Published in final edited form as:
Contemp Clin Trials. 2015 January ; 40: 180–192. doi:10.1016/j.cct.2014.12.005.

Anger Self-Management in Chronic Traumatic Brain Injury: Protocol for a Psycho-educational Treatment With a Structurally Equivalent Control and an Evaluation of Treatment Enactment

Tessa Hart, PhD[a,b], **Jo Ann Brockway, PhD**[c], **Jesse R. Fann, MD, MPH**[d], **Roland D. Maiuro, PhD**[e], and **Monica J. Vaccaro, MS**[a]

[a]Moss Rehabilitation Research Institute, Elkins Park, PA

[b]Department of Rehabilitation Medicine, Jefferson Medical College, Philadelphia, PA

[c]Department of Rehabilitation Medicine, University of Washington, Seattle, WA

[d]Department of Psychiatry & Behavioral Sciences, University of Washington, Seattle, WA

[e]Seattle Anger Management and Domestic Violence Programs

Abstract

Anger and irritability are important and persistent clinical problems following traumatic brain injury (TBI). Treatment options include medications, behavioral modification, and psychotherapies, but some are impractical and none have proven efficacy with this population. We describe a randomized multi-center clinical trial testing a novel, one-on-one, 8-session psychoeducational treatment program, Anger Self-Management Training (ASMT), designed specifically for people with TBI who have significant cognitive impairment. The trial is notable for its use of a structurally equivalent comparison treatment, called Personal Readjustment and Education (PRE), which was created for the study and is intended to maximize equipoise for both participants and treaters. Fidelity assessment is conducted in real time and used in therapist supervision sessions. The primary outcome is change in self-reported anger on validated measures from pre-treatment to 1 week after the final session. Secondary outcomes include participant anger as reported by a significant other; emotional distress in domains other than anger/ irritability; behavioral functioning; and quality of life. An interim assessment after the 4th session will allow examination of the trajectory of any observed treatment effects, and a follow-up assessment 2 months after the end of intervention will allow examination of persistence of effects. A treatment enactment phase, in which participants are interviewed several months after the last therapy session, is designed to provide qualitative data on whether and to what extent the principles and techniques learned in treatment are still carried out in daily life.

Corresponding Author: Tessa Hart, PhD, Moss Rehabilitation Research Institute, Elkins Park, PA 19027; PH +1 215-663-6153 FAX +1 215-663-6113; thart@einstein.edu.

Keywords

Brain injuries; Anger management; Psychological treatment; Problem solving

1. Introduction

Anger is an important clinical problem after traumatic brain injury (TBI). As many as one-third of survivors of TBI experience symptoms, ranging from irritability to aggressive outbursts, that are identified as new or worse since the injury (1–3). These complaints do not appear related to the severity of injury, affecting those with mild TBI as well as moderate to severe. Unlike other emotional states that may be exacerbated by TBI, such as depression, anger may not remit spontaneously (4), and problematic irritability has been linked to unfavorable social outcomes such as family problems, social isolation, and loss of employment (5, 6). Thus, it is important to develop and evaluate the efficacy of treatments for post-traumatic anger and irritability.

With regard to pharmacologic treatments in the postacute stage after TBI, a recent meta-analysis (7) reported encouraging findings for methylphenidate for combative behavior, and a Cochrane review concluded that there is some evidence for the efficacy of beta-blockers in treating agitation and aggression following acquired brain injury (8). One well designed study found preliminary evidence for amantadine hydrochloride in reducing irritability in patients with chronic TBI (9). In clinical practice, sedatives or neuroleptics may be used to alleviate symptoms, but may impede cognitive recovery (10). Operant conditioning methods based on changing the contingencies of behavior have been reported successful in single case studies (11). However, these methods are time-consuming and require tight control over the environment, making them impractical for outpatient use. In addition, these methods typically do not result in the learning of new skills to manage anger and frustration. Psychoeducational methods based on cognitive behavior therapy (CBT) do teach new skills and are effective for anger management in the general population (12, 13), but often require a level of abstraction (“thinking about thinking”) that is difficult for patients with TBI. Nonetheless, at least one small RCT (14) and several uncontrolled studies (15, 16) have noted that anger management principles can be adapted and taught to people with cognitive impairment due to brain injury.

