlberg et al., 2007) scales were included.

A lack of common outcome measures is cited as a limitation of social communication interventions in ABI (Togher, Wiseman-Hakes, et al., 2014). The need for increased standardisation in outcome measurement has also been identified in aphasia research, where development of a core outcome set (COS) is currently underway (Wallace, Worrall, Rose and Le Dorze, 2018). Inclusion depends on both the availability of validated instruments that reliably measure the construct under investigation and feasibility of use. Discourse measures, for example, were omitted from the first version of the COS for aphasia treatment trials because of the lack of available instruments and feasibility issues (Wallace et al., 2018). In a wider discussion of complex intervention outcomes in rehabilitation, Cameron (2010) cautions against applying measures of limited reach that favour a positive outcome at the expense of true measurement of the construct under investigation. Sohlberg and Turkstra, (2011) endorse this, citing examples from the literature where social communication intervention aims were unlikely to be achieved from positive change on a limited number of isolated behaviours.

GAS (Kirusek and Sherman, 1968) was used to measure the achievement of individualised goals in three studies in this review (Braden et al., 2010; Dahlberg et al., 2007 Finch et al., 2017). Struchen, (2014) highlights an advantage of individualised measurement methodologies over available standardised measurement tools in order to address floor and ceiling effects and lack of outcome measure sensitivity. These problems are rooted in the heterogeneity of the population where differences in aetiology and severity of injury on social communication skills impede comparison, not only because of the variable impact
on function but also because response to treatment is likely to be variable, making it difficult to confidently draw conclusions. The RCT is a study design well-suited to investigating a heterogeneous population but the number of fully powered studies is small, and randomisation has been comprised in larger studies by poor compliance and attrition (e.g. McDonald, Tate, et al., 2008; Togher et al., 2013).

The studies in this review fell into three categories: interventions with more specific impairment-based objectives, and context-rooted interventions that have a broader social communication skills remit. The third category, communication partner training initiatives (see Section 2.4.3), focused less on the individual profile of cognitive/behaviour impairment (and its impact on social communication) and more on ways to achieve positive communicative success in real-world settings. The influence of both the environment and communication partners on the communicative capabilities of people with ABI, continues to be an important area of investigation in order to improve social participation. This includes the ability to develop new social networks with peers. Peer learning models will be reviewed in the next section.

2.5 Peer-mediated social communication skills interventions

Griffiths, Houston and Lazenbatt (1995) describe a range of different peer learning models, spanning one-to-one formats (such as buddy systems or partnerships comprising more and less experienced peers working together) to collaborative group formats. Although these models can be applied in organised learning contexts, Boud (2001) observes that we continually learn informally (efficiently or otherwise) from other people in everyday life. Following ABI, individuals spend a lot of time together in rehabilitation, residential and day centre settings. Activity groups are commonly used in post-acute and community rehabilitation to provide opportunities for social interaction and social and leisure learning experiences (Gerber and Gargaro, 2015; Perna, Bubier, Oken, Snyder and Rouselle, 2004). Active participation has also been cited as a means to increase engagement (Brett, Sykes and Pires-Yfantouda, 2017). In a survey of in-patient activity group provision across 10 specialist brain injury rehabilitation
centres in the U.S. and Canada between 2008 and 2011, Hammond, Barrett, Dijkers, Zanca, Horn, Smout, Guerrier, Hauser and Dunning (2015) found that 48% of in-patients attended groups offering leisure activities and community outings. Content varied by treatment centre. These therapeutic recreation groups were seen as beneficial for vicarious learning opportunities. Perna et al. (2004) identified benefits of learning from modelling and reinforcement of behaviours displayed by others with similar impairments, increased confidence and self-esteem from sharing experiences and advising others in a shared situation, and the increased currency of peer feedback over therapist feedback. Individual or group control over the choice of activity is cited as a means to imbue meaning and secure engagement in the group purpose (Mitchell, Veitch and Passey, 2014).

Although activity groups are generally viewed positively as a means to develop socialisation skills with peers and enable social participation, evidence from studies that explicitly test these theories in in-patient rehabilitation settings is limited. Boud (2001) defines ‘peers’ in a peer-mediated relationship as individuals who are accepted as sharing the same status, without power over others by virtue of their role or position. This is important because some previous studies investigating peer mentors to facilitate social participation have recruited neuro-typical mentors such as family members or caregivers to provide peer support. The peer-mediated studies reviewed in the next section define peer mentoring as support from ABI mentors (who may have more experience or expertise) for ABI mentees.

2.5.1 Peer-mediated interventions in ABI

Two RCTs have investigated interventions to train ABI peers to provide social support as a means to facilitate social integration. Hanks, Rapport, Wertheimer and Koviak (2012) conducted an RCT to measure differences between a mentored TBI group (n=47) and their mentored caregivers (n=31) versus a control group of non-mentored TBI (49) and their non-mentored caregivers (31) on measures of community integration, emotional well-being, and quality of life. TBI participants (mild – severe) were recruited at the point of discharge from a
rehabilitation unit. TBI mentors were recruited for TBI participants and caregiver mentors for caregiver participants, under a contingent employment contract to compensate mentors as a means of securing commitment to the study. The project ran for up to 2 years. Mentor selection was based on staff ratings of social competence, openness to talking about disability, and motivation and commitment to participate. All mentors attended the same 20 hour training programme, and weekly one-to-one supervision was provided from a psychologist, nurse or community outreach coordinator. Meetings between mentors and mentees were encouraged to take place in person or by phone weekly for the first month, then bi-weekly for the next 2/3 months and subsequently monthly. The average number of contacts was five (range 1 – 66) and the majority were 5 – 15 minutes long. Findings indicated significant improvements in emotional wellbeing, quality of life and lifestyle measures for the intervention group. Mentored caregivers also reported significantly improved community integration outcomes. Increased levels of anxiety were also recorded in the mentored caregiver group, which the investigators suggest is indicative of increased awareness of problems post-TBI. An attrition rate of 20% was equivalent between the groups. This was a randomised study with an active control group, but there were a number of limitations which impede an evaluation of generalisability of reported effects. Dosage per individual was highly variable and, although training topics were specified, there was insufficient information on content to enable replication. Outcome measures comprised questionnaires and other subjective measures of change, and baseline measures were not recorded.

The second RCT specifically targeted social integration and social participation outcomes. Struchen, Davis, Bogaards, Hudler-Hull, Clark, Mazzei, Sander and Caroselli (2011) conducted a pilot study to test the feasibility of a peer training initiative to develop a social network for community dwelling individuals with TBI (n=12) compared to a waitlist control group (n=18). The intervention comprised socially established TBI mentors (median 6.2 years post-injury) and more recently injured peer partners (median 1.6 years post-injury) matched by geographical location, age, gender and interests. Selection criteria for peer
mentors comprised objective evidence of social participation, an interview with the research team to determine problem-solving capabilities, understanding of relationship issues and the role of a peer mentor, and satisfactory background checks and references. The mentors received two training sessions (4 hours in total) to support their peers to attend social activities for 3 months. A training manual was also provided, along with additional training sessions, as required. It was expected that the peer-mentor pairs would attend two peer-mentor social outings (minimum) each month. Networking was measured though questionnaires, interviews and social activity data at baseline (1 month), and post-intervention. Statistically significant changes in social activity and social network size were not found. Satisfaction levels were high for all participants but there was an increase in depressive symptoms. The investigators reported an attrition rate of 33% (50% losses from the intervention group). The small sample size (as a result of losses following randomisation) resulted in a low powered study. Findings were further confounded by the low treatment intensity (mean mentor-peer face-to-face contacts=1.5; range 0-4) indicating that no peer-mentor pair met the minimum of six contacts during the mentoring period.

Findings from these studies suggest that factors preventing participants achieving the per protocol intervention intensity targets require evaluation and subsequent protocol modification. Attrition and compliance issues also eroded sample sizes, biasing outcomes. Although both studies measured the effects of peer support, the outcome measures used reflect the differing social participation constructs targeted (the impact of social support on well-being and quality of life versus increased social functioning). Both studies investigated intervention feasibility with community-dwelling TBI populations. Neither study measured sustainability of gains. A peer-mediated intervention targeting social participation needs during in-patient rehabilitation has yet to be investigated.

Although evidence of feasibility for peer-supported interventions in ABI is limited, these studies suggest that peer-mediated treatments may hold promise as a means to directly address social participation needs following ABI. Peer-mediated interventions to improve social communication skills have previously
been investigated in education, and are an evidence-based practice standard for the treatment of children and young adults with autistic spectrum disorder (Wong, Odom, Hume, Cox, Fettig, Kucharczyk, Brock, Plavnick, Fleury and Schulz, 2014). Features from these interventions may have application to a peer-mediated model for ABI.

2.5.2 Peer-mediated interventions in education

Peer-mediated interventions in the education context largely employ typically developing children to model social interaction skills in natural settings to non-typically developing children. Neuro-typical peers are systematically taught strategies to engage their peer partners in social and learning opportunities in natural settings (Wong et al., 2014). Three systematic reviews of peer-mediated interventions for children and adolescents have been published in recent years. Findings from single case designs between 1978 and 2008 (n=42) were examined by Chan, Lang, Rispoli, O'Reilly, Sigafoos and Cole (2009) and between 2008 and 2014 (n=14) by Watkins, O'Reilly, Kuhn, Gevarter, Lancioni, Sigafoos and Lang (2015). Chang and Locke (2016) examined findings from experimental group interventions (n=5) published between 1996 and 2014. Intervention components fell into two categories: methods used to train peers and intervention methods implemented by those peers. Methods used to train peers included the following components: direct verbal explanation, discussion using guided questions to teach intervention concepts (e.g. generating topics for discussion), modelling, role play or practice, feedback and redirection where necessary to ensure implementation fidelity (Chan et al., 2009; Watkins et al., 2015). Direct pre-intervention social communication strategy training to participants and/or peers also featured in the later single case interventions reported by Watkins et al. (2015). Components common to peer implementation included peer initiation of an interaction, peer maintenance of an interaction through repetition, topic expansion and making requests, responding to interaction attempts, following the participant’s lead (Chan et al., 2009) and environmental modification to incorporate participant interests (Watkins et al., 2015). Group training methods included a didactic component, strategy training through modelling by the teacher trainer and role play/rehearsal with peers.
During peer implementation, teacher trainers were present to provide support and facilitation. Peers were typically selected in these studies by teacher nomination. Specified selection criteria included typically developing language and social skills, compliance with direction, a good attendance/availability record, teacher recommendation (Watkins et al., 2015) and high social status within the classroom (Chang and Locke, 2016). Outcomes measures across the studies spanned a range of social communication skill measures, but all of them included direct observational measures of social interaction. Overall, the majority of studies reported positive gains on post-intervention measures of social communication, but maintenance outcomes were not consistently measured and results were variable. In terms of methodological quality, of the more recent single case designs reviewed by Watkins et al. (2015) and the group studies reviewed by Chang and Locke (2016), 90% were rated strong or adequate. The earlier studies reviewed by Chan et al. (2009) were limited by an absence of fidelity measures in 91% of the studies, undermining confidence in the results.

The generally positive findings reported in these reviews suggest that a peer-mediated intervention may hold promise to improve social participation in ABI. The interventions comprised a range of components, suggesting that the model holds potential for versatile application. There are also commonalities with current best practice recommendations for context-specific and person-centred interventions for working with cognitive communication impairment (Togher, Wiseman-Hakes, et al., 2014).

2.6 Summary

Social communication skills deficits are some of the pervasive impairments following ABI (Sohlberg and Mateer, 2001). Their impact impedes re-integration into previous life roles and they are a barrier to the development of new social networks (Sander and Struchen, 2011). Interventions for social communication skills have targeted a wide range of communication constructs and delivery mechanisms, and findings have been largely positive but the number of high quality level 1 studies is low. Moreover, therapist effects have been shown to potentially disempower individuals with ABI as the relationship is not equal, and
the conversation style is not typical of conversations with familiar or unfamiliar people in everyday settings (Togher, Taylor, Aird and Grant, 2006). Peer-mediated interventions in education have demonstrated that training programmes designed for peers can facilitate improved social interaction skills in one-to-one or group settings. This approach holds promise as an intervention model to develop social interaction skills following ABI in an everyday environment with peers rather than a therapist. Chapter 3 describes the peer-mediated intervention developed for this study and its theoretical underpinnings.
Chapter 3 A peer-mediated intervention for social communication skills in ABI

This chapter describes the peer-mediated intervention evaluated in this study. It is a novel, complex intervention; these are defined by Medical Research Council (MRC) guidance as comprising multiple interacting components and behaviours, and involving some adaptation to context (Craig, Dieppe, Macintyre, Michie, Nazareth and Petticrew, 2008). In accordance with MRC guidance, the intervention theory is reported in Section 3.1. Section 3.2 describes the synthesis of these theoretical components into the intervention. Procedures for tailoring the intervention content to meet individual needs are also described.

3.1 The theoretical bases for behaviour change in ABI

The challenge for individuals following severe ABI is to learn to apply previously acquired knowledge and skills in different ways that take account of the changes in learning capability that follow complex injury. For clinicians designing therapy programmes, an understanding of learning theory therefore underlies sound rehabilitation practice. Hart, Tsaousides, Zanca, Whyte, Packel, Ferraro and Dijkers (2014) observe that rehabilitation research is not routinely embedded in explicit learning models and further, that neurorehabilitation more generally lacks an overarching treatment theory. Hart and Powell (2011) suggest that one reason for this may be the multiplicity of models employed by its multi-professional practitioners. Whyte (2008) looked to the World Health Organisation’s International Classification of Functioning (ICF) framework for an organising theory of enablement (WHO, 2001), but concluded that this taxonomy cannot provide a unifying theory for rehabilitation practice that adequately defines the changes and relationships between each of its component domains (body function and structure, activities, participation, environmental and personal factors). However, there are theoretical perspectives that address the learning principles that facilitate behaviour change at different levels of the ICF. At the body function and structure level, theories of neuronal reorganisation after ABI have implications for instructional learning at the impairment and activity levels, and social development theories, including an apprenticeship model, provide a
framework to facilitate learning at the level of participation. These are discussed in the following sections.

3.1.1 Neuronal reorganisation following ABI

There is now substantial evidence to indicate that mechanisms that harness neuronal plasticity following brain injury include behavioural experience, and both quantity and quality of structured inputs (Nudo, 2013). Kleim and Jones (2008) synthesized neuroscientific research to draw up a framework of theoretical principles that underlie the capacity of the central nervous system to adapt following brain damage. They define neural plasticity as the mechanism through which the brain learns in response to new experiences. In the same way that reorganisation occurs in healthy brains in response to new learning from experience, so the damaged brain will learn or re-learn new or compensatory behaviours and skills in response to experience, with or without the stimuli provided by rehabilitation. This may result in an adaptive (or maladaptive) functional outcome. The 10 principles of experience-dependent plasticity (Kleim and Jones, 2008) that are relevant to rehabilitation in ABI are defined as follows:

- Use it or lose it (neural circuitry that is not in use will degrade over time)
- Use it and improve it (neural reorganisation can be induced through training of skills over time)
- Specificity (the type of training experience predicts the degree of behaviour change)
- Repetition matters (homeopathic doses are not sufficient to induce lasting neural change)
- Intensity matters (sufficient intensity needs to take account of the adverse effects of under and over use on functional outcome)
- Time matters (the effects of plasticity-induced change may be time dependent)
- Salience matters (the saliency of the experience is likely to influence the neuro-plastic response)
- Age matters (plasticity processes are more responsive in younger brains)
- Transference (plasticity-induced change in one area of neural circuitry may promote plasticity in others)
- Interference (plasticity-induced change in response to one training experience may be detrimental to the acquisition of other skills)

Kleim and Jones’ (2008) principles addressed the rehabilitation of motor skills. Sohlberg and Turkstra (2011) applied the principles to cognitive rehabilitation, where direct instruction and strategy instruction have strongly influenced neurorehabilitation practice. They identified three instructional approaches used in cognitive rehabilitation, each drawn from different theoretical models but sharing a requirement for structured techniques to facilitate learning. Restorative approaches are designed to remediate the impairment (e.g. drill-based attention training), compensatory approaches are designed to provide strategies to maximize function by circumventing the impairment (such as external aids for communication or memory, for example), metacognitive approaches target reduced awareness of deficits through strategies to improve self-monitoring and self-regulation. Sohlberg and Turkstra (2011) mapped these instructional design and delivery principles onto Kleim and Jones’ (2008) framework. This is summarised below (Kleim and Jones’ principles are listed in brackets).

Design principles:
- Context-specific skill acquisition, where both stimuli and context match the target task (specificity)
- A limited number of learning targets to maximize salience (interference)
- Personally relevant and meaningful learning targets to maximize salience (salience matters)
- Regular evaluation of progress, to take account of change potential in acute and chronic stages (time matters)
- Flexible intervention design to accommodate the individual’s adaptive capability. Modulating factors include age and stage of recovery (age matters)
Delivery principles:

- Gains need to be maintained over time or they will be lost (use it or lose it)
- Train specific and functional skills (use it and improve it)
- Practice requires multiple repetitions (repetition matters)
- Intensive practice harnesses plasticity (intensity matters)
- Gains secured from achieving one treatment target can promote the acquisition of similar skills (transference)

These guiding principles serve as a useful framework for rehabilitation research, but the type, quantity, quality and timing of stimulation that might harness plasticity awaits systematic testing. For example, early animal studies showed that enriching an environment through the provision of social contact with others increased synaptic connections (Robertson and Murre, 1999) but the factors that constitute environmental enrichment in the general human population is unclear. It is also not clear which specific inputs optimize learning or how they should be applied in a heterogeneous population such as ABI, where the efficacy of different intervention approaches is likely to be influenced by a range of variables including injury type and severity, the task and the environment.

One example of this is the potentially differential learning effects of explicit and implicit learning approaches. Explicit (or declarative) learning approaches require conscious learning and retrieval of information, and implicit (or procedural) learning involves acquisition through unconscious learning or modification through experience. Sohlberg and Turkstra (2011) argue that the clinical decision to use either explicit or implicit learning strategies in a therapy programme will depend on the individual’s declarative memory and executive skills. Neural structures responsible for explicit learning appear more vulnerable to injury than those associated with implicit learning (Skidmore, 2015). Declarative memory impairments can impede new learning. The traditional approach has been to circumvent opportunity for error by using procedural approaches that build automaticity through repetition without conscious effort. This bottom-up errorless approach may be effective for multi-step routines where
skill transfer is not required, but in complex tasks (such as social communication) explicit and implicit learning are inextricably linked. For example, intentional listening for facts or instructions in a group meeting requires explicit learning but the co-operation required to share opinion is learned implicitly. Importantly, the way in which these learning approaches are applied in intervention delivery can shape the outcome. Skidmore (2015) cites evidence from a stroke study (Boyd and Winstein, 2004) to show that explicit instructions delivered at the outset can impede the formation of a motor plan, which the authors ascribe to increased demand on working memory inhibiting procedural learning. Skidmore (2015) summarises the current evidence to suggest that explicit and implicit learning approaches compete for limited cognitive resources, although optimal learning may comprise a balance of both approaches. The use of implicit approaches alone may build a dependency on external cues that impedes skill transfer to a different context, and the sole use of explicit approaches may reduce implicit learning capability.

An example of an intervention study employing both learning approaches is described by Schmidt, Fleming, Ownsworth and Lannin (2012). The intervention used metacognitive strategy training to improve self-awareness on a meal preparation task. TBI participants (n=54) were randomised into three post-intervention feedback conditions: video plus guided verbal feedback, guided verbal feedback but with no video footage, and no feedback. Participants prepared a meal on four occasions. Clinicians used a metacognitive (pause, prompt, praise) technique, enabling participants time to self-correct before intervening with a prompt (i.e. an explicit approach). Task repetitions provided opportunities for implicit learning. In the video plus verbal feedback condition, participants and therapist reviewed the film together. Participants were encouraged to watch for errors and generate compensation strategies to apply in the next session (i.e. an explicit learning approach). Discrepancies in ratings were discussed in a non-confrontational manner. In the verbal feedback condition the same principles were followed but without video review. Mean reduction in errors for the video plus verbal feedback group was 70.7%, for the verbal feedback group 20.7%, and the experiential (i.e. no feedback) group
37.6%. These findings showed increased online awareness as a result of self-observation with guided feedback. The use of video feedback was not associated with increased distress. Further, the authors cite the outcomes for the experiential group as indicative of the effectiveness of metacognitive strategy intervention.

Traditional social communication skills programmes using explicit learning approaches to train competency in the person with ABI alone have been cited as ineffective. Ylvisaker, Turkstra and Coelho (2005) concluded from a review of meta analyses of social skills training interventions in TBI, learning disability and emotionally and behaviourally disturbed populations, that high quality evidence for socially meaningful training effects from decontextualized intervention programmes is low. This suggests that change at the ICF level of participation requires consideration of a different set of theoretical frameworks, because social communication competency is influenced by the interactive effects of other people and the environment. Social learning and development theories are reviewed in the next section.

3.1.2 Social learning and development theories

The social learning and development theories provide important insights into mechanisms for new learning and behaviour change, with application to rehabilitating social communication skills for everyday life. These theories view learning as a social process, where behaviour change is explained by reciprocal interactions between the learner and their social environment. They include three important propositions for behaviour change in ABI: that learning collaboratively with peers may be the optimal environment in which to develop new skills and strategies, that learning occurs through observation of others, and that learning may occur incidentally rather than as a result of planned intent.

Collaborative group learning and learning with peers have previously been identified as effective mechanisms for change in education (Senior and Howard, 2014) and rehabilitation (Standal and Jespersen, 2008). Lave and Wenger (1991) defined learning as a product of social participation rather than the outcome of acquired propositional knowledge alone. This interpretation views
learning not as a one person activity, but mediated by the perspectives of all participants in the learning context, and social interaction as the mechanism through which the learning takes place. Vygotsky (1978) highlighted the importance of dialogue for cognitive change, arguing that social learning precedes cognitive change. Vygotsky’s theories were largely developed in the child education forums of the 1930s but his ideas have subsequently been further interpreted and expanded. For example, Damon (1984) describes the co-operative quality of peer encounters, enabling an exchange of ideas between equals. He draws on the theoretical writings of Vygotsky’s contemporaries, Piaget and Stack Sullivan, to further elucidate the benefits of peer interaction on learning: peers speak to each other directly, and in ways that can be easily understood, they learn from each other through collaborative effort, and can give and share corrective feedback that may be acted upon more positively than feedback from a teacher or clinician.

Vygotsky also advocated using a peer tutor as an alternative model for learning. A peer tutor is defined as a more advanced peer who provides a scaffolded learning opportunity to a less able peer (Vygotsky, 1978). Learning within this model is theorized to take place in the ‘zone of proximal development’ (ZPD), defined as the distance between actual skills and potential capability when working collaboratively with more advanced peers. However, the required difference in capability between the advanced peer and the tutee is not clear. Mugny and Doise (1978) compared peer pairs (comprising a more and a less advanced peer) using either the same or different cognitive strategies to complete a task. Findings showed evidence of benefit for both peers in tasks that required co-operation to resolve differences in approach, suggesting that collaborative working facilitates learning for both parties. The peer tutor model has been tested in educational settings as an instructional strategy (repetition of key concepts) to supplement teacher-led activity and improve academic outcomes. A meta-analysis of single case studies between 1966 and 2011 (n=26 for 938 participants) showed a moderate to large effect size at primary and secondary level, with emotionally and behaviourally disordered students benefitting most (Bowman-Perrott, Davis, Vannest, Williams, Greenwood and
Parker, 2013). However, peer tutor support to practise rote learning is not the same as developing reasoning skills for social competence. These skills may best be developed through collaborative approaches (Damon, 1984). However, the mechanisms to enhance peer learning through collaboration require clarification.

The concept of vicarious learning was first used by Bandura (1962) in the context of behavioural learning via video, and may be defined as social learning from an observed situation, in the absence of direct interaction, overt performance or direct reinforcement. Bandura (1971) contrasts this indirect form of learning to theories such as operant conditioning, in which new behaviour is learnt and reinforced through directly experienced consequences. Bandura argues that complex behaviour (including novel forms that are dependent on social cues) can only be learned through observation of example. Importantly, the speed of behaviour acquisition can be increased through the provision of appropriate models of behaviour. Rosenthal and Bandura (1978) define modelling influences as the example of another person or people, with or without additional features from the environment which may be more or less compelling (e.g. individuals keeping to a footpath and a ‘keep off the grass’ sign on the lawn). In situations where there are multiple models, Bandura suggests that observers will draw on behavioural features from different models rather than select and imitate behaviours solely from one model.

Rosenthal and Bandura (1978) identify four distinct effects of modelling influences on observers. Firstly, observational learning effects are defined as the acquisition of new behavioural patterns that were previously not present in the behavioural repertoire or not available in usable form. Secondly, inhibitory and disinhibitory effects are defined as a strengthening or weakening of a response or changes in response frequency within the behavioural repertoire. Thirdly, response facilitation effects refer to the priming stimulus of the model. Rosenthal and Bandura specify the subtle behavioural configurations that can be elicited through sensitive facilitation. For example, one person talking about a holiday experience is likely to provoke others to share their experiences. Bandura suggests that a plausible goal in social learning and development may
include sensitive cueing and elicitation to draw out the best in the pre-existing behavioural repertoires of others. Finally, modelling effects include a response to these new standards of social performance such that the individual is guided to independently regulate their own social behaviour.

Bandura (1971) provided a four-stage model to describe the components of observational learning. Firstly, attention to the modelled behaviour will be influenced by its personal relevance to the observer, the observer’s level of arousal, and the ability to interpret meaning from the modelled behaviour. Secondly, retention includes representational retention capability (e.g. from visual information or the language to be used for mental rehearsal). Thirdly, reproduction of the representation requires overt practice and repetition. Rosenthal and Bandura (1978) identify the integrative capability of social learning techniques as central to learning and reproducing complex behaviour patterns because they are modelled and practised as integrated sequences. The final component is motivation, to enable consolidation of learning. Findings from the application of these theories to neurorehabilitation are beginning to emerge.

Oouchida, Suzuki, Aizu, Takeuchi and Izumi (2013) identified a growing body of literature reporting positive findings from action observation treatments, in which behaviour patterns are modelled, and the learner observes and then imitates the movement. Action observation therapies have been investigated in the treatment of motor deficits in stroke patients with aphasia (e.g. Bonifazi, Tomaiuolo, Altoe, Ceravolo, Proviniali and Marangalo, 2013), cerebral palsy (Buccino, Arisi, Gough, Aprile, Ferr, Serotti, Tiberi and Fazzi, 2012) and Parkinson’s disease (see Caligiore, Mustile, Spalletta and Baldassarre, 2017, for a review). The neural mechanisms underpinning these effects are thought to involve the mirror neuron system. The same neural systems are activated when actions are observed as when they are executed. It is claimed that these systems are responsible for understanding both the goal and the intention of the movement which underpin the ability to learn by imitation (Acharya and Shukla, 2012; Rizzolatti and Craighero, 2004).
Although the potential application of these observational learning theories to ABI appears intuitively compelling, theories of experience-dependent plasticity suggest that regular and active practice with other people is required to improve social competence following brain injury. According to social development theorists Lave and Wenger (1991), learning takes place through active social participation within a community of practice, which requires more than incidental conversation on a topic of shared interest. To be a community, a group of people need a domain of practice and opportunity to build relationships that enable regular social interaction and learning over time. This includes collaborative creation of a repertoire of stories, experiences and other artefacts that shape the identity of the group. Lave and Wenger (1991) cite the example of Alcoholics Anonymous as a community of practice, whereby shared histories and stories enable a reconstruction of identity. Language and social interaction are important tools, but it is the community of practice that provides the resource for incidental learning about the rules of discourse (as opposed to direct instruction for socially appropriate behaviour for that setting). In this context, motivation to participate is theorized to be an incentive for learning.

These social development theories share common themes with current treatment recommendations for developing social communication skills in ABI. They include setting individualised treatments into meaningful, real-world contexts to address everyday communication needs (MacDonald and Wiseman-Hakes, 2010; Togher, Wiseman-Hakes, et al., 2014). The origins of these approaches can be found in the work of Ylvisaker, who developed his ideas from a range of philosophies, paradigms and social development theories into detailed approaches for working with people with brain injury. These are broadly described for this review as an apprenticeship model and discussed in the next section.

3.1.3 The apprenticeship model

Traditional models of intervention for social communication skills in ABI have largely been drawn from programmes developed for different clinical populations. According to Ylvisaker (2006), they typically comprise training to increase knowledge of social rules and practice in the procedural routines to perform
them, and are delivered in decontextualized training settings. However, there is a relationship between behaviour regulation following ABI and social communication skills, in that poor social interactive competence as a result of cognitive impairment is less a disorder of social skills knowledge and more a question of poor behavioural control (Ylvisaker, Turkstra and Coelho, 2005).

Moreover, the transfer of any improved behavioural control demonstrated in decontextualised training settings to real-world environments cannot be assumed. Automatic generalisation is the exception for individuals with impaired executive skills and declarative memory (Turkstra, Coelho and Ylvisaker, 2005). These individuals are typically unable to participate effectively in non-routine social interactions where skills need to be flexibly applied.

Ylvisaker and Feeney (2009) used the term apprenticeship model to describe a rehabilitation approach that employs techniques and strategies to support positive participation within real-world activity. Ylvisaker, Jacobs and Feeney (2003) draw on a scaffolding metaphor (from Wood, Bruner and Ross, 1976) to describe the integration of tailored strategies and supports that engage a learner, and facilitate participation in activities of personal relevance in a combination that ensures success. The apprenticeship model mirrors the components of a trade apprenticeship, by providing full support at the outset (through task modelling and a repertoire of strategies to build skills) and gradually reduces supports over time as skills increase, in order to build task independence. Rather than following contingency management principles to modify specific behaviours, guided participation within meaningful activities is designed to enable success in situ using antecedent supports (Ylvisaker, Jacobs and Feeney, 2003). The components of this approach include self-coaching, and training in real-world settings using project-based learning. These are outlined below.

Ylvisaker (2006) describes the principles of self-coaching as a method of behaviour modelling and regulation. This approach comprises self-regulatory or self-talk scripts associated with personally compelling metaphors of admired individuals who encapsulate the aspirational values of the person with ABI (e.g. self-coaching to become a Michelle Obama kind of a person, or a Bob Geldof kind of a person). Ylvisaker acknowledges the influence of Interacting Cognitive
Subsystems (ICS) as the framework for this approach (Barnard, 1999; Teasdale and Barnard, 1993). This information processing theory contrasts the literal semantic informational meanings stored in propositional code with the more abstract affective meanings stored in implicational code. Ylvisaker advocates tapping into implicational codes to develop a method to shape positive strategic behaviour (e.g. thinking of oneself as someone who looks out for other people, or who sees the best in others). The development of self-talk scripts, embedded in the metaphor, are recommended to meet the identified interaction goal in the target environment (e.g. what would Michelle Obama say in this situation?).

Ylvisaker acknowledges the need for multiple practice opportunities to build automaticity, and advises use of video to build self-awareness and self-monitoring skills. Douglas, Knox, De Maio, Bridge, Drummond and Whiteoak (2016) incorporated these principles into a novel 6 week context-sensitive social communication skills intervention for severe TBI (n=13), and reported significant improvements on subscales from the Communication-Specific Coping Scale (research version) (Douglas et al., 2016), the La Trobe Communication Questionnaire (self-report) (Douglas, O’Flaherty and Snow, 2000), and the stress scale from the Depression, Anxiety and Stress Scales (DASS-21) (Lovibond and Lovibond, 1995).

Ylvisaker also elaborates on the nature of the relationship between staff and participants using the apprenticeship model, where the transfer of control away from the therapist to the person with ABI has been proposed as pre-requisite to collaborative working (Ylvisaker, Feeney and Capo, 2007). A positive interaction style is at the core of the approach, comprising a therapist manner that demonstrates respect through active listening, a calm demeanour, a positive outlook, and a willingness to finding common ground (Feeney and Capo, 2010; Ylvisaker and Feeney, 1998).

A key feature of the apprenticeship model is that the intervention is context-sensitive and learning takes place in situ. Ylvisaker et al. (2003) contrast the features of a traditional impairment approach, in which the goal is to restore an impaired cognitive function in a clinic setting (followed by the introduction of a
compensatory strategy if the restoration of the impairment is unsuccessful) with a context-sensitive approach, where the goal is to enable participation in a chosen real-world and person-specific activity. The approach does not preclude the use of compensatory strategies to reduce activity limitation or the use of internalized strategies to address impairment limitation, but these would be tailored for the target activity and environment to support participation. Critics might suggest that this limits opportunity for skill transfer. Ylvisaker et al. (2003) argue that this has already been limited by a compromised ability to adapt to novel situations and to think clearly under pressure. Therefore, contextualized interaction practice to develop context-specific interaction habits is an indicator of effective rehabilitation practice following brain injury (Ylvisaker et al., 2003).

Ylvisaker and Feeney (2009) acknowledge the sociocultural perspective of Vygotsky, and Lave and Wenger, as influential in facilitating learning through participation because it recognises the interconnectedness of cognitive capabilities for successful task completion. They advocate embedding participation into activities and settings of personal relevance using group project-based learning methods. Ylvisaker, Feeney and Capo (2007) theorise on the potential benefits of the group project method, identifying it as a motivating context to address complex cognitive, behavioural and social interaction needs, and to facilitate learning through collaboration with others over time. Projects are designed to achieve a productive and meaningful goal, and increase a sense of personal competence by placing the individual into an expert role. Examples include: rebuilding a children’s playground, producing a manual for people who cannot read, a political debate group (Feeney and Capo, 2010), and developing a staff training video (Ylvisaker, Feeney and Capo, 2007). Features common to each project include a concrete or measurable product that is considered useful or helpful for others (so that participants work as producers rather than consumers of a service), a duration of weeks/months for completion (so the project is integrated into the person’s medium-term routine), the use of strategies/supports for planning, organisation and recall (to allow independence and a sense of control), provision of a positive context for collaborative effort, social interaction, and self-regulation.
Feeney and Capo (2010) and Ylvisaker and Feeney (1998) provide case illustrations of individual participant gains from project-based learning but the model awaits empirical testing for evidence of effectiveness to treat social communication impairment. However, there is evidence to indicate that individuals can show increased social communication capability in a defined expert role. Togher (2000) compared the information giving skills of individuals with severe TBI to matched controls with spinal cord injury (n=14; mean years post-injury=12.56) as part of a community driver awareness programme. No significant difference was found between the two groups. There is also evidence to indicate that in a passive role or where there is a power imbalance (e.g. between therapist and client) capability can be reduced (Togher, Hand and Code, 1997), suggesting that the expert role is a variable influencing outcome.

3.1.4 Summary

This section has examined theoretical components to facilitate new learning following ABI. These include theories of neuronal reorganisation and their implications for instructional learning, and social learning and development theories that take account of the influences of the social environment on learning. The social learning and development theorists view learning as a social process, and this section has encompassed a review of peer learning models (Vygotsky, 1978), observational learning theories originating in the work of Bandura (1971), learning through social participation within a community of practice (Lave and Wenger, 1991) and the apprenticeship model, an approach designed to enable learning through positive participation in real-world activity (Ylvisaker and Feeney, 2009). Components from these theories have been integrated into the peer-mediated intervention model tested in this study, and described in the next section.

