

## **Perspective training to treat anger problems after brain injury: Two case studies**

Jill Winegardner<sup>1</sup>, Clare Keohane<sup>1</sup>, Leyla Prince<sup>1</sup>, and Dawn Neumann<sup>2</sup>

<sup>1</sup>Oliver Zangwill Centre for Neuropsychological Rehabilitation

<sup>2</sup>Department of Physical Medicine and Rehabilitation, Indiana University School of Medicine

Jill Winegardner (corresponding author)

Oliver Zangwill Centre for Neuropsychological Rehabilitation

Princess of Wales Hospital

Lynn Road

Ely

CB6 1DN

UK

Tel: 01353 652165

Fax: 01353 652164

Email: [jill.winegardner@ozc.nhs.uk](mailto:jill.winegardner@ozc.nhs.uk)

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## **Abstract**

**BACKGROUND:** People with acquired brain injury (ABI) often show increased anger and aggression. Anger after ABI has been linked to attributions of hostile intent. The more intentional and hostile the judgments of other's behaviours are, the angrier the responses become. People with ABI make harsher attributions than healthy controls (negative attribution bias). Poor perspective-taking may distort assessment of others' intentions, thereby contributing to this bias and subsequent anger responses.

**OBJECTIVE:** Examine changes in anger and perspective-taking after a Perspectives Group in two participants with ABI.

**METHODS:** This study is a case report exploring observational changes in anger, hostility, verbal and physical aggression and perspective-taking in two males with ABI and severe emotion dysregulation. Participants and their spouses also provided qualitative feedback through a semi-structured interview following perspectives training. The six-week "Perspectives Group" used hypothetical and real-life situations to teach participants to consider the perspectives of others when determining their intentions.

**RESULTS:** Both participants showed post-treatment declines in aggression. Although only minimal changes occurred on the perspective-taking measure, spouses described important behavioural changes in their partners that indicated both decreased aggression and better perspective taking.

**CONCLUSIONS:** These preliminary findings support further investigation of perspectives training for reducing anger after ABI.

### **Keywords:**

Brain injury

Anger management

Perspectives training

Perspective taking

Hostility bias

Attributions

## Introduction

Emotion dysregulation manifested by increased anger /aggression is not only one of the most common consequences of acquired brain injury (ABI), but also one that has a powerful impact on survivors and their relationships with others (Baguley, 2006; Draper, Ponsford, & Schönberger, 2007; Lezak, 1987; Rao et al., 2009; R. L. Wood, Liossi, & Wood, 2005; Wood & Thomas, 2013). There are very few evidence-based studies describing treatments that effectively reduce anger / aggression after an ABI. From the handful of empirical studies that have investigated treatments for anger and aggression after ABI, it appears that cognitive behavioural therapy (CBT), used alone or in conjunction with supplemental strategies (eg. psycho-education, problem solving, self-monitoring), is the most widely used and successful behavioural treatment approach (Demark & Gemeinhardt, 2002; Hart, Vaccaro, Hays, & Maiuro, 2012; Medd & Tate, 2000; Walker et al., 2010).

In general, CBT helps patients to identify negative or irrational thought patterns (cognitive distortions) and teaches them how to reframe these thoughts in order to reduce or alter unpleasant feelings and overcome problems with emotional distress (e.g. depression, anxiety, anger) (A. Beck, Rush, Shaw, & Emery, 1979; R. Beck & Fernandez, 1998; Bradbury et al., 2008; Salkovskis, 1997). Cognitive distortions can affect how people view themselves or how they interpret the world around them (others' behaviours; situations). CBT is used to treat anger and aggression after ABI because it has been a long-standing belief that cognitive distortions are, at least in part, the source of the problem (Alderman, 2003; R. Beck & Fernandez, 1998; Hart et al., 2012; Walker et al., 2010).