The purpose of this paper is to describe the development and design of a randomized controlled trial to test the efficacy of a fully manualized psychoeducational treatment for problematic anger following TBI. The treatment was designed to stand alone as an outpatient service or to be used within a comprehensive TBI rehabilitation program; and to be used either as a sole treatment, or in concert with psychoactive medication. An uncontrolled pilot study on the first version of the treatment, called Anger Self-Management Training (ASMT), provided an initial indication of feasibility for persons with chronic TBI who had significant limitations in memory, executive function, and other cognitive/communication functions. In addition, anger decreased significantly on both self-report and proxy-report measures, although the absence of a control precluded definitive conclusions as to treatment efficacy (17). Based on feedback gained in the pilot study, we made minor

modifications to the ASMT manual (e.g., changing specific exercises or examples that had been unclear) and prepared for a larger, controlled trial. We developed a second fully manualized comparison therapy against which ASMT could be tested, and organized a multi-center trial to evaluate the comparative efficacy of the two treatments. In this paper we describe the challenges faced and solutions achieved in developing and mounting this RCT, including decisions about the primary and secondary outcomes and target population; decisions about the nature of the control arms and procedures to maximize the credibility and fidelity of both treatments; therapist training and supervision procedures; and the special challenges of allocation masking in this behavioral trial.

2. Design and Methods

2.1 Overview of Design

This study is a multi-center randomized controlled trial of an 8-session psychoeducational intervention for anger and irritability in people with significant, chronic (≥ 6 months post) TBI. Treatment is administered on an outpatient basis approximately once per week in 60–90 minute individual sessions. After baseline assessment, participants are randomized 2:1, respectively, to Anger Self-Management Training (ASMT) or to an intervention developed for the study, called Personal Readjustment and Education (PRE), which is intended to provide nonspecific ingredients such as time and attention from an empathic therapist, an opportunity to ventilate feelings, and encouragement to develop one's own coping mechanisms. Assessment of primary outcome (self-reported anger on validated measures) and secondary outcomes occurs before randomization, midway through treatment, 1 week after treatment, and 2 months later. A structured interview is conducted after the final quantitative assessment to gauge treatment enactment, i.e., the extent to which the participant recalls and uses the concepts and methods of the intervention in daily life.

2.2 Participants and recruitment methods

Participants with complicated-mild to severe TBI are recruited from the patient rolls of the participating clinical sites, research registries (including each site's cohort within the National Institute on Disability and Rehabilitation Research-funded TBI Model Systems (18)), and community sources such as brain injury support groups. To engage in further eligibility screening, participants must self-identify as having problems with anger/irritability and be interested and available for an approximately 8-week course of face-to-face interaction with a therapist. Interested participants are screened according to the following criteria:

Inclusion criteria:

- Age ≥ 16 at the time of injury (to minimize variability due to impact of TBI on the developing brain)
- Ages 18 to 65 at the time of enrollment
- TBI (closed or penetrating) occurring a minimum of 6 months prior to enrollment (to minimize the effects of spontaneous recovery on the outcome measures)

- TBI documented as complicated-mild, moderate, or severe by *any one or more* of the following indices. A variety of indices of TBI severity are accepted because in trials involving chronic TBI, primary medical records are not always complete. For the indices involving loss or alteration of consciousness, intoxication, sedation, intubation, or use of paralytics are ruled out as causes:
  - post-resuscitation score on Glasgow Coma Scale (GCS; 19) < 13 or GCS Motor < 6;
  - loss of consciousness, unresponsiveness or coma attributable to the TBI and persisting ≥ 1 hour;
  - post-traumatic amnesia, or disorientation (oriented × 0, 1 or 2) attributable to the TBI and persisting ≥ 24 hours; or
  - neuro-imaging study positive for TBI-related findings such as contusion, hematoma, hemorrhage, diffuse axonal injury, shear injury, and/ or depressed skull fracture
- Able to travel independently in the community (to maximize the probability that participants will be cognitively and physically able to engage in the treatment)
- Indication from self- or proxy report that participant has problematic anger/ irritability that is *new since the injury* or *worse than before the injury* (to rule out participants with anger that substantially predates the injury and that may be intractable)
- Self-report of anger ≥ 1 standard deviation above the mean for age and gender on the Trait Anger or Anger Expression-Out (AX-O) subscales of the State-Trait Anger Expression Inventory-2 (STAXI-2; 20), or a score of ≥ 9 on the Brief Anger-Aggression Questionnaire (BAAQ; 21)
- Able to speak and understand English sufficiently to complete the screening and outcome measures and to participate in a verbally based treatment program, which thus far exists only in English
- Informed consent given by participant or legally authorized representative.