3.2 The peer-mediated intervention

The following sections provide an overview of the peer-mediated intervention designed and tested during this study. The intervention involved peer facilitation of a project-based activity in which participants collaborated as members of an
expert committee without staff present. Table 3.1 summarises the rationale and core components of the intervention, specifically the peer facilitator training and the protocol for group meetings. The structure follows the format of applicable items from the Template for Intervention and Description Replication (TIDieR) guidelines for accurate reporting of interventions with sufficient detail for replication (Hoffmann, Glasziou, Boutron, Milne, Perera, Moher, Altman, Barbour, Macdonald, Johnston, Kadoorie, Dixon-Woods, McCulloch, Wyatt, Phelan and Michie, 2014). References are provided for context, along with worked examples for each component of the approach. The following sections provide an overview of the approach. This description ensured consistency of delivery over the pilot and main phases of the study.

3.2.1 Intervention description, rationale and content

The purpose of the intervention was to enable a peer to successfully facilitate an ABI group discussion in order to improve the social communication skills of the group participants. A project-based approach was chosen to enable the ABI group to work collaboratively together on a meaningful common goal that drew on participant expertise, and simultaneously provided multiple practice opportunities to develop social interaction skills. The group was set up as an expert committee. Members discussed topics associated with their rehabilitation without staff present, and with the option of providing feedback or recommendations to the management team in the study setting. Group meetings were designed to enable active social participation within a community of practice (Lave and Wenger, 1991), and incorporated principles described in the apprenticeship model (Ylvisaker and Feeney, 2009).

3.2.2 Group meetings

The group met twice a week for 8 weeks in order to provide sufficient intensity and frequency of practice to facilitate behaviour change. Discussion was facilitated by an ABI peer. Environmental supports were in place to manage the task demand and cue positive behaviour (Ylvisaker and Feeney, 2003; Ylvisaker et al., 2007). Supports included a meeting set-up consistent with an executive-style committee, comprising high quality stationery and bottled water to shape
behavioural and task expectation, name plates to enable personalised interaction and reduce reliance on memory, and a meeting agenda to provide structure. See Table 3.1 for details.

3.2.3 Peer facilitator selection and training

Defining appropriate selection criteria for the peer facilitator was critical to ensuring effective delivery. The peer-mediated interventions in ABI in Section 2.5.1 selected peer partners for provision of social support on the basis of geographical location, age, gender and interests. A peer-led intervention designed to facilitate group social interaction is without precedent in the ABI field, and selection of the peer facilitator drew on criteria identified in the education interventions (Section 2.5.2). These comprised staff recommendation, motivation to regularly attend, an ability to understand and engage with the training concepts and also the degree of social regard in which the peer was held by others.

A one-to-one training model was chosen to train the peer to facilitate interaction between participants in order to enhance the benefits of vicarious learning theorised to take place when peers work collaboratively together. The peer-training was delivered by the SLT researcher, an SLT with more than 10 years experience working with communication impairments following ABI. Peer training was delivered over 16 hours across 4 weeks and was consistent with principles of experience-dependent neuroplasticity for new skill acquisition (Kleim and Jones, 2008). See Table 3.1 for full details.

3.2.4 Tailoring

Methods to train the ABI peer facilitator drew on Sohlberg and Turkstra’s (Sohlberg and Turkstra, 2011) design and delivery framework for cognitive rehabilitation adapted from Kleim and Jones (2008), whereby a small number of highly relevant learning targets and context-specific stimuli, flexibly applied to match the learner’s capability, were used to maximize salience. The components of this individualised learning framework included the use of a personally relevant metaphor (Ylvisaker and Feeney, 2000) and self-talk strategies (Ylvisaker, 2006)
for independent behaviour regulation. Procedures for strategy learning (described by Sohlberg and Turkstra, 2011) were tailored to the peer facilitator’s cognitive profile of strength and need. Tailoring also included the option of further staff supported practice outside of the training sessions, as required. The programme was intensive and opportunities for repetition were built in through the use of role play and rehearsal (Ylvisaker, 2006) to enhance the learning response. A combination of structured top-down learning opportunities, task repetition for procedural learning and environmental supports to facilitate direct transfer into the group setting were also included. These are features of metacognitive strategy training, an approach recommended to treat cognitive communication disorders (Togher, Wiseman-Hakes, et al., 2014). Video clips from the group meetings were used for feedback and reflection. The use of video has previously been shown to be effective in improving self-awareness in ABI (Schmidt et al., 2012) and has been identified as a strength in previous social communication skills interventions (Brotherton, Wisotzek and Milan, 1988; Douglas et al., 2015; Douglas et al., 2016; Helffenstein and Wechsler, 1982).
Table 3.1 Description of the peer-mediated intervention using TIDieR template

<table>
<thead>
<tr>
<th>TIDieR template item</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name/description</td>
<td>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</td>
<td></td>
</tr>
<tr>
<td>Rationale and content:</td>
<td>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:</td>
<td></td>
</tr>
<tr>
<td>• Group meetings</td>
<td>Set up for an executive-style committee to discuss issues associated with brain injury rehabilitation</td>
<td>Ylvisaker, Feeney and Capo (2007)</td>
</tr>
<tr>
<td></td>
<td>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</td>
<td>Ylvisaker, Jacobs and Feeney (2003)</td>
</tr>
<tr>
<td></td>
<td>Modifications to the environment provided positive behaviour supports to shape target behaviours (see Item 3 equipment/materials)</td>
<td></td>
</tr>
<tr>
<td>• Peer facilitator selection and training</td>
<td>Selection of the peer facilitator based on observation of positive social behaviours (e.g. a confident communicator, respectful of others’ opinions); recommendation from a knowledgeable other</td>
<td>Ylvisaker, Sellars and Edelman (1998)</td>
</tr>
<tr>
<td></td>
<td>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</td>
<td>Ylvisaker, Feeney and Capo (2007)</td>
</tr>
<tr>
<td>Use of metaphor to establish a positive role identity that matches the individual’s perceived sense of self</td>
<td>Ylvisaker (2006)</td>
<td></td>
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<td>---</td>
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<tr>
<td>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</td>
<td>Ylvisaker and Feeney (2000)</td>
<td></td>
</tr>
<tr>
<td>Strategy design and development based on the individual profile of cognitive-linguistic, physical and sensory capabilities, and psychological status</td>
<td>Sohlberg and Turkstra (2011)</td>
<td></td>
</tr>
<tr>
<td>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</td>
<td>Schmidt et al. (2012)</td>
<td></td>
</tr>
<tr>
<td>Use of self-talk strategies, scripts and role play for rehearsal</td>
<td>Ylvisaker (2006)</td>
<td></td>
</tr>
</tbody>
</table>

- **Core principles and procedures of the peer facilitator training:**

<table>
<thead>
<tr>
<th>Sessions 1 – 4</th>
<th><strong>Elicitation of a personally compelling metaphor</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>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</td>
<td>See Ylvisaker, McPherson, Kayes and Pellett (2008) for a full explanation and worked example of metaphor creation</td>
</tr>
</tbody>
</table>
| 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) 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) | **See Ylvisaker (2006) for procedures** |
| **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                                      | • 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  
| Morning of groups                                   | • 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  
| 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 Appendix 6 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) 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) for procedures for delivering tailored and context-sensitive treatments  
See Sohlberg and Turkstra (2011) for procedures for individual training plans for strategy learning in cognitive rehabilitation |
3.3 Summary

This chapter has described the peer-mediated intervention evaluated in this study and its theoretical foundations. Specifically, these comprise principles of neuronal reorganisation following injury and models of social learning and development, and their impact on new learning in ABI. The intervention purpose was to train a peer to facilitate the group in order to improve the social interaction skills of the group participants.

The ability of this study to demonstrate evidence of change as a result of this novel peer-mediated intervention depends on an outcome measure with sufficient sensitivity to capture change in group interaction behaviours over time. The INCOG guidelines for cognitive communication recommend measurement of social communication outcomes at the level of participation in real-world settings (Togher, Wiseman-Hakes, et al., 2014). The limitations of the available outcome measures for social communication skills were discussed in Chapter 2. Problems include floor and ceiling effects and lack of measurement sensitivity to the constructs under investigation. As a result, the INT, a measure of group interactional behaviours, using social network analysis approaches, was developed for this study. Chapter 4 presents the INT and its theoretical underpinnings, to illustrate the rationale for the design and development of this tool.
Chapter 4 Measuring outcomes using social network analysis

This chapter examines the applicability of social network analysis (SNA) approaches to group intervention outcomes for social communication skills. Section 4.1 reviews the literature from three selected fields: language change, health behaviour and group meeting behaviour. Section 4.2 describes and illustrates the Interaction Network Tool, an SNA tool devised to measure social communication group outcomes for this study. A statistical measure through which to interpret findings is described and illustrated in Section 4.3. Section 4.4 presents a summary of findings.

Social network investigations evaluate patterns of interaction between network participants. Social network analytical techniques examine the structure of these interconnecting relationships (Wasserman and Faust, 1994). Analysis tools measure structural network properties such as overall network cohesion, the strength of the ties between participants, identification of network leaders or more peripheral participants. Findings are typically represented as visualisations of connections, using diagrams, maps or graphs. These network models enable evaluation of interaction patterns in situ and over time.

An ecologically valid measure of social communication effectiveness encompasses evaluation of interaction patterns or relationships in a real world social setting. A perspective that views the group social environment as an interdependent network potentially holds promise as a measurement approach. This contrasts with more traditional measures that chart change in the discrete skills of each participant, independently of the environment and of others. Social network theories and analysis techniques have been used across multiple academic fields and research contexts. Their application to the field of social communication skills in ABI may allow identification and measurement of communication behaviour change in functional settings.

4.1 Social networks literature review

The earliest application of SNA to investigate group influences on social communication behaviour was in the field of psychiatry. Moreno (1934) used a
quantitative method for measuring social relationships, known as sociometry. He used sociograms to illustrate the structure of friendship groups from observation and questionnaire data, in which individuals were depicted as points on a graph and relationships as lines between them. The concept of sociograms was developed in subsequent decades by the application of matrices and graph theory (Quatman and Chelladurai, 2008). Advances in visualisation tools enabled simultaneous analysis of individual interactions within the context of a group network (Cartwright and Harary, 1956). SNA tools and approaches have developed in different ways across different fields of investigation (Borgatti, Mehra, Brass and Labiance, 2009). The following sections review SNA approaches used in language change, health behaviour and small group interaction behaviours. Findings relevant to the measurement of social communication skills in ABI will be summarised at the end of each section.

4.1.1 Language change

In socio-linguistic studies of groups bound together by shared socio-cultural norms and practices, social network relationships have been shown to influence linguistic change (Milroy and Milroy, 1985; Eckert, 2000). The degree of influence over others in a given social grouping has been variously correlated with either central or peripheral positions within a network. A study of Philadelphia neighbourhood relationships (Labov, 2001) and high-school networks in Detroit (Eckert, 2000) showed centrally connected group leaders to be agents of linguistic change. By contrast, a study of language variation across three Belfast communities in the 1970s (Milroy and Milroy, 1985) showed community leaders at the centre of the network to be the keepers of the linguistic norms. Individuals on the periphery, with weaker ties to a social network, were the drivers of language change (Milroy and Margrain, 1980).

In order to reconcile these contrasting views of network influence and language change, Fagyal, Swarup, Escobar, Gasser and Lakkaraj (2010) used computational modelling to identify three network pre-requisites for change: the presence of leaders (individuals or hubs), peripheral members, and individual/group awareness of positions within that social network. They
concluded that the role of central or peripheral members of the network, as either agents of change or keepers of existing vernacular norms, will differ according to the other variables within the network, including shared goals and social context. Language innovation and renewal in the Detroit high school study, for example, was driven by centrally positioned charismatic network leaders as drivers of on-going change. In the context of the Belfast study, the role of centrally positioned leaders in the maintenance of linguistic norms demonstrated stability, and loyalty to the values of the community.

The data collection methods of these investigators were ethnographic in approach. Field workers acted as participant observers and data were gathered through observation and interview to record linguistic variation. Eckert (2000) used social network theories to link linguistic variation to social constructs of class and gender. Milroy and Milroy (1985) used a network strength scale (based on community ties) and Labov (2001) used a socioeconomic status index. Investigators compared scores from these indices to measurements of linguistic variables.

These findings indicate the capability of social network tools to measure the changes in social learning that naturally occur within a network of individuals bound together by shared values or interests. This holds promise for the design of a situational measurement tool to show patterns of social interaction with a small group network. Specifically:

- Patterns of communication can be influenced by the social network
- Influencers are members of the network rather than external agents
- Group leaders have the potential to stabilise or change communication behaviours
- SNA theories and techniques enable changing practice to be monitored and managed

The SNA approaches used in these studies provide a means of understanding and evaluating linguistic change in naturally evolving social networks. Can these approaches be used to measure outcomes from planned behaviour change
initiatives? A review of the application of SNA in health behaviour change interventions may offer insights to answer this question.

4.1.2 Health behaviour

The degree to which social networks shape health behaviours has been a prolific field of study. Investigations into models of health behaviour change are driven by the potential burden and risk to public health of preventable conditions caused by lifestyle choices and disease management practices. To date, SNA techniques have been used to investigate a wide range of issues in the public health arena including smoking cessation (e.g. Ennett and Bauman, 1994), substance abuse (e.g. Latkin, Mandell, Oziemkowska, Celentano, Vlahov, Ensminger and Knowlton, 1995), obesity (e.g. Christakis and Fowler, 2007) and physical activity (e.g. Gesell, Tesdahl and Ruchman, 2012).

Early studies charted transmission patterns of infectious disease and subsequent behaviour change linked to chronic conditions (see Valente and Pitts, 2017 for a review). The earliest example is generally accepted to be a diffusion study investigating the effect of social network influence on adoption patterns of a new antibiotic within a medical community in Illinois (Coleman, Katz and Menzel, 1966). Findings showed that doctors with the most friendship or professional ties to others in the medical community were most influential in accelerating take-up. More isolated doctors were last to adopt the new drug. This finding indicated that network interconnectedness can be associated with positive behaviour change.

The role of opinion leadership, defined as the informal influence of one person over the desirable behaviour of others (Flodgren, Parmelli, Doumit, Gattellari, O’Brien, Grimshaw and Eccles, 2011), has been widely investigated as a means to promote knowledge transfer in healthcare. Flodgren et al. (2011) drew on social learning theory to define the rationale for convincing, personable and trustworthy peers as compelling behavioural change agents whose influence derives from a combination of knowledge and skills, conformity to norms and interpersonal connectedness, rather than status or position. In a systematic review of studies using this approach (n=18), Flodgren et al. (2011) found a
12% increase in compliance with the target behaviour when an opinion leader was used to disseminate information versus knowledge transfer using more traditional methods of information distribution (via educational materials, workshops, lectures or education on the phone, for example). Study designs varied between information delivery using only an opinion leader or an opinion leader plus one or more knowledge transfer combinations (e.g. an opinion leader plus a standardised lecture and printed leaflets). Methodological weaknesses in most of the studies meant that risk of bias could not be excluded from the overall findings. However, the authors concluded that opinion leaders are a promising means for the dissemination of evidence-based health strategies.

Initiatives to intentionally create new social networks to educate, monitor the development of knowledge acquisition and maintain behaviours have also been investigated. The data in these studies is gathered largely from observation and/or participant nominations (where participants named their actual or preferred social contacts) derived from questionnaires, short surveys or interviews. For example, Molloy Elreda, Coatsworth, Gest, Ram and Bamberger (2016) used surveys adapted from validated rating scales to gather data on relationships between group participants in a parenting education study (n=214). Analyses of these connections enabled individual perceptions of change (from counts of nominated others) to be contrasted with group perceptions (measured by the number of reciprocated nominations). Measures of individual intra-group relationships (positive and negative) were evaluated as predictors of outcome (e.g. the number of episodes of parent/child conflict). The investigation found an association between a supportive group network and positive parenting outcomes, such as increased emotional awareness (acknowledging the effect of the child’s mood on the parenting interaction, for example) and a decrease in parenting stress. It also found that increased group and individual discomfort (e.g. from a defensive response to feedback on parenting practices or an abrasive personal style) predicted gains in supportive parenting behaviours. The authors hypothesised that the group network can support those with most room for improvement and that there is a threshold of discomfort in group relationships within which gains may be achieved without detrimental effect.
Gesell, Barkin and Valente (2013) also gathered network diagnostic data to test the effectiveness of a novel behavioural intervention to prevent obesity in children. In this study, network data was analysed on a session by session basis and used to guide activity set-up and programme content, with the aim of changing health behaviour through the creation of a supportive social network. The intervention was delivered to groups of 8 – 10 participants (n=305 adult-child pairs) over 12 weeks by trained group facilitators. The researchers hypothesised that the adoption of new behaviours could be accelerated through the use of strategies to create new social ties and increase group cohesion, such that the group members would source advice and support on healthy living from each other. A network diagnostic tool measured group interactivity (the number of network ties in and out of group sessions) and the researchers used this data to devise session action plans (e.g. facilitators were given activities to draw specific individuals into group discussion or to pair individuals with the strong ties to others with weak ties). Changes in the network structure showed a two-fold increase in the number of advice and discussion partners contacted by participants outside of the group meetings. These findings show that in neuro-typical groups, cohesion and connectedness can be directly targeted to create a new social network over a short time.

These studies (Molloy Elreda et al., 2016; Gesell, Barkin and Valente, 2013) used SNA tools to enable quantification and visualisation of relationships at the overall network level (to measure network size, structure and degree of interconnection), and at the individual level, where a person’s position could be determined by self and other reports. Gesell, Barkin and Valente (2013) reported on a range of network metrics to evaluate the degree of network integration in their obesity prevention study. This information was used to identify network isolates and strategies for integration. The network metrics (or standards of measurement) identified as most helpful for intervention monitoring included the following.

At the network level:
• network density (defined as the number of ties divided by the number possible ties) to show the degree of connection between network participants (known as nodes)
• centralisation (the degree of connectedness between all the points in the network)
• transitivity (whether a person’s friends are friends with each other)
• cohesion (the pattern of direct connections between members of the group)

At the individual level:
• degree (the number of ties from one person to others in the network)
• reciprocity (the number of ties that are reciprocated)
• isolate (a person without connection to others)

SNA software tools have been used by investigators to describe and calculate these and other properties of large and small networks. For example, DeLay, Hanish, Martin and Fabes (2016) used RSiena (Ripley, Snijders and Preciado, 2012) to analyse changes in the network structure of a group of pre-school children (n=292) over 1 year. Metrics included density and transitivity at the network level, and degree and reciprocity at the individual level. Data were correlated with individual node characteristics, including demographic variables. Findings, based on observation of peer interaction patterns and teacher evaluation of pre-school capabilities, showed that children chose friends with similar interests, behaviour profiles and cognitive capabilities and that these peer relationships influenced pre-school competency. Pow, Gayen, Elliott and Raeside (2012) described an investigation into the effectiveness of a sexual health intervention across Scotland using UCINET (Borgatti, Everett and Freeman, 2009) to analyse networks. Metrics included centrality measures (such as the position of school nurse as a point of liaison) correlated with partnership delivery outcomes (measured by the use of resources, the number of onward referrals to specialist service providers and the quality of the links between services, for example). Findings showed that increased interconnections resulted in improved programme outcomes. Andre, Ijaz, Tillinghast, Krebs, Diem, Metchock, Crisp and McElroy (2007) used InFlow (Krebs, 2002) to analyse data on a tuberculosis
outbreak. Investigators used three analysis metrics: degree, betweenness (the extent to which a node is connected to other nodes that are not connected to each other) and reach (the number of node contacts within two steps of the focal node). These data provided information on transmission patterns, as well as information on named contacts (identified by more than one confirmed case) as a means to control the spread of infection. These findings show the potential of social network software tools to capture network structures and interaction patterns within large quantities of data.

In summary, this review of health investigations shows the potential of social network interventions and measurement techniques to introduce, accelerate and monitor behaviour change. Specifically:

- Group interventions can successfully create new networks in a neurotypical population over a short time span
- Engaging personal qualities and delivery styles of peer leaders were associated with increased group cohesion
- SNA tools can provide feedback data and strategy instruction for group facilitators
- Social network tools can be used to describe and measure change in the pattern of connections over time

These findings have been drawn from investigations into moderately large networks. Their applicability to communication change behaviours in small groups requires further investigation. Recent studies investigating the application of social network technologies to small group interactions in neurotypical populations may offer new insights relevant to the ABI field.

4.1.3 Small group communication behaviours

The studies examined in this section analysed group conversations according to speaking activity, non-verbal behaviours and attention to the conversation using sociometric data gathered from digital devices that quantify communication behaviours and use visualisation tools to provide group feedback. The aim was
to address participation imbalances that might undermine the effectiveness of small group working, such as conversation dominance (Rienks and Heylen, 2006) or under-participation (Sturm, Herwijnen, Eyck and Terken, 2007; Bachour, Kaplan and Dillenbourg, 2010). A positive outcome is characterised by a more balanced pattern of contribution in conversation, with all participants listening and talking in approximately equal measure.

Pentland (2012) described electronic badges worn by participants in group meetings that gather 100+ data points per minute (comprising verbal and non-verbal behaviours). Communication constructs were operationalised (e.g. conversation energy was defined by the number of exchanges; group engagement as the distribution of verbal and non-verbal communication behaviours across participants). Raw data summaries were presented to participants in the form of network maps. These data were used as a basis to explain group interaction processes, to provide on-going training and to measure outcomes.

Other investigators use the raw data gathered from digital devices to provide real-time feedback to group participants via shared screens or individual devices, such as phones (Kim, Chang, Holland and Pentland, 2008). DiMicco, Pandolfo and Bender (2004) compared interaction patterns in discussion groups of four participants across two conditions: one with a real-time display of speaker participation rates in graph form, and one without (n=92). Proportional speaking time was calculated from data gathered via headset microphones. Over-participants in the experimental condition adjusted their speaking time in response to information on the display but under-participants did not. Sturm et al. (2007) measured change in speaking time and eye gaze in discussion groups of three or four participants across two conditions, with and without dynamic, real-time feedback (n=82). Close-talk microphones monitored speaking time and infrared cameras tracked head movements via reflective headbands. Feedback was provided via symbols on a shared display to indicate an individual’s cumulative speaking time and current turn duration, cumulative visual attention to other speakers, and from other speakers. Significant changes in speaking behaviours were observed in both under- and over-participants in the feedback
condition. An increase in eye gaze behaviour was also observed, but this did not reach significance level. The authors acknowledge that outside of a laboratory setting, the technology for data capture would be intrusive.

The use of digital technologies to capture communication behaviours in a group and provide feedback to support behaviour change potentially holds promise for individuals with social communication deficits following ABI, but with certain provisos. Specifically:

- These studies show the potential of social network technologies to capture small group interaction processes
- They demonstrate the potential for positive change in interaction patterns in response to support in situ
- The use of digital equipment to gather raw data can be potentially invasive
- There is no evidence as to whether behaviour change achieved with the support of real-time feedback tools generalises to more natural settings

4.1.4 Summary of findings

This study will compare outcomes from a peer-facilitated intervention to a staff-led social activity group. Findings from this review of selected SNA literature suggest that a situated measure of communicative behaviour may capture change in behaviour over time and in a functional context. The application of the methodology to measuring outcomes in social communication skills intervention in ABI will be discussed.

Observational methods are applicable for gathering relational data from a network where boundaries are known (Pow et al., 2012). Automatic data extraction offers ease of data collection and a full data set. However, the review of the literature into group meeting behaviours shows that the use of digital equipment attached to participants to automatically record initiations and responses is currently intrusive and might be a distraction to cognitively impaired individuals. Further, real-time feedback displays that require simultaneous processing of information on communication performance whilst engaging in an
interaction are likely to present a communication challenge. Video recording of the encounter is an alternative option, and is a familiar procedure in a rehabilitation environment. Coding from video recordings that comprise multiple camera angles to capture all participants’ verbal and non-verbal communication can potentially provide a complete record for evaluation.

SNA techniques are employed to evaluate relational data. These data refer to the connections or ties that relate one participant (or node) to another within a given network. Relational data is therefore an expression of the interactive connections between participants rather than simply an expression of the characteristics or behaviours of the individual nodes themselves (Wasserman and Faust, 1994). The properties of the ties between the interacting participants in a social interaction requires careful specification based on underlying theory, in order to accurately calculate meaningful structural features of the network (such as the identification of network dominators or isolates, or the density of the interactive ties between participants). The omission of any communication behaviours that underpin the interaction potentially renders the findings and visualisation (in the form of a network map) unrepresentative, distorting the outcome.

The coding of complex communication behaviours requires a trained observer. In their study of pre-school children, DeLay et al. (2016) reported an observation protocol in which eight to ten raters were intensively trained (over 3 to 4 weeks) to use a coding scheme (that comprised 26 classroom behaviours and play activities), and to accurately identify the classroom participants. Coding took place in 10 second periods, four times each day, two or three times each week over two terms across 18 classroom networks. Over 38,000 observation codes were recorded for that study sample and prepared for analysis. With a smaller study sample, it is likely that the number of codes generated for a small group across a sample that could be upwards of 5 minutes in length would run into hundreds, requiring computer processing for ease of descriptive analysis. Software to analyse the structural properties of the network would also provide network visualisation options to illustrate group interaction processes in situ and
over time. The next section describes the Interactional Network Tool, the measure developed for this study based on these ideas.

4.2 The Interactional Network Tool

The Interactional Network Tool (INT) evaluates interaction patterns within a group setting. It uses relational data in the form of communication behaviour frequencies, upon which subsequent analyses can be performed. Network visualisations can be generated to illustrate patterns of interaction between group participants. These network maps are produced from the data using bespoke macros within NodeXL, an open source software tool for network analysis and visualisation (Smith, Schneiderman, Milic-Frayling, Mendes Rodrigues, Barash, Dunne, Capone, Perer and Gleave, 2009). The design and functionality components were specified by the SLT researcher and implemented by an experienced software engineer. Section 4.2.1 describes the data coding system. Section 4.2.2 describes the properties of the network data. Section 4.2.3 illustrates the network matrices that define the network structure and Section 4.2.4 presents the network visualisations.

4.2.1 The data coding system

The coding system for the INT is presented in Figure 4.1. It is organised into two higher order categories of initiations and responses. These categories are further sub-divided into verbal and non-verbal behaviours. The rationale for the organisation and inclusion of these behaviours draws on the conversation and discourse analysis literature.
Conversation exchanges are made up of initiation and response combinations (Coulthard, 1984; Eggins and Slade, 1997). Sinclair and Coulthard (1975) adopted a sociolinguistic approach to discourse analysis in which initiations and responses are classified as moves, and moves comprise speech acts (such as a question or statement). This approach was designed to evaluate classroom discourse, but the way people with ABI interact as conversation partners has previously also been evaluated using initiation and response moves (Coelho, Liles and Duffy, 1991; Coelho, Youse and Le, 2002), as both are known to be affected in ABI. The definition of initiation and response behaviours on the INT is deliberately broad. For example, interaction code 1 (verbal initiation to one other) is intended to capture all verbal initiation behaviours rather than the detail of particular utterance types. This is important because the intervention is not intended to increase specific initiations, such as questioning for example. Rather, the aim is to support active participation that is sensitive to the behaviour of others in a group interaction. This necessitates initiating and responding adaptively to others. Response behaviours take account of the observation that speaking turns are constructed between speaker and listener(s) (Goodwin, 1981) and codes include both one word and longer responses.

**Figure 4.1 INT: conversation behaviour codes**

<table>
<thead>
<tr>
<th></th>
<th>Initiation to one other - verbal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Initiation to group - verbal</td>
</tr>
<tr>
<td>3</td>
<td>Initiation: eye gaze (people) - non-verbal</td>
</tr>
<tr>
<td>4</td>
<td>Initiation: eye gaze (objects) - non-verbal</td>
</tr>
<tr>
<td>5</td>
<td>Initiation – non-verbal: pointing/reaching/gesturing</td>
</tr>
<tr>
<td>6</td>
<td>Initiation - non-verbal: facial expression</td>
</tr>
<tr>
<td>7</td>
<td>Response - verbal (1 word) to one other</td>
</tr>
<tr>
<td>8</td>
<td>Response - verbal (1 word) to group</td>
</tr>
<tr>
<td>9</td>
<td>Response - verbal (more than 1 word) to one other</td>
</tr>
<tr>
<td>10</td>
<td>Response - verbal (more than 1 word) to group</td>
</tr>
<tr>
<td>11</td>
<td>Response – non-verbal: head nod/shake</td>
</tr>
<tr>
<td>12</td>
<td>Response – non-verbal: pointing/reaching/gesturing</td>
</tr>
<tr>
<td>13</td>
<td>Response – non-verbal: facial expression</td>
</tr>
<tr>
<td>14</td>
<td>Other vocal response: laughter, scream, singing, fillers (e.g. um)</td>
</tr>
</tbody>
</table>
The coding scheme also includes non-verbal elements as important contributors to the conversation exchange. This inclusion draws on the theoretical model of social communication skills presented by Trower, Bryant, Argyle and Marzillier (1978). These authors acknowledge that while verbal elements are a means to exchange information and accomplish tasks, non-verbal behaviours (from facial expression, gesture and pointing) have an effect on interpersonal relationships. Gaze behaviours are also part of the model. Trower et al. (1978) draw on the work of Kendon (1967) to demonstrate the role of gaze in synchronizing social behaviour. Gaze can also be used as means to provide feedback or to demonstrate attention (Goodwin, 1981; Vinciarelli and Mohammadi, 2011). Non-linguistic vocal behaviours (such as a sigh or tutting) have also been included as indicators of emotional state (Vinciarelli and Mohammadi, 2011).

Previous analyses have variously characterised small group conversations as sequences of turns between pairs of participants (Parker, 1984) or as a series of exchanges between one or more of the group (Goodwin, 1981). Individual and group initiation and response codes are included in the coding system.

4.2.2 The network data

In the SNA field, structural features of a network are described using terminology derived from graph theory (Scott, 2017). The data imported into the INT are unimodal (all the nodes in this bounded network represent participants in a group). They are entered as pairs of names and ties are directed (i.e. connections between two nodes are not necessarily reciprocal). The data are unweighted (whereby all participant codes are weighted equally and each code represents a single observation). They are multiplex (multiple behavioural codes are available to denote the connections between node pairs).

Data are entered into the INT spreadsheet as sequences of turns between node pairs. There are important differences in spreadsheet design for a conventional dataset versus a network dataset (Gibbs and McKendrick, 2011). In a conventional presentation, each row in the data table represents a participant or case and the data is entered into the corresponding cell for each column variable.
Subsequent descriptive or inferential analyses enable comparison of participants by interaction type. See Table 4.1 for an example spreadsheet from the statistical software package IBM SPSS Statistics.

### Table 4.1 Example conventional data spreadsheet

<table>
<thead>
<tr>
<th></th>
<th>Interaction Type 1</th>
<th>Interaction Type 2</th>
<th>Interaction Type 3</th>
<th>Interaction Type 4</th>
<th>Interaction Type 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>11</td>
<td>6</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
<td>25</td>
<td>10</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>10</td>
<td>5</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

In a relational dataset, each row in the data table represents a relationship between node pairs (see Table 4.2).

### Table 4.2 Example relational data spreadsheet

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>DO NOT MOVE OR EDIT CELLS WITHIN THE RED BORDER</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>Session</strong></td>
<td><strong>Subject</strong></td>
<td><strong>Object</strong></td>
<td><strong>Interaction Type</strong></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Ines</td>
<td>Group</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Jamil</td>
<td>Ines</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Ines</td>
<td>Group</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>Jamil</td>
<td>Ines</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>Ines</td>
<td>Jamil</td>
<td>11</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>Ines</td>
<td>Jamil</td>
<td>14</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>Jack</td>
<td>Ines</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>Ines</td>
<td>Group</td>
<td>2</td>
</tr>
</tbody>
</table>

Data are entered into four columns on the spreadsheet. The first column offers an option to code the session (e.g. by number, date or time). Every connection or relationship within the group network can be followed from its source to its destination. Source nodes are entered into the second column and destination
nodes into the third column. The destination node ‘group’ is also included in the node pairing system to distinguish between connections between individuals and between an individual and the group. Each row represents one connection between the node pair, and the fourth column specifies the interaction code for that connection. For example, Table 4.2 line 3 shows Ines verbally initiating to the group and line 4 shows Jamil giving a one word response to Ines. The spreadsheet data in the INT are entered in sequence, providing a chronological record for review and cross-checking. The example given in Table 4.2 illustrates eight entries but the spreadsheet size extends to thousands of lines. These data are then directly imported into the bespoke macros in NodeXL.

4.2.3 The matrices defining the network structure

The INT generates a matrix of the relational contacts from the spreadsheet data. Table 4.3 shows an example matrix. The number recorded in each cell shows the frequency of connections between the source (named in the top row) and the destination (named in the vertical column). The matrix in Table 4.3 shows the data as a single multiplex network, where the frequencies in each cell represent the total counts (i.e. all codes) between each node pair. Filtering options are also available to view the outcome using different code combinations (e.g. codes 1-6 initiations only) or single codes. The INT matrix data can be represented in a network visualisation. The initiation and response connections shown in the matrix in Table 4.3 are represented in Figure 4.2 Box 1, to illustrate a balanced interaction where all participants contribute an approximately equal share.

Table 4.3 Example matrix

<table>
<thead>
<tr>
<th>Subject</th>
<th>Ines</th>
<th>Jamal</th>
<th>Jack</th>
<th>Anetha</th>
<th>Clara</th>
<th>Aran</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ines</td>
<td>4</td>
<td>2</td>
<td>7</td>
<td>4</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Jamal</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Jack</td>
<td>9</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Anetha</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Clara</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Aran</td>
<td>1</td>
<td>4</td>
<td>12</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Group</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
4.2.4 The network visualisations

The network visualisations (known as sociograms or network graphs) illustrate profiles of connections between participants. In this format, it is possible to observe who interacts with whom, and identify conversation dominators and isolates. As the number of interactions increases, the edge weights (or lines connecting participants) become thicker and more colour dense. Direction is indicated through arrows attached to the lines. Scott (2017) draws together a number of network visualisation principles, citing a circle layout as a frequently used and familiar shape through which to organise and interpret structural details. The INT uses a circle layout that enables manual positioning of the nodes to aid interpretation of the display (in the event of occlusions, for example) without disruption to the line weights connecting the participants. Visual exploration of sub-sets of the data is enabled through the filtering option (see Section 4.2.3). Comparison of the visual displays across data collection points enables visualisation of change over time.

Three network graphs are shown in Figure 4.2 to illustrate different patterns of interaction. The balanced sociogram in Box 1 shows a successful group encounter. Edges (or lines), verbal and non-verbal, connect all the participants in the group directly, rather than with or through a group leader. The unbalanced sociogram in Box 2, shows an encounter where the interaction is dominated by a minority of participants. Isolates and under participators are clearly identifiable in this representation. Box 3 shows a very unbalanced profile, with one participant dominating the encounter and few reciprocal exchanges within the interaction.