Notably, empirical findings from recent research provide some insight into the type of maladaptive thoughts that people with brain injury are having that are linked with their anger and aggression. Specifically, new research shows that the more a person with brain injury perceives others' actions to be intentional, hostile, and /or

the reason for a negative outcome (blame), the angrier their response (Neumann, Malec, & Hammond, 2015). This robust relationship is referred to as the attribution-emotion association (Fincham & Bradbury, 1992; Kelley & Michela, 1980). This association becomes most clinically relevant when people are prone to making judgments about other people's actions that are abnormally harsh and disproportionate to the circumstance. This tendency is referred to as negative attribution bias (Blackwood, Howard, Bentall, & Murray, 2014; Kassinove & Sukhodolsky, 1995). A pilot study examining negative attribution bias in people with ABI found their attributions of others' actions to be more intentional, hostile and blameworthy compared to judgments made by healthy control peers (Neumann, Malec, & Hammond, 2015). As expected, their negative attributions were commensurate with more intense anger. Negative attribution bias and subsequent anger and aggression can create serious interpersonal challenges affecting all areas of social participation including family relationships, friendships, leisure and social activities, and ability to participate in educational or vocational endeavours (Dyer, Bell, McCann, & Rauch, 2006).

Based on the finding that elevated anger after ABI is related to negative attribution bias, we designed a treatment program to address this specific need. We aimed to reduce anger by teaching people to interpret others' actions as more benign and less hostile through training perspective-taking skills. Consistent with CBT, the goal was to help people reappraise cognitively distorted judgments about others' behaviours. However, our training differed from traditional CBT in that it focused solely on reframing attributions of hostile intent and blame regarding others' behaviours, instead of attempting to reframe all types of cognitive distortions. Moreover, our primary technique for helping participants reframe their thoughts was through perspective taking training using hypothetical and real-life personal incidents.

We chose to focus training on perspective taking skills because of the association that has been found between hostility bias and theory of mind (ToM). Theory of mind, which relies heavily on perspective taking skills, is the ability to accurately infer others' mental states, including intentions (Harwood & Farrar, 2006; Jeon et al., 2013). Some studies have found that people with poor ToM are more likely to have negative attribution bias (Jeon et al., 2013; Penn, Roberts, Combs, & Sterne, 2007). Although the directionality of this relationship between ToM and negative attribution bias is unclear, perspective taking is suspected to play a key role. Putting oneself in another person's theoretical shoes is likely to help one more accurately determine the intentions and other mental states of that person. ToM and perspective taking are often impaired after ABI (McDonald & Flanagan, 2004; McDonald, Flanagan, Rollins, & Kinch, 2003; Neumann, Zupan, Malec, & Hammond, 2014), and it is not unreasonable to assume these impairments are contributing to negative attribution bias and anger in this population. Therefore, perspective taking is a logical target for treatment.

Thus, the purpose of this case study was to examine changes in anger and perspective-taking in two adult males with ABI who participated in a Perspectives Group designed to teach perspective-taking skills to generate more benign reasons for peoples' behaviours.

## **Methods**

This is a case study in which two adult males with ABI were assessed on measures of anger and aggression at three time points: baseline, pre-intervention, and post-intervention; and perspective-taking at two points: pre- and post-intervention. It should be noted that the pre-intervention measures were taken after both participants had completed the initial six weeks of an intensive neuropsychological rehabilitation program and before commencing the Perspectives Group.

## *Participants*

The participants were two men who were enrolled in a holistic neuropsychological rehabilitation programme prior to initiation of the Perspectives Group. They first completed the intensive phase of the programme in which they attended the programme four days a week for six weeks. During these six weeks, their schedule included individual and group sessions that focused on topics such as Understanding Brain Injury, Attention and Memory, Executive Functions, Communication, and Mood. Both participants also received individual psychotherapy, underwent further assessment, and participated in a support group. Both participants clinically exhibited major problems with negative attribution bias and with emotion dysregulation and were therefore selected to participate in the Perspectives Group in the subsequent integration phase of the programme. Neither participant received any therapeutic input related to perspectives training prior to the Perspectives Group. During the integration phase, they attended the programme two days a week for individual sessions focused on their personal goals alongside the support group and the Perspectives Group.

- CJ: The first participant was a 37-year-old male who sustained a severe traumatic brain injury at age 13 and received no rehabilitation services prior to entering the programme. Medical information indicated that he sustained a compound depressed fracture of the right frontal bone with inward depression of several fragments of bone. A CT scan revealed a haemorrhagic contusion in the right frontal lobe. He also sustained lacerations and bruising of the head, a fractured jaw, and loss of teeth. He was in a coma for an unspecified but considerable time and subsequently exhibited poor memory and was aggressive and disruptive in school and at home. He was expelled from school before taking exams due to behaviour problems. Cognitive testing revealed particular difficulties with verbal skills and in particular with abstract

reasoning. There was no other relevant medical or psychiatric history other than a remote history of alcohol abuse. Overall, from the time of his brain injury, he made a good physical recovery and lived independently but had ongoing problems in controlling his emotions, especially anger, and also had difficulty with attention and memory. As an adult, he was unable to sustain employment for more than a few months at a time due to interpersonal conflict. His doctor referred him for rehabilitation because he and his partner were expecting a child and his doctor feared that his anger and hostility would be detrimental to the child. During his initial assessment, CJ said “I think people are talking about me and this winds me up.”