Exclusion criteria:

- Abnormally low/ suppressed outward expression of anger, as evidenced by T score on the STAXI-2 AX-O subscale <40 (to rule out participants whose anger is mismatched to the strategies and concepts in the treatment protocol, which are more geared to outward expression)
- Psychiatric condition or substance abuse that could interfere with treatment effects and/ or render the treatment inappropriate to presenting problem, i.e.:
  - Any history of schizophrenia or schizo-affective disorder
  - Current psychosis, major depressive disorder, or suicidal ideation; or history of manic or hypomanic episode as determined by the Mini-International Neuropsychiatric Interview for DSM-IV (MINI; 22)

  - Current alcohol dependence, as determined by the MINI
  - Self-reported use of cocaine or amphetamines “daily” or “almost daily” using the relevant questions from the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST; 23)

- TBI requiring hospitalization that has occurred within 6 months prior to enrollment
- Current involvement in one-to-one counseling or psychotherapy targeted to emotional health issues (group therapy is permitted as long as it is not focused on anger management; e.g., attendance in support groups or drug/ alcohol groups is permitted)
- Current involvement in another treatment trial that may affect participation or outcomes
- Evidence of severe, intractable anger as indicated by history of violence-related crimes, e.g., charges for assault.

Note that participants are not excluded for use of psychoactive medications such as antidepressants or anticonvulsants, which may be prescribed for people with TBI for mood control as well as other indications. We elected not to exclude for concurrent medications as this might decrease both the size and the representativeness of the sample. We do, however, require that participants be on stable doses of psychoactive medications for at least 2 weeks prior to baseline assessments. We also send letters to each participant’s physician letting him or her know about the trial and asking that psychoactive medications be kept at stable doses, if possible, for its duration. Rather than attempting to limit treatments that may be concurrent to the trial (except for one-to-one counseling that may conflict or overlap with the experimental treatment), we *measure* concurrent treatments in the event that they could provide useful covariates in analyses of treatment response. Using an interview and forms developed for the study, we query participants at each assessment session about all medications and their doses, and the type and frequency of any behavioral treatments received (e.g., Physical or Occupational Therapy, vocational counseling).

2.3 Significant others

All participants in the trial are encouraged to nominate a significant other (SO)—a spouse or partner, parent, adult child, sibling, close friend, etc., who is willing and able to provide data about the participant at each assessment point and to participate in 3 of the 8 treatment sessions (see details of interventions, below). The SO need not live with the participant, but the two should spend time together regularly. If there is no SO available or appropriate to participate in treatment, we ask that one still provide data. For some participants, there may be no SO invited for either purpose. Here again, we elected not to make the participation of an SO an inclusion criterion, so as not to limit the size or the representativeness of the sample; many persons with chronic TBI and problematic anger have “burned their bridges” socially, for the very reason that the trial is designed to address. Moreover, as described below, the primary treatment model is on *self*-management of anger, which might benefit from, but should not require, the support of another person.

2.4 Baseline assessment

Prior to randomization, the following measures of case mix are recorded to characterize the sample and to provide covariates needed to interpret treatment response.

Demographic data include gender, age at injury and current age; race and ethnicity; level of education; pre-injury and current occupation; with whom the participant is residing, and pre-injury and current marital status. Regarding SOs participating in the study, we record their level of involvement (none, data collection only, data collection + treatment), and for those participating, their gender and relationship to the participant.

In any study of TBI, it is important to record data pertaining to the severity of the injury, typically gauged by depth of unconsciousness soon after injury (e.g., GCS score on emergency admission); duration of unconsciousness (length of coma, or time between injury and ability to follow simple commands), and/ or duration of impaired consciousness, including confusion/amnesia following the resolution of coma. This last measure, duration of post-traumatic amnesia (PTA), is generally considered the best index of the extent of diffuse axonal injury, and is marked by the return of continuous day-to-day recall and orientation to time, place, and person. Because we recruit participants at variable times post injury, from different medical systems, precise measures of these severity indices are not always available from the medical record. We abstract as many of the 3 severity indices as can be found in the medical record. In addition, to provide a measure of severity that would be common to all participants, we administer a brief standardized interview designed to assist the participant in estimating retrospectively the duration of PTA. This interview has been used in other studies of chronic TBI, and the retrospective estimate has been found to correlate reasonably well with PTA measured prospectively (24, 25). We also record the date and cause of injury (vehicle collision, fall, etc.), the date and type of neuroimaging study, if any (CT or MRI), and type/ site of abnormality (frontal/ nonfrontal, left/ right, diffuse axonal injury), for secondary analyses correlating neurologic indices to treatment response.