These network visualisations are representations, and illustrate qualitative patterns of interaction between participants. However, Hansen and Smith, (2014) draw attention to the dangers of over-interpreting visualisations. They point to the need for reference to the network metrics (i.e. the measures used to calculate network properties) and valid statistical techniques to test hypotheses. They advise that the relational nature of network data is likely to require a unique statistical approach. Section 4.4. describes and illustrates the application
of the Herfindahl-Hirschman Index, a statistical measure of equality of participation adopted for this study.
Figure 4.2 Three interaction scenarios

<table>
<thead>
<tr>
<th>Box 1: Balanced</th>
<th>Box 2: Unbalanced</th>
<th>Box 3: Highly unbalanced</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Balanced Scenario" /></td>
<td><img src="image2" alt="Unbalanced Scenario" /></td>
<td><img src="image3" alt="Highly Unbalanced Scenario" /></td>
</tr>
</tbody>
</table>
4.3 The Herfindahl-Hirschman Index

The Herfindahl-Hirschman Index, named after the independently produced but subsequently amalgamated work of economists Orris Herfindahl (Herfindahl, 1950) and Albert Hirschman (Hirschman, 1945), was developed as a measure of market concentration and equality. The two components of the index are density and distribution: i.e. the number of entities or participants in a given context, and the degree of distribution or share between them. Although widely known for its application in the field of competition law, it has been used to measure market concentration and equality across a range of industries and in a variety of other contexts, including household income concentration (Sarris and Karfakis, 2006), industry expansion and rates of return (Sargent and Holmes, 2014), as a measure of biodiversity within a given habitat (Hartell, Smale, Heisey and Senauer, 1998) and to measure competitive balance in sporting leagues (Owen, Ryan and Weatherston, 2007). As a measure of equality, it was chosen to measure equality of participation in conversation (as a function of the number of participants and the degree of participation in the interaction).

The index is calculated by squaring the share of the participants (in a given environment) and then summing the squares. The formula is as follows:

\[
\text{Herfindahl-Hirschman Index (HHI)} = \sum_{i=1}^{n} s_i^2
\]

where, \(n\) = number of participants
\(S \ (i=1 \text{ to } n)\) = participant shares

A weakness of the measure concerns the aggregation effect (de Pablo, Giacinti, Tassile and Saavedra, 2014), where a comparison of one group of participants holding a given share with a second smaller group of participants holding the same relative shares, results in a higher index calculation for the smaller group. Measurement error is cited as a further weakness, as the procedure of squaring participant shares weights the index towards changes in the shares of the largest players (Roberts, 2014).
To overcome these weaknesses, a normalized HHI (NHHI) is recommended (Liston-Heyes and Pilkington, 2004; Owen, Ryan and Weatherston, 2007). Participant shares are expressed as a fraction ranging from 0 to 1, where 0 indicates an equal distribution between all participants and 1 indicates domination by a single participant. The formula is as follows:

\[ \text{NHHI} = \frac{\text{HHI} - \frac{1}{n}}{1 - \frac{1}{n}} \]

Liston-Heyes and Pilkington (2004) provide interpretation guidelines for these values. They suggest that a value well below 0.2 approximates to a balanced distribution; a value between 0.2 and 0.6 indicates domination by a minority of participants; a value above 0.6 indicates domination by one participant. Kurshid, Rohit and Singh (2009) further refine the indicators for a balanced distribution. They refer to the NHHI values published by the US Department of Justice and Federal Trade Commission (1997) to suggest a value below 0.1 indicates balance and 0.1 to 0.18 indicates moderate balance. These thresholds are arbitrary (Roberts, 2014), and their interpretation is therefore context dependent. The benefit of using a normalized measure is that it is unaffected by the number of participants, and can therefore be used to compare different groups of unequal sizes over time (Khurshid, Rohit and Singh, 2009; Owen, Ryan and Weatherston, 2007).

The applicability of the procedure for measuring equality of participation in a social communication group context will now be explored. The normalized index and interpretation guidelines from Liston-Heyes and Pilkington (2004) were applied to the illustrative network data that underpins the network visualisations in Figure 4.2 (see Section 4.2.4). Findings are presented in Table 4.4.
Table 4.4 Scenario data and NHHI findings (range 0-1)

<table>
<thead>
<tr>
<th>Scenario 1: Balanced</th>
<th>Scenario 2: Domination by more than 1</th>
<th>Scenario 3: Domination by 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initiations and responses</td>
<td>Initiations and responses</td>
</tr>
<tr>
<td>Counts</td>
<td>Proportion</td>
<td>Counts</td>
</tr>
<tr>
<td>Ines</td>
<td>49</td>
<td>0.17</td>
</tr>
<tr>
<td>Jamal</td>
<td>46</td>
<td>0.16</td>
</tr>
<tr>
<td>Jack</td>
<td>55</td>
<td>0.19</td>
</tr>
<tr>
<td>Anisha</td>
<td>37</td>
<td>0.13</td>
</tr>
<tr>
<td>Clara</td>
<td>51</td>
<td>0.18</td>
</tr>
<tr>
<td>Aran</td>
<td>46</td>
<td>0.16</td>
</tr>
</tbody>
</table>

NHHI values (Liston-Heyes and Pilkington, 2004): <0.2=balanced; 0.2-0.6=unbalanced; 0.6-1=highly unbalanced

The network metrics for each illustrative scenario show that the NHHI values match the threshold value expectations for a balanced, unbalanced and highly unbalanced network, as shown visually via the network visualisations in Figure 4.2.

The degree to which the index enables accurate comparison over time can be investigated by analysis of step-wise variations in the share of the interaction held by participants. Findings are illustrated in Table 4.5.
Table 4.5 Proportional variation of change from dominance by one participant to a balanced interaction

<table>
<thead>
<tr>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
<th>Participant 4</th>
<th>Participant 5</th>
<th>Participant 6</th>
<th>NHHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0.9</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.78</td>
</tr>
<tr>
<td>0.8</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.59</td>
</tr>
<tr>
<td>0.7</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
<td>0.42</td>
</tr>
<tr>
<td>0.6</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
<td>0.28</td>
</tr>
<tr>
<td>0.5</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.16</td>
</tr>
<tr>
<td>0.4</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.08</td>
</tr>
<tr>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.04</td>
</tr>
<tr>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Table 4.5 shows that normalized HHI values are weighted toward scenarios where one participant holds an unusually large share. Even though the scale does not appear to be linear, an NHHI value between 0.2 and 0.6 shows domination by a minority. A value below 0.2 (indicating a more balanced interaction) is only reached when all participants are engaged in the interaction. The threshold guidelines would therefore appear accurate in this case. Table 4.6 illustrates NHHI values where two individuals dominate a conversation.

Table 4.6 Proportional variation of change (two participants with equal shares)

<table>
<thead>
<tr>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
<th>Participant 4</th>
<th>Participant 5</th>
<th>Participant 6</th>
<th>NHHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.4</td>
</tr>
<tr>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.23</td>
</tr>
<tr>
<td>0.4</td>
<td>0.4</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
<td>0.20</td>
</tr>
<tr>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
<td>0.14</td>
</tr>
<tr>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0</td>
<td>0</td>
<td>0.11</td>
</tr>
<tr>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.1</td>
<td>0.02</td>
</tr>
</tbody>
</table>

This illustration of NHHI values show a potential overestimation of improvement when equal shares of an interaction are held by more than one participant. A value above 0.2 confirms domination by a minority but a value below 0.2 (indicating a balanced interaction) is reached when only four of six participants
are engaged. Measurement of change over time is also likely to be less clear when values are low across all time points. In terms of clinical application, the index is highly sensitive to more than one conversation dominator. This is likely to bias outcomes in a social communication group facilitated by more than one person. Threshold guidelines therefore need careful interpretation, and possible readjustment, in this instance.

In summary, the NHHI provides a framework through which to quantify equality of participation in a social communication group. The approach has been applied to scenario data to illustrate the INT, a tool developed to measure interaction patterns in situ for this study. Guidelines, drawn from the application of the tool in other contexts, have been explored to investigate the accuracy of threshold interpretation for group encounters. Findings show that the scale of the index is non-linear, and that threshold guidelines are approximations only. Change over time will be more easily demonstrated when the disparity between pre- and post-intervention values is wide.

4.4 Summary

This chapter has evaluated SNA approaches to measuring change in group interventions for social communication skills. A review of selected fields within the social network literature showed the potential benefits of applying this methodology to a situated measure for a group intervention following ABI. The INT, a measurement tool developed for this study, was presented. The NHHI, an index to determine equality of participation, was described and tested on the relational data used to illustrate the INT. Potential strengths and shortcomings from this theoretical analysis were identified. The sensitivity of the INT will be tested (alongside other measures) on data from a pilot study, using both conventional statistical approaches and relational approaches. Pilot study methods and findings are reported in Chapter 5.
Chapter 5 Pilot study: feasibility of a peer-mediated intervention for social communication skills in ABI

This chapter reports a pilot study of the peer-mediated intervention to improve social communication skills following ABI. Outcomes were compared to a staff-led social activity group (usual care). Medical Research Council guidelines for developing and evaluating complex interventions (Craig et al., 2008), state the importance of a pilot study to test the feasibility of a new intervention. Feasibility criteria were based on the stated pilot study objectives:

- To determine whether the intervention is feasible with this clinical population
- To evaluate the sensitivity of outcome measures to changes in group interaction over time
- To determine participant satisfaction with this model of intervention

The protocol for the main study was subsequently amended in the light of the pilot study evaluation; the main study is reported in Chapter 6. Pilot study methods are reported in Section 5.1 and results in Section 5.2

5.1 Methods

An experimental parallel group design was chosen to investigate whether a peer-mediated training intervention improves outcomes on measures of social communication skills compared to a staff-led social activity group. Parallel group designs are the most common form of RCT (Tilling, Sterne, Brookes and Peters, 2005). This is the design most strongly represented in previous investigations into new interventions in the field of social communication skills for adults following brain injury.

Ethical approval for the study was gained from the local NHS Research Ethics Committee on 6th March 2014. See Appendix 1.1 for the REC approval letter. All participants (or their representatives) gave informed, written consent to participation in the study. The Information Security Policy and Data Protection
Policy were strictly adhered to at UCL and at the research site. Pseudonyms have been used to maintain confidentiality of data.

Participant recruitment methods are reported in Section 5.1.1 and selection procedures for the peer facilitator in Section 5.1.2. Profiling assessment procedures are reported in Section 5.1.3. Allocation procedures and progression through the study are reported in Section 5.1.4. Demographic and profiling data are reported by group in Section 5.1.5 and Section 5.1.6 describes the group activity. Sections 5.1.7 and 5.1.8 describe the measurement and rating procedures and the data analysis procedures respectively. The results of pre-intervention analyses are presented in Section 5.1.9.

5.1.1 Participant recruitment

Twelve participants were recruited from one centre, a non-NHS residential brain injury facility providing post-acute specialist rehabilitation services for individuals with severe ABI. Services at this centre were provided across medium and longer-term placements in ward, home and independent living accommodation.

The inclusion/exclusion criteria for the study were as follows:

Inclusion criteria

I. Adults between 18 and 65 years
II. A diagnosis of severe TBI (measured by PTA exceeding 24 hours or by other neurological evidence, such as surgery to reduce intracranial swelling, or other persisting neurological signs), or severe acquired brain injury with similar cognitive presentation to TBI (measured by a GCS score of less than 9 or other persisting neurological signs)
III. At least 6 months post-onset of injury
IV. Evidence of a social communication impairment following injury (from baseline profile assessments and expert report)
V. Ability to tolerate group activity (from expert report)

Exclusion criteria

I. Extensive cognitive impairment preventing active involvement in programmes of rehabilitation
II. Insufficient English to converse with peers
III. Significant aphasia affecting both the understanding and use of language
IV. Severe depression or a psychiatric disorder impeding participation in group activity

Ward managers or other familiar members of the clinical care team initially approached potential participants who met the recruitment criteria to gauge their interest. Interested participants were then referred to the speech and language therapy team. Potential participants and close others met a member of the speech and language therapy team to discuss the purpose of the study, the schedule, participant involvement and the advantages and disadvantages of taking part. Written information sheets (see Appendix 2) were supplemented by spoken elaboration with diagrams, where necessary, to enhance understanding and retention. Additional time was given to allow for the formulation of questions. The information was repeated on a separate occasion to evaluate the consistency of the potential participant’s response.

The ability to consent was determined by the members of the treating clinical team. Seven participants consented to participate. Consent was obtained on behalf of the five participants without capacity to do so (or whose capacity to consent was borderline) from a consultee. Consultees were trusted family members or friends, with personal knowledge to enable confirmation of the individual’s pre-injury wishes about participating in research. Consent forms are included in Appendix 3. Recruitment took place in May/June 2014. Consecutive referrals meeting the eligibility criteria were invited to participate until target numbers were met. Injury severity and clinical characteristics for all participants recruited to the pilot study are reported in Appendix 4.1.

5.1.2 Selection of the peer facilitator

The peer facilitator was selected during the first two weeks of the group meetings.
Selection criteria were as follows:
I. The ability to support the group to interact successfully, as recommended by a knowledgeable other (e.g. ward manager, key worker or another member of the clinical team). Specifically, these skills included the ability to:
- listen
- show interest and respect for other people and their opinions
- draw others into a conversation
- move a conversation forward
- have the presence/leadership style to hold attention and respect
- understand and use metaphor

II. Observation by the SLT researcher of these social competencies in the group meetings during the baseline measurement period.

5.1.3 Profiling assessment procedure

The following battery of standardised tests was administered to establish participant profiles of cognitive and communication capabilities known to be vulnerable to the effects of brain injury.

- Wechsler Abbreviated Scale for Intelligence – second edition (WASI-II)

The WASI II (Wechsler, 2011) is a standardised measure of intelligence. It comprises four tests that are quick to administer, and therefore suitable for those with a lower tolerance threshold for cognitive assessment. Sub-tests from the WASI II have previously been used in studies as a measure of verbal and non-verbal reasoning capability in brain injury (Kinnunen, Greenwood, Powell, Leech, Hawkins, Bonnelle, Patel, Counsell and Sharp, 2011; Chamelian and Feinstein, 2006).

The block design test measures the ability to analyse abstract visual information through construction tasks. The matrix-reasoning test measures visual processing and the ability to classify and organise information using diagrams and shapes. Block design and matrix reasoning scores are combined to estimate perceptual reasoning capability (PRI score).
The vocabulary test measures knowledge of words and the ability to explain verbal concepts. The similarities test requires explanation of how pairs of items are alike. This test measures verbal reasoning and the ability to form verbal concepts. Composite scores from the vocabulary and similarities tests are combined for an estimation of verbal comprehension (VCI score).

The block design, matrix reasoning, vocabulary and similarities tests were administered, following standard procedure. The estimate of full scale IQ (FSIQ-4) from the combined scores of the four sub-tests provided a measure of general cognitive ability.

- Semantic fluency test

The semantic fluency test (available in Strauss, Sherman and Spreen, 2006) is a word generation task. It measures lexical knowledge and semantic memory through the generation of words within a semantic category. Participants were asked to generate the names of as many animals as they could think of in one minute.

Optimal performance is achieved through the use of organisational strategies to generate items within a specific semantic sub-category and then to move on to the next (Ardila, Ostrosky-Solís and Bernal, 2006). As such, this task taps into the executive control required to manage a range of cognitive processes. These include the ability to maintain attention to the task, verbal planning and initiation (Troyer, Moscovitch, Winocur, Alexander and Stuss, 1998), the flexibility to switch between semantic sub-categories (Troyer, Moscovitch and Winocur, 1997) and the ability to self-monitor and work within a time constraint.

The sensitivity of verbal fluency tests to frontal and temporal lobe injuries has been investigated extensively in the field of ABI (Henry and Crawford, 2004). A recent study examining semantic fluency in brain injured individuals showed a reduction in the number of items produced at six months post injury as
compared to a normative sample (Zaninotto, Guirado, Baldivia, Nunes, Amorim, Teixeira, de Lucia, de Andrade and Paiva, 2014).

- La Trobe Communication Questionnaire (LCQ)

The LCQ (Douglas, O’Flaherty and Snow, 2000) is a measure of perceived social communication impairment following TBI. There are two forms: a self-report version to be completed by the person with ABI and an other-report version for their communication partner (family member, friend or carer, for example). The questionnaires are completed separately. Each is made up of 30 questions to determine the perceived frequency of deficits (e.g. when talking to others, do you say or do things others might find embarrassing?). Items on both forms are identical. Responses are made on a four point Likert scale (never or rarely, sometimes, often, usually or always). Items requiring reverse scoring are also included. Total scores range from 30 – 120. A higher score indicates a perception of more impaired social communication skills.

Acceptable internal consistency and test/re-test reliability has previously been demonstrated (Douglas, Bracy and Snow, 2007). Struchen, Pappadis, Mazzei, Clark, Davis and Sander (2008) found acceptable construct validity in a comparison of ratings made by adults with TBI and non-injured matched controls.

- The Awareness of Social Inference Test (TASIT) Part 1

The ability to read social cues is an important perceptual social communication skill, and deficits in this area can potentially impede success in social settings (Bornhofen and McDonald, 2008b). The TASIT (McDonald, Flanagan and Rollins, 2002) is a standardised assessment that examines three aspects of social perception. Part 1 evaluates the ability to interpret emotional intention from facial expression, tone of voice and gesture. Part 2 evaluates the ability to distinguish between sincerity and sarcasm. Part 3 evaluates the ability to distinguish between sarcasm and lies. Participants in this study completed Part 1 only. Video clips showing a dynamic social exchange were presented, and the participant was required to identify the emotion conveyed from an ambiguous
script. Judgements therefore needed to be based on nonverbal information (from facial and/or vocal expression and cues from body language). Seven choices were provided on a written cue sheet: happy, surprised, sad, angry, anxious, revolted or neutral.

Previous studies comparing TBI to non-injured controls have demonstrated the sensitivity of the TASIT to social perception deficits following TBI (McDonald, Flanagan, Rollins and Kinch, 2003; McDonald, Flanagan, Martin and Saunders, 2004).

5.1.4 Group allocation procedures and progression through the study

Following profiling assessments, participants were assigned a code by the SLT researcher and the codes were randomly allocated to either the intervention group (n=6) or control group (n=6) using an online randomisation procedure (http://random.org) by a UCL researcher who was blind to case. Figure 5.1 presents participant allocation and progression through the study in a CONSORT diagram (Moher et al., 2010).

Figure 5.1. CONSORT diagram showing participant allocation and progression through the pilot study
Of the twelve participants recruited to the pilot study, one participant was withdrawn from the intervention group prior to the first meeting due to a change in behavioural presentation. Two participants withdrew from the intervention group during the first week of group meetings as they no longer wished to participate. As a result of the withdrawals, two participants were re-allocated to the intervention group. The first was randomly identified (using the UCL randomisation service) and re-allocated in readiness for week 2 of the group meetings. A second participant was re-allocated in week 5 of the study as reduced numbers might compromise the viability of the group discussions. This was a non-random allocation and therefore data from this participant (and those lost as a result of withdrawal) were not included in the intervention analyses.

The intention-to-treat criterion for outcome reporting in RCTs, recommended in the Consolidated Standards of Reporting Trials (CONSORT) statement (Moher, Hopewell, Schulz, Montori, Gotzsche, Devereaux, Elbourne, Egger and Altman, 2010) was not applied as this was a feasibility study, the sample size was small and reporting findings on untreated participants increases susceptibility to a type II error (Gupta, 2011). Demographic and profiling variables are presented by group in the next section.

5.1.5 Demographic and profiling data

Demographic and profiling data are presented following re-allocation due to losses. The CONSORT statement (Moher et al., 2010) advises against significance testing on baseline demographic and clinical characteristics because any differences between the groups will be a chance occurrence as a result of randomisation. Small sample sizes also meant that power to detect difference was low. Means and standard deviations are reported for all variables.

Demographic variables for the intervention group are presented in Table 5.1 and for the control group in Table 5.2. Cognitive and communication profiling data for the intervention group are presented in Table 5.3. and for the control group in Table 5.4. Pseudonyms have been used to preserve anonymity. The peer facilitator is identified in Table 5.1 in bold type.
Table 5.1 Demographic variables: intervention group (n=5)

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age (years)</th>
<th>Male/female</th>
<th>Education (years)</th>
<th>Time post onset (years)</th>
<th>Injury severity/clinical characteristics, as documented in clinical notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicholas</td>
<td>60</td>
<td>M</td>
<td>13</td>
<td>41</td>
<td>TBI: Multiple brain injuries over 40 years: RTA, seizure activity, falls. Persisting cognitive impairment and behavioural needs.</td>
</tr>
<tr>
<td>Jason</td>
<td>63</td>
<td>M</td>
<td>13</td>
<td>25</td>
<td>TBI: Multiple injuries over 25 years: RTA, falls, seizure activity. Extensive long-standing gliosis in left cerebral hemisphere. Long standing low-density change in left frontal and temporal lobes. Severe cognitive impairment and behavioural needs.</td>
</tr>
<tr>
<td>Mean</td>
<td>44.8</td>
<td>4/1</td>
<td>13.4</td>
<td>13.9</td>
<td>TBI/ABI: 3/2</td>
</tr>
<tr>
<td>(sd)</td>
<td>(18.08)</td>
<td>(1.52)</td>
<td>(18.34)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Peer facilitator identified in bold type

Table 5.2 Demographic variables: control group (n=4)

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age (years)</th>
<th>Male/female</th>
<th>Education (years)</th>
<th>Time post onset (years)</th>
<th>Injury severity/clinical characteristics, as documented in clinical notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>43.25</td>
<td>1/3</td>
<td>13.5</td>
<td>2.71</td>
<td>TBI/ABI: 0/4</td>
</tr>
<tr>
<td>(sd)</td>
<td>(10.37)</td>
<td>(3.32)</td>
<td>(2.91)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
De Boer, Waterlander, Kuijper, Steenhuis and Twisk (2015) define meaningful difference in baseline characteristics as a potential confound that may influence the study outcome. Visual inspection of the data indicated difference between the groups in average time post-injury, which was lower for the control group. This difference may have influenced outcomes, however the potential bias worked against the experimental hypothesis. Previous studies investigating social communication skills in ABI have suggested increased potential for gain for those with less severe injury in the earlier phase of recovery (McDonald, Tate, et al., 2008). The control group may therefore have had increased scope for improvement.

Table 5.3 Profiling variables: intervention group

<table>
<thead>
<tr>
<th>Participant</th>
<th>LCQ self (120-30)</th>
<th>LCQ other (120-30)</th>
<th>Semantic fluency (0-28+)</th>
<th>TASIT Part 1 (0-28)</th>
<th>VCI (45-160)</th>
<th>PRI (45-160)</th>
<th>FSIQ 4 (40-160)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicholas</td>
<td>51</td>
<td>67</td>
<td>5</td>
<td>7</td>
<td>59</td>
<td>62</td>
<td>58</td>
</tr>
<tr>
<td>Jason</td>
<td>50</td>
<td>63</td>
<td>7</td>
<td>12</td>
<td>70</td>
<td>83</td>
<td>74</td>
</tr>
<tr>
<td><strong>Lisa</strong></td>
<td><strong>70</strong></td>
<td><strong>52</strong></td>
<td><strong>14</strong></td>
<td><strong>23</strong></td>
<td><strong>92</strong></td>
<td><strong>78</strong></td>
<td><strong>83</strong></td>
</tr>
<tr>
<td>Peter</td>
<td>60</td>
<td>72</td>
<td>5</td>
<td>12</td>
<td>62</td>
<td>73</td>
<td>65</td>
</tr>
<tr>
<td>Bill</td>
<td>47</td>
<td>50</td>
<td>15</td>
<td>20</td>
<td>90</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>55.60 (9.40)</td>
<td>60.80 (9.52)</td>
<td>9.20 (4.92)</td>
<td>14.80 (6.54)</td>
<td>74.60 (15.52)</td>
<td>76.40 (9.45)</td>
<td>73.20 (11.82)</td>
</tr>
</tbody>
</table>

**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 (self and other); TASIT The Awareness of Social Inference Test; Peer facilitator identified in bold type

Table 5.4 Profiling variables: control group

<table>
<thead>
<tr>
<th>Participant</th>
<th>LCQ self (120-30)</th>
<th>LCQ other (120-30)</th>
<th>Semantic fluency (0-28+)</th>
<th>TASIT Part 1 (0-28)</th>
<th>VCI (45-160)</th>
<th>PRI (45-160)</th>
<th>FSIQ 4 (40-160)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felix</td>
<td>45</td>
<td>76</td>
<td>14</td>
<td>18</td>
<td>95</td>
<td>75</td>
<td>83</td>
</tr>
<tr>
<td>Alison</td>
<td>65</td>
<td>50</td>
<td>11</td>
<td>17</td>
<td>91</td>
<td>69</td>
<td>78</td>
</tr>
<tr>
<td>Imelda</td>
<td>55</td>
<td>92</td>
<td>9</td>
<td>17</td>
<td>75</td>
<td>57</td>
<td>65</td>
</tr>
<tr>
<td>Pippa</td>
<td>57</td>
<td>78</td>
<td>11</td>
<td>14</td>
<td>49</td>
<td>51</td>
<td>46</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>55.50 (8.23)</td>
<td>74.00 (17.51)</td>
<td>11.25 (2.06)</td>
<td>16.50 (1.73)</td>
<td>77.50 (20.87)</td>
<td>63.00 (10.95)</td>
<td>68.00 (16.51)</td>
</tr>
</tbody>
</table>

**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
These data confirmed a profile of severe cognitive and communication deficit for both participant groups. Mean LCQ group scores were compared to normative data (Douglas, O’Flaherty and Snow, 2000). Higher scores indicate greater impairment on this measure. Scores for both groups fell within -0.5 standard deviations of the neurotypical mean on the LCQ-self (mean 52.47; sd 9.62) and between -1.3 and -2.8 standard deviations of the normative mean on the LCQ-other questionnaire (mean 47.17; sd 9.93). Semantic fluency group scores were compared to normative scores stratified by age (Tombaugh, Kozak and Rees, 1999). Group scores for average age level 40 - 49 were between 2.2 and 2.8 standard deviations below the normative mean (mean 20.7; sd 4.2). TASIT Part 1 group scores were compared to normative data from McDonald, Flanagan and Rollins (2002). Scores were between 6 and 8 standard deviations below the mean (mean 25.92; sd 1.44). Data from the WASI-II were compared to the means for matched controls (Wechsler, 2011). VCI group scores were between 1.4 and 1.7 standard deviations below the mean (mean 100; sd 15.3). PRI group scores were between 1.5 and 2.7 standard deviations below the mean (mean 96.7; sd 12.9). FSIQ 4 group scores were between 1.8 and 2.3 standard deviations below the mean (mean 98.1; sd 13.4).

Visual inspection of the mean scores and standard deviations showed difference between the groups on the LCQ-other and the WASI-II PRI scale. Difference between the groups on the LCQ–other (questionnaire findings from communication partners) was unlikely to influence treatment effects. Perceptual reasoning capability was a potentially confounding factor (with two participants in the control group scoring below 60). However, the mean full scale IQ scores (which are a combination of VCI and PRI scores) showed a smaller difference in mean scores between the groups. The standard deviations across all scales of the WASI-II reflected the variability of scores within both groups.

5.1.6 Group activity

The intervention group followed a project-based approach (Ylvisaker, Feeney and Capo, 2007), and was set up as an ‘expert committee’ (see Chapter 3, Section
3.2). Members discussed 18 topics associated with the operational running of the facility (see Appendix 6.1). These topics were allocated randomly to each session using the randomisation service provided by UCL. A peer-facilitator was trained to support group interaction needs (see Table 3.1). Members of staff were not present in these group meetings. Participants were told that staff members were close by. A call bell was in place for participants to seek assistance, if required. Staff monitored proceedings remotely (via video link) in order to comply with standard monitoring procedures at the centre. See Appendix 5 for risk assessment documentation.

The control group meetings comprised social activities supported by trained therapy assistants (usual care). In the first meeting the therapy assistants offered the group the choice of discussion, craft or quiz-style activities. Participants unanimously chose a quiz group. Quiz topics are listed in Appendix 7.

5.1.7 Measurement and rating procedures

This was a repeated measures design and data were collected using the primary outcome measures at four measurement points. Figure 5.2 illustrates the timeline and data collection points.
Figure 5.2 Study design flow chart

- Recruitment n=12
- Profiling assessments
- Group allocation
- Baseline 1
- Baseline 2
- Intervention group n=6
- Therapy peer facilitator training (16 sessions)
- Peer tutor selection
- Baseline 1
- Baseline 2
- Control group (usual care) n=6
- Post-intervention
- Satisfaction questionnaire
- Maintenance

Week | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12
---|---|---|---|---|---|---|---|---|---|---|---|---
Group meeting (x2 weekly)
The intervention and control groups met twice a week for 8 consecutive weeks. Sessions were timetabled for 1 hour. Peer facilitator training was delivered in 16 sessions over 4 weeks (weeks 3 – 6). See Chapter 3, Table 3.1 for training procedures. Baseline measures were recorded in week 2 (with all participants present) and again in week 3 (without the peer facilitator present in the intervention group). This was a planned absence to determine group stability at baseline with and without the peer facilitator (and the peer facilitator attended a training session at this time). In order to minimise the potentially intrusive effect of filming on participant behaviour, data from week 1 were excluded from analyses. Post-intervention outcome measures were taken during week 8. Following a 4 week break, the groups met again for maintenance measures in week 12.

5.1.7.1 Primary and secondary outcome measures

In addition to an evaluation of the feasibility of the intervention, the purpose of the pilot study was to evaluate the sensitivity of the established measures to changes in group social interaction over time. Three primary outcome measures were selected to evaluate conversation samples at each of the four measurement points: The Adapted Measure of Participation in Conversation from the Adapted Kagan Scales (MPC) (Togher, Power, Tate, McDonald and Rietdijk, 2010), scales from the BRISS-R (Farrell, Rabinowitz, Wallander and Curran, 1985; Flanagan, McDonald and Togher, 1995; Marsh and Knight, 1991) and the PPIC (Linscott, Knight and Godfrey, 1996). These measures have been used in parallel group design studies reporting on interventions for impaired social communication skills in ABI. Each has been used to measure change in dyadic encounters rather than groups. The reliability, validity and sensitivity of these measures when applied to changes in group interactions requires investigation. The INT was also used as a primary outcome measure to assess change in group encounters. A satisfaction questionnaire was developed as a secondary outcome measure to evaluate participants’ opinions of this model of intervention.

- The Adapted Measure of Participation in Conversation from The Adapted Kagan Scales (MPC) (Togher et al., 2010)
The MPC was originally developed for the aphasia population (Kagan et al., 2004). The adapted measure comprises two sub-scales, interaction and transaction, both tailored to reflect the social communication needs of people with TBI. The interaction sub-scale measures the person’s ability to engage verbally and non-verbally in conversation, such that the engagement is shared between the conversation partners. The transaction subscale measures the ability to share and request information.

On both sub-scales, raters are required to score a participant on a 9 point Likert scale (0 – 4 with a half point scoring option, and where zero indicates no participation). Questions guide the rater (e.g. ‘Does the person add information to maintain the topic?’; ‘Do they present information in an organised way?’). Descriptors (or anchors) accompany the scale (e.g. on the interaction sub-scale, ‘no attempt to engage with the communication partner’ scores zero; on the transaction sub-scale, ‘consistently conveys content to achieve the task purpose’ scores three).

The measure has been used to evaluate change in two-way conversations between individuals with TBI and their neuro-typical communication partners, including paid carers (Behn et al., 2012) and friends and family (Togher et al., 2013). Excellent inter-rater reliability has previously been reported (Togher, McDonald, Coelho and Byom, 2014).


The Personal Conversational Style Scale (PCSS) and the Person Directed Behaviour Scale (PDBS) measure the degree of adjustment to the social communication context following ABI. The PCSS is comprised of three sub-scales: self-disclosure, use of humour and social manners. The PDBS rates the
use of reinforcers, self-centred behaviour and partner involvement behaviour. Rating on all sub-scales requires consideration of a participant’s social behaviour in the context of others. Both scales are therefore sensitive to the loss of higher-level social judgment and awareness that frequently accompanies damage to the frontal lobes.

Behaviours are rated on a Likert scale (0 – 7), where zero indicates very inappropriate behaviours and seven indicates very appropriate behaviours. Behavioural descriptors are included to aid scoring (e.g. on the PCSS use of humour sub-scale ‘childish/excessive humour some of the time’ scores 2; on the PDBS self-centred behaviour sub-scale ‘talked about self some of the time’ scores 5).

These scales have been used to measure change in dyadic conversations between individuals with ABI and their non-injured and unfamiliar communication partners. Flanagan, McDonald and Togher (1995) reported inter-rater reliability as good to excellent. McDonald, Tate, et al. (2008) reported more variable findings. Fair to excellent inter-rater reliability was reported on the PDBS and poor to good reliability on the PCSS. This study used the scales to measure change in group conversation.

- **Profile of Pragmatic Impairment in Communication (PPIC)** (Linscott, Knight and Godfrey, 1996)

This measure (previously known as the Profile of Functional Impairment in Communication) assesses the presence and frequency of 84 social communication behaviours specific to the TBI population. These are organised across 10 sub-scales, based on Grice’s model of pragmatic communication (Grice, 1975).

The measure is comprised of two scoring systems. Raters are required to score a participant on specific behaviour items (SBI) using a 4 point Likert scale (0 – 3, where zero indicates not at all and 3 indicates nearly always/always). There is also a response option for not applicable. Reverse scoring is required on some
items. Scoring is aided by accompanying notes to define terms (e.g. in the clarity of expression subscale, item 50 'is obscure' is defined as 'the subject leaves important information hidden or unexplained'). A separate feature summary scale (FSS) requires the rater to give an overall participant score for each subscale on a Likert scale (0 – 5, where zero is normal and 5 severely impaired). A non-applicable scoring option is not included on the FSS. Scoring instructions specify that the FSS is an aggregate summation of the SBI scores, but that this does not infer a proportional relationship between the two. Data from the feature summary scales have been used in previous studies (Dahlberg et al., 2007; Braden et al., 2010) to measure change in conversations between a person with TBI and an unfamiliar neurotypical person (such as a research assistant). Inter-rater reliability for the FSS has previously been reported as good (Linscott, Knight and Godfrey, 1996). FSS data were used to measure change in this study.

The notes accompanying this measure specify that the context of use should be within a dyadic encounter. The notes also recommend assessment over multiple interactions of a consistent structure.

- **The Interactional Network Tool (INT)**

The SLT researcher developed this measure for the purposes of this study. It uses behavioural counts in conjunction with principles of social network analysis (Moreno, 1934) to graphically represent patterns of contribution within a group setting. See Section 4.2 for a full description of the INT and its coding system.

Raters were instructed to focus on a named participant and to code behaviours between that participant and other interactors in the group. In this way, each interaction sample was coded from the perspective of the named participant. The sociograms generated for each participant within an encounter represent the pattern of interaction between participants in the context of the group.

This is a relational measure. The sociograms are derived from quantitative data, and provide a qualitative view of the degree of participation within an encounter:
for example, who interacts with whom; whether particular individuals dominate the conversation; initiators (who draw others into the conversation) and responders. In contrast with the MPC, BRISS-R and PPIC, the INT is specifically designed to capture change in group interaction patterns over time.