- HI: The second participant was a 46-year-old who sustained a subarachnoid haemorrhage while undergoing neurosurgical intervention at age 35. He was married and a father of two children with autistic spectrum disorder. He presented with severe anxiety, depression, reduced confidence, fatigue, inability to work competitively, and limited social participation. Earlier psychological assessment revealed complaints including “trying to keep calm and away from stress and paranoia,” being “quick to anger,” “emotions build up too much,” saying things that upset others by being ‘blunt’ or saying what he was thinking, and rumination, especially with an angry or vengeful theme. He and his wife reported severe marital discord subsequent to the injury, with the possibility of imminent dissolution of the marriage. Cognitive assessment revealed difficulties with divided attention, organising information to remember and planning and self-monitoring in unstructured situations. He was impulsive and disinhibited.

### *Measures*

Aggression Questionnaire-Short Form (12-item version) (Bryant & Smith, 2001). The AQ-12 is a subjective assessment that measures four aspects of aggression: physical aggression, verbal aggression, anger and hostility (3 items per



subscale). Participants are asked to use a six-point Likert scale to rate how “characteristic” or “uncharacteristic” statements are of them. Higher ratings endorse stronger aggression characteristics. This short form is an abbreviated measure adapted from the original 29-item Buss Perry Aggression Questionnaire. This revised four-factor model of aggression has been deemed psychometrically superior to the original Buss Perry Aggression Questionnaire, showing evidence for good construct and discriminant validity, as well as acceptable goodness of fit (Bryant & Smith, 2001).

Interpersonal Reactivity Index (IRI) (Davis, 1980): The IRI measures four constructs of empathy: Perspective Taking (tendency to spontaneously adopt the psychological point of view of others in everyday life); Empathic Concern (tendency to experience feelings of sympathy and compassion for unfortunate others); Fantasy (tendency to imaginatively transpose oneself into fictional situations); and Personal Distress (tendency to experience distress and discomfort in response to extreme distress in others). Participants are presented with statements and asked to use a Likert scale to rate how well each statement describes them. Subtest scores range from 0-28. The IRI has previously been used to evaluate empathy in people with TBI; additionally, it has been shown to have substantial test-retest reliability and internal reliability (Davis, 1980, 1983). Due to the focus of the training, perspective-taking was the primary variable of interest for this study; thus outcomes are only presented for this construct.

*Semi-Structured Qualitative Interview with Participant and Spouse:* A semi-structured interview was conducted with each client and his wife either one week (HI) or three weeks (CJ) after they had completed the rehabilitation programme. The interviews pertained to the entire programme and consisted of the following questions: How is your life different now compared to before the OZC programme? Which parts of the programme have you found most helpful? What have been the

least helpful aspects of the programme? What strategies or tools are you using now? Have you noticed changes in your relationship? What do you see as the reasons for these changes? Have you noticed changes in any other relationships? What do you see as the reasons for these changes? Is there anything else you'd like to add?

*Treatment: Perspectives Training*

This six-week training program incorporated cognitive reappraisal strategies and perceptual positioning to modify negative attributions in response to hypothetical and real-life situations. These exercises are described below:

1. Each session started by asking participants to watch a video scenario that depicted situations in which personal motives are ambiguous, such as someone cutting into the queue in a shop. After each video, participants were first asked questions regarding how angry they would feel in this situation. They typically replied that they would feel very angry in all the scenarios. Participants were then asked to generate as many options as possible to explain the intent behind the behaviour in the video scenario – e.g., the person was rude, the person did not see you in the queue, the person was in a desperate hurry because of an emergency, etc. This technique is part of the Goal Management Framework (GMF) (Levine et al., 2000), a tool that is used to facilitate decision-making and problem-solving. One of the steps requires the person to generate as many different solutions as possible by thinking broadly and creatively and without judging the options. In this group, we asked the participants to think “outside the box” to generate as many different explanations for the observed behaviour as possible without judging whether the explanations were benign or hostile.
2. The participants were next asked to role-play the video scenario they had just observed and discussed. They were encouraged to assume a neutral or benign interpretation of the motive for the observed behaviour rather than a

hostile interpretation in the role play; this benign attribution resulted in their experiencing little or no anger toward the person in the role play.