Participant status at baseline is evaluated in a single testing and interviewing session of approximately 2 hours. Neuropsychological status is measured using a brief battery of tests to allow for later examination of the relationship of cognitive function (particularly memory and executive function) to treatment response. To measure overall intelligence we use the Wechsler Abbreviated Scale of Intelligence (Vocabulary and Matrix Reasoning subtests; 26) for episodic memory we administer the Rey Auditory Verbal Learning Test (27) and for executive function we use the Trail Making Test, Parts A and B (28) and the Brixton Spatial Anticipation Test (29). We also assess reading level using the Wide Range Achievement Test- Version 4 (30). This is done for two reasons: to provide a gross estimate of premorbid intelligence, and to provide advance information to therapists when participants have low literacy (i.e., so that therapists will know to assist the participants with handouts and written assignments).

Other measures administered at baseline include a Readiness to Change ruler (31) to gauge the participant’s stage of change in dealing differently with anger, and the Post- Traumatic Stress Disorder Checklist-Civilian Version (PCL-C; 32) due to the known association

between irritability and PTSD (33). The level of habitual alcohol use during the previous year is measured by the interview version of the AUDIT (34). We also administer the Toronto Alexithymia Scale- 20 item version (35), to assess the potential effects of self-reported ability to identify and distinguish emotional states at baseline.

2.4 Randomization

Randomization is performed in blocks of 3 to accommodate the needs of scheduling with therapists who are providing clinical services as well as research therapies. Data collectors are masked to block size. Randomization tables are computer generated for each center by the Data Coordinating Center. To minimize recruitment bias, results of the randomization tables are stored in an Access database where the coordinator from each site logs in and enters relevant patient information before the assignment is provided. Once the group assignment is determined, the study coordinator passes this information on to the therapist providing that group treatment. The outcome data collector is never allowed access to any treatment allocation information.

2.5 Primary outcome

In the general population, self-reported anger using a validated, standardized measure is routinely used as the primary outcome for trials of anger management therapies. People with moderate to severe TBI, however, may fail to report or under-report symptoms that are apparent to others, a phenomenon that has been termed impaired self-awareness (36). Moreover, under-reporting may be more pronounced for emotional difficulties, including annoyance and irritability, compared to cognitive or physical deficits (37–39). In addition to the possibility of inaccurate self-reporting overall, we considered the possibility that self-reported anger might paradoxically increase after treatment, due to the effects of treatment on self-awareness.

To circumvent these problems, we considered using an objective measure of anger reactivity, such as galvanic skin response measured during an imagined anger-provoking situation, or measurement of behavior during an actual provocation. However, we were unable to locate such a measure that would be feasible as well as sufficiently reliable, sensitive, and specific (40, 41). We also gave serious consideration to the use of an anger measure as reported by a proxy (SO). We ultimately decided against this for 3 main reasons. First, using this strategy would mean that the sample would need to be restricted to participants who had an available proxy. As noted earlier, given the social isolation experienced by many people with TBI and problematic anger, we were concerned about turning away participants who would otherwise meet criteria, as well as making the sample less than maximally representative of the target population. Second, we recognized that available proxies might know the participants to different degrees due to having different relationships to them (parents, spouses, siblings, friends, etc.). We were concerned that these disparities would introduce unwanted variation into the measurement of anger. Third, treating proxy report as primary was simply a misfit for an intervention focusing on teaching *self-management* skills to participants.

Considering the trade-offs among these options, we decided to use self-reported anger as the primary outcome. We recognize that one limitation imposed by this choice is the necessity for study participants to acknowledge a "problematic" level of anger at the outset; otherwise no change would be discernible from treatment, and indeed participants would not be motivated to pursue treatment otherwise. Thus, the trial will not be able to address the important issue of treating participants who are unaware or minimally aware of anger difficulties.

For the primary outcome measure, we selected the STAXI-2 because of its simplicity of wording, favorable psychometric properties, with age- and gender-corrected scores, and widespread use in mainstream anger treatment trials. We also included the 6-item BAAQ due to its sensitivity to more extreme behavioral manifestations of anger, including passive-aggression. Our pilot/ feasibility study confirmed that both scales were understandable to cognitively impaired participants with TBI. Moreover, both of the measures were sensitive to changes experienced during treatment, with scores moving in the expected direction and exhibiting moderate to large effect sizes (17). Based on this pilot study and on previous work with the STAXI-2, we selected the Trait Anger and Anger Expression-Out subscales to serve as primary outcome scores along with the BAAQ raw score. Results of the pilot study also suggested that improvement by 1 standard deviation on any one of these 3 measures, which proved not to be redundant with one another, could be considered a clinically meaningful response. We used this assumption to prepare power calculations, described below.