- **Satisfaction Questionnaire**

The SLT researcher developed a satisfaction questionnaire, as a secondary outcome measure, to evaluate participant views on the group meetings (see Appendix 9). This questionnaire was completed within a few days of the final group meeting. Support was provided, where required, from someone not associated with the group meetings to guard against positive bias.

The questionnaire was developed according to guidelines for simplicity of presentation (Taylor-Powell and Renner, 2000). These include a short and uncluttered appearance; clear and concrete phrasing to match the skills of the participants and participant anonymity. Participants were asked to rate four unnumbered statements on a five point Likert scale, (strongly agree; agree; neutral; disagree; strongly disagree). It has previously been suggested that unnumbered scales increase the opportunity for score variation and thereby increase scale reliability (Cook, Heath, Thompson and Thompson, 2001). 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

5.1.7.2 Interaction rating procedure

All group meetings were filmed according to a pre-determined protocol using four tripod mounted GoPro Hero 3 edition camcorders in order to capture the group interaction from multiple angles. An EDUTIGE ETM-001 dual microphone was
attached to each camera. See Appendix 8 for a description and illustration of the filming protocol.

Ten minute clips of each participant engaging in group interaction were prepared for analysis using Final Cut Pro editing software version 10.2.3 (Apple Inc). Although there are no established standards in the field, 10 minute conversation samples are regarded as adequate to capture the occurrence of behaviours such as conversation repair, rate of speech and length of utterance in the aphasia population (Boles and Bombard, 1998). In the ABI literature, sample lengths range from 5 minutes (Togher et al., 2010) to 15 minutes (Helffenstein and Wechsler, 1982).

All samples commenced 5 minutes from the start of the group meeting, irrespective of whether the target participant was active in the conversation at that point. Each sample began with a new sentence and/or new idea and ended at an appropriate pause in the exchange. Sampling from the same time point is in accordance with accepted protocols to guard against sample selection bias (Correll, van Steenbrugge and Scholten, 2010). A discourse sampling protocol from 5 minutes into a conversation has previously been followed where the conversation was more than 10 minutes in length (Best, Maxim, Heilemann, Beckley, Johnson, Edwards, Howard and Beeke, 2016).

Each clip presented three-way views of the participant interacting with the rest of the group on one screen. See Figure 5.3. for a static illustration of clips.
All clips were coded using pseudonyms and copied onto an encrypted hard drive in random sequence to conceal the time point of data collection. These clips were rated using the primary outcome measures of the study.

Four raters were recruited and trained to evaluate the pilot study data. Two raters evaluated 24 (of 31 films). Two further raters were recruited and trained to evaluate the remaining seven films. All raters were blind to the nature of the intervention, the groups, the allocation and the phase of the intervention, and to other raters’ scores. The first rater was undertaking a masters degree in Speech and Language Sciences leading to professional qualification as an SLT at University College London. The second was undertaking a post-graduate masters degree in Language Sciences, also at University College London. A third rater was a recent graduate of a masters degree course in Human Communication Science at the same institution. The fourth was a recently qualified SLT, graduating from the professional MSc in Speech and Language Sciences at University College London. All raters were familiar with the profile of
communication impairment seen in ABI, but unfamiliar with the outcome measures used for this study.

Raters received approximately 5 hours of training over two sessions to familiarise them with the primary outcome measures using video material not associated with this study. Independent practice tasks were completed between sessions to consolidate training. The rater pairs independently evaluated the sampled data.

5.1.8 Data analysis procedures

Data analyses were conducted to test inter-rater reliability and the sensitivity of the outcome measures to changes in group interaction over time. Three of the four outcome measures comprised Likert scale data. There are a number of controversies in the literature associated with the quantitative analysis of pilot study data and Likert scale data. A brief discussion of adjustment for multiple comparisons, analysis of Likert scale data and testing for statistical significance where sample sizes are small provides the rationale for the approaches used in this pilot study.

5.1.8.1 Adjustment for multiple comparisons

The four primary outcome measures comprised a total of 32 scales and multiple comparisons risked inflation of the family-wise error rate (increasing the probability of a false positive result or Type I error). Adjustments are routinely recommended to maintain the family-wise error rate at 5% when multiple comparisons are conducted. The exception to this is the evaluation of pilot data. Rothman (1990) argues that adjustment is not a requirement in exploratory contexts, to enable pilot data to be fully examined and to avoid errors in interpretation of observations.

In this analysis of pilot data, statistical correction for multiple comparisons was not made but scales were aggregated to reduce the number of comparisons. Following the procedure documented by Braden et al. (2010), the 10 subscales of the PPIC were summed for each participant to provide an overall summary score from FSS data. For the BRISS-R, data from three subscales of the PCSS
(social manners, use of humour and self-disclosure) and the PDBS (use of reinforcers, self-centred behaviour and partner-directed behaviour) were summed for each participant to provide one PCSS and one PDBS summary score. For the INT, scores for each participant were summed to provide an overall score for initiations and an overall score for responses. This aggregation procedure reduced the total number of rating scales to seven.

5.1.8.2 Analysis of Likert scale data

The treatment of Likert scale data as continuous data (rather than ordinal) is controversial. The ‘ordinalist’ view is that Likert scales have a rank order, that the distances between the values are not measurable or equal, and that the ordinal level of measurement requires the use of non-parametric statistical techniques for data analysis (Jamieson, 2004). Carifio and Perla (2007) contend that there is a difference between single items on a Likert scale (that are ordinal level data) and the overall scale, which is an aggregation of a number of items and therefore interval level data. In line with the approaches adopted in other studies in the field (Dahlberg et al., 2007; McDonald, Tate, et al., 2008; Togher et al., 2013), the aggregated rating scales were treated as interval data. Normally distributed interval scale data meet the conditions for more powerful parametric statistical analysis.

All statistical testing, where applied, was conducted using the IBM SPSS statistical software package (version 24.0 and version 25.0). The Shapiro-Wilk test was used to test for deviation of scores from a normal distribution. This provides sufficient power to test for normality of data distribution when sample sizes are below 50 (Ghasemi and Zahediasl, 2012). Levene’s test was used to test for homogeneity of variance between the groups where sample sizes were equal.

5.1.8.3 Tests of statistical significance on pilot data

Lee, Whitehead, Jacques and Julious (2014) advise against hypothesis testing in a pilot study as the purpose is to inform decisions for further investigation. Without a power calculation, feasibility studies tend to be inadequately powered.
to reliably detect differences between groups on statistical tests of significance (Kannan and Gowri, 2015). Recommendations are for descriptive statistics and estimation using confidence intervals. Lee et al. (2014) recommend that $p$ values, where calculated, are accompanied by a disclaimer acknowledging insufficient power. In this evaluation, descriptive statistics (medians, means and standard deviations) were reported as a measure of stability or change within the groups. Confidence intervals were reported to indicate the range in which results were most likely to fall. These were reported on rater reliability calculations and where findings on statistical tests were significant.

Statistical tests of significance were reported for some analyses in order to determine change over time. The alpha level was set at 0.05. Findings from these analyses informed selection of the primary outcome measures for the second phase of the study. The use of parametric analysis techniques requires that the necessary assumptions are met. These include independent samples, a normal distribution and equality of variance. There are differences in the literature as to how rigidly these assumptions should be applied. For example, some sources describe an approximately normal distribution; others define a small sample size as less than 30 and specify that non-parametric statistical procedures should be followed. Norman (2010) counters there are no restrictions on sample size when using a $t$ test or the $F$ test from ANOVA. In this analysis, parametric tests were used to examine the sensitivity of outcome measures to change in group interaction patterns.

5.1.9 Pre-intervention analyses

Preliminary analyses comprise inter-rater reliability calculations and baseline comparisons between the groups.

5.1.9.1 Inter-rater reliability

Analyses were conducted to determine rater reliability across the primary outcome measures. Inter-rater reliability was calculated using intra-class correlations (Shrout and Fleiss, 1979). Intra-class correlations (ICCs) calculate the degree of variance between raters in relation to the variation in scores. A
high level of agreement therefore requires low rater variation on a wide variation in scores. ICCs have been used in previous studies in this field to establish reliability (Dahlberg et al., 2007; McDonald, Tate, et al., 2008; Togher et al., 2013).

Rater reliability was measured using ICC type 3,1 as the same two raters evaluated each case. This type is defined in SPSS as two-way mixed. The mixed effects model was chosen because the participants were randomly selected but the raters were fixed. ‘Single measures’ and ‘absolute agreement’ were selected in order to determine the generalisable accuracy and reliability of scores, as subsequent analyses were conducted using the scores from one rater (rather than rater average). The first rater was selected, as a trained SLT with knowledge of the ABI population.

Results for intra-class correlation calculations for all primary outcome measure sub-scales are presented in Table 5.5. Values generally fall between 0 and 1, with 1 defined as perfect agreement, 0 defined as random agreement and minus numbers indicating disagreement (Hallgren, 2012). Cicchetti (1994) proposes interpretation guidelines for magnitudes of agreement. Values below 0.4 are considered poor, values between 0.4 and 0.59 are considered fair, values between 0.6 and 0.74 are considered good, and excellent for values at 0.75 and above. Confidence intervals are reported. This is a probability estimate, specifying the range of values within which there is a 95% chance that the true interval value is likely to fall. Using confidence intervals to report probability coverage on a scale of 0 – 1 as indicative of ‘poor’ to ‘excellent’ reliability, is recommended for ICC reporting (Koo and Li, 2016).
Table 5.5 Intra-class correlations (ICC 3,1) with confidence intervals (CI) 95% for the primary outcome measures

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>ICC (3,1)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MPC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>0.77</td>
<td>0.58 – 0.88</td>
</tr>
<tr>
<td>Transaction</td>
<td>0.74</td>
<td>0.52 – 0.87</td>
</tr>
<tr>
<td><strong>BRISS-R</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal conversational style (PCSS)</td>
<td>0.49</td>
<td>0.32 - 0.63</td>
</tr>
<tr>
<td>Partner directed behaviour (PDBS)</td>
<td>0.50</td>
<td>0.33 - 0.64</td>
</tr>
<tr>
<td><strong>PPIC</strong> (10 sub-scales)</td>
<td>0.68</td>
<td>0.61 – 0.73</td>
</tr>
<tr>
<td><strong>INT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>0.83</td>
<td>0.68 – 0.91</td>
</tr>
<tr>
<td>Responses</td>
<td>0.69</td>
<td>0.45 – 0.84</td>
</tr>
</tbody>
</table>

**Abbreviations:** MPC Adapted Measure of Participation in Conversation; BRISS-R Behaviourally Referenced Rating System of Intermediate Social Skills; PCSS Personal Conversational Style Scale; PDBS Person Directed Behaviour Scale; PPIC Profile of Pragmatic Impairment in Communication; INT Interactional Network Tool.

ICCs were high for the MPC interaction and transaction scales (ICC=0.77, 0.74), indicating ‘excellent’ and ‘good’ ratings agreement respectively. ICCs for the INT initiations and responses were also high (ICC=0.83, 0.69) indicating ‘excellent’ and ‘good’ agreement. Confidence intervals ranged from ‘fair’ to ‘excellent’ across both measures. These levels of agreement indicated that further hypothesis testing using these ratings was warranted, as statistical power was not unduly reduced by measurement error.

Reliability ratings for the BRISS-R scales presented a more variable picture. ICCs for the PCSS and PDBS scales indicated ‘fair’ agreement between raters. Confidence intervals ranged from ‘poor’ to ‘good’. This finding indicated evidence of rater measurement error with the potential to reduce statistical power on subsequent analyses.

ICCs for the PPIC scale indicated good ratings agreement (ICC=0.68). However, the confidence interval was narrow (0.61-0.73). This was unusual given the small sample size and atypical in comparison to the CI ranges for the other...
primary outcome measures, suggesting lower variability of score distribution. On inspection, the data showed presence of skew. Forty two percent of the scores fell into the category of zero (median score=1; range 0-5).

As this is an exploratory study designed to evaluate sensitivity of outcomes across all measures, further analyses were conducted on the BRISS-R and the PPIC. However, these findings potentially undermined the validity of their application to group encounters, precluding their selection for the main study.

5.1.9.2 Between group comparisons at baseline

Statistical analyses were used to evaluate differences between the groups at baseline on the primary outcome measures. Independent t-tests were used where data were normally distributed, and the Mann-Whitney U test was conducted where variables were non-normally distributed (Shapiro-Wilk p<0.05).

Scores from all outcome measures were compared across two pre-intervention measurement points (baseline 1 and baseline 2) to examine differences between the intervention and control groups at baseline. One participant in the intervention group was not present for the evaluation in week 3. This was a planned absence for the peer facilitator, reducing the number of samples to 15. Results are reported in Tables 5.6 and 5.7. The Shapiro-Wilk test was conducted to determine normality of distribution. Data from the non-randomly allocated participant have not been included in this comparison.

Scores from four of the seven outcome scales/sub-scales were normally distributed (BRISS-R, PPIC, INT initiations). Levene’s test for homogeneity of variance was not conducted as sample sizes were not equal. Visual inspection of the standard deviations (sd) showed the spread of scores was markedly large for the intervention group on the PPIC: intervention group mean (sd)=22.9 (17.7); control group mean (sd)=12.88 (3.98). Independent-samples t-tests were therefore used to compare mean scores between the groups for the BRISS-R scales and the INT. Findings are reported in Table 5.6. A Mann-Whitney U test was conducted on the remaining scales and reported in Table 5.7.
Table 5.6 Means and standard deviations at baselines 1 and 2 for the intervention and control groups

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Intervention (n=4)</th>
<th>Control (n=4)</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRISS-R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCSS</td>
<td>9.71 (2.92)</td>
<td>12.38 (2.97)</td>
<td>-1.743</td>
<td>12.788</td>
<td>0.11</td>
</tr>
<tr>
<td>PDBS</td>
<td>8.86 (5.90)</td>
<td>10.38 (3.02)</td>
<td>-0.616</td>
<td>8.701</td>
<td>0.55</td>
</tr>
<tr>
<td>INT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>17.57 (11.52)</td>
<td>20.75 (21.16)</td>
<td>-0.367</td>
<td>11.06</td>
<td>0.72</td>
</tr>
</tbody>
</table>

**Abbreviations:** BRISS-R Behaviourally Referenced Rating System of Intermediate Social Skills; PCSS Personal Conversational Style Scale; PDBS Person Directed Behaviour Scale; INT Interactional Network Tool.

The test identified no difference between the groups on these measures (although a cautious interpretation is required given reduced power to detect difference given the small sample size). The differences in standard deviations between the groups indicated wide variability in the number of initiations for the control group. A Mann-Whitney U test was conducted on the remaining 4 scales. Results are reported in Table 5.7.

Table 5.7 Differences in the distribution of group scores at baselines 1 and 2

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Intervention (n=4)</th>
<th>Control (n=4)</th>
<th>U</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>2.50</td>
<td>2.25</td>
<td>26</td>
<td>-.238</td>
<td>0.812</td>
</tr>
<tr>
<td>Transaction</td>
<td>2.00</td>
<td>2.50</td>
<td>25</td>
<td>-.354</td>
<td>0.723</td>
</tr>
<tr>
<td>PPIC</td>
<td>24.00</td>
<td>14.00</td>
<td>22.5</td>
<td>-.638</td>
<td>0.523</td>
</tr>
<tr>
<td>INT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responses</td>
<td>36.00</td>
<td>24.50</td>
<td>26</td>
<td>-.232</td>
<td>0.817</td>
</tr>
</tbody>
</table>

**Abbreviations:** MPC – Adapted Measure of Participation in Conversation; PPIC Profile of Pragmatic Impairment in Communication; INT Interactional Network Tool
Differences in the distribution of scores between the groups on the MPC scales were broadly similar. Differences in the distribution of scores between the groups on the PPIC (intervention group Md=24, n=7; control group Md=14, n=8) and the INT responses (intervention group Md=36, n=7; control group Md=24.5, n=8) are wide on visual inspection. On statistical testing, none of the measures reached significance, indicating no difference between the groups. This finding must be interpreted with caution as power to detect difference is low.

5.1.9.3 Within group comparisons at baseline

Baseline comparisons were also conducted to explore differences in the intervention group at baseline with and without the peer facilitator present. Measures were compared across the two pre-intervention time points (baseline 1 and baseline 2). The peer facilitator was present for the first (n=4) but not the second baseline measurement assessment (n=3). Means and standard deviations are reported in Table 5.8 as the sample size of the intervention group was too small to test for statistical significance. This comparison was also conducted for the control group, and means and standard deviations are presented in Table 5.9.
Table 5.8 Comparison of two pre-intervention baselines for the intervention group

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Baseline 1</th>
<th>Baseline 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peer facilitator present</td>
<td>Peer facilitator not present</td>
</tr>
<tr>
<td></td>
<td>(n=4)</td>
<td>(n=3)</td>
</tr>
<tr>
<td><strong>MPC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>2.13 (1.89)</td>
<td>2.17 (1.53)</td>
</tr>
<tr>
<td>Transaction</td>
<td>2.38 (1.89)</td>
<td>1.83 (1.76)</td>
</tr>
<tr>
<td><strong>BRISS-R:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCSS</td>
<td>10.50 (3.42)</td>
<td>8.67 (2.31)</td>
</tr>
<tr>
<td>PDBS</td>
<td>8.75 (6.95)</td>
<td>9.00 (5.57)</td>
</tr>
<tr>
<td><strong>PPIC</strong></td>
<td>19.00 (18.67)</td>
<td>26.67 (19.14)</td>
</tr>
<tr>
<td><strong>INT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>18.25 (14.10)</td>
<td>16.67 (9.87)</td>
</tr>
<tr>
<td>Responses</td>
<td>56.25 (60.92)</td>
<td>24.67 (21.39)</td>
</tr>
</tbody>
</table>

Abbreviations: MPC Adapted Measure of Participation in Conversation; BRISS-R Behaviourally Referenced Rating System of Intermediate Social Skills, PCSS Personal Conversational Style Scale; PDBS Person Directed Behaviour Scale; PPIC Profile of Pragmatic Impairment in Communication; INT Interactional Network Tool

Mean scores for the intervention group were broadly similar on the MPC interaction, BRISS-R PDBS and the INT initiation scales whether or not the peer facilitator was present. Mean scores fell on the MPC transaction scale, BRISS-R PCSS and PPIC scales, and mean response scores on the INT at baseline 2. The spread of scores was similar across time points on the MPC, BRISS-R, PPIC and the INT initiations scale. Standard deviations on the INT response scale showed variability. Table 5.9 shows that control group scores increased at baseline 2 on all measures except the PPIC. The standard deviations show that the spread of scores between baselines 1 and 2 were broadly similar.
Table 5.9  Comparison between two pre-intervention baselines for the control group

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Baseline 1 (n=4)</th>
<th>Baseline 2 (n=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td><strong>MPC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>2.00 (0.71)</td>
<td>2.25 (0.29)</td>
</tr>
<tr>
<td>Transaction</td>
<td>2.38 (0.63)</td>
<td>2.63 (0.25)</td>
</tr>
<tr>
<td><strong>BRISS-R:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCSS</td>
<td>11.00 (2.94)</td>
<td>13.75 (2.63)</td>
</tr>
<tr>
<td>PDBS</td>
<td>9.50 (3.42)</td>
<td>11.25 (2.75)</td>
</tr>
<tr>
<td><strong>PPIC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>16.00 (19.44)</td>
<td>25.50 (24.63)</td>
</tr>
<tr>
<td>Responses</td>
<td>21.00 (8.98)</td>
<td>27.00 (11.92)</td>
</tr>
</tbody>
</table>

**Abbreviations:** MPC Adapted Measure of Participation in Conversation; BRISS-R Behaviorally Referenced Rating System of Intermediate Social Skills; PCSS Personal Conversational Style Scale; PDBS Person Directed Behaviour Scale; PPIC Profile of Pragmatic Impairment in Communication; INT: Interactional Network Tool

This pre-intervention comparison of the groups across two time points showed broad similarities in mean scores, indicating stability at baseline. Differential sensitivity across the scales was indicated given the variable direction of change between measures. Analyses were then conducted to explore the intervention effects.

5.2 Results

Treatment effects were evaluated using repeated measures analyses. Post-intervention comparisons of means between groups at the end of week 8 and maintenance comparisons at the end of week 12 were conducted using a two-way repeated measures ANOVA. There is no non-parametric alternative to a two-way repeated measures ANOVA. Norman (2010) cites Pearson (Pearson, 1931) to show that ANOVA is sufficiently robust to handle highly skewed, non-normal distributions on samples sizes of 4, 5 and 10 (although the findings and their generalisability from the sample size will need verification). Post-treatment outcomes and maintenance measures were compared to the first baseline measurement point, as the peer facilitator was present. Section 5.2.1 reports
Section 5.2.2 reports pre-post intervention comparisons. Section 5.2.3 reports changes over time from baseline to maintenance (week 12). Section 5.2.4 examines intervention effects on the INT.

5.2.1 Participant attendance

Of the nine participants completing the pilot phase of this study, six completed 100% of the sessions (i.e. 18 sessions, comprising intervention and maintenance phases). Two participants in the intervention group attended 94% of the planned sessions (i.e. each absent for one session). One participant in the intervention group attended 88% (i.e. absent for two sessions).

The peer facilitator attended 14 of the 16 planned individual training sessions (88%). These sessions spanned 4 weeks. Both sessions were missed in the third week of the training following exacerbation of a pre-existing but previously undiagnosed bi-polar disorder.

5.2.2 Pre- and post-intervention comparisons

Comparisons between baseline and post-intervention outcomes were conducted using a two-way repeated measures ANOVA. Means, standard deviations and interaction effects are reported in Table 5.10. All scales marked with an asterisk violated the assumption of equality of variance (Levene’s test), indicating unequal variance of scores across the groups.
Table 5.10  Pre-post intervention comparisons (baseline and post intervention)

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Intervention Group (n=4)</th>
<th>Control Group (n=4)</th>
<th>Interaction effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Mean (SD)</td>
<td>Baseline</td>
</tr>
<tr>
<td>MPC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction*</td>
<td>2.13 (1.89)</td>
<td>1.50 (0.91)</td>
<td>2.00 (0.71)</td>
</tr>
<tr>
<td>Transaction*</td>
<td>2.38 (1.89)</td>
<td>1.88 (1.38)</td>
<td>2.38 (0.63)</td>
</tr>
<tr>
<td>BRISS-R:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCSS</td>
<td>10.50 (3.42)</td>
<td>9.00 (1.83)</td>
<td>11.00 (2.94)</td>
</tr>
<tr>
<td>PDBS* **</td>
<td>8.75 (6.95)</td>
<td>5.75 (0.50)</td>
<td>9.50 (3.42)</td>
</tr>
<tr>
<td>PPIC*</td>
<td>19.00 (18.67)</td>
<td>24.00 (12.94)</td>
<td>12.50 (5.07)</td>
</tr>
<tr>
<td>INT:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations**</td>
<td>18.25 (14.10)</td>
<td>29.00 (50.70)</td>
<td>16.00 (19.94)</td>
</tr>
<tr>
<td>Responses* **</td>
<td>56.25 (60.92)</td>
<td>27.00 (27.54)</td>
<td>21.00 (8.98)</td>
</tr>
</tbody>
</table>

**Abbreviations:** MPC Adapted Measure of Participation in Conversation; BRISS-R Behaviourally Referenced Rating System of Intermediate Social Skills; PCSS Personal Conversational Style Scale; PDBS Person Directed Behaviour Scale; PPIC Profile of Pragmatic Impairment in Communication; INT Interational Network Tool.

*=violation of equality of variance (Levene’s test: p≤0.05); **=violation of normality of distribution (Shapiro-Wilk: p≤0.05)
Mean scores increased across all measures between baseline and post-intervention for the control group and decreased for the intervention group, with the exception of the INT where the mean number of initiations for the intervention group increased. There was a significant interaction between the two treatment conditions between baseline and post-intervention on the MPC interaction scale ($F=6.171$, $df=1,6$, $p=.05$). This is illustrated in Figure 5.4. The control group displayed significantly improved mean scores on this scale. Inferential error bars were used to evaluate the size of the effect. These are illustrated in Figure 5.5. Confidence intervals (95%) are wide at baseline as a result of the small sample size and heterogeneity of the sample. The degree of overlap on the post-intervention bars shows the similarity between the groups.

Figure 5.4 Mean scores on the MPC interaction scale pre- and post-intervention for the intervention ($n=4$) and control ($n=4$) groups
5.2.3 Pre-intervention and maintenance comparisons

Means, standard deviations and interaction effects for baseline and maintenance (week 12) comparisons between the groups are presented in Table 5.11. All scales marked with an asterisk violated the assumption of equality of variance, indicating unequal variance of scores across the groups.

The distribution of data was not normal on three of the seven scales and equality of variance was not met on six of the scales, impacting the power and precision of the test. Mean scores increased across all scales for the control group. The profile of change for the intervention group was mixed, showing a decline and no change in mean scores on MPC sub-scales, an increase on the BRISS-R and PPIC scales and a decline in the mean number of initiations and responses on the INT. Standard deviations indicated a wide spread of scores on the INT and the PPIC for both groups. No interaction effect was observed across the measures between baseline and maintenance. No significant differences were found between post-intervention measures and maintenance scores on the seven scales. This indicates that behaviour was stable, however comparisons were under-powered.
### Table 5.11 Baseline and maintenance comparisons

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Intervention Group (n=4)</th>
<th>Control Group (n=4)</th>
<th>Interaction effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Mean (SD)</td>
<td>Maintenance Mean(SD)</td>
<td>Baseline Mean (SD)</td>
</tr>
<tr>
<td><strong>MPC</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction* **</td>
<td>2.13 (1.89)</td>
<td>1.50 (0.58)</td>
<td>2.00 (0.71)</td>
</tr>
<tr>
<td>Transaction*</td>
<td>2.38 (1.89)</td>
<td>2.38 (1.25)</td>
<td>2.38 (0.63)</td>
</tr>
<tr>
<td><strong>BRISS-R:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCSS*</td>
<td>10.50 (3.42)</td>
<td>10.25 (2.22)</td>
<td>11.00(2.94)</td>
</tr>
<tr>
<td>PDBS</td>
<td>8.75 (6.95)</td>
<td>7.50 (3.42)</td>
<td>9.50 (3.42)</td>
</tr>
<tr>
<td><strong>PPIC</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*</td>
<td>19.00(18.67)</td>
<td>24.75(11.79)</td>
<td>12.50 (5.07)</td>
</tr>
<tr>
<td><strong>INT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations**</td>
<td>18.25(14.10)</td>
<td>23.50(31.80)</td>
<td>16.00(19.44)</td>
</tr>
<tr>
<td>Responses* **</td>
<td>56.25(60.92)</td>
<td>21.75(14.45)</td>
<td>21.00 (8.98)</td>
</tr>
</tbody>
</table>

**Abbreviations:** MPC – Adapted Measure of Participation in Conversation. BRISS-R – Behaviourally Referenced Rating System of Intermediate Social Skills, PCSS – Personal Conversational Style Scale, PDBS – Person Directed Behaviour Scale. PPIC – Profile of Pragmatic Impairment in Communication. INT: Interational Network Tool.

* = violations of equality of variance (Levene's test; p ≤ 0.05); ** = violation of normality of distribution (Shapiro-Wilk; p ≤ 0.05).
5.2.4 Analysis of intervention effects on the INT

Initiation and response data from the INT were not normally distributed (Shapiro-Wilk: \( p \leq 0.05 \)). Response data did not meet the assumption of equality of variance (Levene's test: \( p \leq 0.05 \)). Mean frequency counts and standard deviations are presented across all three measurement points in Table 5.12. The standard deviations show marked variability within and between the groups.

The application of social network approaches provides an explanatory context for these mean frequency counts and standard deviations. A within and between group comparison of initiation and response percentages was conducted. For this analysis, the INT spreadsheet data for each participant in the intervention (\( n=4 \)) and control (\( n=4 \)) groups were pooled. Initiation and response frequency counts from the INT matrices were then combined at each measurement point in order to calculate a measure of equality of participation. A normalized HHI value was calculated to provide a measure of equality of participation over time for both groups. Table 5.13 presents participant initiation and response proportions for each group, and the corresponding NHHI values across the three measurement points. The peer facilitator in the intervention group is indicated in bold type.
Table 5.12 INT: mean frequency counts and standard deviations for the intervention and control groups at baseline, post-intervention and maintenance

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Intervention Group (n=4)</th>
<th>Control Group (n=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Mean (SD)</td>
<td>Post-intervention Mean (SD)</td>
</tr>
<tr>
<td>Initiations**</td>
<td>18.25(14.10)</td>
<td>29.00(50.70)</td>
</tr>
<tr>
<td>Responses **</td>
<td>56.25(60.92)</td>
<td>27.00 (27.54)</td>
</tr>
</tbody>
</table>

*=violations of equality of variance (Levene’s test: p≤0.05)  **=violation of normality of distribution (Shapiro-Wilk: p≤0.05)
Table 5.13 Interaction percentages and the NHHI

<table>
<thead>
<tr>
<th>Pilot study</th>
<th>Normalised Herfindahl-Hirschman Index (range 0 – 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>Intervention n=4</td>
<td></td>
</tr>
<tr>
<td>Nicholas</td>
<td>0.02</td>
</tr>
<tr>
<td>Peter</td>
<td>0.03</td>
</tr>
<tr>
<td>Jason</td>
<td>0.46</td>
</tr>
<tr>
<td>Lisa</td>
<td>0.49</td>
</tr>
<tr>
<td>Control n=4</td>
<td></td>
</tr>
<tr>
<td>Pippa</td>
<td>0.34</td>
</tr>
<tr>
<td>Alison</td>
<td>0.29</td>
</tr>
<tr>
<td>Donald</td>
<td>0.10</td>
</tr>
<tr>
<td>Imelda</td>
<td>0.27</td>
</tr>
</tbody>
</table>

The NHHI for the intervention group at baseline (0.27) indicates domination of the encounter by a minority of participants. This pattern of domination by a minority was unchanged post-intervention (0.26). A decrease to 0.14 at maintenance indicates a more balanced pattern of interaction. The NHHI for the control group indicates a balanced distribution of counts at baseline (NHHI 0.4). This is maintained post-intervention. Maintenance measures show a further decrease toward a perfectly balanced interaction (NHHI 0.01). This profile of change over time is illustrated in Figure 5.6.
Figure 5.6  NHHI at baseline, post-intervention and maintenance for the intervention and control groups

Sociograms in Figure 5.7. illustrate the patterns of participation between participants in each group across three measurement points. This is a qualitative view drawn from the quantitative data recorded on the INT pooled spreadsheets and matrices. Therapy assistants (TA1 and TA2) facilitated the control group.
Figure 5.7 INT graphs showing pooled initiations and responses by group

<table>
<thead>
<tr>
<th>Intervention: Baseline</th>
<th>Intervention: Post-Intervention</th>
<th>Intervention: Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Graph" /></td>
<td><img src="image2" alt="Graph" /></td>
<td><img src="image3" alt="Graph" /></td>
</tr>
<tr>
<td><img src="image4" alt="Graph" /></td>
<td><img src="image5" alt="Graph" /></td>
<td><img src="image6" alt="Graph" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control: Baseline</th>
<th>Control: Post-Intervention</th>
<th>Control: Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Graph" /></td>
<td><img src="image8" alt="Graph" /></td>
<td><img src="image9" alt="Graph" /></td>
</tr>
<tr>
<td><img src="image10" alt="Graph" /></td>
<td><img src="image11" alt="Graph" /></td>
<td><img src="image12" alt="Graph" /></td>
</tr>
</tbody>
</table>

TA= therapy assistant
The baseline profile (NHHI 0.27) for the intervention group shows an encounter dominated by two participants (Lisa and Jason). This pattern of dominance was also present post-treatment (NHHI 0.26). Another dominant player post-treatment was Bill. However, data from this participant were omitted from the NHHI analysis as a result of non-random re-allocation due to early losses. By maintenance, the pattern of domination from Lisa continued but the frequency of interactions with Jason (previously an over-participator) had reduced, and the frequency of interactions with Peter and Nicholas (previously under-participators) had increased from post-treatment. Overall, the network graphs show that paired interactions for this group were largely with Lisa, with minimal direct interaction between the other participants.

The sociogram for the control group shows a relatively balanced pattern of activity across group meetings. It also shows that data from some of the dominant players are missing from the analysis. Data from one participant (Patrick) were excluded from the NHHI calculation as a result of re-allocation. Samples for the two therapy assistants were also not prepared and rated (as they were not participants in the study), and therefore are also missing from the analysis. In this example, the sociograms show the influential role of therapy assistants on the control group interaction. These therapy assistant ratings were drawn from client coded behaviours, where therapy assistants stimulated clients to participate. They are likely to be a small fraction of the total. It is clear that therapy assistant data requires rating in its own right and its omission undermines the validity of the outcome. This is an important finding from this pilot study.

In summary, the NHHI values indicate a more equally distributed pattern of participation across all three measurement points for the control group compared to the intervention group. The intervention group showed a more balanced pattern of participation over time. However, these findings were calculated from an incomplete data set. The sociograms show that data from dominant players in both groups have not been included in the analyses, potentially skewing the
NHFI findings. This is a new group interaction measure without pre-existing methodology. Pilot study feasibility analyses require testing of all measurement and validation procedures in preparation for the main study. This analysis has shown that initiation and response ratings for all group interactors at each measurement point is required in order to determine the proportion of the total interaction that is attributable to participants versus staff. Modification to the protocol for data analysis is therefore required in preparation for the main study.

5.2.5 Group satisfaction questionnaire

Data from the satisfaction questionnaire is ordinal. Descriptive statistics (means and standard deviations) are reported. Responses were scored on an unnumbered five point scale. These data points were later converted to numeric values where 5 indicated strong agreement and 1 indicated strong disagreement. Responses were at the satisfied end of the scale across all statements for both groups. Mean scores and standard deviations are reported. Results are presented in Table 5.14. Findings indicated that participants in the intervention group found this model of intervention to be acceptable.

**Table 5.14 Group satisfaction questionnaire**

<table>
<thead>
<tr>
<th>Questionnaire categories</th>
<th>Intervention Group (n=4) Mean (SD)</th>
<th>Control Group (n=4) Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group purpose</td>
<td>4.75 (0.50)</td>
<td>4.50 (0.58)</td>
</tr>
<tr>
<td>Communication</td>
<td>4.00 (0)</td>
<td>4.25 (0.50)</td>
</tr>
<tr>
<td>Participation</td>
<td>3.50 (1.29)</td>
<td>4.25 (0.50)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>4.50 (0.58)</td>
<td>4.50 (0.58)</td>
</tr>
</tbody>
</table>

5.2.6 Summary of results

Reliability ratings of the primary outcome measures were variable. ICCs were high for the MPC scales and the INT. Findings for the BRISS-R scales indicated evidence of measurement error. Scoring anomalies on the PPIC indicated reduced variability in the distribution of scores. The intervention and control groups were comparable at baseline across the demographic and profiling
assessment variables. The measures were compared at two pre-intervention measurement points and the groups were stable at baseline.