3. The participants were next asked to produce personal examples of situations in which the motives of others were unclear or unknown, such as someone pulling in to a parking space they were about to enter. They were first asked to generate alternative explanations for the behaviour of the other person, just as they had done with the video scenarios. Participants then worked through their personal scenarios in a “perceptual positioning” exercise. Perceptual positioning is a neurolinguistic programming technique (Dilts, Bandler, & Bandler, 1978) in which one mentally reviews a situation from a number of different perspectives in order to appreciate the perspective of others. This technique involved setting up chairs, each one representing the perspective of each person in the scenario including the participant and the others in his scenario. The participant took turns sitting in each chair and expressing the perspective of that person. He was then encouraged to reflect on what that person may have thought and felt.

#### *Procedures*

Two participants who were enrolled in a holistic neuropsychological rehabilitation program were selected to participate in the Perspectives Group because they presented with hostility bias, anger, and emotion dysregulation. Participants were administered the AQ-12 twice before treatment: once prior to entering the rehabilitation programme (baseline); once after completing the intensive phase of rehabilitation, but before introduction of perspectives training (pre-intervention); and once after the perspectives training ended (post-intervention). The IRI was administered once after the first six weeks of the general rehabilitation programme (baseline) and again after the perspectives training group (post-intervention). These assessments were administered by staff members who were

different from those who conducted the perspectives training group. Participants also participated in a semi-structured qualitative interview with their partners shortly after the rehabilitation program ended. After the pre-intervention measures were taken, the two participants began the 6-week Perspectives Group. Each session was held once a week for one hour. The group was conducted by three staff members (one psychologist and two speech and language therapists) who took turns in pairs leading the sessions. While the participants were participating in the Perspectives Training, they were also participating in the integration phase of their programme with a focus on broad goals including learning and use of cognitive and mood strategies, improving communication skills, and social and vocational goals. These sessions did not specifically focus on perspective taking or anger management, though they addressed related areas.

## **Results**

For the AQ-12, we calculated the mean item responses for the total and for each subtest (Verbal and Physical Aggression, Anger and Hostility). The item scale ranged from 1 to 6, with higher ratings indicating stronger aggression characteristics (see Table 1 and Figure 1). In order to put HI and CJ's performance into context relative to people without brain injury, we compared their mean ratings at baseline, pre-intervention and post-intervention to mean ratings collected from a college sample (n=343; 72.7% female) without brain injury; data from the college sample was obtained as part of the Bryant and Smith study and was provided by Dr. Bryant for the purposes of comparison (Bryant & Smith, 2001).

HI and CJ's baseline and pre-intervention scores were more than one standard deviation *higher* than the college sample for total aggression and all other constructs, with the exception of Anger for CJ; CJ's baseline and pre-intervention Anger scores were within one standard deviation of the college sample. Post-intervention, all of HI's aggression scores, except Anger, were within one standard

deviation of the college sample means; and Anger was more than one standard deviation *below* the college sample. Although CJ's Verbal Aggression score was still substantially above the college sample, his post-intervention scores for Physical Aggression and Anger were within one standard deviation of the college sample, and Hostility was more than one standard deviation below the college sample. These results suggest that even though HI and CJ's Aggression scores trended downward from baseline to pre-intervention, their Aggression scores only reduced to within the range of healthy controls after treatment.

We also examined how much HI and CJ's Aggression scores changed from baseline to pre-intervention, and from pre-intervention to post-intervention. It has been suggested that scores that change by .5 standard deviation indicate a clinically meaningful change (Jaeschke, Singer, & Guyatt, 1989). Taking a more conservative approach, we determined which Aggression scores for both participants decreased by 1.5 standard deviations or more (determined from college sample). As can be seen in Table 1, although Aggression scores reduced a small amount between baseline and pre-intervention, only one score decreased by 1.5 standard deviation (HI's Hostility score from a 6 to a 4.33). In contrast, we observed many reductions in Aggression scores from pre-intervention to post-intervention that were 1.5 standard deviations or more. HI's scores changed by 1.5 standard deviation or more for Verbal Aggression, Anger, Hostility and Total Aggression; CJ's scores changed for Physical Aggression, Anger, Hostility and Total Aggression (see Table 1).