2.6 Secondary outcomes

Report of participants' anger from the point of view of an SO is included as a secondary outcome, both as an alternative to potentially faulty self-report and as an important outcome in its own right. For the SO measures, we use the same 3 scales as administered to participants (with appropriate changes in wording) to allow for direct comparisons between the two. Although not every participant in our pilot study had an SO available to provide data, that study did reveal pre- to post-treatment changes on SO scores, although the effects were not as large as those for participant self-report.

Emotional status (aside from anger) is another important domain for secondary outcome assessment, both to determine whether improvement in anger will generalize to other difficulties (e.g., depression, anxiety) and to determine if baseline emotional status might predict treatment response. We selected the Brief Symptom Inventory (42) because it is a relatively brief, yet comprehensive measure of psychiatric symptoms in a number of domains, including hostility, and because it has been endorsed for measurement of TBI outcomes by the Common Data Elements (CDE) initiative (43).

Behavioral status, specifically the extent of frontal/ executive dysfunction, was targeted as another secondary outcome given the hypothesized link between anger and executive function that motivated the design of the ASMT (see below). For this measure we selected the Frontal Systems Behavior Scale (FrSBe; 44), which is endorsed for TBI by the CDE initiative, contains both self- and proxy-rated versions, and has 3 subscales (Apathy,

Disinhibition, and Cognitive Executive Function) to allow for fine-grained examination of treatment effects on dysexecutive behavior.

Finally, we selected two measures of global outcome that are both endorsed by the CDE: the Glasgow Outcome Scale- Extended (45), which assigns a single score to the respondent's status with regard to independence in the home and community, and the Diener Satisfaction With Life Scale (46), a widely used measure of overall life satisfaction.

Importantly, we ensure that all outcome measures (including the anger scales comprising the primary outcome) are amenable to telephone administration, to maximize data capture in case participants cannot attend in-person sessions. Partly for this reason, we administer all self-report scales as interviews (examiner reading the items and recording the responses), even when the participant is present in person, so that in-person and telephone administrations will be comparable. We have also found that this method of administering "self-administered" questionnaires helps to eliminate skipped or misunderstood items when working with a population with cognitive and visual difficulties.

2.7 Schedule of measurement

Primary and secondary measures are administered prior to randomization (at baseline, or T1), and after treatment (T3), which comprises the primary outcome. We stipulate that at least 1 week (but not more than 2) should elapse between the final treatment session and T3, to minimize a "halo" or recency effect from the last session. An interim assessment (T2) is conducted between the 4^{th} and 5^{th} sessions, i.e., halfway through the planned 8-session treatment course. This is done in order to examine the trajectory of any observed treatment effects: e.g., to determine whether fewer than 8 sessions might achieve the same outcomes. The motivation for inserting the T2 assessment was derived in part from the pilot study, in which some participants and SOs began to comment on positive changes at about this point. A follow-up assessment (T4) is administered 8 weeks after T3, to assess the persistence of any observed treatment effects. Table 1 summarizes the measures that are administered at each assessment wave to the participant and SO.

2.8 Assessment of treatment enactment

At least 1 week after the completion of T4, the final contact is made with the participant to conduct a Treatment Enactment interview over the telephone. Treatment enactment is considered to be a logical extension of treatment fidelity, i.e., the extent to which a treatment is administered as it was designed (47, 48). Treatment receipt refers to the extent to which the participant understands the content of the intervention. This may be inferred by behavior during treatment sessions, completion of homework assignments, and the like. Treatment enactment, however, refers to the use of the concepts learned during treatment in the participant's daily life, after the active intervention phase. This construct is challenging to measure, but may be approximated with self-report of behavior at some point after the intervention has ended. In the current trial, we are using structured, audio recorded telephone interviews, conducted at least 10 weeks after the cessation of treatment by a person who is not otherwise connected to the trial, to gather information on treatment enactment in both treatment arms. A combination of open-ended questions and Likert-type

items is used. Participants are asked if they remember each of a list of concepts, topics, and techniques covered in the ASMT or PRE therapy sessions: for example, “You and your therapist talked about your O’s, which are the Other Feelings wrapped up with anger, such as feeling disrespected, anxious, or hurt. You worked on recognizing your O’s and giving voice to them, instead of expressing yourself with anger. Do you remember this strategy coming up in your discussions with your therapist?” Each item is thoroughly described in this fashion so as to capitalize on recognition memory, which we expect to be easier for participants compared to free recall. For each item that is endorsed as remembered, participants are then asked to rate separately, on Likert-type scales from 0–4, the frequency with which they currently “think about” or use the item, and its helpfulness (if it is used or considered at all). Respondents are additionally asked whether they continue to use the handouts and written tools they were given in therapy, and whether they have created new ones for themselves. A final set of questions asks about barriers to enactment: whether internal or external factors have interfered with the desired use of treatment-related strategies. The overall purpose of the treatment enactment interview is to provide information (mostly qualitative) on which anger management concepts and skills are most useful in the long term for persons with TBI, and what barriers and facilitators affect long-term use of learned strategies.