An evaluation of treatment effects showed a consistent direction of change between baseline and post-intervention measures. A significant interaction on the MPC interaction scale ($F=6.171$, df=1,6, $p=.05$) showed improved mean scores for the control group. A comparison of outcomes between baseline and maintenance showed inconsistent patterns of change across the measures for the intervention group. The data were not normally distributed and variances were not equal. The analyses showed no significant differences between the groups from baseline to maintenance.

Frequency counts from the INT were evaluated using an NHHI. There were missing data in both groups which resulted in an incomplete data set for analysis. The data from the satisfaction questionnaire showed that the intervention group found the intervention acceptable.

Overall, these findings show that the new peer-mediated intervention did not result in improved social communication skills compared to a staff-led social activity group. However, these findings have informed the feasibility of the approach and enabled identification of modifications for subsequent investigation. These will be discussed in the next section.

5.3 Evaluation of the pilot study

In line with recommended practice (Thabane, Ma, Cheng, Ismaila, Rios, Robson, Thabane, Giangregorio and Goldsmith, 2010), the primary purpose of this pilot phase was to test the feasibility of the approach and to inform the design for the main study, with a cautious evaluation of treatment effects. Preliminary findings indicated that protocol modification was required prior to further testing. The outcome measures showed differential sensitivity to change in social communication skills. These findings will be discussed using headings from the methodological framework for pilot studies devised by Lancaster, Dodd and Williamson (2004).
1. Integrity of the study protocol
2. Testing of data collection (participant forms, questionnaires)
3. Randomisation procedures
4. Recruitment and retention
5. Feasibility/acceptability of the intervention
6. Selection of the primary outcome measures

5.3.1 Integrity of the study protocol

Participants attended over 85% of planned sessions indicating that the length and frequency of group sessions is a feasible inclusion into the participants’ weekly timetables in this setting, without disruption to existing therapy or leisure routines. The peer facilitator attended over 85% of the facilitator training sessions. However, the fidelity of the intervention was compromised by a change in the facilitator’s presentation over the course of the intervention, requiring adaptations to the implementation plan. This change in presentation was consistent with a pre-existing but undiagnosed bi-polar disorder. The fluctuating pattern of presentation impeded the consistency of engagement in the training programme and the ability to use and apply core concepts. Great care needs to be taken in the selection of the peer facilitator given their importance in the delivery of the intervention.

5.3.2 Assessment and data collection

The research team was aware of the potential burden of multiple profiling assessment sessions for participants. Most participants tolerated these sessions without difficulty. No information was collected on perceived change in social communication skills and behaviour from participants and close others. This was a limitation of the pilot study. Amendments for the main study included a 30 minute assessment of social communication ability to explore perceived change.

All other aspects of data collection were conducted as per the research protocol (camera set-up, transfer of footage, data storage, use of film clips for the facilitator training) without requirement for adaptation.
5.3.3 Randomisation procedures

Randomisation procedures were conducted using the service provided by UCL. Blinding was used alongside randomisation to control for bias in participant allocation and scoring. Participants could not be blinded to treatment allocation, which is usual in behavioural interventions that involve informed consent. Participants were unable to reveal details of their allocation to raters and film clips for rating were reviewed to ensure concealment of the phase of intervention.

Two participants were re-allocated prior to the intervention. Post-randomisation transfer of participants between groups to retain balance in group numbers has occurred in previous larger scale social communication intervention studies (McDonald, Tate, et al., 2008; Togher et al., 2013). However, this strategy risks introduction of bias into the study. Increasing participant numbers reduces the impact of early attrition and withdrawal.

5.3.4 Recruitment and retention

Although a sufficient number of participants were recruited to the study, 25% were lost prior to the intervention phase. All losses were from the intervention group. Reluctance to attend a group may reflect a lower tolerance threshold for group activity with or without staff present. This selection criterion was modified for the main study. The upper age limit was increased from 65 to 70 years to allow recruitment of more participants from the facility. This is consistent with a current trend of increased numbers of older adults with ABI as a result of injuries, such as falls (Finch et al., 2016).

5.3.5 Feasibility/acceptability of the intervention

Overall, participant feedback on this intervention was positive. However, participants in the intervention group commented that discussion topics related to the operational running of the facility were repetitive. Modifications to the agenda were required, to include aspirational goals and discharge-specific discussion topics.
5.3.6 Selection of the primary outcome measures

Three validated scales, previously used in studies investigating changes in social communication skills, were selected to evaluate change over time. These enabled comparisons with other intervention studies in the field, in line with guidelines for reporting outcomes in parallel group designs (Moher et al., 2010). Each had previously been used to evaluate change in conversations between dyads but were unproven in group encounters. These measures proved differentially sensitive.

Guyatt, Walter and Norman (1987) specify three areas for investigation with new measurement procedures: reliability (do the measures produce the same results?), content validity (do the scales measure what is intended?) and sensitivity to clinically important differences. These will be discussed below.

- Reliability

Score consistency over time is a measure of reliability, and has been cited as a marker of usefulness in evaluations of new measurement tools (Guyatt, Walter and Norman, 1987). Test-retest reliability can be determined from the consistency of repeated measures for the control group. Scores were consistent across all measures.

Reliability across different raters is another measure of reliability. Inter-rater reliability was high for both the MPC and INT scales. Both achieved ‘excellent’ and ‘good’ rating without extensive training. These scales therefore met the inter-rater reliability criterion for inclusion in the main study. The BRISS-R scales indicated only ‘fair’ level of agreement. It has been acknowledged by previous researchers that a high level of rater agreement is not easily achieved with this measure, even with extensive rater training (Togher, McDonald, et al., 2014). The PPIC showed a good level of agreement, but scoring anomalies in the application to group encounters reduced the range of variance in the ratings and undermined reliability. Neither the BRISS-R nor the PPIC scales therefore met the reliability criterion for group evaluation.
• Validity

Scoring anomalies will impact test validity. Raters reported that the guidance notes for the MPC scales aided the scoring without lengthy deliberation on the degree of fit. The INT required observation and recording of behavioural counts without deliberation. Both measures therefore met the content validity criterion for the main study.

Anomalies were identified by raters on both the PPIC and BRISS-R scales reducing their applicability for measuring change in group encounters. On the BRISS-R PCSS, for example, guidance notes specify a rating of normal, if the participant is mostly silent. Raters commented that they followed this guidance resulting in normal ratings for some participants where conversational style behaviours fell outside of this range (e.g. non-responsiveness to members of the group). A high proportion of normal ratings were also given on the PPIC. Raters reported difficulties rating not applicable versus not present on the SBI scale, and then degree of impairment on the FSS. In the absence of clear evidence, ratings defaulted to normal. Scoring errors were also identified on the PPIC with negative statements, which were interspersed with positive statements, and required reverse scoring. In a review of the advantages and disadvantages of Likert-type scales, Hartley (2013) suggests that validity can be increased by removing negatively worded items or presenting those items separately to overcome the difficulties of reverse thinking and scoring.

Rating dilemmas also arose on the BRISS-R and PPIC on items where conversation norms can differ between a group and a dyadic encounter. On the BRISS-R social manners scale, for example, multiple interruptions are classed as inappropriate behaviour. Raters commented that in the group conversations, they were often used appropriately as a means to negotiate a turn. On the literal content subscale of the PPIC, ‘leaves out parts of sentences’ may be a result of conversational cross talk in a group rather than an omission within a sequence. These difficulties were not entirely unexpected given that both tools have
previously been used to measure change in dyadic encounters. PPIC instructions specify a dyadic interaction as the context for assessment.

- Sensitivity/responsiveness
The sensitivity or responsiveness of a measure is a function of the properties of the measure, the conditions in which it is applied and the research design (Lipsey, 1983). The three scales trialled in this pilot study were drawn from the social communication skills literature, and have all been validated in dyadic conversations. Difficulties generalizing some constructs to group conversation have been discussed. The scales have also been applied to two different social groups: one unstructured discussion group without staff present, and one highly structured, staff-led group. These factors are all potential sources of discriminative measurement inconsistency, defined as the ability of a measure to differentiate between two groups (Brock, Goldie and Greenwood, 2002). Evaluative inconsistencies, defined as the responsiveness of the measure to magnitude of change over time (Ottenbacher and Cusick, 1993), may also be present as the scales are recording change in a repeated measures design.

Quantifying measurement sensitivity (discriminative and evaluative) requires some knowledge of the changes in score that are of minimal clinical importance (Guyatt, Walter and Norman, 1987). This is problematic with one new measure and three existing measures applied in a new context with an unproven intervention. This pilot study has also shown that missing data from the INT further undermines this evaluation of measurement sensitivity.

5.3.7 Summary

The purpose of this pilot study was to determine the feasibility of the intervention approach and to select outcome measures for the next phase of the study that are sensitive to changes in group encounters over time. As a result, the following adaptations to the protocol were required for the main study:

- Modification of participant selection criteria to increase the upper age limit from 65 to 70
• Clarification of participant selection criteria to include evidence of the ability to tolerate group activity (to be provided at the recruitment and referral stage)
• Careful appointment of the peer facilitator to ensure selection excludes the presence of a psychiatric disorder
• Modification of the discussion agenda for the intervention group, to include more general rehabilitation topics
• Inclusion of the LCQ as a secondary outcome measure to evaluate perceived changes in social communication skills by participants and a familiar communication partner
• Rating of conversation samples for all group interactors, including therapy assistants, across all measurement points on the INT

The BRISS-R scales and the PPIC did not meet the criteria for reliability, validity or responsiveness to measuring change in group encounters. There was a significant interaction on the MPC in favour of the control group, demonstrating that the methodology can detect change in group behaviour. The MPC scales and the INT were selected as the primary outcome measures for the main study. The main study is reported in Chapter 6.
Chapter 6 Main study: a parallel investigation of a peer-mediated intervention for social communication skills in ABI

This chapter reports the method and results for the main study. Twelve new participants with severe ABI were recruited from the same in-patient neuro-rehabilitation centre described in the pilot study (see Section 5.1.1). Following adaptations to the study protocol, the aim of the main study was to investigate whether the peer-led intervention was more effective than the staff-led activity group in improving social communication skills. Two experimental hypotheses underpinned this research question, namely that:

- the peer intervention will result in a greater improvement over time on the conversation interaction and transaction subscales of MPC (Togher et al., 2010) than the staff-facilitated control group

- participants in the peer-facilitated group will demonstrate a more equal pattern of verbal and non-verbal initiations and responses post-intervention and at follow-up on the INT, and the distribution pattern in the staff-led group will be constant at each measurement point

The MPC (Togher et al., 2010) was previously described in Section 5.1.7. The INT was described in Section 4.2. Amendments to the study protocol were discussed in Section 5.3 and are summarised in Section 6.1. Methods are reported in Section 6.1 and results in Section 6.2.

6.1 Methods

Following evaluation of the pilot study protocol, a request for substantial amendment was submitted to the local NHS Research Ethics Committee and approved on 25th March 2015. See Appendix 1.2 for the REC approval letter. The study design remained the same.

Amendments to the protocol are summarised as follows:
• Inclusion of the LCQ (Douglas, O’Flaherty and Snow, 2000) as a secondary outcome measure of perceived change following the intervention
• Revised discussion topics for the intervention group (see Appendix 6.2)
• Revised inclusion criteria to include adults between 18 and 70 years (previously 65 years)
• Selection criteria to include evidence of ability to tolerate group activity for all participants and to exclude psychiatric disorder for the peer facilitator
• INT ratings to include all group participants, including therapy assistants

6.1.1 Participant recruitment

Recruitment took place in April 2015. Clinical teams at the brain injury facility were alerted to the modified selection criteria. Five participants were able to consent to participate. Members of the treating clinical team determined that seven participants were either without capacity to consent or that their capacity was borderline. Consent was therefore obtained from a consultee with personal knowledge of pre-injury wishes about participating in research. As per the pilot study, it was not possible to blind participants to the intervention condition. All other aspects of the recruitment and randomisation procedure were conducted as described in the pilot study (see Chapter 5, Section 5.1). Participant data, injury severity and clinical characteristics for participants recruited to the main study are reported in Appendix 4.2.

6.1.2 Selection of the peer facilitator

The peer facilitator was selected during the first two weeks of the group meetings as per the selection criteria described in the pilot study (see Section 5.1.2 and Section 5.3.7). The first peer facilitator developed an infection at the beginning of week 3 (week 1 of the facilitator training sessions). Following discussion with the treating clinical team, the peer facilitator agreed to step down from this role and continue as a participant. Another peer facilitator from the intervention group was appointed without disruption to the training schedule.
6.1.3 Profiling assessment procedure

The same battery of standardised tests was administered as described in the pilot study (see Section 5.1.3), to establish participant profiles of cognitive and communication ability.

6.1.4 Group allocation and progression through the study

Following the profiling assessments, the twelve participants were randomly assigned to either the intervention or control groups following procedures for allocation concealment previously described in Section 5.1.4. Figure 6.1 presents participant allocation and progression through this phase of the study in a CONSORT diagram.

Figure 6.1 CONSORT diagram showing participant allocation and progression through the main study

```
12 participants randomised to:

<table>
<thead>
<tr>
<th>Intervention group</th>
<th>n=6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td></td>
</tr>
<tr>
<td>Weeks 1-3</td>
<td>n=5</td>
</tr>
<tr>
<td>dropout</td>
<td>n=1</td>
</tr>
<tr>
<td>n=5</td>
<td></td>
</tr>
<tr>
<td>Intervention phase</td>
<td></td>
</tr>
<tr>
<td>n=5</td>
<td></td>
</tr>
<tr>
<td>dropout</td>
<td>n=1</td>
</tr>
<tr>
<td>n=4</td>
<td></td>
</tr>
<tr>
<td>Post-intervention measures Week 8</td>
<td></td>
</tr>
<tr>
<td>n=5</td>
<td></td>
</tr>
<tr>
<td>Maintenance measures Week 12</td>
<td></td>
</tr>
<tr>
<td>n=5</td>
<td></td>
</tr>
<tr>
<td>dropout</td>
<td>n=1</td>
</tr>
<tr>
<td>n=4</td>
<td></td>
</tr>
</tbody>
</table>
```

Three participants withdrew from the study. One no longer wished to participate and withdrew from the intervention group during the baseline period in week 3. Two participants withdrew from the control group, both due to unplanned surgical procedures. Of these, one withdrew on the day of the first meeting and the second withdrew in week 5. As per the pilot study, data from participants that withdrew from the study were not included in the intervention analyses. The intention-to-treat criterion for outcome reporting was not applied as the sample size was small and reporting findings on untreated participants increased susceptibility to a type II error. Demographic and profiling data are presented in the next section.

6.1.5 Demographic and profiling data

Demographic and profiling variables are presented for final groups, following losses. Means and standard deviations are reported for all variables. Demographic variables for the intervention group are presented in Table 6.1 and for the control group in Table 6.2. Cognitive and communication profiling data for the intervention group are presented in Table 6.3 and for the control group in Table 6.4. Pseudonyms have been used to preserve anonymity. The peer facilitator is indicated in bold type.
Table 6.1 Demographic variables: intervention group

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age (years)</th>
<th>Male/female</th>
<th>Education (years)</th>
<th>Time post onset (years)</th>
<th>Injury severity/clinical characteristics, as documented in clinical notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexis</td>
<td>39</td>
<td>F</td>
<td>10</td>
<td>24</td>
<td>TBI: RTA. Comatose for several months. Cognitive impairment requiring on-going support with ADLs.</td>
</tr>
<tr>
<td>Madison</td>
<td>45</td>
<td>F</td>
<td>16</td>
<td>6</td>
<td>ABI: Intracranial mass lesion. Hydrocephalic ischemia. Severe cognitive impairment requiring full support and supervision in daily routines.</td>
</tr>
<tr>
<td>Aden</td>
<td>53</td>
<td>M</td>
<td>12</td>
<td>0.7</td>
<td>ABI: Severe bilateral HSV encephalitis. Severe cognitive impairment.</td>
</tr>
<tr>
<td>Magnus</td>
<td>57</td>
<td>M</td>
<td>15</td>
<td>1.1</td>
<td>ABI: Hypoxic brain injury following multi-organ failure and cardiac arrest. Severe cognitive and physical impairment.</td>
</tr>
<tr>
<td>Clive</td>
<td>50</td>
<td>M</td>
<td>11</td>
<td>5</td>
<td>ABI: Intracranial haemorrhage (ruptured AVM). Severe and persisting cognitive impairment and behavioural issues.</td>
</tr>
<tr>
<td>Mean (sd)</td>
<td>48.8 (7.01)</td>
<td>3/2</td>
<td>12.8 (2.59)</td>
<td>7.36 (9.59)</td>
<td>TBI/ABI: 1/4</td>
</tr>
</tbody>
</table>

Peer facilitator indicated in bold type

Table 6.2 Demographic variables: control group

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age (years)</th>
<th>Male/female</th>
<th>Education (years)</th>
<th>Time post onset (years)</th>
<th>Injury severity/clinical characteristics, as documented in clinical notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natalie</td>
<td>43</td>
<td>F</td>
<td>15</td>
<td>1</td>
<td>ABI: Subarachnoid haemorrhage (grade 5). Severe cognitive impairment. Support required with ADLs.</td>
</tr>
<tr>
<td>Jacob</td>
<td>49</td>
<td>M</td>
<td>11</td>
<td>1</td>
<td>ABI: Obstructive hydrocephalus with interventions for raised intra-cranial pressure. Severe cognitive impairment. Support required with all ADLs.</td>
</tr>
<tr>
<td>Regan</td>
<td>68</td>
<td>F</td>
<td>16</td>
<td>1</td>
<td>ABI: Hypoxic brain injury following cardiac arrest. Intracranial haemorrhage. Severe cognitive and physical impairment. Support required with ADLs.</td>
</tr>
<tr>
<td>Sidney</td>
<td>33</td>
<td>M</td>
<td>13</td>
<td>2</td>
<td>TBI: Subarachnoid haemorrhage and basal skull fracture following fall. Multiple surgical interventions to reduce swelling. Severe cognitive and physical impairment.</td>
</tr>
<tr>
<td>Mean (sd)</td>
<td>48.25 (14.73)</td>
<td>2/2</td>
<td>13.75 (2.22)</td>
<td>1.03 (0.05)</td>
<td>TBI/ABI: 1/3</td>
</tr>
</tbody>
</table>
Visual inspection of the data showed difference between the groups in mean time post-injury. This difference operated in favour of the control group, as previous studies have indicated greater potential for gain for those in an earlier stage of recovery (e.g. McDonald, Tate, et al., 2008).

Table 6.3 Profiling variables: intervention group

<table>
<thead>
<tr>
<th>Participant</th>
<th>LCQ-self</th>
<th>LCQ-other</th>
<th>Semantic fluency</th>
<th>TASIT Part 1</th>
<th>WASI-II VCI</th>
<th>PRI</th>
<th>FSIQ 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score range</td>
<td>120-30</td>
<td>120-30</td>
<td>0-28+</td>
<td>0-28</td>
<td>45-160</td>
<td>45-160</td>
<td>40-160</td>
</tr>
<tr>
<td>(low-high)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Composite</td>
<td>scores</td>
<td></td>
</tr>
<tr>
<td>Alexis</td>
<td>46</td>
<td>57</td>
<td>11</td>
<td>23</td>
<td>86</td>
<td>86</td>
<td>84</td>
</tr>
<tr>
<td>Madison</td>
<td>36</td>
<td>66</td>
<td>10</td>
<td>10</td>
<td>56</td>
<td>55</td>
<td>52</td>
</tr>
<tr>
<td>Aden</td>
<td>46</td>
<td>64</td>
<td>14</td>
<td>17</td>
<td>99</td>
<td>83</td>
<td>90</td>
</tr>
<tr>
<td>Magnus</td>
<td>58</td>
<td>69</td>
<td>10</td>
<td>13</td>
<td>81</td>
<td>51</td>
<td>65</td>
</tr>
<tr>
<td>Clive</td>
<td>36</td>
<td>56</td>
<td>14</td>
<td>13</td>
<td>75</td>
<td>65</td>
<td>68</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>44.40(9.10)</td>
<td>62.40(5.68)</td>
<td>11.80</td>
<td>15.20</td>
<td>79.40(15.79)</td>
<td>68.00(15.94)</td>
<td>71.80(15.27)</td>
</tr>
</tbody>
</table>

**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

Table 6.4 Profiling variables: control group

<table>
<thead>
<tr>
<th>Participant</th>
<th>LCQ-self</th>
<th>LCQ-other</th>
<th>Semantic fluency</th>
<th>TASIT Part 1</th>
<th>WASI-II VCI</th>
<th>PRI</th>
<th>FSIQ 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score range</td>
<td>120-30</td>
<td>120-30</td>
<td>0-28+</td>
<td>0-28</td>
<td>45-160</td>
<td>45-160</td>
<td>40-160</td>
</tr>
<tr>
<td>(low-high)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Composite</td>
<td>scores</td>
<td></td>
</tr>
<tr>
<td>Natalie</td>
<td>37</td>
<td>58</td>
<td>10</td>
<td>22</td>
<td>85</td>
<td>81</td>
<td>81</td>
</tr>
<tr>
<td>Jacob</td>
<td>48</td>
<td>64</td>
<td>3</td>
<td>9</td>
<td>49</td>
<td>52</td>
<td>47</td>
</tr>
<tr>
<td>Regan</td>
<td>46</td>
<td>80</td>
<td>16</td>
<td>14</td>
<td>102</td>
<td>58</td>
<td>79</td>
</tr>
<tr>
<td>Sidney</td>
<td>39</td>
<td>78</td>
<td>9</td>
<td>16</td>
<td>56</td>
<td>71</td>
<td>62</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>42.50(5.32)</td>
<td>70.00(10.71)</td>
<td>9.50</td>
<td>15.25</td>
<td>73.00(24.83)</td>
<td>65.50(13.03)</td>
<td>67.25(15.97)</td>
</tr>
</tbody>
</table>

**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
These data demonstrated severe cognitive and communication deficits across all assessments for both groups. Mean group scores were compared to LCQ normative data (Douglas, O’Flaherty and Snow, 2000). Higher scores indicate greater impairment on this measure. Group scores fell within -1.1 standard deviations of the normative mean on the LCQ-self (mean 52.47; sd 9.62) and between -1.5 and -2.3 standard deviations of the normative mean for the LCQ-other (mean 47.17; sd 9.93). Semantic fluency group scores were compared to normative scores stratified by age (Tombaugh, Kozak and Rees, 1999). Group scores for average age level 40 – 49 years were between 2.1 and 2.7 standard deviations below the normative mean (mean 20.7; sd 4.2). TASIT Part 1 group scores were compared to normative data from McDonald, Flanagan and Rollins (2002). Scores were more than 7 standard deviations below the normative mean (mean 25.92; sd 1.44). Data from the WASI-II were compared to the means for matched controls (Wechsler, 2011). VCI group scores were between 1.3 and 1.8 standard deviations below the mean (mean 100; sd 15.3). PRI group scores were between 2.2 and 2.5 standard deviations below the mean (mean 96.7; sd 12.9). FSIQ 4 group scores were between 1.9 and 2.3 standard deviations below the mean (mean 98.1; sd 13.4).

Visual inspection of mean scores and standard deviations between the groups shows difference on the LCQ-other. This score was derived from questionnaire ratings by communication partners and was unlikely to influence treatment effects. Mean scores on the remaining profiling tests showed broad similarity between the groups. Standard deviations across the VCI, PRI and FSIQ 4 scales of the WASI-II reflected the variability of individual scores within both groups.

6.1.6 Group activity

The intervention group discussed 18 topics associated with rehabilitation following brain injury (see Appendix 6.2). The control group was led by two trained therapy assistants. Participants were offered a choice of activity at the first meeting and they collectively chose a quiz group. The therapy assistants were encouraged to set each quiz within a themed discussion topic to facilitate
opinion sharing. See Appendix 7 for a list of topics. All other procedures for group activity were as documented for the pilot study (Section 5.1.6).

6.1.7 Measurement and rating procedures

Data were collected using the primary outcome measures at four measurement points. The timeline and data collection points are illustrated in Figure 6.2.
Figure 6.2 Study design flow chart

- Recruitment n=12
- Profiling assessments
- Group allocation
- Interventions
- Peer tutor selection
- Therapy peer facilitator training (16 sessions)
- Intervention group n=6
- Post-intervention
- Maintenance

- Control group (usual care) n=6
- Baseline 1
- Baseline 2
- Post-intervention
- Maintenance

Week: 1 2 3 4 5 6 7 8 9 10 11 12

- Group meeting (x2 weekly)
Baseline and outcome measures were recorded on the second day of the meetings in week 2, week 3 and week 8. Maintenance measures were recorded on the first meeting in week 12 rather than the second meeting, as one participant was absent on the final meeting date. All other procedures for data collection were as described in the pilot study (see Section 5.1.7). Procedures for training the peer facilitator were as documented in Chapter 3.

6.1.7.1 Primary and secondary outcome measures

Two primary outcome measures were employed to evaluate findings at each of the four measurement points: the MPC (Togher et al., 2010) and the INT. See Section 5.1.7.1 for a description of these tools.

The Satisfaction Questionnaire developed for the pilot study (see Appendix 9 and Section 5.1.7.1 for a description) was employed as a secondary outcome measure. An additional assessment, the LCQ, was repeated within a few days of the final group meeting as a secondary outcome measure of perceived change in social communication skills. Two forms were re-administered: the LCQ self-report for participants and an other-report for familiar communication partners. See Section 5.1.3 for a description of the LCQ.

6.1.7.2 Interaction rating procedure

Group interactions were video-recorded and data were prepared into 10 minute clips for analysis following the procedure documented for the pilot study (Section 5.1.7.2). Three raters evaluated the baseline, post-intervention and maintenance data. The first rater was a recent graduate of a masters degree in Human Communication Science at University College London. The second rater was a newly qualified SLT and recent graduate of the professional MSc in Speech and Language Sciences at University College London. These raters also rated samples from the pilot study. Procedures for rater training were as described in Section 5.1.7.2. The third rater was an SLT with four years experience, specialising in neurological disorders and a recent graduate of the MSc in Neuroscience at University College London. This rater coded 8 samples using the
INT only. This rater received 60 minutes of one to one training, using material not associated with the study. This was supplemented by independent practice tasks with feedback from the SLT researcher to consolidate learning. Raters were blind to the intervention, group, allocation and phase of intervention, and to other raters’ scores. All raters independently evaluated the sampled data.

6.1.8 Data analysis procedures

In this evaluation, descriptive statistics are reported as a summary measure of stability of change within the groups on both the primary and secondary outcome measures. Confidence intervals (95%) provide an estimate of the likely parameters within which results are likely to fall. These were reported on reliability calculations and on statistical testing of the MPC data.

On pre-intervention analyses, means, standard deviations and (in some analyses) non-parametric methods were applied to determine difference between the groups. Analyses of intervention effects were conducted using conventional significance tests on the MPC data, where scores are measured on a continuous scale. Parametric tests were conducted where the data were normally distributed. The INT data follows a scale free distribution. An NHHI weight was therefore calculated, as a measure of change in equality of participation over time.

6.1.9 Pre-intervention analyses

These analyses comprise inter-rater reliability calculations and baseline comparisons between the groups.

6.1.9.1 Rater reliability

Rater reliability was calculated on scores from rater 1 and rater 2. ICC type 3,1 was used as the same two raters evaluated each case. Rater 1 evaluated 35 films and rater 2 evaluated 4 films, giving a sampling rate of 11%. Optimal sample sizes have been calculated for ICC 1,1 (Walter, Eliasziw and Donner, 1998) and ICC 2,1 (Doros and Lew, 2010). Optimal sample sizes have not been
previously calculated for ICC (3,1). Raters are modelled as fixed effects, and confidence intervals are therefore a function of rater effect. The task of estimating rater effects for ICC (3,1) is therefore problematic (Doros and Lew, 2010). The results of this analysis are presented in Table 6.5.

Table 6.5 Intra-class correlations (ICC 3,1) with confidence intervals (CI) 95% for the primary outcome measures

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>ICC (3,1)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MPC</strong> Interaction</td>
<td>0.86</td>
<td>-0.19 – 0.99</td>
</tr>
<tr>
<td>Transaction</td>
<td>0.58</td>
<td>-0.93 – 0.97</td>
</tr>
<tr>
<td><strong>INT</strong> Initiations</td>
<td>0.97</td>
<td>0.69 – 0.99</td>
</tr>
<tr>
<td>Responses</td>
<td>0.85</td>
<td>0.01 – 0.99</td>
</tr>
</tbody>
</table>

**Abbreviations:** MPC Adapted Measure of Participation in Conversation; INT Interactional Network Tool

ICCs were high for the MPC interaction scale (ICC=0.86) indicating ‘excellent’ agreement. ICCs for the transaction scales (ICC=0.58) indicated ‘fair’ agreement. ICCs were high for the INT initiations and responses (ICC=0.97, 0.85) indicating ‘excellent’ agreement. The width of the confidence intervals on these measures indicated that the number of samples was insufficient to confidently detect levels of reliability. However, the pilot study findings, based on a sampling rate of 100%, involving the same raters, and using otherwise identical procedures, were ‘excellent’ and ‘good’ respectively. Confidence intervals ranged from ‘fair’ to ‘excellent’ on both the MPC scales and the INT. Therefore, given the high levels of agreement on the pilot study results, further hypothesis testing was conducted on the main study data.

6.1.9.2 Between group comparisons at baseline

Statistical analyses were used to evaluate group scores at baseline on the MPC (Togher et al., 2010) and the INT. Mean scores taken from two pre-intervention measurement points (baseline 1 and baseline 2) were compared. The planned
absence of the peer facilitator in week 3 reduced the number of samples to 17. Results are reported in Tables 6.6 and 6.7.

Table 6.6 Means and standard deviations at baselines 1 and 2 for the intervention and control groups

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Intervention group (mean of B1 and B2)</th>
<th>Control group (mean of B1 and B2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Samples n=9</td>
<td>Samples n=8</td>
</tr>
<tr>
<td><strong>MPC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>2.33 (1.44)</td>
<td>2.19 (1.69)</td>
</tr>
<tr>
<td>Transaction</td>
<td>2.39 (1.43)</td>
<td>2.13 (1.77)</td>
</tr>
<tr>
<td><strong>INT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>16.10 (18.80)</td>
<td>7.00 (9.04)</td>
</tr>
<tr>
<td>Responses</td>
<td>25.11 (29.60)</td>
<td>17.75 (13.20)</td>
</tr>
</tbody>
</table>

*Abbreviations: MPC Adapted Measure of Participation in Conversation; INT Interactional Network Tool; B baseline*

Table 6.7 Differences in the distribution of group scores at baselines 1 and 2

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Intervention</th>
<th>Control</th>
<th>U</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median score</td>
<td>Median score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Samples n=9</td>
<td>Samples n=8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MPC</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>2.50</td>
<td>2.25</td>
<td>34.0</td>
<td>-.195</td>
<td>0.85</td>
</tr>
<tr>
<td>Transaction</td>
<td>3.00</td>
<td>2.25</td>
<td>34.5</td>
<td>-.147</td>
<td>0.88</td>
</tr>
<tr>
<td><strong>INT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>4.00</td>
<td>4.00</td>
<td>22.0</td>
<td>-1.355</td>
<td>0.18</td>
</tr>
<tr>
<td>Responses</td>
<td>13.00</td>
<td>23.50</td>
<td>33.5</td>
<td>-.241</td>
<td>0.81</td>
</tr>
</tbody>
</table>

*Abbreviations: MPC Adapted Measure of Participation in Conversation; INT Interactional Network Tool*

There was similarity between the group means and standard deviations on the MPC subscales. Means and standard deviations on the INT were wide, indicating variability in the number of initiations and responses for both groups. The Mann-Whitney U test identified no difference between the groups on these measures (although the small sample size reduced power to detect difference). This
comparison showed that the distribution of scores between the groups was broadly similar at baseline, although a cautious interpretation is required.

6.1.9.3 Within-group comparisons at baseline

Comparisons were also conducted to evaluate difference between the intervention group at baseline with and without the peer facilitator present. This was a planned absence and the peer facilitator attended training at this time. The peer facilitator was present at baseline 1 (n=6) but not at baseline 2 (n=4). One participant withdrew from the study at the start of week 3, reducing the group number to 4 at baseline 2. Sample sizes were too small to apply inferential statistics. Means and standard deviations are therefore reported for the intervention group in Table 6.8.

Table 6.8 Comparison of two pre-intervention baselines for the intervention group

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Baseline 1</th>
<th>Baseline 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peer facilitator present</td>
<td>Peer facilitator not present</td>
</tr>
<tr>
<td></td>
<td>Participants n=6</td>
<td>Participants n=4</td>
</tr>
<tr>
<td></td>
<td>Samples n=5</td>
<td>Samples n=4</td>
</tr>
<tr>
<td><strong>MPC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>1.90 (1.52)</td>
<td>2.87 (1.53)</td>
</tr>
<tr>
<td>Transaction</td>
<td>2.00 (1.54)</td>
<td>2.87 (1.31)</td>
</tr>
<tr>
<td><strong>INT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>20.00 (20.35)</td>
<td>11.25 (16.50)</td>
</tr>
<tr>
<td>Responses</td>
<td>33.20 (39.34)</td>
<td>15.00 (5.60)</td>
</tr>
</tbody>
</table>

**Abbreviations:** MPC Adapted Measure of Participation in Conversation; INT Interactional Network Tool

Data for the participant drop-out were not included in the baseline analysis. Mean scores increased at baseline 2 on the MPC scales. Mean counts decreased on the INT without the peer facilitator present. The spread of scores was similar on the MPC scales. Standard deviations showed variability on the INT. This finding indicates some differential sensitivity across the scales. A within-group difference may be attributable to group size. Participant numbers fell from six at
all previous meetings to four at baseline 2. Investigations into the effects of peer learning in other clinical populations suggest that outcomes may be positively related to smaller group sizes (Lou, Abrami, Spence, Poulsen, Chambers and d'Apollonia, 1996). A comparison was also conducted for the control group. Means and standard deviations are presented in Table 6.9.

Table 6.9 Comparison between two pre-intervention baselines for the control group

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Baseline 1</th>
<th>Baseline 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participants n=5</td>
<td>Participants n=5</td>
</tr>
<tr>
<td></td>
<td>Samples n=4</td>
<td>Samples n=4</td>
</tr>
<tr>
<td><strong>MPC</strong></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Interaction</td>
<td>2.25 (1.76)</td>
<td>2.13 (1.89)</td>
</tr>
<tr>
<td>Transaction</td>
<td>2.25 (1.76)</td>
<td>2.00 (2.04)</td>
</tr>
<tr>
<td><strong>INT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiations</td>
<td>6.25 (7.80)</td>
<td>7.75 (11.32)</td>
</tr>
<tr>
<td>Responses</td>
<td>20.50 (9.26)</td>
<td>15.00 (17.34)</td>
</tr>
</tbody>
</table>

Abbriviations: MPC Adapted Measure of Participation in Conversation; INT Interactional Network Tool

Two participants withdrew from the control group and their baseline data were not included in the analysis. Mean scores for the control group were broadly similar across measurement points on the MPC scales and the INT. The spread of scores was similar on the MPC scales and variable on the INT.