Little change was observed on the IRI Perspective-taking subscale. Based on normative data for this measure, scores between 12.58 to 22.16 are within the normal range (mean=17.37; standard deviation=4.79). At pre-intervention, HI's score was slightly above the mean (18) and increased by one point post-intervention. CJ's score was slightly below normal range at pre-intervention (11), and increased to within normal range post-intervention (13) (see Figure 2). However, these changes

did not meet the minimal “clinically meaningful” change criteria of .5 standard deviation. Despite the lack of robust changes on this perspective-taking measure, semi-structured qualitative interviews indicated otherwise. See below.

### *Qualitative results*

*Q: How is your life different now compared to before the Oliver Zangwill Centre programme?*

CJ: “I feel like I’m a different person, I don’t feel like I’m the CJ that I’ve always known, you know. I actually feel now, I’m the right aged mind for the right aged body. Where before I always felt, I felt his age sometimes [looking at 10 month old son] didn’t I? I felt a lot younger, a lot more stubborn.”

“I’ve noticed a big difference definitely, with all the different tasks that I’ve been studying and learning, you know, like, perspectives that was a good one, I didn’t like to put myself into someone else’s shoes.”

HI: (wife Dottie replies): “From then to now- vastly different. I’m not walking on eggshells, which was how my whole life was with HI.

HI: “I agree with that. “

Dottie: “Yes that’s right, thank you dear! .... But, so we was walking on eggshells the whole time, waiting for HI’s temper to blow all the time....”

HI: “Our son said, Daddy’s always moody and Daddy’s always...”

Dottie: “Yes ‘why is Daddy like this’ coming from what was then a seven year old, it was horrifying. And yes now you’ve saved our marriage, number one, but you really did because it was getting to that point where you know something was going to have to happen, ... it was just intolerable, terrible and now we have a father, a husband someone who listens, who doesn’t just think of himself anymore he thinks of other people, how they might feel, and yes, we’re all so much more relaxed and a proper family for the first time ever.”

HI: "I'm different, I'm calmer, a lot calmer."

Dottie: "More thoughtful."

HI: "Yeah that's the word, thoughtful."

Dottie: "Thoughtful of other people."

*Q: Which parts of the programme have you found most helpful?*

CJ: "You know, [my 10 year old stepson] looks up to me which is good, something for him to be proud of, which with him having autism is... helps me understand where the perspectives come in.... I was putting some of these perspectives into him and I've noticed in my eyes it's helped him as well, you know, with his behaviour."

HI: "Mood and... you can answer this one." (to Dottie)

Dottie: "Well the nice thing was, for me was role-play."

HI: "Yeah that's perspectives."

Dottie: "Because ...that situation we were in and then how he used to treat me sometimes,...but then he turned around and said 'I'm sorry' and he would have never bothered saying anything like that before, he wouldn't have even considered thinking could I have been..."

HI: "Too self-centred."

Dottie: "Very self-centred., But yes role-play was important for him to see my point of view."

Dottie: "...Yeah I've got a caring, compassionate husband who's starting to think of me now and care about me and how I'm feeling..."

*Q: Have you noticed any changes in your relationship?*

CJ: "Yeah I feel like my wife has let her guard down."

Wife: "It's just more chilled, and CJ's definitely more chilled."

HI: "And I see a lot of good for, I'm going to say perspectives, that was the key, doing mood week and perspectives, because now I put myself in others' shoes."

*Q: Have you noticed changes in any other relationships?*

HI: "Yeah, it's more understanding what people, like I'm trying to get in touch with my dad again, because I can see his point of view on that. You know, I know full out why we detached, some of the reasons why he would have got annoyed so I've used, put myself in his shoes to see how it is."

HI: "Dottie's stepdad, [Bill] he said some rotten words to [my wife's] niece and I said to Dottie, because she got very upset with it last night, I said 'look Bill's had a stroke, he's probably lost that ability, coz I had, I'd lost that ability, but he's old, you can't re-train him. And he's lost the ability so whatever he thinks is right is completely wrong. And I was trying to tell Dottie, look at this from his point of view, he's not the same, that man you knew before has gone, the stroke has lost that, you know his barrier is up, instead of thinking 'stop-think' he just goes straight through."