2.9 Interventions

2.9.1 Development of the ASMT—In developing the experimental treatment, we recognized that we could not formulate a single treatment that would address all of the root causes of anger/ irritability after TBI. Even within an individual, these causes may be varied, and minimally can include (1) direct injury to the brain circuitry that controls emotional responses, especially damage to frontal and anterior temporal cortices with their limbic system connections (49); (2) secondary effects of medications and other medical treatments (50); (3) secondary effects of cognitive difficulties, e.g., frustration incurred by problems communicating or keeping up with others (51); (4) secondary effects of lifestyle changes, including financial losses, social isolation, and loss of independence; and (5) exacerbation of pre-injury personality/ coping style. Rather than trying to address all of these causes directly, we designed a treatment that would address two characteristic deficits in frontal/ executive function which, regardless of other sources, often act as a “final common pathway” to exacerbate the problematic expression of anger. The first of these is impaired self-awareness. As noted above, people with TBI may exhibit incomplete awareness of problems that affect themselves and others, and this tendency is more pronounced for emotional and behavioral difficulties (52). Even when the problem is recognized (as it would have to be for participants to enter this trial, as previously noted), there may be minimization of the seriousness of it and/ or a tendency to blame others. The second executive capacity targeted by the experimental intervention is problem-solving: the ability to detect a problem situation, to consider options for solving it, to select the option best suited to the situation, to implement it and to monitor its success, adjusting as necessary to improve the outcome. The flexibility of behavior required to deploy this sequence is notably impaired by TBI (53), with many people reverting to stereotyped behavior (in this case, anger or aggression) in response to any perceived threat. Thus, we selected (1) improving self-monitoring and self-awareness of anger and (2) increasing the repertoire of problem-solving responses to anger-

provoking situations as the scaffolding of “active ingredients” around which to build the ASMT. There was evidence in the literature that these two skill sets could indeed be taught to persons with significant TBI. Self-monitoring has been successfully taught to people with TBI to improve social skills and to decrease belligerent and aggressive behavior (54, 55). Teaching the steps of problem-solving has been recommended as a treatment of choice for executive dysfunction due to TBI based on a systematic review of the literature (56). Thus, the ASMT was designed to focus on both of these elements at its core.

Many previous studies on anger management have offered this treatment in a group format. The obvious advantages of group treatment are that participants learn from hearing about one another’s situations, and that feedback from peers can be more readiy accepted than feedback from a therapist. Despite these considerations, we elected to design the ASMT as a 1:1 rather than group intervention to minimize the variability of receipt of intended ingredients. We also believed that future implementation of the treatment protocol, if found to be efficacious, would be more flexible as a 1:1 treatment. Although more resource intensive, an individual treatment protocol can offer advantages for establishing trust and comfort, monitoring comprehension and retention of therapeutic concepts, and attending to a participant's learning challenges, personal progress, and needs. Finally, we considered logistic reasons to be important (i.e., participants could be randomized and treated immediately rather than waiting for adequate numbers for group composition). We settled on an 8-session format, with 60–90 minutes per session, after outlining the critical content, aiming for a balance between comprehensiveness and feasibility. We aimed for 1 week between each treatment session to allow for practice and incorporation of learned concepts, and to match the familiar weekly format of many psychotherapies.

In light of the fact that not every participant would have an SO involved in treatment, we determined that the involvement of available SOs should not include every treatment session. We elected to involve the SO, if any, in 3 sessions: the first, the 4th (midpoint), and the last. All of these sessions are begun with the participant alone with the SO invited about halfway in; the therapist then assists the participant in sharing relevant material with the SO. An SO involved in treatment is also contacted by phone by the therapist between the 6th and 7th sessions for a brief (10–15 minute) discussion. The purpose of this contact is to obtain the SO’s perspective on the participant’s progress, or lack thereof. This interview is matched by a self-assessment performed during the 6th session; the therapist comments on both informal assessments and adds his or her own feedback during session 7.