In summary, results from the preliminary analyses indicated an acceptable level of rater agreement on the MPC scales and INT counts. There were no statistical differences in the distribution of scores between the groups at baseline (although samples sizes reduced power to detect difference). Within-group analyses showed difference in the mean scores for the intervention group across the two measurement points at baseline, which may be attributable to a change in group size. The control group size remained stable across the two measurement points. Analyses were then conducted on the intervention effects.
6.2 Results

Treatment effects on the primary outcome measures were evaluated using repeated measures analyses. Post-treatment outcomes and maintenance measures were compared to the first baseline measurement point, as the peer facilitator was present. Comparisons were conducted on the MPC scales using a two-way repeated measures ANOVA. Section 6.2.1 reports attendance percentages by group. Section 6.2.2 reports change over time comparisons on the MPC. Section 6.2.3 reports intervention effects on the INT.

In this analysis of findings on the MPC scales, p-values were reported where the data met the assumptions for the use of parametric tests. The alpha level was set at 0.05. Adjustment was not made for multiple comparisons, as tests of statistical significance were applied to one measure. The small sample size reduced power to detect statistical difference, increasing susceptibility to Type II errors. Effect sizes were therefore also reported as an expression of the magnitude of change over time. Kraemer and Kupfer (2006) make a distinction between statistical significance (measured by p-values) and clinical significance (measured by effect sizes). P-values indicate the probability that an observed difference between the groups is a random occurrence. The effect size provides information on the magnitude of the difference between the groups, independently of sample size. In line with other studies in the field of social communication skills in acquired brain injury, Cohen’s d was reported as the measure of effect size. Cohen approximates d=.2 to a small effect, d=.5 to a medium effect and d=.8 to a large effect (Field, 2013). This ‘rule of thumb’ is context dependent and therefore beneficial for setting thresholds of clinical significance in the field, and for comparisons such as meta-analyses.

Outcomes from the INT were analysed using descriptive statistics to evaluate the behavioural frequencies that make up the equal interval data set. The data were also evaluated using SNA techniques, which treat the data as relational. Sociograms provided a qualitative view of change over time. The NHHI was applied as a quantitative measure of equality of participation.
6.2.1 Participant attendance

Participant attendance rates were acceptable. One participant in the intervention group and three participants in the control group completed 100% of the sessions (18). Three participants in the intervention group and one participant in the control group attended 94% of the sessions (i.e. each absent for 1 session). One participant in the intervention group attended 89% of the sessions (i.e. absent for 2 sessions). The peer facilitator attended 100% of the individual training sessions.

6.2.2 Change over time comparisons: MPC

Baseline, post-intervention and maintenance data for the MPC are presented in Table 6.10. A comparison of means between baseline, post-intervention and maintenance showed that data from the MPC interaction and transaction scales met the parametric assumptions of normality of data distribution (Shapiro-Wilk test \(p \leq 0.05\)). Levene’s test for homogeneity of variance was not conducted as sample sizes were not equal. A two-way repeated ANOVA was conducted on these scales. Means, standard deviations and interaction effects are presented in Table 6.10. The data violated the assumption of sphericity on both scales (Mauchly’s test \(p = .01\)). A cautious interpretation of this finding is required as the power of this test is dependent on sample size. A Greenhouse-Geisser correction for sphericity is reported, as \(\varepsilon < .75\) for both scales (Field, 2013).
Table 6.10 Change over time comparisons on the MPC

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Intervention Group (n=5)</th>
<th>Control Group (n=4)</th>
<th>Interaction effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Mean (SD)</td>
<td>Post-intervention Mean (SD)</td>
<td>Maintenance Mean (SD)</td>
</tr>
<tr>
<td>MPC</td>
<td>1.90 (1.52)</td>
<td>2.50 (1.06)</td>
<td>3.10 (0.42)</td>
</tr>
<tr>
<td>Interaction</td>
<td>2.00 (1.54)</td>
<td>2.80 (1.15)</td>
<td>3.30 (0.57)</td>
</tr>
</tbody>
</table>

**Abbreviations:** MPC Adapted Measure of Participation in Conversation; *Greenhouse-Geisser statistic reported; es effect size (d)
Mean scores from pre-treatment to post-treatment on the MPC scales increased for the intervention group and decreased for the control group. On the MPC interaction scale, the difference in mean scores from pre-treatment to post-treatment did not reach statistical significance \((p=.07)\) but the effect size showed a small difference in magnitude between the groups \((d=.4)\). On the MPC transaction scale, there was a significant interaction between the two groups from pre-treatment to post-treatment \((F=8.37, df=1,7, p=.02)\). The intervention group displayed significantly improved mean scores on this scale. The effect size \((d=.60)\) showed a medium difference in magnitude between the mean scores of the two groups.

From baseline to maintenance, mean scores increased for the intervention group. Across the three measurement points, means scores for the intervention group increased across both scales. For the control group, mean scores decreased from baseline to maintenance. On the interaction scale, mean scores decreased between baseline and post-intervention, increasing at maintenance but not to baseline level. Mean scores decreased across the three measurement points on the transaction scale.

The difference in mean scores between the groups from baseline to maintenance did not reach statistical significance on the interaction or transaction scales but power to detect statistical difference was reduced by the small sample size. The magnitude of difference in mean scores between the two groups was large. The effect size was large for the interaction scale \((d=1.0)\) and the transaction scale \((d=1.22)\). These findings are illustrated in Figure 6.3 and Figure 6.4.
Figure 6.3 Mean scores on the MPC interaction scale at baseline, post-intervention and at maintenance for the intervention (n=5) and control (n=4) groups

![MPC Interaction Graph]

Figure 6.4 Mean scores on the MPC transaction scale at baseline, post-intervention and at maintenance for the intervention (n=5) and control (n=4) groups

![MPC Transaction Graph]
Inferential error bars (95% confidence intervals) are presented in Figure 6.5 across all three measurement points for both groups. Confidence intervals were wide for both groups on both scales, illustrating the variability of scores within the groups. Intervals were widest for the control group. Repeated measures analysis (ANOVA) showed a significant difference between the groups post-intervention on the transaction scale, which is not clearly represented by the confidence intervals because the number of observations that comprise the mean is low. The range within which the population mean was estimated to fall was therefore wide. A reduction in this margin of error would require a larger sample size.

There is a contrast in the width of the confidence interval at maintenance between the groups. The narrow intervals for the intervention group reflects the degree of dispersion (measured by the standard deviation) as a result of score similarity. Participant scores were clustered near the top of the range indicating a ceiling effect for the intervention group on both the interaction and transaction scales, which reduces the ability of this measure to detect difference. Control group scores remained stable. The magnitude of difference between the groups was \( d = .98 \) on the interaction scale and \( d = 1.22 \) on the transaction scale. The small standard deviations for the intervention group distorted the effect size. The magnitude of difference indicated by these effect sizes at maintenance is therefore misleading.
Figure 6.5 Error bar plots with 95% confidence intervals to illustrate the differences in means for MPC interaction and transaction scores at baseline, post-intervention and at maintenance for the intervention (n=5) and control groups (n=4).
In summary, the results show that mean scores increased for the intervention group on the MPC between pre- and post-intervention measurement points and at maintenance. The post-intervention difference between the groups was significant \((p=.02)\) with a medium effect size \((d=.6)\) on the transaction scale, indicating an improved ability on the part of the intervention group to share information and request detail. The H0 hypothesis (predicting no greater improvement in MPC subscale scores for the intervention group compared to the control group) was therefore rejected. This is a cautious conclusion given the small sample size.

6.2.3 Change over time comparisons on the INT

Data from the INT were evaluated to test the hypothesis that initiation and response counts would be more equally distributed between the participants in the intervention group post-intervention and at maintenance, than at baseline. For these analyses, the coded behavioural frequency counts for each participant present at each measurement stage were pooled. This included data for two participants present for the baseline measurement who subsequently withdrew from the study. Behaviours were also coded for the two therapy assistants facilitating the control group meetings at each measurement point. Initiation and response counts for all participants were combined. A within- and between-group comparison of initiation and response percentages was calculated from the INT matrix data table. A normalized HHI was calculated as a measure of equality of participation over time. Results are reported for the intervention group in Table 6.11 and for the control group in Table 6.12 and Table 6.13. Sociograms are presented in Figure 6.7 to qualitatively illustrate group interaction over time. The peer facilitator in the intervention group was Clive, indicated in bold type.
Table 6.11 Intervention group interaction proportions and NHHI

<table>
<thead>
<tr>
<th>Main Study Intervention Group</th>
<th>Herfindahl-Hirschman Index (range 0-1)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline n=6</td>
<td>Post-intervention n=5</td>
<td>Maintenance n=5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Initiations and responses</td>
<td>Initiations and responses</td>
<td>Initiations and responses</td>
<td>NHHI</td>
</tr>
<tr>
<td>Proportion</td>
<td>Proportion</td>
<td>Proportion</td>
<td>Proportion</td>
<td></td>
</tr>
<tr>
<td>Madison</td>
<td>0.01</td>
<td>0.08</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>Aden</td>
<td>0.40</td>
<td>0.20</td>
<td>0.43</td>
<td></td>
</tr>
<tr>
<td>Alexis</td>
<td>0.07</td>
<td>0.24</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Magnus</td>
<td>0.03</td>
<td>0.08</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td><strong>Clive</strong></td>
<td><strong>0.31</strong></td>
<td><strong>0.39</strong></td>
<td><strong>0.22</strong></td>
<td></td>
</tr>
<tr>
<td>Dan</td>
<td>0.18</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The NHHI for the intervention group at baseline (0.15) indicated a moderately balanced profile, with two participants (Aden and Clive) holding the highest proportion of contributions. The index decreased from baseline to post-intervention (NHHI 0.08) indicating a balanced interaction. Maintenance measures (NHHI 0.12) showed moderate balance between participants without return to pre-intervention levels. Visual inspection of the proportional contributions showed an increase in the percentage contribution of Madison and Magnus (both under-participators at baseline) post-intervention and at maintenance.
Table 6.12  Control group interaction proportions and NHHI

<table>
<thead>
<tr>
<th>Herfindahl-Hirschman Index (range 0-1)</th>
<th>Main Study Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline n=7</td>
</tr>
<tr>
<td></td>
<td>Initiations and responses</td>
</tr>
<tr>
<td>Proportion</td>
<td>Proportion</td>
</tr>
<tr>
<td>Natalie</td>
<td>0.01</td>
</tr>
<tr>
<td>Jacob</td>
<td>0.09</td>
</tr>
<tr>
<td>Regan</td>
<td>0.11</td>
</tr>
<tr>
<td>Sidney</td>
<td>0.02</td>
</tr>
<tr>
<td>Hal</td>
<td>0.22</td>
</tr>
<tr>
<td>TA1</td>
<td>0.27</td>
</tr>
<tr>
<td>TA2</td>
<td>0.18</td>
</tr>
</tbody>
</table>

The NHHI for the control group indicated a balanced distribution of initiations and responses at baseline (NHHI 0.05) with participants demonstrating a relatively equal share in the interaction. The index increased to NHHI 0.15 post-intervention indicating a moderate balance and fell to NHHI 0.11 at maintenance demonstrating an improved distribution of initiations and responses between participants. However, the percentage contributions from the therapy assistants facilitating the group were high at each measurement point suggesting potential outcome bias. Analysis of step-wise variations in the share of the interaction (see Section 4.3) showed the sensitivity of the index to two conversation dominators. In this instance improved participation scores may be a result of increased contribution from the two staff facilitators, rather than changes in patterns of participation within the group. To test this effect, therapy assistant initiations and responses were combined into a single participation source to calculate the NHHI. Findings are illustrated in Table 6.13.
Table 6.13 Control group: amended interaction proportions for therapy assistants and NHHI

<table>
<thead>
<tr>
<th>Herfindahl-Hirschman Index (range 0-1)</th>
<th>Main Study Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline n=7</td>
</tr>
<tr>
<td></td>
<td>Initiations and responses</td>
</tr>
<tr>
<td></td>
<td>Proportion</td>
</tr>
<tr>
<td>Natalie</td>
<td>0.01</td>
</tr>
<tr>
<td>Jacob</td>
<td>0.09</td>
</tr>
<tr>
<td>Regan</td>
<td>0.11</td>
</tr>
<tr>
<td>Sidney</td>
<td>0.02</td>
</tr>
<tr>
<td>Hal</td>
<td>0.22</td>
</tr>
<tr>
<td>TA1</td>
<td>0.45</td>
</tr>
<tr>
<td>TA2</td>
<td></td>
</tr>
</tbody>
</table>

Re-calculation of the proportion of therapy assistant contribution showed a moderately balanced pattern of participation for the control group at baseline (NHHI 0.14). The index increased to NHHI 0.42 post-intervention, with the therapy assistants holding 71% of the interaction. This reduced to 65% at maintenance. The NHHI of 0.33 indicated domination by a minority. These changes over time for each group are illustrated in Figure 6.6. Connections between group participants are illustrated in the sociograms in Figure 6.7.
The sociograms in Figure 6.7 qualitatively illustrate group interaction over time. The profile of connections for the intervention group showed increased involvement between all participants over time. The pattern of connections at baseline confirm Madison as a conversation isolate. Connections between Madison and other participants increased (including recorded initiations to the group) post-intervention. An increase in the thickness and density of the arrows connecting Madison to other participants at the maintenance measurement point indicates an increase in interaction frequency.

Aden was a conversation dominator at baseline. His percentage of initiations and responses was 40% at the baseline measurement point. This reduced to 20% post-intervention, and increased to 43% at maintenance (see Table 6.11). These percentages might suggest that there was no improvement in his interaction pattern. However, the patterns of connections in the sociograms set this
percentage into context and show that he both initiated conversation with (and to) the group and responded to initiations from an increasing number of communication partners over time.

The interaction profile for the control group shows a moderately balanced profile of participation at baseline, indicating a pattern of question and answer exchanges. The pattern of interactions shows the therapy assistants were interaction dominators post-intervention and at maintenance. Jacob was a conversation isolate and his percentage of initiations and responses decreased over time (see Table 6.13). His profile of connections indicates dependence on the therapy assistants, post-intervention and at maintenance in order to participate. The encounters post-intervention and at maintenance are largely characterised by paired interactions between participants and one or both therapy assistants, and between therapy assistants.

Findings from these analyses show that the intervention group demonstrated a more balanced pattern of participation post-intervention and a moderately balanced profile at maintenance, in which the pattern of connections between participants was more widely distributed. The H0 hypothesis, (predicting no change over time) was therefore rejected. Initial calculations showed that the balance of participation within the control group decreased to one of moderate balance post-intervention and at maintenance. Further analyses illustrated potential bias in the NHHI as these values were derived from the interaction patterns of the therapy assistants, and not the ABI participants in the group. This is a weakness in the measure, overcome in this instance by combining facilitator contributions to illustrate change. Re-calculation showed that the pattern of interaction in the control group became less balanced over time, as contributions from the therapy assistants increased.
Figure 6.7 INT graphs showing pooled interaction profiles by group

<table>
<thead>
<tr>
<th>Intervention group: Baseline</th>
<th>Intervention group: Post-intervention</th>
<th>Intervention group: Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group: Baseline</td>
<td>Control group: Post-Intervention</td>
<td>Control group: Maintenance</td>
</tr>
</tbody>
</table>

TA= therapy assistant
6.2.4 Change over time on the secondary outcome measures

The secondary outcome measures comprise the LCQ and satisfaction questionnaire data. Means and standard deviations are reported for both measures.

The LCQ measures the frequency of social communication impairments. It was administered at baseline and repeated within a few days of the final group meeting to measure perceived change by participants and a familiar communication partner. Questionnaires were completed by members of the clinical team (e.g. key worker, ward manager), as participant contact with others known to them pre-injury was highly variable. A previous investigation showed no significant difference between relatives and clinicians in perception of difficulty on this measure (McNeill-Brown and Douglas, 1997). Lower scores indicate improved skill (range 30 – 120). Means and standard deviations are reported in Table 6.14.

Table 6.14. LCQ change over time comparisons by group

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Intervention Group (n=5)</th>
<th>Control Group (n=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre Mean (SD)</td>
<td>Post Mean (SD)</td>
</tr>
<tr>
<td>LCQ: Self</td>
<td>44.40 (9.10)</td>
<td>40.00 (5.61)</td>
</tr>
<tr>
<td>LCQ: Other</td>
<td>62.40 (5.68)</td>
<td>55.00 (10.61)</td>
</tr>
</tbody>
</table>

There was a small improvement in mean scores on the LCQ-self questionnaire for the intervention group. Mean scores declined for the control group. Mean scores improved on the LCQ-other questionnaire for both groups. Findings indicated evidence of perceived positive change in social skills on the part of familiar communication partners. This finding requires cautious interpretation. There was a risk of observer bias as communication partners were not blind to group allocation or to the phase of questionnaire completion. Further, pre/post questionnaires were not always completed by the same familiar member of staff.
Training in questionnaire completion was not provided, and reverse scoring errors were evident on some items.

The satisfaction questionnaire was administered within a few days of the final group meeting. Responses to four statements were rated on an unnumbered Likert scale (strongly agree; agree; neutral; disagree; strongly disagree), and later converted to a numeric scale, where 5 indicates strong agreement and 1 indicates strong disagreement. Means and standard deviations are reported in Table 6.15.

Table 6.15 Group satisfaction questionnaire

<table>
<thead>
<tr>
<th>Questionnaire categories</th>
<th>Intervention Group (n=5)</th>
<th>Control Group (n=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Group purpose</td>
<td>4.40 (0.55)</td>
<td>4.50 (0.58)</td>
</tr>
<tr>
<td>Communication</td>
<td>4.40 (0.55)</td>
<td>4.75 (0.50)</td>
</tr>
<tr>
<td>Participation</td>
<td>3.80 (1.10)</td>
<td>4.25 (0.50)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>3.60 (0.55)</td>
<td>4.75 (0.50)</td>
</tr>
</tbody>
</table>

Overall, mean scores were lower for the intervention group. The data were not normally distributed as a result of the small sample size, and there was presence of skew. Ratings for participation (‘we have all worked well together in this group’) fell outside the range of agreement as a result of one person disagreeing with the statement. Ratings for satisfaction (‘I have enjoyed being part of this group’) fell outside the range of agreement with two participants rating this statement as neutral.

6.2.5 Summary

Of the 12 participants recruited, nine completed the main study. Attendance rates were high. Reliability ratings for the primary outcome measures were acceptable. With the exception of mean time post-injury, the groups were comparable on demographic and profiling variables at baseline. On the primary outcome measures, average pre-intervention scores (across two time points) were broadly similar, indicating stability between the groups at baseline. A
within-group difference for the intervention group may be attributable to a reduction in the group size at the second measurement point.

The first hypothesis, that the peer intervention will result in greater improvement than control group scores on the MPC scales, was partially supported. Repeated measures analyses showed an increase in mean scores for the intervention group between baseline and post-intervention on the MPC. Mean scores increased further at maintenance, but there was a ceiling effect for this group and standard deviations were small. Mean scores decreased between baseline and post-intervention, and between baseline and maintenance for the control group. There was a significant interaction on the transaction scale post-intervention (p=0.02) and the effect size was medium (d=.6), indicating an improved ability in the intervention group to respond to shared content in conversation. Maintenance measures of change did not reach statistical significance, but ceiling effects reduced the ability to detect difference. The magnitude of difference between the groups was high on both scales, but these findings are a function of the small standard deviations recorded by the intervention group which distort the effect sizes.

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. The application of the NHHI to the INT data showed a more equal distribution of initiations and responses 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. The sociograms confirmed these profiles of interaction, providing a qualitative picture of the pattern of connections between participants.

Analyses of the secondary outcome measures showed limited change in mean scores for the intervention group on the LCQ-self questionnaire, and a small increase on the LCQ-other questionnaires. Mean scores for the control group decreased on the LCQ-self questionnaire and increased on the LCQ-other
questionnaire. Findings from the satisfaction questionnaire showed mean scores were lower for the intervention group than the control group. These findings will be discussed in the next chapter.
Chapter 7 Discussion

This thesis has investigated the efficacy of a peer-mediated social communication skills intervention for people with severe ABI. The aims of the investigation were to test for feasibility and to compare the effectiveness of the intervention to a social activity control group. A further aim was to evaluate the sensitivity of existing outcome measures to changes in group interaction, and the sensitivity of a new measure of group social participation developed for this study. Participant satisfaction with this new model of intervention was also evaluated. Previous interventions for social communication skills in ABI were reviewed in Chapter 2. The theoretical basis for the novel intervention was drawn from social development theories of peer-learning as a potent mechanism for behaviour change, and the proposition that learning collaboratively with peers rather than a clinician can facilitate improved social interaction skills. This was discussed in Chapter 3. A novel measure to evaluate group outcomes was presented in Chapter 4. Feasibility was tested and evaluated in the pilot study (Chapter 5). The main study (Chapter 6) tested an amended protocol, comparing the effectiveness of the peer-led intervention to a staff-led group.

The current chapter will evaluate the key findings from this intervention study and the implications for clinical practice and future research. The main study findings are discussed in Section 7.1. The peer learning model is evaluated in Section 7.2, and Section 7.3 discusses the issue of outcome measurement for group social interaction. Section 7.4 discusses implementation issues and recommendations for future research. A summary of limitations and final conclusions are presented in Sections 7.5 and 7.6 respectively.

7.1 Main study findings

The purpose of the main study was to determine the effectiveness of a peer-led social communication skills intervention for people with severe ABI. The peer-mediated training intervention was compared to a staff-led social activity group. Participation in group conversation was measured on two primary outcome measures: the MPC and the INT. Findings showed that a peer partner can be
trained to facilitate participation in a group interaction without staff present. A statistically significant outcome was recorded on the MPC transaction scale post-intervention, indicating an improved ability to initiate and respond to shared content in group conversation for the peer-led group. Post-intervention and maintenance measures on the INT showed a more equal distribution of initiations and responses between participants. The sociograms also revealed that the pattern of connections between participants became more widely distributed over time, resulting in a more balanced and inclusive conversation. These findings indicate that individuals with communication impairments following severe ABI can demonstrate an improved ability to socially connect and engage collaboratively with peers over time in a real-world and meaningful task without support from a neuro-typical communication partner.

Findings showed no evidence of change for the staff-led social activity group. An evaluation of the social activity group interaction patterns on the INT found that the proportional contribution of the therapy assistants increased over time. The sociograms post-intervention and at maintenance showed a distribution of paired interactions involving therapy assistants and participants rather than a more equal distribution between participants. These findings have important implications for the way in which social communication impairments are remediated in clinical practice. This will be discussed in an evaluation of the peer learning model in the next section.

7.2 The peer learning model

The review of previous social communication skills interventions for ABI in Chapter 2 showed that social communication capabilities are vital for successful reintegration into previous life roles following injury. Findings also showed that outcomes from previous group and individual interventions examining a range of social communication constructs were generally positive. Previous systematic reviews (Cicerone et al., 2011; Finch et al., 2016) have concluded that social communication skills are responsive to remediation following ABI. Findings from the present review in Chapter 2 showed that the transfer of social communication competency into real-world settings was variable. Using the OECBM classification
(Howick et al., 2011), the review of the Level 1 group social communication intervention studies showed no evidence of generalisation of gains into everyday life in four of the five studies and only limited evidence of generalisation on a fifth. This reinforces the assertion from Ylvisaker, Turkstra and Coelho (2005) that following ABI, skills learned in the training setting do not automatically transfer into new contexts. In their systematic review of social communication skills interventions, Finch et al. (2016) identified as a current knowledge gap the translation of participant improvement on measures of social communication behaviour into gains in real-world social participation. The present study has shown that the peer learning model provides a means to bridge this gap. Previous interventions have addressed the issue of skill transfer via practice opportunities within the target setting (e.g. Douglas et al., 2016), or through communication partner training for paid professionals and family members (e.g. Behn et al., 2012; Togher et al., 2013). Frequent communication partners also include ABI peers with whom severely injured individuals will independently spend time in post-acute rehabilitation settings, residential homes, activity centres and vocational rehabilitation settings. However, training for this group has not yet been investigated. People need effective social interaction skills in order to build interpersonal relationships. This study has shown that the peer learning model enables independent relationship-building skills to be trained in a socially valid and natural environment, with training effects measured in terms of group participation in an everyday social life.

Findings from this study extend our understanding of the peer learning model and the effects of its application to social communication skills training in ABI. Its use has previously been established in the education context, where peer-mediated interventions to address difficulties building social relationships in ASD are now a practice standard (Wong et al., 2014). A key component of the model as employed in this study was the project-based learning approach. Ylvisaker, Feeney and Capo (2007) theorised on the benefits of project-based learning following brain injury as a meaningful context within which to achieve a therapeutic goal. In addition, they discuss an expert role within the project as a motivating means to address social interaction needs, with collaborative support from staff. The effect of an empowering context on interaction has previously
been tested. In a study comparing the information-giving skills of TBI participants to those of matched controls as speakers at a one-off education event for two neurotypical schoolboys, Togher (2000) showed no difference between the groups, concluding that the TBI participants and controls were able to give and request similar amounts of information when placed in a defined role. The present study has extended this finding to show the impact of an empowering role on interpersonal interaction skills, over time and with a group of peers.

In the present study, project-based learning was combined with a peer-mediated approach to investigate the benefits of support from a peer rather than staff. It drew directly on the theories of Lave and Wenger (1991) and the benefits of collaborative participation within a community of practice. Membership of the group required distinctive qualification (i.e. a unique knowledge and shared experience of brain injury) thereby excluding staff. The social and cognitive benefits of peer interaction have previously been theorised to enhance learning in education settings. Examples include the ability of peers to exchange ideas openly with each using a plain-speaking style, and the benefits of mutual peer feedback versus corrective feedback from professionals (Damon, 1984). The use of a project approach set within a community of practice enabled these ideas to be tested between equals in a neuro-rehabilitation setting. The collective goal was both meaningful and challenging (to make a positive difference in the rehabilitation centre), and entailed a pooling of experience and sharing of aspiration through collaborative discussion over time, thereby enhancing incidental learning of the social rules for group interaction through active participation over time. An important facet of the peer-mediated model employed in the present study is that it implicitly recognised the participants’ knowledge of socially relevant behaviour, directly addressing the apparent disconnect seen in ABI between intact knowledge and the ability to act on that knowledge. This approach contrasts with traditional social communication intervention programmes that provide training from staff to remediate observed deficits, which implies loss of that knowledge of social rules. A community of practice enables opportunity for socially appropriate behaviour without direct instruction. The peer facilitator was trained to encourage group participation in
order to achieve the collective goal, and was not seen as a leader. It may be that participants perceive membership of the community of practice to be without hierarchy, providing opportunity for an equal voice, and this contrasts with the regulatory power of professionals external to that community.

Facilitation and support from a trained peer was an essential component of the approach. A group environment can be unpredictable, and unstructured environments present a potential barrier to self-organisation and positive engagement following ABI (Wilson, Gracey, Malley, Bateman and Evans, 2009; Ylvisaker, Jacobs and Feeney, 2003). In a previous study, Togher et al. (2006) examined discourse patterns in a TBI dyad and a small peer group without staff present. The encounters took place in a clinic setting and were described as unstructured chat. The analysis showed some evidence of collaborative and co-constructed dialogue, but engagement in the conversation was impeded by difficulties with self-organisation and an absence of peer partner support. Importantly, findings from the present study show that a peer can be trained to address interaction needs within the context of an ABI group.

The peer-mediated intervention in the present study set group interaction goals within the peer facilitator training sessions (from pre-selected video clips of the group meetings to illustrate areas of need). This contrasts with interventions where therapists support participants to set individually agreed (and often generic) goals to remediate observed deficits (such as avoidance of eye contact or poor initiation in conversation) across the course of an intervention (e.g. Dahlberg et al., 2007; Finch et al., 2017). In the present study, the intervention goals and strategies to achieve them were both group and context-specific, enabling peer learning to take place through naturally-facilitated practice in the target setting. This approach meets the conditions for effective rehabilitation practice for individuals whose ability to transfer learning into new situations has been compromised through injury (Ylvisaker et al., 2003). The inclusion of individualised and meaningful goals, a training approach to match the needs of the learner, planned transfer of skills to the target setting, the inclusion of communication partners and measures of real world outcomes meets current
best practice recommendations for individuals with cognitive communication needs following ABI (Togher, Wiseman-Hakes, et al., 2014).

A further important feature of this intervention is that the group meetings were conducted without staff present, enabling independent discussion. Togher (2000) refers to this type of interaction as prestigious discourse, in which the person with ABI is the primary knower and has the opportunity to speak on their own behalf. The relationship between social communication competence, the resumption of previous life roles and community integration has previously been identified (e.g. Sander, Clark and Pappadis, 2010; Ylvisaker, Turkstra and Coelho, 2005). Yet the opportunity to practise prestigious discourse skills in an empowering social role in preparation for community re-integration is not routinely provided in a rehabilitation setting. In a typical staff-led encounter, the staff member is routinely the primary knower, the meeting has a pre-set purpose and structure, and it is usually followed by a performance evaluation. One explanation for the lack of change in the staff-supported control group in the present study may be the effect of professional power on the interaction. This has previously been explored in discourse analyses of interactions in neurotypical and TBI groups. Fairclough, (2015) illustrated how control and constraint can be exercised over conversation contributions when the professional relationship between the interactants is not equal. Examples between police officers and witnesses, and doctors and medical students, showed that the police officers and doctors controlled the direction of the interaction through questions and topic selection. As the subordinates in the relationship, the witnesses and students were obliged to respond and talk to those topics. Previous discourse analysis of people with TBI in conversation with healthcare professionals has also shown the potential for an imbalance in interactional roles and the effect on communication. For example, Togher, Hand and Code (1997) compared interaction patterns between therapists and participants with TBI versus neurotypical matched controls. The therapists gave less information to the TBI group than to the controls and they used more checking behaviours (e.g. What do you think about that? How might that help?) as a means to encourage talk. These behaviours are within the accepted bounds of a professional therapeutic approach and may provide an explanation for the high proportional contribution to the interaction of
the therapy assistants seen in this study. Togher (2000) recommended methods for clinicians to counter inequalities in institutional relationships, such as developing a more informal interaction style and providing opportunities for individuals with TBI to engage as the primary knower. This study has presented an alternative and ecologically valid approach, demonstrating that individuals with severe communication deficits can show improved skills in independent discussion when facilitated by a peer rather than with support from staff.

The components of the one-to-one peer training approach drew on the work of Ylvisaker, who combined many of the ideas from social development theorists into an apprenticeship model for clinicians working with individuals with ABI (Ylvisaker et al., 2003). The peer facilitator training programme followed these methods, comprising principles of self-coaching (the use of metaphor and self-talk scripts, a network of prompts and opportunities for rehearsal, video reflection and feedback). The core procedures of this model were recently empirically tested in a one-to-one training programme, and shown to improve every day interactions for individuals with TBI and a neuro-typical communication partner (Douglas et al., 2015; Douglas et al., 2016). The present study has applied the principles of the apprenticeship model to a new context and training purpose: to train an individual with ABI to facilitate interaction in a group of peers.

Video learning trials are a core component of the apprenticeship model and the use of video in the one-to-one peer-facilitator training for this study was wide-ranging, encompassing reflection on individual and group interaction behaviour. Video therapy has previously been described as an objective, immediate and vivid tool for use in brain injury rehabilitation (Ylvisaker, Szekeres, Henry, Sullivan and Wheeler, 1987). As a reflective tool for feedback and evaluation, the strength of the approach lay in its provision of concrete examples of otherwise abstract concepts. Helffenstein and Wechsler (1982) cited video plus verbal feedback as the active behaviour change ingredient in their programme for social interaction skills in ABI. Subsequent studies have reported that video plus verbal feedback is an effective treatment for self-regulation and self-awareness deficits, although there are no guidelines on the optimal timing post-
injury to maximise individual treatment effects (Schmidt et al., 2012). The use of video was a core component of this intervention and findings suggest that it is an effective tool to enhance peer learning, but the optimal timing for use in a post-acute rehabilitation setting remains unclear.

In summary, this evaluation of the peer learning model has shown that the approach holds promise as a means to improve real-world social participation following ABI. The next section discusses outcome measurement for group interaction.

7.3 Outcome measurement for group social interaction

Overall, the present study has highlighted the lack of suitable measures of social participation. This is surprising given that therapy groups and social interaction groups are commonplace in post-acute and community rehabilitation settings following ABI, and social and leisure activity groups are common in residential and day centre settings. Existing measures to evaluate social interaction outcomes following ABI have been designed for dyadic conversation, typically between the person with ABI and a neuro-typical conversation partner. Evaluating change in group conversation behaviour is a new field of investigation, and there are a number of challenges to defining and measuring the construct. Previous investigators have observed that differences in individual behavioural frequencies are not necessarily indicative of better or worse social communication skills. Behavioural characteristics following ABI encompass a wide distribution, from communicative excess to insufficiency (Hartley, 1995) and they do not easily lend themselves to measurement on a traditional linear rating scale (Sim, Power and Togher, 2013) Importantly, their frequency is context dependent. Against this background, the present study developed the INT, a new tool to evaluate participation in group conversation. Section 7.3.1 will evaluate the INT. Section 7.3.2 will discuss the existing dyadic interaction measurement tools and their application to group conversation in this study. Section 7.3.3 will evaluate the self-report tools that were tested. The use of self-report tools to evaluate participant satisfaction will be discussed in Section 7.3.4.
7.3.1 Evaluation of the INT

The theoretical foundation for the INT is drawn from the proposition that individuals can be influenced to modify their interactional behaviour by their social network. These social network theories were described in Chapter 4. SNA techniques have previously been used to evaluate changes within a given social network using network measurement methodologies. They are well-suited to evaluating group social interaction outcomes because the data is relational, i.e. it expresses the connections between a group of interactants.

The INT coding system has a theoretical basis in discourse analysis models using initiation and response categories to analyse interaction. This approach has previously been tested in ABI studies as a method to evaluate interaction effectiveness (e.g. Coelho, Liles and Duffy, 1991; Coelho, Youse and Le, 2002). A natural conversational interaction between peers is typically characterised by active engagement and attention to participant talk and non-verbal communication, and provides opportunity for contribution from all group members. Behaviours with the potential to disrupt a conversational interchange include a lack of acknowledgement of others, a failure to initiate or respond to an utterance when selected to do so (e.g. via a question), or the under- or over-use of eye gaze in a way that infringes social norms. In contrast with previous ABI discourse analysis approaches using measures of spoken language, the INT incorporates non-verbal initiations and responses (e.g. gesture, eye gaze, body movement and facial expression) because non-verbal behaviours are an important contributor to the flow of interaction. Rater feedback indicated that the verbal and non-verbal interaction types that make up the coding system were representative of the group conversation to be coded. Further research to evaluate the individual codes and their usage would provide the basis for refinement of the INT coding system for future investigations. Turn duration is another measure of conversation participation that would be a practical addition in the future development of this tool.

With regard to INT rating procedures, interaction turns were coded directly from video recorded samples. This approach contrasts with previous discourse
analysis procedures using transcription to tally frequency codes, and it enables coding of the data in its original state. Direct coding of the data saved time, and the clinical utility of the approach was further demonstrated in reliability findings that indicated a high level of agreement between independent raters.