## **Discussion**

After ABI, chronic problems with anger and aggression are very common and they are often difficult to treat.(Baguley, 2006) As described earlier, recent research has connected some aspects of anger and aggression in people with ABI to the negative attributions they make about others' behaviours. Furthermore, it appears that people with ABI have a tendency to judge others' actions more harshly than their peers do (negative attribution bias) (Dyer et al., 2006; Kelley & Michela, 1980; Neumann et al., 2015). Based on these findings, we created a novel six-week perspectives training intervention to encourage participants with ABI to perceive others' behaviours as more benign, thereby reducing the number of situations viewed as worthy of anger, with the overall goal of reducing anger and aggression.

We pilot tested this new intervention using a case study design with two participants who were enrolled in our holistic neuropsychological rehabilitation program. Videos depicting hypothetical situations and participants' real life personal events were used to teach them to put themselves in the situation of the other person whose behaviour they were judging. This new vantage point helped them to



adopt more benign alternatives to explain the other person's behaviours. This in turn resulted in fewer situations being appraised as anger-provoking, and angry behaviour reduced.

Both participants started off at baseline and pre-intervention with levels of aggression that mostly exceeded a typical college sample of healthy controls. After treatment, the majority of HI and CJ's Aggression scores were within a standard deviation of the college sample, and two post-intervention scores were even lower (Anger for HI and Hostility for CJ). Although both participants showed small reductions on the Aggression subscales after their first six weeks of intensive rehabilitation, the substantial changes occurred after the Perspectives Training group. The small changes from baseline to pre-intervention were not surprising as they did receive psycho-education about brain injury and began learning strategies to help with both cognitive and mood alterations during that first part of the programme; however, neither received treatment directly targeting anger management or perspective taking until the Perspectives Training group which began after the pre-intervention testing. More prominent reductions in anger were observed directly after the perspective training, many of which were more than 1.5 standard deviations lower than their performance at the pre-intervention testing phase. Although this is a promising early finding, the case control design of the study prohibits us from making conclusions about causal inferences regarding the treatment on outcomes. Consequently, these results should be interpreted cautiously and should only be used as justification for further research.

In contrast to our findings for aggression and to our expected outcomes, we did not observe substantial changes on the perspective-taking measure. One participant (CJ) moved into the normal range of perspective-taking on the IRI from below normal, but this was only a two point change (less than a half of a standard deviation). HI was already within normal range on the perspective-taking scale at

pre-intervention, limiting room for improvement; however because his pre-intervention behaviour suggested he did not have very good perspective-taking skills, it is possible his pre-intervention self-rating was inaccurate. Notably, the qualitative reports from the participants and their wives during the post-intervention semi-structured interview did indeed endorse meaningful changes in their perspective-taking after the intervention. Participants' wives described examples of meaningful improvements in their spouse's perspective-taking skills.

While it is currently unclear as to why no change was observed on the perspective-taking measure, there are a few possibilities that may explain this finding. One possibility is that this measure is not sensitive enough to detect changes. To our knowledge this measure has only been used as a post-intervention outcome measure in one other published study (Neumann, Babbage, Zupan, & Willer, 2015); that study did not find a significant change either. Whether this is a function of the intervention or the measure is unknown. Future studies should consider other possible assessments to evaluate perspective-taking. Another possibility is there is a problem with the language in the perspective-taking measure. Some items are grammatically complex and may have been difficult for the participants with ABI to interpret and answer accurately. It is also possible that our participants had limited self-awareness of their perspective-taking abilities, and/or participants developed an increased awareness of perspective-taking only after training. Potentially, pre-intervention scores were inflated and post-intervention scores were accurate (especially for HI who was within normal range pre-intervention), meaning that a big change would not be observed. Perhaps a bigger change would have been observed if their wives had completed this questionnaire.

### *Limitations*

This case study was conducted in a clinical setting, which can often make it difficult to implement rigorous research designs. As part of a clinical program that

already administers a plethora of lengthy assessments, we were very limited in the number of measures we were able to add to our clinic's standard test battery and in the frequency of test administration. Additionally, the design of our case study had limited control conditions, making it difficult to determine the effect of treatment. For instance, we only had two baseline assessments for the aggression questionnaire and one pre-intervention assessment for perspective-taking, which does not meet the minimum three times that is recommended for single-subject designs (Tate et al., 2013). Another aspect we were not able to control is the treatment they were receiving while participating in the perspectives-training group. They were actively enrolled in a rehabilitation programme and therefore were receiving other treatment while partaking in the Perspectives Group. However, it is important to note that none of the other components of their rehabilitation programmes focused specifically on perspective taking. However, it is possible that some of the improvement in anger and aggression may have been due to some of the other general rehabilitation they were receiving at the time.