The content of each session of the ASMT treatment is detailed in Table 2. In general, self-awareness and self-monitoring are emphasized in the first half of the sequence; the participant gains practice and skill in identifying his or her anger signs, which include not only bodily sensations such as flushing and tensing but also what we term “small a’s,” mild feelings of anger (e.g., annoyance). Theoretically, participants who become more adept at identifying when they begin to get angry can also learn to handle the situation before it progresses to a more destructive “large A”—overt anger or rage. In this first part of the treatment sequence, participants also learn to recognize “O’s”—Other Feelings that often signal the threat that leads to anger, such as feeling ashamed, belittled, or confused. Participants practice using these feelings to express their reactions to problematic situations,

which (hypothetically) gains sympathy from the other person involved and leads more directly to problem resolution. Participants then learn an algorithm for taking time to consider how they can solve an anger-provoking problem, using the specific techniques practiced in the second half of the program (see Table 2), rather than reacting in knee-jerk fashion with anger that escalates the situation.

Of note, this treatment model does *not* include "cognitive restructuring" techniques that are common in Cognitive Behavioral Therapy. Thus, participants are *not* encouraged to examine their thinking for cognitive distortions or other irrational or maladaptive patterns. In ASMT for TBI, we focus on learning greater awareness and more precise discrimination of *feelings* as they occur, and on specific ways to increase the *behavioral* repertoire of constructive problem-solving approaches to anger provocation.

2.9.2 Development of the control or comparison condition—While the pilot study of the ASMT showed improvement from pre- to post-treatment (17), the lack of a control condition could not preclude the influence of nonspecific factors such as therapist attention and interest, demand characteristics such as wanting to please the therapist/ researcher, expectation of improvement, and natural fluctuation in symptoms over time. For the larger trial, we therefore wished to provide an alternative condition that would control for some if not all of these factors. There are considerable challenges inherent in selecting a suitable control for non-pharmacologic treatments, for which there are no alternatives that allow for double blinding and other benefits of true placebos (57). In designing our control condition, we put particular emphasis on maximizing internal validity, including the principle that relevant content must be included to keep the treatments credible and ethical for both participants and treaters (58). We ruled out a comparison to usual care because anger management for people with chronic TBI varies widely, often consisting of no care at all. A dose control or dismantling design was premature due to the need to further establish the efficacy of ASMT. We considered a wait-list or delayed treatment control group, which controls for expectancy effects and also allows treatment effects to be confirmed later in the control group. However, the extended follow-up desired for the trial would render the waiting period unacceptably long, risking an increased drop-out rate. Moreover, there is some evidence that expectancy effects, which are a main reason to use a wait-list group, may actually not be well controlled by this design (59).

Ultimately we decided to construct a novel, fully manualized treatment to serve as an alternative condition to the ASMT. Called Personal Readjustment and Education (PRE), this condition provides nonspecific ingredients such as empathic attention from a therapist and a supportive atmosphere in which to ventilate feelings and reactions to life events. Although the therapist may use active listening and reflection and offer summaries to assist patients in conceptualizing day-to-day problems, s/he is proscribed from providing specific suggestions, advice, or directive feedback (all of which are provided in ASMT). Another ingredient in PRE is education: the participant receives accurate, but reassuring information about the effects of TBI and its recovery course, with encouragement to focus on intact skills and improvements noted over time. To maximize the credibility of PRE for both participants and providers, it is *structurally equivalent* to the ASMT condition. That is, both treatments are highly structured and fully manualized; consist of 8 weekly one-to-one

sessions, with the same degree of participation requested from the SO; and contain handouts, exercises, and assignments for between sessions. See Table 2 for a side-by-side comparison of the elements of the 2 treatment arms.

In the PRE condition, the somewhat counter-intuitive prohibition against providing direct advice about how to handle anger necessitated special attention to the manner in which the treatment conditions are described to participants, and special training and supervision methods for the therapists. During the consent process, all participants are informed orally and in writing that we are testing two methods of helping people with TBI to deal more effectively with anger and irritability, and that we do not know if either or both will be effective, or if one will be superior to the other. In the first session of the PRE treatment, with subsequent reminders as needed, the participant and SO, if any, are told that the intervention will provide education about TBI and its impact, as well as encouragement and support for the person with TBI to develop his/ her own ways of adjusting to the changes brought about by the injury. They are also told that anger and irritability may be one consequence of incomplete adjustment to a life-changing event; the PRE program does not focus exclusively on these symptoms but more comprehensively on the range of changes experienced within the person and the family system, as well as in community interactions. Participants are explicitly told that the therapist will not give them solutions or "tell them what to do," in contrast to many other therapeutic models. In this sense the PRE harkens back to psychotherapeutic models in which the therapist provides reflection and consolidation rather than problem-solving and advice.