This is the first investigation into change in group social interaction and the video recorded samples needed to be of sufficient coverage and quality to capture detail of conversation, gesture, facial expression and eye gaze for up to eight participants. A television production company drew up the filming protocol to limit bias in the data record (see Appendix 8). The use of a filming protocol in this study is a measure of quality control that brings confidence to the results. It is recommended that future studies adopt this protocol to evaluate interaction change in groups.

The raters evaluated conversation samples portraying clips from three simultaneous views on one, time sequenced, video of the group interaction. Trials with four camera views prior to the study commencement revealed this format to be visually too complex to watch and rate. One rater suggested that a useful future development would be provision of a secondary viewing folder with full-size views of all camera angles to more accurately capture eye gaze movements. This modification would further enhance the filming protocol for future research.

A potential limitation of frequency counts as a method of conversation outcome measurement is that their presence or absence in a given conversation sample is dependent on context and the length of the video sample. Samples were 10 minutes in length. In previous social communication skills investigations in ABI, sample lengths have ranged from 5 minutes (Togher et al., 2013) to 15 minutes (Helffenstein and Wechsler, 1982). However, these are based on dyadic conversations, and the ability of a 10 minute sample to capture a representative snapshot of conversation between four and eight individuals with variable interpersonal communication skills cannot be guaranteed. Future research to investigate the effects of peer group conversation sample lengths on
measurement outcomes is therefore warranted to establish optimal sample duration.

In common with previous discourse analyses (e.g. Gordon, Rigon and Duff, 2015; Gordon, Tranel and Duff, 2014), the present study measured equality of contribution as an indicator of ability to adapt conversational behaviour in response to the behaviour of others. The NHHI, an index originally developed to measure concentration in the field of competition law, was chosen as a measure of equality of participation in a social communication group. The NHHI uses proportional share to determine the balance of the interaction across a participant group. This was an innovative application of the measure; interpretation guidelines were untested with the ABI population and the procedures followed in this study were exploratory. Although more research needs to be conducted to determine its reliability as an index of conversation share, the measure has previously been flexibly applied across a range of different contexts to determine balance of contribution, and thus appears to hold promise.

The INT sociograms produce a visual profile of patterns of participation, showing the weight of each participant’s contribution in the group interaction. The sociograms provide a unique view of the structure of the group interaction in context, providing insights into changes in patterns of connection over time that would not otherwise be apparent. In the present study, the INT was used to evaluate outcomes at key measurement points. In contrast, Gesell, Barkin and Valente (2013) used an SNA tool to evaluate individual session outcomes in order to plan subsequent session activities and group facilitator strategies to maximise intervention effectiveness. The sociograms may also be a useful tool to incorporate in this way into the peer facilitator training for the current intervention. In the present study, all interaction types (initiations and responses) were represented in the analysis for this thesis. For future data presentations, the tool’s filters can be applied to visualise more specific profiles of participation for more detailed interaction analyses. For example, sociograms can be generated to portray individual interaction types or combinations of interaction types (such as initiations or responses; verbal or non-verbal
behaviours) either by group, by participant or between sub-groups of participants. This also has important implications for clinical practice. Firstly, the INT sociograms provide a salient feedback method for group participants and a means to set goals for conversation behaviour in a group setting. In this context, the sociograms become a visual metaphor for behaviour change. For example, a participant reviewing a sociogram showing two conversation isolates and a thick black arrow between themselves and one other participant might set a goal to be more inclusive in conversation, with the aim of achieving a less thick and less black arrow or a profile that is multi-directional. Secondly, the sociograms can be used to provide objective and quantifiable evidence of change in review reports for funding bodies or discharge reports for new clinical teams.

In summary, the INT shows promise as a new tool to evaluate ABI group interaction in rehabilitation settings. There is also potential for application across other clinical populations, SLT settings and multi-disciplinary group environments. In clinical training environments, there is further potential for its application as an evaluation and feedback tool for trainee clinicians to address the potentially negative effect of professional power on interactions.

7.3.2 The dyadic interaction measurement tools

A measure of participation in a conversational exchange, the MPC, was selected as the main primary outcome measure. Measurement of participation contrasts with other dyadic interaction measurement tools that evaluate change in isolated behaviours, which provides no guarantee of change within the overall interaction. The pilot study tested the PPIC, the BRISS-R and the MPC for sensitivity to change in group interaction behaviours, but only the MPC met reliability, validity and responsiveness criteria, suggesting sensitivity to change in peer group encounters. Main study findings showed ceiling effects at the maintenance measurement point. Evidence of restricted range at the upper end of the scale indicated insensitivity to change in participation between a group of peers. This finding was not unexpected, given that the measure was designed to evaluate people with TBI in a dyadic conversation, and suggests that the expected range of achievement on this measure differs in a peer-facilitated group intervention.
This finding has important implications for measuring change in peer-mediated interventions in clinical settings where the aim is to empower people to independently assume social roles in everyday life.

7.3.3 Self-report tools

Both secondary outcome measures adopted in this study used self-report questionnaire data to evaluate change. Self-report measures have previously been reported as subject to bias in the ABI population as a result of severe cognitive deficits or mood (Appleton et al., 2011; McDonald, Tate, et al., 2008). The LCQ was used to evaluate change in individual social communication skills. In common with Behn et al. (2012), Finch et al. (2017) and McDonald, Tate, et al. (2008), there was no significant improvement on the LCQ self-report questionnaire. Social interaction is a complex construct and the present study investigated change in participation in group interaction, which the LCQ is not designed to directly measure. In common with Finch et al. (2017), findings in the present study suggest that the absence of change on the measure may have been due to insensitivity to the construct under investigation. In the present study, findings on the LCQ other-report questionnaire showed a perception of improved skills for both groups, although bias cannot be excluded as it was not possible to blind raters (all familiar communication partners) to the group or phase of intervention.

7.3.4 Participant satisfaction

Intervention and control group attendance in both phases of the study was high, indicating that this model of intervention was acceptable to participants. Participant satisfaction was directly evaluated using an informal feedback questionnaire administered after the final group meeting by a person unrelated to the study to guard against bias. In the main study, mean scores on the group satisfaction questionnaire were lower for the intervention group. Hoepner and Turkstra (2013) describe the complexity of questionnaire completion for this clinical group. It places demands on declarative and working memory, and it requires the integration of examples from past experience to form an accurate judgement. It is also possible that this finding reflected task differences between
the groups. The peer-facilitated intervention group encouraged active participation on a collaborative task. This may have been perceived as challenging at times, without staff to immediately smooth over differences of opinion or respond to behavioural needs. The control group activity, on the other hand, was familiar and supported by staff.

In the pilot study, satisfaction levels were high for both participant groups. This result replicates findings from Struchen et al. (2011) who also reported high participant satisfaction in the intervention group, but no statistically significant evidence of improved social functioning. Future studies could trial an alternative feedback methodology (e.g. to rate satisfaction after each group meeting) in order to increase the salience of the task for participants and provide more informative feedback as the meetings progress. This approach would also provide evidence of the stability of the measure over time.

In summary, measurement of change in group social interaction is a new field for research and development. This investigation tested previous measurement tools, designed for dyadic conversation, and self-report tools, and applied them in a new context: to an evaluation of change in interactional participation between a group of peers with ABI. The INT, a new tool using SNA approaches to measure participation in group interactional behaviour, was designed and evaluated. The INT holds promise as a new measure of participation in conversation between peers in real-world environments.

### 7.4 Implementation and future research

To the best of this author’s knowledge, this is the first intervention study to train a peer with severe ABI to facilitate group social interaction, and findings suggest that further large-scale investigation is warranted. This section discusses implementation issues and future research needs. Section 7.4.1. discusses participant recruitment and retention, and selection of the peer facilitator. Section 7.4.2 focuses on implementation of the intervention. Section 7.4.3 targets issues of outcome measurement.
Findings from this preliminary investigation indicate that a peer-mediated intervention is a promising approach to improve social communication competence for individuals with severe ABI, but the sample size was small. MRC guidance (Craig et al., 2008) acknowledges that even a fully powered experimental study of a complex intervention is unlikely to provide a complete evaluation of effectiveness that is generalisable across environments and participant groups. Evaluation and implementation recommendations therefore specify the inclusion of strategies to monitor effects over time through replication in clinical practice. Future research designed to replicate methods adopted in this study and to test modifications with a larger sample size would add empirical support for the effectiveness of the approach. Replication over multiple sites, with intervention delivered by SLTs would provide comparative data for evaluation of context-specific implementation factors influencing outcomes, and enable a pooled evaluation of findings from a larger sample size.

The use of a randomised design is recommended for future testing of this intervention in clinical settings. The experimental parallel group design with an active control arm adopted in this study equalised the risks of non-specific treatment effects (such as group maturation and the evolution of relationships over time) across both treatment arms, increasing confidence in the results. MRC guidelines (Craig et al., 2008) recommend a randomised design where the likelihood of bias from exposure to other factors is high.

7.4.1 Participant recruitment and retention, and selection of the peer facilitator

The results of this investigation demonstrate that implementation of the peer-led intervention is feasible in a post-acute setting for individuals with severe ABI. Further research to replicate the intervention with a severe participant group and to determine efficacy with less severe participant groups (e.g. moderate ABI) is recommended. Training a less severely impaired peer to facilitate a severe participant group may also hold promise as a means to enhance peer learning. Struchen et al. (2011) investigated a peer training intervention to provide social support in the community to a moderate-severe TBI group. In contrast, the present study recruited participants with severe traumatic and non-traumatic
injuries with similar cognitive presentation to TBI. These eligibility criteria enable generalisation to a population that is representative of rehabilitation environments, which findings from more carefully selected groups does not allow. Previous researchers have acknowledged the pitfalls of restricted eligibility. For example, Dahlberg et al. (2007) concluded that findings from a social communication skills study of community-dwelling TBI participants that excluded individuals with a history of substance abuse, psychological disorders or dual neurological diagnoses, were unrepresentative of the wider TBI population. In contrast, in the present study eligibility criteria were intentionally broad and also included individuals without the capacity to consent to treatment, because the ability to build and maintain social relationships is equally as important for this group.

Participants in the present study were drawn from a neuro-rehabilitation centre for severe ABI providing medium and longer-term placements across ward, home and independent living accommodation. Unlike previous studies, findings are therefore generalisable to individuals with severe injuries at both post-acute and later stages of recovery. There is also theoretical application to different environments, such as community settings, day centres and vocational work placements which would benefit further investigation.

Issues influencing recruitment and retention for future research are likely to be site and context-specific. In the present study, recruitment for the planned sample size in the post-acute rehabilitation setting was achieved in a timely manner, such that momentum was maintained from the point of recruitment to commencement. In contrast, Appleton et al. (2011) described participant recruitment in an in-patient setting as slow, with insufficient numbers available to implement a randomised study design. Struchen et al. (2011) identified an extended time interval between recruitment and commencement, and potential loss of interest, as a possible cause of subsequent losses, which may be an issue in a community-dwelling population. In the present pilot study, it was pre-intervention losses from the intervention group that compromised randomisation and indicated that recruitment criteria required review. The evaluation showed that some referrers had overestimated participant abilities to tolerate group
activity (e.g. falsely assuming that a willingness to watch TV with fellow residents or eat with others in the dining room was indicative of ability to actively participate in a group), resulting in early losses in the pilot stage. This was successfully overcome in the main study by amending the protocol to specify supporting evidence of ability to tolerate groups (i.e. evidence of previous group attendance). It is also possible that some referrers may have underestimated capability to participate in rehabilitation or group activity, precluding recruitment of other potential candidates meeting eligibility criteria. This has been identified as a feasibility risk by Appleton et al. (2011) in a post-acute rehabilitation setting, who reported an overly-cautious approach from the treating team in fitness to participate decisions. Consistent with recommendations from Appleton et al. (2011), future research should include a staff education programme to reduce the potential for sampling bias. In the main study, two participants withdrew due to medical/surgical reasons. Previous investigations into medical/surgical interruption to in-patient post-acute rehabilitation highlight the variety of complications accompanying TBI that require specialist input, and adversely impact rehabilitation outcomes (Hammond et al., 2015). The risk of potential losses due to medical instability in the post-acute recovery phase requires consideration in recruitment decisions in future research studies.

Researchers have previously acknowledged the difficulties of retaining individuals with ABI in research programmes (Newberry et al., 2010). In the present study, overall losses in both phases of the pilot and main studies (25%) were broadly in line with previous RCTs delivering complex interventions for social communication. For example, Dahlberg et al. (2007) reported 25% losses over 12 weeks of treatment and a 9 month follow-up phase. McDonald, Tate, et al. (2008) reported 24% losses over a 12 week programme (without follow-up assessment). In a non-randomised trial in an in-patient setting, Appleton et al. (2011) reported 47% losses between baseline and post-intervention assessments.

A key finding from the present study was the importance of carefully defined selection criteria and procedures for the peer facilitator to ensure per protocol delivery of the intervention. This appointment is a critical ingredient in effecting
change in group outcomes and proved challenging in both the pilot and main study phases. In the pilot study, per protocol intervention intensity targets were not met, undermining the ability to demonstrate effectiveness. This replicates the peer-led intervention finding reported by Struchen et al. (2011), in which low intensity was attributed to a reduced number of one-to-one contacts. In the present pilot study, a previously undiagnosed psychiatric disorder compromised the peer facilitator’s ability to consistently engage with the training concepts impeding intervention delivery. Selection procedures for the main study were refined following this finding. However, the first peer facilitator in the main study developed an infection following selection and stepped down from the role. Replacement was limited to selection from the remaining participants in the randomised intervention group. Future studies using a parallel group design should consider appointing the peer facilitator prior to randomisation, to widen the pool of candidates for selection.

7.4.2 Intervention and delivery

In the present study, the intensity of the group intervention (16 hours over 8 weeks, twice weekly meetings) is broadly consistent with that of Dahlberg et al. (2007), for example, who reported positive outcomes from a delivery schedule of 18 hours over 12 weeks. Other group intervention studies report higher intensities. For example, McDonald, Tate, et al. (2008) reported 48 hours over 12 weeks, and Togher et al. (2013) reported 35 hours over 10 weeks for their communication partner training programme. For the peer facilitators, this was an intensive intervention of an additional 16 hours over 4 weeks, and there are implications for feasibility of implementation in clinical practice. This training regime may be burdensome for some peer facilitators and resource intensive for staff in some settings. However, intensive delivery models are consistent with current recommendations for active multi-disciplinary rehabilitation following moderate to severe ABI. In a systematic review of multi-disciplinary rehabilitation for adults with ABI of working age, Turner-Stokes, Pick, Nair, Disler and Wade (2015) found strong evidence of benefit from comprehensive milieu-orientated cognitive group therapies in rehabilitation environments with peers sharing similar impairments following severe ABI. Further, individuals with a
profile of moderate to severe impairment receiving intensive rehabilitation demonstrated earlier functional gains. In an evaluation of a peer-led programme to facilitate community integration, Struchen et al. (2011) suggested training more than one peer for each intervention group participant to increase support opportunities. Delivering the training to two peer facilitators in the present study intervention may also be a resource efficient means to increase peer learning, but the impact of this strategy on training intensity and peer learning opportunity requires further investigation. Further research to refine the peer training content and delivery methods is recommended in order to optimise the intervention schedule for clinical implementation.

The feasibility of implementation in clinical practice is likely to be influenced by institutional processes, with the potential to affect research outcomes. In a previous study set in a residential post-acute rehabilitation setting, Appleton et al. (2011) identified problems with routine therapies impeding participant attendance. Wells et al. (2012) also cited gate-keeping by clinicians as a method of protecting routine clinical practice from the perceived disruption of the research process. In the present study, negotiation with clinical management teams took place at an early stage to ensure that the study timetable did not interrupt routine therapies. Peer facilitator training sessions were flexibly timetabled (often at weekends) to accommodate routine therapies, leisure activities and the need for rest. As a new and unproven intervention, training was secondary to the planned rehabilitation timetable and the research team were guided by decisions of the treating team regarding the prioritisation of routine therapies and other appointments over group attendance. Challenges included the ongoing education of permanent and agency staff to support participant recall of group meetings. Regular staff reminders were also required to ensure participants were ready on time and to avoid appointment clashes. Staff shortages often resulted in unplanned and ad hoc arrangements to accompany participants to and from the group meetings. It is possible that negative or positive experiences from these associated activities altered participant expectations or attitudes. These findings reinforce the importance of staff training to effectively incorporate research programmes into real-world clinical settings in future studies. Future studies may also consider inclusion of
case examples into an intervention manual as a means to report contextual components with the potential to affect outcomes.

Dissemination through a training manual would increase accessibility of the core training concepts and delivery methodologies for SLTs, and would be vital for a larger scale trial over multiple sites. Future studies would need to employ objective methods to ensure that the treatment is implemented as intended (i.e. treatment fidelity). Hart (2009) defines fidelity assessment as typically involving independent rater evaluation of target behaviours or treatment contents, drawn from the active ingredients identified in the underpinning intervention theory, and as specified in a treatment manual. Methods to evaluate implementation include video observation of treatment sessions or coding of treatment notes using a checklist monitoring tool. Such measures can be incorporated into a large-scale trial. Methods to evaluate strategy implementation by the peer facilitator in the group setting is a further step for future investigation.

MRC guidelines (Craig et al., 2008) also recommend incorporating implementation strategies that take account of the barriers and enablers to behaviour change. This peer-mediated intervention has multiple components and further investigation is required to determine what works and why. Future research could systematically investigate the active ingredients underpinning treatment effects to maximise implementation across contexts using, for example, an established taxonomy of behaviour change techniques (Michie, Ashford, Sniehotta, Dombrowski, Bishop and French, 2011)

7.4.3 Outcome measurement

This study has shown that the development of new measures of real-world communication capability in groups is a priority for training social communication skills in ABI. The INT provides a promising new way to measure participation in group interaction but further development is needed. Interaction sample lengths of 10 minutes were used, based on previous studies into dyadic conversation. Future investigation into the effect of sample duration on INT group interaction measurement outcomes is recommended.
An evaluation of the INT interaction codes based on usage in the present study will provide preliminary data on content validity to determine whether the current interaction codes measure the participation construct. This analysis will enable further refinement, through new code generation or code reduction. Score consistency has been previously cited as a measure of reliability (Guyatt, Walter and Norman, 1987), and the INT frequency counts for the intervention and control groups in the main study were consistent across measurement points. Inter-rater reliability was also high. This is preliminary data from a small sample and replication with different samples and across different group contexts will provide further information on the reliability and precision of the tool.

The NHHI is a useful measure of equality of participation that has previously been applied in very different contexts to this. The index provides a summary statistic, and further testing is required to strengthen interpretation guidelines for use with social communication groups. 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 (i.e. a balanced group interaction requires some participants to increase and others to decrease the frequency of their contributions). The analyses showed that the relational data produced by the INT is not suitable for inferential statistical analyses, precluding conventional effect size calculation and power analysis. Effect size calculation and power analysis using data from the MPC was also not possible as a result of the ceiling effects seen on this measure. Exploration of more conventional statistical approaches for use with relational data would allow comparison with more established procedures, and also enable power calculations to estimate sample sizes for a future larger scale trial.

Finally, the rating procedures devised for this study comprised a filming protocol designed to reduce bias in the data record through maximal coverage enabling simultaneous multi-party conversations to be captured from four directions. It is recommended that this protocol is adopted in future research involving group interaction. To facilitate this, it could be published online and disseminated through relevant research channels including social media.
7.5 Limitations

This was an exploratory study of a novel intervention. Overall, these preliminary findings are promising but the sample size was small, and the results require a cautious interpretation. A future study with an increased sample size is warranted in order to increase confidence in the results. The follow-up phase of the present study was limited to 4 weeks post-intervention, determined by a typical minimum length of stay in the research setting of 3-4 months. A longer follow-up period would have provided more information on longer-term effects.

A further limitation is the absence of a validated outcome measure to evaluate change in a group interaction for people with ABI. Given this, The INT was developed to measure social participation in peer-facilitated groups for this study. The tool measures patterns of social interaction in a group setting, and provides new insights into group relationships through network visualisation. The application of the NHHI was also exploratory, enabling a measure of interactional participation, as conventional statistical procedures were not suitable to use with data that follows a scale free distribution. Without conventional statistical procedures to determine effect sizes, sample size calculation for future research has not been possible. The INT is a novel measure, both previously untested and in prototype form, but the evaluation has shown that it holds promise as a useful measure of group social interaction.

7.6 Conclusion

This research has shown that a peer-mediated social communication skills intervention for severe ABI is feasible, that a peer with severe ABI can be trained to facilitate social interaction, and that a peer-facilitated group can result in an improved ability to socially connect and participate collaboratively in a real-world task without staff present. This has important implications for clinical practice in ABI, where the goal of rehabilitation is community integration, requiring skills to meet real-world social participation needs. The intervention provides training to build skills to independently negotiate meaning through a prestigious discourse opportunity. Further testing to evaluate findings with a large sample size across multiple settings is therefore warranted.
This study has also developed and tested a novel tool to measure social participation in a real-world environment. The INT offers a new approach to analyzing patterns of social interaction and measuring outcomes in group settings, with a novel focus on capturing social connections between people. Further development and validation of this instrument is indicated. In summary, this research brings two innovations to social communication skills training in ABI. Both the peer-led intervention and the INT bring new possibilities to the rehabilitation of real-world social communication for individuals with ABI.
References


production of green technology: a comparative analysis of fuel cell patents. 


McDonald, S., Bornhofen, C., Togher, L., Flanagan, S., Gertler, P. and Bowen, R.


Spikman, J.M., Timmerman, M.E., Milders, M.V., Veenstra, W.S. and van der


Appendices

Appendix 1 Ethical approval
1.1 NRES approval letter
(identifying information has been removed)

06 March 2014

Dr Suzanne Beeke
Senior Lecturer, Department of Psychology and Language Sciences, UCL
University College London
Language and Communication Research Department
Chandler House, 2 Wakefield Street
London
WC1N 1PF

Dear Dr Beeke

Study title: An investigation into the effectiveness of a social communication skills training programme for adults following severe traumatic brain injury (TBI) using a peer-to-peer learning model.

REC reference: [redacted]
IRAS project ID: 130601

Thank you for your letter of 03 March 2014, responding to the Committee’s request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Vice-Chair.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details, unless you expressly withhold permission to do so. Publication will be no earlier than three months from the date of this favourable opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to withhold permission to publish, please contact the REC Manager [redacted].

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

Mental Capacity Act 2005

A Research Ethics Committee established by the Health Research Authority
I confirm that the Committee has approved this research project for the purposes of the Mental Capacity Act 2005. The Committee is satisfied that the requirements of section 31 of the Act will be met in relation to research carried out as part of this project on, or in relation to, a person who lacks capacity to consent to taking part in the project.

**Ethical review of research sites**

**NHS sites**

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

**Conditions of the favourable opinion**

The favourable opinion is subject to the following conditions being met prior to the start of the study.

- **Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.**

  - **Management permission ("R&D approval") should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements.**

  - Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at [http://www.rdforum.nhs.uk](http://www.rdforum.nhs.uk).

- **Where a NHS organisation's role in the study is limited to identifying and referring potential participants to research sites ("participant identification centre"), guidance should be sought from the R&D office on the information it requires to give permission for this activity.**

- **For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.**

- **Sponsors are not required to notify the Committee of approvals from host organisations.**

**Registration of Clinical Trials**

All clinical trials (defined as the first four categories on the IRAS filter page) must be registered on a publically accessible database within 6 weeks of recruitment of the first participant (for medical device studies, within the timeline determined by the current registration and publication trees).

There is no requirement to separately notify the REC but you should do so at the earliest opportunity e.g when submitting an amendment. We will audit the registration details as part of the annual progress reporting process.

To ensure transparency in research, we strongly recommend that all research is registered but for non-clinical trials this is not currently mandatory.

---

A Research Ethics Committee established by the Health Research Authority
If a sponsor wishes to contest the need for registration they should contact Catherine Blewett (catherineblewett@nhs.net), the HRA does not, however, expect exceptions to be made. Guidance on where to register is provided within IRAS.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

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Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Reporting requirements

A Research Ethics Committee established by the Health Research Authority
The attached document “After ethical review – guidance for researchers” gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study

The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

Feedback

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website.

Further information is available at National Research Ethics Service website > After Review

Please quote this number on all correspondence

We are pleased to welcome researchers and R & D staff at our NRES committee members’ training days – see details at http://www.hra.nhs.uk/hra-training/

With the Committee’s best wishes for the success of this project.

Yours sincerely

Chair

Email: 

Enclosures: “After ethical review – guidance for researchers” [SL-AR2]

Copy to: Ms Suzanne Emerton
280

1.2 NRES substantial amendment approval letter

25 March 2015

Dear

Study title: An investigation into the effectiveness of a social communication skills training programme for adults following severe traumatic brain injury (TBI) using a peer-to-peer learning model.

REC reference: 
Amendment number: 2
Amendment date: 05 March 2015
IRAS project ID: 130601

The above amendment was reviewed by the Sub-Committee in correspondence.

Ethical opinion

The members of the Committee taking part in the review gave a favourable ethical opinion of the amendment on the basis described in the notice of amendment form and supporting documentation.

Approved documents

The documents reviewed and approved at the meeting were:

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<td>Participant consent form [Consent form peer tutor v4_tracked changes]</td>
<td>4</td>
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Membership of the Committee

The members of the Committee who took part in the review are listed on the attached sheet.

R&D approval

All investigators and research collaborators in the NHS should notify the R&D office for the relevant NHS care organisation of this amendment and check whether it affects R&D approval of the research.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

We are pleased to welcome researchers and R & D staff at our NRES committee members’ training days – see details at [http://www.hra.nhs.uk/hra-training/](http://www.hra.nhs.uk/hra-training/)

Please quote this number on all correspondence

Yours sincerely

Chair

E-mail: ***************

Enclosures: List of names and professions of members who took part in the review

Copy to: Dr Suzanne Beeke, University College London
Ms Suzanne Emerton

NRES Committee

Attendance at Sub-Committee of the REC meeting on 24 March 2015

Committee Members:

<table>
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Appendix 2 Information sheets

2.1 Participant information sheet
(Identifying information has been removed)

PARTICIPANT INFORMATION SHEET
REC Reference Number: [REMOVED]

We would like to invite you to take part in a research study here at [REMOVED].

A New Intervention For Social Skills Following Brain Injury (Student Study)

The ward/home manager, your key worker or another member of your team will read this information sheet with you. They will answer any questions that you have.

This information sheet is in two parts.

**Part 1** answers two **important** questions:
1. Why are we doing the research?
2. What does it involve?

**Part 2** gives more **details**.
Please read this information carefully.
Talk about it with family, friends and staff if you wish.

Information sheet – participant 26.1.15 Version 3
Part 1

What is the purpose of the research?

We want to test a new therapy to improve social communication skills.

Why have I been invited?

- Changes in social communication skills after a brain injury can have a big impact on your life.
- Sometimes these changes are not obvious until you are back at home.
- Social communication skills are important in everyday life.
- Social communication skills include making a good impression, successfully getting your point across and being a good listener.
- They are important for strong family relationships and for keeping old friends.
- They are also important for meeting new people and making new friendships.

Do I have to take part?

It is up to you to decide to join the study. We will describe the study and go through this information sheet. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. This will not affect the standard of care you receive.

What will happen to me if I take part?

There will be three stages to the research.

Stage 1:

- You will complete some assessments that look at the changes to your thinking and communication that have occurred as a result of the brain injury.

- There will be up to nine sessions, each lasting for about an hour. **One of these assessments will be a short video sample of conversation with a clinician.** You may have completed some of these assessments already as part of your routine care.

Stage 2:

You will join **one** of two groups:

**Social Activity Group (6 people)**

- You will have the opportunity to practise social skills in discussion or craft activities.

- This will be just the same as one of the typical social activity groups available here at [insert information].

- Staff support will be available.

**Social Skills Group (6 people)**

- You will have the opportunity to practise social skills while giving your opinion on a number of different topics to do with [insert information] and rehabilitation following injury.

- Staff will oversee the activity from close by, but will not be present in the room. This is so that everyone can freely exchange views.

- This group will meet twice a week for eight weeks.
Stage 3:

- After the groups have finished, we will ask for your opinion on the groups
- We will ask for a second video sample of conversation with a clinician
- We will also ask you to complete a questionnaire about social skills
- You will be invited to share some of the general findings from the research with other people at [redacted]
- This may be either face to face or in a newsletter
- You do not have to take part in sharing the general findings if you do not want to. It is entirely optional

Can I choose which group I join?

No. You have an equal chance of being assigned to either group. At the moment we do not know which group is the most beneficial. We will be comparing the differences between the groups.

What are the possible benefits of taking part?

- If the therapy helps, the results will show improved social communication skills
- If the therapy does not help then things will stay the same.

What are the possible disadvantages of taking part?

- All the group meetings will be filmed, which some people may find uncomfortable

We are filming so that we have a detailed record of the changes to social communication skills that take place during the group meetings. We will ask your permission to film the group meetings.

- If you are in the social skills group, we will ask your permission for short film clips of the group meetings to be used in the training for the fellow resident who is leading the group. Some people may be worried about their privacy.

The speech and language therapist will only show short clips of the meetings that illustrate a specific point about social communication skills. These clips will be selected in advance. Video feedback is effective in brain injury rehabilitation.

What information will be collected?

1. We will collect information on changes to your social communication skills that take place during the group meetings. These changes will be recorded on the film footage.

2. We will also collect information about your injury from your clinical records. We need to know when the injury happened and what areas of the brain were damaged.
3. We will also collect information on the changes to thinking and communication that have happened as a result of your injury. This information will be gathered from the assessments completed during the first stage of the study.

**Will the information collected be kept confidential?**

Yes, we will maintain confidentiality by:

- **Never using your real name**

  When writing or talking about the research to other professionals we will never use your real name. No one outside your clinical team will know your name, address or any other details.

  The research team at UCL will view the films. Only the speech and language therapy researcher from UCL will know participants’ real names.

- **Securely storing the film footage**

  All the films will be securely stored, and the information will only be used for research and teaching purposes.

- **Asking your permission to share information with other professionals**

  We will ask your permission to tell your GP that you are taking part in this research. If you give us permission, we can make sure that your medical record is up to date with information about the study.

  We will ask your permission for short clips of film to be viewed by brain injury rehabilitation professionals at conferences and for teaching purposes.

  There is a chance that people may recognize the participants but it is a small chance. Keeping information confidential is part of the code of ethics for rehabilitation professionals.

**What will happen after the research study stops?**

This treatment will not be available after the research study finishes. If it is successful, we hope that similar ways of treating social skills difficulties may become more widely available in a few years time.

The results of this study will be reported at conferences and in written reports. We will ensure that you cannot be identified in these reports. If you would like a copy of any report, please let us know.

**How will you keep me informed about the research?**

- We will keep you up-to-date via a newsletter
- If you leave Glenside before the research has finished, this letter will be sent to your home address

**What will happen if I say: ”No, I do not want to take part in this research“?**
If you decide not to take part, this will not affect the care you receive now or in the future. You will continue with your therapy and also with social activity groups at [insert site]. These will not be part of the research study.

**What will happen if I say: “Yes, I want to take part in this research”?**

A member of the speech and language therapy department will ask you to sign a form to say you agree. You will have a copy of this form to keep. If you change your mind, you can still withdraw at any time without giving a reason. If you withdraw from the study, the research team will use the data already collected.

**What do I need to do now?**

- Think about the information from today
- Read Part 2
- Talk about it to family, friends and staff
- Ask questions if there is anything you do not understand or if you need more information
- Let us know if you would like independent help to decide whether or not to take part

Your ward manager or key worker will talk to you again in one week to find out your decision.
Part 2
More Information

Data Protection

Information about you will be kept confidential. All the films will be stored securely at each stage of the research. While the groups are running, the film footage will be stored on an encrypted portable hard drive in a locked filing cabinet at [redacted]. The speech and language therapist will transfer short film clips from the group meetings onto an encrypted data stick to use in the training sessions for the fellow resident leading the meetings. These will be deleted after use.

After the groups have finished, the speech and language therapist researcher will transfer the encrypted portable hard drive to a locked cabinet at UCL. Data will be shared with the research team at UCL via an encrypted data stick and deleted from the stick once analysed. After the study has ended, the data will be stored in an off-site records office at UCL. Access is strictly controlled. UCL has a policy of storing this data for 20 years. It will then be securely destroyed.

Checks on the research

[redacted] NHS Research Ethics Committee has already checked that the research is ok. This committee is independent. They are there to protect your safety, rights, wellbeing and dignity.
University College London will also check that the research is being done properly.

What to do if you have a complaint

If you wish to complain, or have any concerns about any aspect of the way you have been approached or treated by members of staff during your participation in the research, [redacted], National Health Service or UCL complaints mechanisms are available to you. Please tell your researcher if you are unhappy about the research. If you are not happy with how your complaint is addressed please contact:

Professor Jane Maxim
Division of Psychology and Language Sciences
University College London
Chandler House
2 Wakefield Street
London WC1N 1PF

Email: j.maxim@ucl.ac.uk
Tel: 020 7679 4275

What if there is a problem?

In the unlikely event that you are harmed by taking part in this study, compensation may be available. If you suspect that the harm is the result of the Sponsor’s (University College London) or [redacted]’s negligence then you may be able to claim compensation. After discussion with your researcher, please make the claim in writing to Dr Suzanne Beeke who is the Chief Investigator for the research and is based at University College London. The Chief Investigator will then pass the claim to the Sponsor’s Insurers, via the Sponsor’s office. You may have to bear the costs of the legal action initially, and you should consult a lawyer about this.

Information sheet – participant 26.1.15 Version 3
Contacts

The Chief Investigator for this research is:

Dr Suzanne Beeke
Language and Communication Research Department
University College London
Chandler House
2 Wakefield Street
London WC1N 1PF

Email: s.beeke@ucl.ac.uk
Tel: 020 7679 4275

The speech and language therapy researcher is:

Susan Howell

This study is part of an educational programme undertaken by the speech and language therapy researcher at University College London.

Thank you for reading this information. Please ask any questions you have about the research. You will be given a copy of this Information Sheet to keep.
2.2 Consultee information sheet
(identifying information has been removed)

CONSULTEE INFORMATION SHEET

A New Intervention For Social Skills Following Brain Injury (Student Study)
Your friend/relative has been invited to take part in a research study here at [redacted] We feel your relative/friend is unable to decide for themselves whether to participate in this study. Can you help decide if he/she should join the study? You are free to decide whether you wish to provide this advice or not. We would like to know of their likely wishes toward participation in research. Please let us know of any advance decisions they may have made about participating in research. Their opinion matters.

If you decide that your relative/friend would have no objection to taking part, please read and sign the consultee declaration on the last page of this information sheet. We will then give you a copy to keep. We will keep you fully informed during the study so that you can let us know if you have any concerns, or if you think your relative/friend no longer should take part.

If you decide that your friend/relative would not wish to take part, it will not affect the standard of care they receive in any way.

If you are unsure about taking on the role of consultee, you may seek independent advice.

We will understand if you do not want to take on the responsibility of consultee.

The following information is the same as that provided to your friend/relative. As you read it, please remember that you are being asked to set aside your own views and consider your friend or relative's views and feelings about taking part in the study.

Please ask if the information is not clear or if you would like further details.

What is the purpose of the study?
We want to test a new therapy to improve social communication skills. These skills include making a good impression, successfully getting your point across and being a good listener.