Another limitation of the study is that we did not assess negative attribution bias as an actual outcome despite our approach being based on the attribution-emotion and negative attribution bias models. Unfortunately, available hostility bias measures can often take 30-60 minutes for a patient with brain injury to complete, which was not an option in our setting. Furthermore, as discussed above, reduced sensitivity and/ or other limitations with the IRI may have prevented us from observing changes in perspective-taking. Since perspective-taking scores did not change substantially, it is hard to know if we truly changed perspective taking and if that is what helped to reduce the anger/ aggression.

Despite these limitations, the declines we observed in anger and aggression and the subjective feedback from participants and their wives suggest this type of intervention for treating anger and aggression warrants further testing. Future studies

are needed with more participants and a control group along with measures to better assess perspective-taking and negative attribution biases.

## **Conclusions**

Anger and aggression after brain injury appear to be related in part to negative judgments made about others' motives and behaviours. Some people with ABI may be more inclined to make abnormally harsh attributions compared to others. We attempted to reduce anger and aggression through a novel intervention addressing negative attribution bias via perspective-taking training in a case study with two participants with ABI. Reductions in anger and aggression were observed in our two participants after participating in a 6-week group training perspective taking skills. Findings were substantiated by spouses' feedback indicating a meaningful change in the participants' behaviour and overall improvement in their interpersonal interactions. Perspective taking training to reduce anger and aggression after ABI warrants further investigation.

## **Declaration of interest**

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Table 1. Participants' aggression scores at all testing points and compared to a college sample of healthy controls.

Aggression Questionnaire Scores and comparisons to a college sample.			
	HI	CJ	College Sample (n=343) Mean (SD)
<b>Total Aggression</b>			
Baseline Item Response Mean	5.58 <sup>a</sup>	4.48 <sup>a</sup>	2.49 (.95)
Pre-Intervention Item Response Mean	4.25 <sup>a</sup>	4.08 <sup>a</sup>	
Post-Intervention Item Response Mean	1.92 <sup>w**</sup>	2.08 <sup>w**</sup>	
<b>Physical Aggression</b>			
Baseline Item Response Mean	6 <sup>a</sup>	5.33 <sup>a</sup>	1.93 (1.18)
Pre-Intervention Item Response Mean	4.33 <sup>a</sup>	4.33 <sup>a</sup>	
Post-Intervention Item Response Mean	2.33 <sup>w</sup>	1.33 <sup>w**</sup>	
<b>Verbal Aggression</b>			
Baseline Item Response Mean	5.33 <sup>a</sup>	5.33 <sup>a</sup>	2.89 (1.27)
Pre-Intervention Item Response Mean	4.33 <sup>a</sup>	4.33 <sup>a</sup>	
Post-Intervention Item Response Mean	2 <sup>w**</sup>	4.33 <sup>a</sup>	
<b>Anger</b>			
Baseline Item Response Mean	5 <sup>a</sup>	3 <sup>w</sup>	2.47 (1.25)
Pre-Intervention Item Response Mean	4 <sup>a</sup>	3.33 <sup>w</sup>	
Post-Intervention Item Response Mean	1 <sup>b**</sup>	1.33 <sup>w**</sup>	
<b>Hostility</b>			
Baseline Item Response Mean	6 <sup>a</sup>	5.33 <sup>a</sup>	2.68 (1.1)
Pre-Intervention Item Response Mean	4.33 <sup>a*</sup>	4.33 <sup>a</sup>	
Post-Intervention Item Response Mean e	2.33 <sup>w**</sup>	1.33 <sup>b**</sup>	

<sup>a</sup> Indicates that the score is more than one standard deviation above the college sample mean; <sup>b</sup> indicates the score is more than one standard deviation *below* the mean; <sup>w</sup> indicates that the score is within one standard deviation of the mean. College sample means are from the Bryant study (Bryant & Smith, 2001). \*Indicates change from baseline to pre-intervention is at least 1.5 standard deviations; \*\*indicates the change from pre-intervention to post-intervention is at least 1.5 standard deviations.