Why has my friend/relative been invited to take part?
Changes in communication skills after a brain injury can have a big impact on a person's life. Sometimes these changes are not obvious until the person is back at home. These skills are important for strong family relationships and for keeping old friends. They are also important for meeting new people and making new friendships.

What does the research involve?
There will be three stages to the research. All the research will take place at [redacted]
Stage 1:
The participant will complete some assessments that look at the changes to thinking and communication that have occurred as a result of the brain injury. There will be up to nine sessions, each lasting for about an hour. One of these assessments will be a short video sample of conversation with a clinician. Some of these assessments may already have been completed as part of routine care.

Stage 2:
The participant will be assigned to one of two groups. They have an equal chance of being assigned to either group.

The first group is a social activity group (six people) where there will be an opportunity to practise social skills in discussion or craft activities. Staff support will be available in this group. The group will meet twice a week for eight weeks.

The second is the social skills group where six participants will have the opportunity to practise skills while giving their opinions on a number of different discussion topics to do with food, keeping up with hobbies, opportunities to socialize or access to computers. Staff will oversee the activity from close by but will not be present in the room, so that everyone can freely exchange views. This group will meet twice a week for eight weeks.

A fellow resident at will lead these group meetings. This person will receive an additional 16 hours of intensive one to one training with a speech and language therapist to support the group to practise and develop new skills.

Stage 3:
After the groups have finished, a speech and language therapist will ask for your friend or family member’s opinion on the groups. We will ask for a second video sample of conversation with a familiar and an unfamiliar clinician. We will also support your friend or family member to complete a questionnaire about social skills.

Participants will then be invited to share some of the general findings with other people at , either face to face or in a newsletter. This is entirely optional.

What are the possible benefits of taking part?
If the intervention helps, your friend or family member will show improved social communication skills. If the intervention does not help, then things will stay the same.

What are the possible disadvantages of taking part?
All the group meetings will be filmed, which some people may find uncomfortable. We are filming so that we have a detailed record of any changes to social communication skills that take place during the group meetings. The films are confidential research data. We will ask permission to film the participants in the group setting.

If the participant is a member of the social skills group, we will ask permission for short film clips of the group meetings to be used in the training for the fellow resident who is leading the group. Some people may be worried about their privacy. The speech and language therapist will only show short clips of the meetings that illustrate a specific learning point.
about social communication skills. These clips will be selected in advance. Using film of interactions has been shown to be effective in brain injury rehabilitation.

**What information will be collected?**
We will collect information on any changes to social communication skills that take place during the group meetings. These changes will be recorded on the film footage. We will also collect information about your friend or relative’s injury from clinical records. We need to know when the injury happened and what areas of the brain were damaged. We will also collect information on the changes to thinking and communication that happened as a result of the injury. This information will be gathered from the assessments completed during the first stage of the study.

**Will the information collected be kept confidential?**
Yes. When writing or talking about the research to other professionals we will never use real names. No one outside the clinical team will know names, addresses or any other details.

The research team at UCL will view the films after the groups have finished. Only the speech and language therapy researcher from [redacted] will know participants’ real names.

Clips from the footage may be used in future at professional conferences and for teaching. There is a chance that people may recognize the participants but it is a small chance. Keeping information confidential is part of the code of ethics for rehabilitation professionals.

All the films will be securely stored at each stage of the research. While the groups are running, the film footage will be stored on an encrypted portable hard drive in a locked filing cabinet at [redacted]. The speech and language therapist will transfer short film clips from the social skills group meetings onto an encrypted data stick to use in the training sessions for the fellow resident leading the meetings. These will be deleted after use. After the groups have finished, the speech and language therapist researcher will transfer the encrypted portable hard drive to a locked cabinet at UCL. Data will be shared with the research team at UCL via an encrypted data stick and deleted from the stick once analysed.

After the study has ended, the data will be stored in an off-site records office at UCL where access is strictly controlled. UCL has a policy of storing research data for 20 years, after which it will be securely destroyed.

We will ask permission to tell the participant’s GP or other healthcare professional about their involvement in the research. If permission is granted, we can make sure that medical records are up to date with information about the study.

**What will happen after the research study stops?**
This treatment will not be available after the research study finishes. If it is successful, we hope that similar ways of treating social skills difficulties may become more widely available in a few years time.

The results of this study will be reported at conferences and in written reports. We will ensure that participants cannot be identified in these reports. If you would like a copy of
any report, please let us know.

**How will you keep participants informed about the research?**
We will keep participants up-to-date via a newsletter. If the participant leaves before the research has finished, this letter will be sent to the home address.

**Checks on the research**
NHS Research Ethics Committee has already checked that the research is ok. This committee is independent. They are there to protect the safety, rights, wellbeing and dignity of the participants. University College London will also check that the research is being done properly.

**What will happen if I don’t feel able to advise on my friend/relative’s views or wishes about participating in the study?**
Your advice is entirely voluntary and you do not have to provide advice if you do not feel able to or do not wish to do so.

**What will happen if I advise that my friend would not want to take part in the research?**
If you decide that your friend/relative would not wish to take part, this decision will not affect the care your friend or relative receives either now or in the future. Your friend/relative will continue with their therapy programme, and also with social activity groups at [ ]. These will not be part of the research study.

**What will happen if I advise that my relative/friend would wish to participate?**
If you feel that your relative/friend would have no objection to taking part, please sign the consultee declaration. A member of the speech and language therapy department is available to talk to you and your relative/friend together, and answer any further questions you may have. You will have a copy of this consultee declaration to keep.

If you change your mind at any stage, please inform the ward manager or a member of the speech and language therapy team. If your relative/friend withdraws when the study is underway, the data already will collected will be used by the research team.

**What to do if you have a complaint**
If you wish to complain, or have any concerns about any aspect of the way you have been approached or treated by members of staff during your participation in the research, [ ]. National Health Service or UCL complaints mechanisms are available to you. Please tell the researcher if you are unhappy about the research. If you are not happy with how your complaint is addressed please contact:

Professor Jane Maxim  
Division of Psychology and Language Sciences  
University College London  
Chandler House  
2 Wakefield Street  
London WC1N 1PF

Email: j.maxim@ucl.ac.uk

Consultee information sheet and declaration 05.3.15 Version 5

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What if there is a problem?
In the unlikely event that you are harmed by taking part in this study, compensation may be available. If you suspect that the harm is the result of the Sponsor’s (University College London) own negligence then you may be able to claim compensation. After discussion with your researcher, please make the claim in writing to Dr Suzanne Beeke who is the Chief Investigator for the research and is based at University College London. The Chief Investigator will then pass the claim to the Sponsor’s Insurers, via the Sponsor’s office. You may have to bear the costs of the legal action initially, and you should consult a lawyer about this.

Contacts
The Chief Investigator for this research is:

Dr Suzanne Beeke
Language and Communication Research Department
University College London
Chandler House
2 Wakefield Street
London WC1N 1PF

Email: s.beeke@ucl.ac.uk
Tel: 020 7679 4275

The speech and language therapy researcher is:

Susan Howell

This study is part of an educational programme undertaken by the speech and language therapy researcher at University College London.

Thank you for reading this information. Please ask any questions you have about the research. You will be given a copy of this Information Sheet to keep.
2.3 Peer facilitator information sheet
(identifying information has been removed)

A New Intervention For Social Skills Following Brain Injury
(Student Study)

You are invited to take on the role of peer tutor in this research study. Before you
decide, it is important for you to understand what this will involve. Please read the
following information carefully and discuss it with others. Ask if it is not clear or if
you want more information. Take time to decide if you wish to take on this role.

This information is supplementary to the information sheet you received when you
agreed to take part in this study. Thank you for reading it.

What is the purpose of the study?
• We are investigating a new way to improve social communication skills
  following brain injury
• These skills are important in order to be successful in everyday life
• You are already a participant in the social skills group and we want to test
  whether this peer group format, led by a peer tutor is an effective way to
  improve social communication skills

Why have I been chosen?
• You have been chosen because of the social communication skills you are
demonstrating in the group meetings so far
• Other members of staff who know you well (independently of this research
study) have also recommended you for this role

Do I have to take part?
• No. It is up to you to decide whether or not to take part
• If you want to take part, you can keep this information sheet
• You will be asked to sign a consent form
• Even if you decide to take part, you can withdraw from this role or the study
  at any time and without giving a reason
• If you decide not to take part, this will not affect any care you receive now or
  in the future
• If you decide to withdraw when the study is underway, data already recorded
  will be used by the research team

What does the role of peer tutor involve?
• You will be trained to help the group to interact with each other more
  successfully in the meetings
• This training is intensive
• You will have one to one sessions with the speech and language therapist four times each week for four weeks
• You will also be leading the group meetings during this time. Staff will oversee the group from close by but will not be present in the room

**What are the possible benefits of taking part as the peer tutor?**

• If the therapy helps, the results will show improved social communication skills within the group
• You may potentially develop skills as a facilitator and mentor
• If the therapy does not help, then things will stay the same.

**What are the possible disadvantages of taking part as the peer tutor?**

• The training sessions with the speech and language therapist will be filmed, which some people may find uncomfortable.

> This training is being delivered for the first time and we are filming so that we have a detailed record of the training programme for further evaluation. These recordings are confidential and will only be used for research purposes.

• The training is intensive (16 sessions over four weeks), and the peer tutor may consider that he/she is missing out on other opportunities for social activity.

> Additional opportunities for social activity will be offered independently of this research study.

**Will the information collected be kept confidential?**

Yes, we will maintain confidentiality by:

• Never using your real name

> When writing or talking about the research to other professionals, we will never use your real name. No one outside your clinical team will know your name, address or any other details. The research team at UCL will view the films after the groups have finished. Only the speech and language therapy researcher from [Redacted] will know your real name.

• Securely storing the film footage

> All the films will be securely stored, and the information will only be used for research and teaching purposes. While the training is underway, the film footage will be stored on an encrypted
portable hard drive in a locked filing cabinet at [redacted]. After the training and the groups have finished, the speech and language therapist researcher will transfer the encrypted portable hard drive to a locked cabinet at UCL. Data will be shared with the research team at UCL via an encrypted data stick and deleted after use. After the study has ended, the data will be stored in an off-site records office at UCL where access is strictly controlled. UCL has a policy of storing this data for 20 years, after which it will be securely destroyed.

- Asking your permission to share information with other professionals

We will ask your permission for short clips of film to be viewed by brain injury rehabilitation professionals at conferences and for teaching purposes. There is a chance that people may recognize the participants, but it is a small chance. Keeping information confidential is part of the code of ethics for rehabilitation professionals.

**What will happen after the research study stops?**

This training will not be available after the research study finishes. If it is successful, we hope that similar ways of treating social skills difficulties may become more widely available in a few years time.

The results of this study will be reported at conferences and in written reports. If you would like a copy of any report, please let us know.

**How will you keep participants informed about the research?**

- We will keep participants up-to-date via a newsletter
- You will be invited to share some of the general findings either face to face or in the newsletter with other people at [redacted]
- This is entirely optional
- If you leave [redacted] before the research has finished, this newsletter will be sent to your home address.

**Who has reviewed the study?**

[redacted] NHS Research Ethics Committee has already checked that the research is ok. This committee is independent. They are there to protect the safety, rights, wellbeing and dignity of all participants.

University College London will also check that the research is being done properly.

**What to do if you have a complaint**

If you wish to complain, or have any concerns about any aspect of the way you have been approached or treated by members of staff during your participation in the research, [redacted] National Health Service or UCL complaints mechanisms are available to you. Please tell your researcher if you are unhappy about the research.
If you are not happy with how your complaint is addressed please contact:

Professor Jane Maxim  
Division of Psychology and Language Sciences  
University College London  
Chandler House  
2 Wakefield Street  
London WC1N 1PF

Email: j.maxim@ucl.ac.uk  
Tel: 020 7679 4275

**What if there is a problem?**

In the unlikely event that you are harmed by taking part in this study, compensation may be available. If you suspect that the harm is the result of the Sponsor’s (University College London) or [participant’s] negligence then you may be able to claim compensation. After discussion with your researcher, please make the claim in writing to Dr Suzanne Beeke who is the Chief Investigator for the research and is based at University College London. The Chief Investigator will then pass the claim to the Sponsor’s Insurers, via the Sponsor’s office. You may have to bear the costs of the legal action initially, and you should consult a lawyer about this.

**Contacts**

The Chief Investigator for this research is:

Dr Suzanne Beeke  
Language and Communication Research Department  
University College London  
Chandler House  
2 Wakefield Street  
London WC1N 1PF

Email: s.beeke@ucl.ac.uk  
Tel: 020 7679 4275

The speech and language therapy researcher is:

Susan Howell
This study is part of an educational programme undertaken by the speech and language therapy researcher at University College London.

Thank you for reading this information. Please ask any questions you have about the research. You will be given a copy of this Information Sheet to keep.
Appendix 3  Consent forms

3.1 Participant consent form
(identifying information has been removed)

CONSENT FORM
PARTICIPANT

A New Intervention For Social Skills Following Brain Injury (Student Study)

Name of Researcher: Susan Howell
Chief Investigator: Dr Suzanne Beeke

REC Reference Number: [Redacted]
UCL Study Number: 13/0477

Participant Identification Number: [Redacted]

Please initial box

1. I confirm that I have read and understood the information sheet dated
   _______________ (version ____) for the above study and have had the
   opportunity to ask questions.

2. I understand that my participation is voluntary and that I am free
   to withdraw at any time, without giving any reason, and without
   my rehabilitation and/or medical care or legal rights being
   affected.

3. I understand that relevant sections of my medical notes and data
   collected during the study may be looked at by individuals from
   [Redacted], from regulatory authorities or from the NHS Trust
   where it is relevant to my taking part in this research. I give
   permission for these individuals to have access to my records.

4. I agree for short parts of my conversation with a clinician to be
   video recorded.

5. I agree to the filming of the group meetings during the study.

6. I agree that the speech and language therapist can use short
   clips of film from the group meetings for training sessions with
   the fellow resident.

7. I understand that anonymised data collected during the study
   will be analysed by the research team at UCL.
8. I understand that if I withdraw from the study, the research team will use the data that has already been recorded. □

9. I agree to the GP being informed of my participation in the study. □

10. I agree that short clips of film can be viewed by brain injury rehabilitation professionals at conferences and for teaching purposes. □

11. I understand that someone will ask me if I am willing to be involved in sharing the general findings after the study is finished and that this is entirely optional. □

12. I understand and agree that the research data will be stored in the UCL records office after the study has finished, and securely destroyed after 20 years. □

13. I agree to take part in the above study. □

Name of participant  Date  Signature

Name of researcher  Date  Signature

When completed: 1 (original) to be kept in care record, 1 for participant; 1 for researcher site file
3.2 Peer facilitator consent form

(Identifying information has been removed)

CONSENT FORM

PEER TUTOR

A New Intervention For Social Skills Following Brain Injury (Student Study)

Name of Researcher: Susan Howell
Name of Chief Investigator: Dr Suzanne Beeke

REC Reference Number: [Redacted]
UCL Study Number: 13/0477

Participant Identification Number:

Please initial box

1. I confirm that I have read and understood the information sheet dated _____________ (version ____) for the above study and have had the opportunity to ask questions.

2. I agree to lead the social skills group meetings as the peer tutor.

3. I understand that I will receive an additional 16 hours of intensive training with the speech and language therapist.

4. I confirm that I have read and understood the information sheet dated _____________ (version ____) for the above study and have had the opportunity to ask questions about the role of the peer tutor.

5. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, and without my rehabilitation and/or medical care or legal rights being affected.

6. I understand that if I withdraw from the study, the research team will use the data that has already been recorded.
7. I agree to the filming of the training sessions with the speech and language therapist. 

8. I agree that short clips of film can be viewed by brain injury rehabilitation professionals at conferences and for teaching purposes. 

9. I agree for short parts of my conversation with a clinician to be video recorded. 

10. I understand that someone will ask me if I am willing to be involved in sharing the general findings after the study is finished and that this is entirely optional. 

11. I understand that relevant sections of my medical notes and data collected during the study may be looked at by individuals from [redacted], from regulatory authorities or from the NHS Trust where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records. 

12. I understand and agree that the research data will be stored in the UCL records office after the study has finished, and securely destroyed after 20 years. 

Name of participant  Date  Signature 

Name of researcher  Date  Signature 

When completed: 1 (original) to be kept in care record, 1 for participant; 1 for researcher site file
3.3 Consultee declaration
(identifying information has been removed)

CONSULTEE DECLARATION FORM

Title of Project: A New Intervention For Social Skills Following Brain Injury
(Student Study)

Name of Researcher: Susan Howell
Name of Chief Investigator: Dr Suzanne Beeke

REC Reference Number: [redacted]
UCL Study Number: 13/0477

Participant Identification Number: Please initial box

1. I [name of consultee] have been consulted about [name of potential
participant]'s participation in this research project. I confirm that I
have read and understood the information sheet dated
[redacted] (version,__) for the above study and have
had the opportunity to ask questions.

2. In my opinion he/she would have no objection to taking part in the
above study.

3. I understand that I can request he/she is withdrawn from the study at
any time, without giving any reason and without his/her care or legal
rights being affected.

4. I understand that relevant sections of the participant's medical notes
and data collected during the study may be looked at by individuals from
[redacted], from regulatory authorities or from the NHS Trust
where it is relevant to the participant taking part in this research.
I give permission for these individuals to have access to the participant's
records.

5. I agree for short parts of the participant's conversation with a clinician
to be video recorded.

6. I agree to the filming of the group meetings during the study.

7. I agree that the speech and language therapist can use short clips
of film from the group meetings in the training sessions for the fellow
resident.

Consultee information sheet and declaration 05.3.15 Version 5 6
8. I understand that anonymised data collected during the study will be analysed by the research team at UCL.

9. I understand that if the participant withdraws from the study, the research team will use the data that has already been recorded.

10. I agree to the participant’s GP being informed of their participation in the study.

11. I agree that short clips of film can be viewed by brain injury rehabilitation professionals at conferences and for teaching purposes.

12. I understand that someone will approach me after the study has finished to ask about the participant’s involvement in sharing the general findings, and that this is entirely optional.

13. I understand and agree that the research data will be stored in the UCL records office after the study has finished, and securely destroyed after 20 years.

Name of Consultee  Relationship to participant

____________________  ______________________
Date  Signature

____________________  ______________________
Name of researcher  Date  Signature

____________________  ______________________
Person undertaking consultation (if different from researcher)  Date  Signature

When completed: 1 (original) to be kept in care record, 1 for consultee; 1 for researcher site file
Appendix 4  Injury severity and clinical characteristics for all participants recruited to the study

### 4.1 Pilot study

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age (years)</th>
<th>Gender</th>
<th>Education (years)</th>
<th>Time post onset (years)</th>
<th>Injury severity/clinical characteristics, as documented in clinical notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>M</td>
<td>13</td>
<td>41</td>
<td>TBI: Multiple brain injuries over 40 years: RTA, seizure activity, falls. Persisting cognitive impairment and behavioural needs.</td>
</tr>
<tr>
<td>2</td>
<td>63</td>
<td>M</td>
<td>13</td>
<td>25</td>
<td>TBI: Multiple injuries over 25 years: RTA, falls, seizure activity. Extensive long-standing gliosis in left cerebral hemisphere. Long standing low-density change in left frontal and temporal lobes. Severe cognitive impairment and behavioural needs.</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>M</td>
<td>13</td>
<td>0.5</td>
<td>TBI: RTA. GCS 3/15 at scene. Severe cognitive impairment and behavioural needs.</td>
</tr>
<tr>
<td>4</td>
<td>39</td>
<td>M</td>
<td>18</td>
<td>0.8</td>
<td>ABI: large spontaneous intra-cerebral haemorrhage requiring multiple surgical interventions to reduce swelling. Severe cognitive impairment. Support required with all ADLs.</td>
</tr>
<tr>
<td>5</td>
<td>42</td>
<td>F</td>
<td>13</td>
<td>7</td>
<td>ABI: hypoxic injury (cardiac arrest). Severe cognitive impairment. Support and supervision required with ADLs.</td>
</tr>
<tr>
<td>6</td>
<td>36</td>
<td>F</td>
<td>16</td>
<td>0.5</td>
<td>ABI: hypoxic injury (poisoning). GCS 4/15 at scene.</td>
</tr>
<tr>
<td>7</td>
<td>57</td>
<td>F</td>
<td>11</td>
<td>5</td>
<td>ABI: anoxic injury (hypoglycaemic coma). Persisting cognitive impairment. Support required with all ADLs.</td>
</tr>
<tr>
<td>8</td>
<td>24</td>
<td>M</td>
<td>13</td>
<td>1.7</td>
<td>TBI: RTA. Bi-frontal contusions and subarachnoid haemorrhage. Severe cognitive impairment and behavioural needs.</td>
</tr>
<tr>
<td>10</td>
<td>19</td>
<td>M</td>
<td>12</td>
<td>1</td>
<td>ABI: RTA (traumatic and anoxic injuries). GCS 4/15 at scene.</td>
</tr>
<tr>
<td>11</td>
<td>34</td>
<td>F</td>
<td>13</td>
<td>1</td>
<td>ABI: hypoxic injury (prolonged hypoglycaemia). Severe and persisting cognitive impairment and behavioural issues.</td>
</tr>
</tbody>
</table>

Participant drop-outs indicated in bold
4.2 Main study

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age (years)</th>
<th>Gender</th>
<th>Education (years)</th>
<th>Time post onset (years)</th>
<th>Injury severity/clinical characteristics, as documented in clinical notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43</td>
<td>F</td>
<td>15</td>
<td>1</td>
<td>ABI: Subarachnoid haemorrhage (grade 5). Severe cognitive impairment. Support required with ADLs.</td>
</tr>
<tr>
<td>2</td>
<td>49</td>
<td>M</td>
<td>11</td>
<td>1</td>
<td>ABI: Obstructive hydrocephalus with interventions for raised intra-cranial pressure. Severe cognitive impairment. Support required with all ADLs.</td>
</tr>
<tr>
<td>3</td>
<td>39</td>
<td>F</td>
<td>10</td>
<td>24</td>
<td>TBI: RTA. Comatose for several months. Cognitive impairment requiring on-going support with ADLs.</td>
</tr>
<tr>
<td>4</td>
<td>56</td>
<td>M</td>
<td>13</td>
<td>3</td>
<td>TBI: Subdural haematoma following fall. Severe cognitive impairment requiring full support in daily routines.</td>
</tr>
<tr>
<td>5</td>
<td>45</td>
<td>F</td>
<td>16</td>
<td>6</td>
<td>ABI: Intracranial mass lesion. Hydrocephalic ischemia. Severe cognitive impairment requiring full support and supervision in daily routines.</td>
</tr>
<tr>
<td>6</td>
<td>53</td>
<td>M</td>
<td>12</td>
<td>0.7</td>
<td>ABI: Severe bilateral HSV encephalitis. Severe cognitive impairment.</td>
</tr>
<tr>
<td>7</td>
<td>68</td>
<td>F</td>
<td>16</td>
<td>1</td>
<td>ABI: Hypoxic brain injury following cardiac arrest. Intracranial haemorrhage. Severe cognitive and physical impairment. Support required with ADLs.</td>
</tr>
<tr>
<td>8</td>
<td>57</td>
<td>M</td>
<td>15</td>
<td>1.1</td>
<td>ABI: Hypoxic brain injury following multi-organ failure and cardiac arrest. Severe cognitive and physical impairment.</td>
</tr>
<tr>
<td>9</td>
<td>33</td>
<td>M</td>
<td>13</td>
<td>2</td>
<td>ABI: Subarachnoid haemorrhage and basal skull fracture following fall. Multiple surgical interventions to reduce swelling. Severe cognitive and physical impairment.</td>
</tr>
<tr>
<td>10</td>
<td>61</td>
<td>M</td>
<td>12</td>
<td>0.5</td>
<td>TBI: Subdural haematoma, subarachnoid haemorrhage, seizures following multiple falls. Severe cognitive impairment.</td>
</tr>
<tr>
<td>11</td>
<td>50</td>
<td>M</td>
<td>11</td>
<td>5</td>
<td>ABI: Intracranial haemorrhage (ruptured AVM). Severe and persisting cognitive impairment and behavioural issues.</td>
</tr>
<tr>
<td>12</td>
<td>31</td>
<td>M</td>
<td>11</td>
<td>8</td>
<td>TBI: Intracranial haemorrhage and basal skull fracture following RTA. GCS 6/15. Severe cognitive impairment.</td>
</tr>
</tbody>
</table>

Participant drop-outs indicated in bold
## Appendix 5 Risk assessment

### Social activity groups

<table>
<thead>
<tr>
<th>Risk</th>
<th>Who may be affected</th>
<th>Control measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environment</strong>&lt;br&gt;Examples of risk: problems arising from lighting, flooring, ventilation, space, flexes, noise</td>
<td>Service users, staff</td>
<td>A system of housekeeping and cleaning is in place&lt;br&gt;Equipment is safety tested&lt;br&gt;Electrical equipment is PAT tested&lt;br&gt;Damage and required repairs are documented and reported to maintenance team&lt;br&gt;Adequate and appropriate space is allocated for storage</td>
</tr>
<tr>
<td><strong>Emergencies</strong>&lt;br&gt;Examples of risk: evacuation needs, injury, medical needs (seizures) assistance to leave the group</td>
<td>Service users, staff</td>
<td>Staff training is in place for evacuation in the event of fire, injury&lt;br&gt;Staff trained in basic life support&lt;br&gt;Therapy team to be informed of emergency medical needs&lt;br&gt;Service users to carry required medication (e.g. midazolam)&lt;br&gt;Staff present to assist in an emergency</td>
</tr>
<tr>
<td><strong>Aggressive verbal and physical behaviour</strong></td>
<td>Service users, staff</td>
<td>Service users to be supported as per individual risk assessments&lt;br&gt;Correct staff to service user ratio to be in place&lt;br&gt;Emergency call button in place&lt;br&gt;Management of Actual or Potential Aggression (MAPA) trained members of staff to be available</td>
</tr>
</tbody>
</table>

UCL Project ID Number: 13/0477
Appendix 6  Intervention group discussion topics

(identifying information has been removed)

6.1 Pilot study topics

### Social Skills Intervention Group Discussion Topics

These following topics were selected for their neutrality, and all relate to the operational running of the rehabilitation facility.

The topics were randomly allocated for discussion in the group meetings (as part of the randomisation service provided by UCL).

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<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Staff uniforms</td>
</tr>
<tr>
<td>2.</td>
<td>The food</td>
</tr>
<tr>
<td>3.</td>
<td>Visiting hours</td>
</tr>
<tr>
<td>4.</td>
<td>Information on what's happening in...</td>
</tr>
<tr>
<td>5.</td>
<td>The decoration</td>
</tr>
<tr>
<td>6.</td>
<td>The grounds and gardens</td>
</tr>
<tr>
<td>7.</td>
<td>Opportunities to socialize with other residents</td>
</tr>
<tr>
<td>8.</td>
<td>Opportunities to go into town</td>
</tr>
<tr>
<td>9.</td>
<td>The shopping facilities</td>
</tr>
<tr>
<td>10.</td>
<td>Recreation opportunities</td>
</tr>
<tr>
<td>11.</td>
<td>The coffee shop</td>
</tr>
<tr>
<td>12.</td>
<td>Access to computers</td>
</tr>
<tr>
<td>13.</td>
<td>Staff helpfulness</td>
</tr>
<tr>
<td>14.</td>
<td>Wi-Fi connection</td>
</tr>
<tr>
<td>15.</td>
<td>Family/friend contact</td>
</tr>
<tr>
<td>16.</td>
<td>Kitchen access</td>
</tr>
<tr>
<td>17.</td>
<td>Getting information about brain injury</td>
</tr>
<tr>
<td>18.</td>
<td>On-site services for residents</td>
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</table>
6.2 Revised topics for main study

(Identifying information has been removed)

**Social Skills Intervention Group Discussion Topics**

The following topics were selected for their neutrality. They comprise a mix of topics that relate to the operational running of the facility and rehabilitation issues following brain injury.

The topics were randomly allocated for discussion in the group meetings (as part of the randomisation service provided by UCL).

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<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Staying in touch with friends and family</td>
</tr>
<tr>
<td>2</td>
<td>Opportunities to socialise with other residents</td>
</tr>
<tr>
<td>3</td>
<td>Accessing information about benefits and other entitlements</td>
</tr>
<tr>
<td>4</td>
<td>Information on what’s happening in the local community</td>
</tr>
<tr>
<td>5</td>
<td>Ideas for returning to work</td>
</tr>
<tr>
<td>6</td>
<td>Advice for keeping up with hobbies</td>
</tr>
<tr>
<td>7</td>
<td>Helping others to understand what has changed since the injury</td>
</tr>
<tr>
<td>8</td>
<td>Short breaks and holidays</td>
</tr>
<tr>
<td>9</td>
<td>Opportunities to go into town</td>
</tr>
<tr>
<td>10</td>
<td>Doing things that make me feel like ‘me’ again</td>
</tr>
<tr>
<td>11</td>
<td>The food at</td>
</tr>
<tr>
<td>12</td>
<td>Staff helpfulness</td>
</tr>
<tr>
<td>13</td>
<td>Access to computers</td>
</tr>
<tr>
<td>14</td>
<td>The shopping facilities</td>
</tr>
<tr>
<td>15</td>
<td>Evening activities</td>
</tr>
<tr>
<td>16</td>
<td>Travel plans and ambitions</td>
</tr>
<tr>
<td>17</td>
<td>Kitchen access</td>
</tr>
<tr>
<td>18</td>
<td>Recreation opportunities at</td>
</tr>
</tbody>
</table>

List of topics for discussion in intervention group meetings 7.4.15 version 3
### Appendix 7 Control group topics
(Selected by therapy assistants)

#### Pilot study

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Who’s who quiz</td>
</tr>
<tr>
<td>2.</td>
<td>Film and TV quiz</td>
</tr>
<tr>
<td>3.</td>
<td>General knowledge quiz</td>
</tr>
<tr>
<td>4.</td>
<td>Elvis song quiz</td>
</tr>
<tr>
<td>5.</td>
<td>General knowledge quiz</td>
</tr>
<tr>
<td>6.</td>
<td>Musical instruments quiz</td>
</tr>
<tr>
<td>7.</td>
<td>Film theme song quiz</td>
</tr>
<tr>
<td>8.</td>
<td>Themed music quiz</td>
</tr>
<tr>
<td>9.</td>
<td>Themed music quiz</td>
</tr>
<tr>
<td>10.</td>
<td>Music quiz</td>
</tr>
<tr>
<td>11.</td>
<td>Music quiz</td>
</tr>
<tr>
<td>12.</td>
<td>Proverbs quiz</td>
</tr>
<tr>
<td>13.</td>
<td>Word quiz</td>
</tr>
<tr>
<td>14.</td>
<td>Twenty questions</td>
</tr>
<tr>
<td>15.</td>
<td>Word quiz</td>
</tr>
<tr>
<td>16.</td>
<td>Twenty questions</td>
</tr>
<tr>
<td>17.</td>
<td>Music quiz</td>
</tr>
<tr>
<td>18.</td>
<td>Animals quiz</td>
</tr>
</tbody>
</table>

#### Main study

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Getting to know each other</td>
</tr>
<tr>
<td>2.</td>
<td>Giving advice discussion</td>
</tr>
<tr>
<td>3.</td>
<td>Earthquake/avalanche discussion</td>
</tr>
<tr>
<td>4.</td>
<td>Migrant issues discussion</td>
</tr>
<tr>
<td>5.</td>
<td>Hatton Garden jewelry theft discussion and general quiz</td>
</tr>
<tr>
<td>6.</td>
<td>Ecology discussion and food quiz</td>
</tr>
<tr>
<td>7.</td>
<td>Survival strategies in an earthquake discussion and general quiz</td>
</tr>
<tr>
<td>8.</td>
<td>Giving advice discussion and general quiz</td>
</tr>
<tr>
<td>9.</td>
<td>Gang crime</td>
</tr>
<tr>
<td>10.</td>
<td>Exercise habits discussion and general quiz</td>
</tr>
<tr>
<td>11.</td>
<td>Driverless cars discussion and world record quiz</td>
</tr>
<tr>
<td>12.</td>
<td>FIFA corruption discussion and happiness and work discussion</td>
</tr>
<tr>
<td>13.</td>
<td>Use of technology in hotel industry discussion and travel quiz</td>
</tr>
<tr>
<td>14.</td>
<td>Theme park accidents discussion and general quiz</td>
</tr>
<tr>
<td>15.</td>
<td>Prison breakouts discussion and general quiz</td>
</tr>
<tr>
<td>16.</td>
<td>The solar system discussion and planets quiz</td>
</tr>
<tr>
<td>17.</td>
<td>Little known facts about tennis (discussion and quiz)</td>
</tr>
<tr>
<td>18.</td>
<td>Who wants to be a millionaire? (team discussion/quiz)</td>
</tr>
</tbody>
</table>
# Appendix 8 Filming Protocol

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameras</td>
<td>4 x GoPro Hero 3 White edition</td>
<td>60 x 40 x 20mm</td>
</tr>
<tr>
<td>Frame Mounts</td>
<td>4 x CamKix mounts (camera housing, thumbscrew, tripod mount, lens cap and UV filter lens protector)</td>
<td></td>
</tr>
<tr>
<td>External Viewer Screen</td>
<td>4 x Color TFT LCD External Monitor Display Viewer Screen</td>
<td>2 inch</td>
</tr>
<tr>
<td>Battery</td>
<td>4 x GoPro Li-ion Polymer Battery</td>
<td></td>
</tr>
<tr>
<td>Memory card</td>
<td>4 x Kingston SDC4 micro SDSH</td>
<td>16 GB</td>
</tr>
<tr>
<td>Tripod</td>
<td>4 x Velbon DF-61 Heavy Duty Aluminum for Photo/Video T</td>
<td></td>
</tr>
<tr>
<td>External microphones</td>
<td>4 x EDUTIGE ETM-001</td>
<td>19 x 10 x 30mm</td>
</tr>
</tbody>
</table>

## Camera positioning

![Camera positioning diagram](image-url)
Appendix 9 Satisfaction questionnaire

Informal Group Satisfaction Questionnaire

Participant Identification Number: Date:

<table>
<thead>
<tr>
<th>Group purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;It is important for the residents across campus to have the opportunity to meet together socially.&quot;</td>
</tr>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I have been able to confidently share my opinions in this group.&quot;</td>
</tr>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;We have all worked well together in this group.&quot;</td>
</tr>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I have enjoyed being part of this group.&quot;</td>
</tr>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>☐</td>
</tr>
</tbody>
</table>

Informal Group Satisfaction Questionnaire 20.2.14, Version 1
## Appendix 10 INT Matrices

### Intervention Group Baseline

<table>
<thead>
<tr>
<th>Subject</th>
<th>Alexis</th>
<th>Madison</th>
<th>Aden</th>
<th>Magnus</th>
<th>Clive</th>
<th>Dan</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>Group</th>
</tr>
</thead>
<tbody>
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</tr>
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### Post-intervention

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<th>Aden</th>
<th>Magnus</th>
<th>Clive</th>
<th>Dan</th>
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<th>0</th>
<th>0</th>
<th>0</th>
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<tr>
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### Maintenance:

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