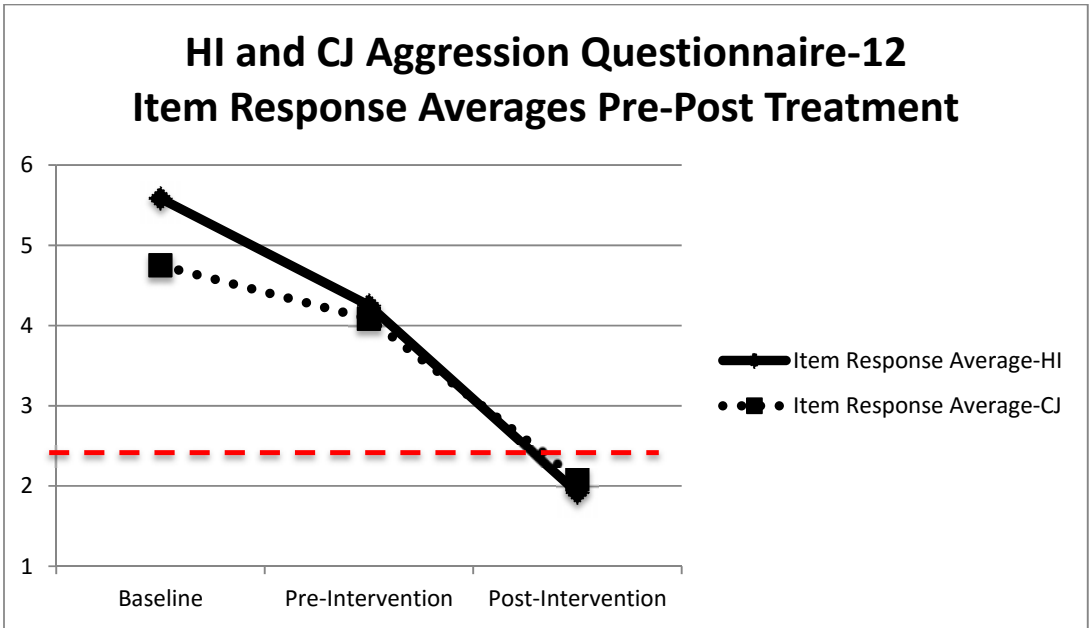


Figure 1. HI and CJ's mean item scores on the Aggression Questionnaire. The dashed line represents the mean aggression scores from the college sample.

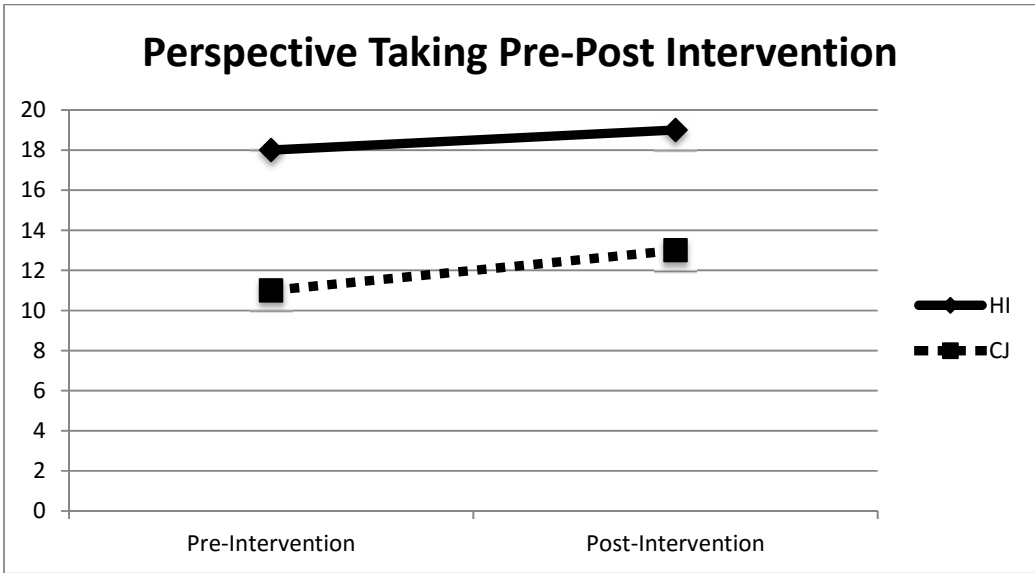


Figure 2: HI and CJ's scores on perspective-taking pre-post intervention.

Table 1. Participants' aggression scores at all testing points and compared to a college sample of healthy controls.

Figure 1. HI and CJ's mean item scores on the Aggression Questionnaire. The dashed line represents the mean aggression scores from the college sample.

Figure 2: HI and CJ's scores on perspective-taking pre-post intervention.