PRE therapists are trained to use open-ended questions ("what thoughts do you have about that?"), empathetic reflection ("so it sounds like you don't know quite what to do"), and genuine praise for accomplishments ("that sounds tough, but you worked it out; good job"). In both the training and ongoing group supervision, specific alternatives are discussed for instances where participants ask for their opinions or for advice or direction. Therapists may remind participants that "It's not my role to tell you what to do," and may turn questions back to the participant ("what are you thinking would be best?"; "think out loud and see what comes to you") or encourage self-initiated brainstorming ("do you have ideas for how this could be different?"; "based on what you've learned from the material we've covered, do you have any new ideas?"). As noted below, we are measuring the perceived credibility of and satisfaction with this non-directive approach, as well as monitoring the rates of drop-out and alternative treatment seeking within the two treatment arms.

2.9.3 Other elements common to both treatment arms—As a check on whether the attention paid to the structural equivalency between the treatment conditions will actually result in effective control for expectancy of change, and equivalent credibility of the two conditions, we use Likert-type scales to measure participant and SO expectancy of change after Session 1, and participant and satisfaction with treatment after Session 8 (or, in case of drop-out, after the last session attended). These measures are administered not by the therapist but by the site Study Coordinator so as to minimize biases involved in trying to please the therapist. We also ask the therapist to perform parallel ratings after Session 1 and Session 8, regarding the extent to which the treatment would be/ was helpful to each participant.

For potential use as covariates in later analyses of treatment response, measures recorded from the treatment program in both arms include the number of treatment sessions attended by the participant and the SO; the length of each session in minutes; and whether or not assignments were completed between sessions.

In both treatment arms, structural elements of the treatment programs are designed to minimize the impact of the cognitive deficits associated with TBI. Every session begins with a brief, but thorough review of the highlights of the previous session, and ends with a review of key ideas in the current session. Assignments need not be completed between sessions, as there is time built into the beginning of each session for the therapist and participant to do uncompleted work together. Any writing or note-taking during sessions is done by the therapist to allow the participant to focus on the content of the material.

2.9.4 Therapist allocation, training, and supervision—Therapists were selected for having at least 1 year of experience in providing clinical services of a counseling nature to people with TBI; however, no prior experience in anger management principles was required. Therapists (two per site) are doctoral level psychologists (including postdoctoral trainees) or masters-trained clinical social workers. Therapists were randomly assigned to treatment arms (per site) to minimize biases associated with treatment preferences. Therapists in the 2 arms receive equivalent amounts of training, supervision, and feedback based on fidelity assessment (described below).

Therapist training involved (1) prior reading of the appropriate treatment manual and materials; (2) a multi-session telephone-based review of each session with supervisors assigned to each treatment arm; (3) a 2-1/2 day face to face training session in which therapists learned the philosophical roots of their respective arms, practiced each portion of the manual with one another, and received feedback from supervisors; (4) completion of a practice case, using volunteers to stand in for participants as trainee therapists administered the entire treatment. Each practice session was audio recorded and reviewed by supervisors, with both positive and corrective feedback to therapists.

When therapists were “cleared” by supervisors to take actual participants, they underwent intensive fidelity checking (described below) and participated in weekly group supervision teleconferences specific to their treatment arm. As the trial has progressed, the frequency of these supervision meetings has reduced to “as needed” based on the accrual of new participants and emerging issues. When appropriate, clips from audio recordings of sessions are played during supervision meetings to illustrate situations of interest, challenges, and examples of particularly effective interactions. Clips can be suggested by therapists or selected by the supervisor based on feedback from the fidelity checks. In addition to these telephone meetings, therapists also have recourse to a list server, one for each treatment arm, on which they may pose questions to one another and supervisors/ treatment developers simultaneously.

2.9.5 Fidelity assessment—One of the authors (J.A.B.) who assisted in the development of both therapy manuals performs fidelity assessment by comparing audiotapes of treatment sessions to detailed checklists containing prescribed and proscribed elements of each session

in both treatment arms. Fidelity data are stored in spreadsheets containing the checklists. Fidelity was initially assessed for every session of each therapist's first 2 study participants, in real time so that feedback could be provided immediately in supervision sessions (group or private). Therapists whose fidelity was not at 100% for a given session continued to have that session monitored in real time until performance was satisfactory. Any therapist who deviated from his/ her respective manual after corrective feedback had another full set of 8 sessions checked by the supervisor. Once a therapist had been "passed" on all sessions, the fidelity assessment became less intensive; throughout the remainder of the trial, one session per each new participant is quasi-randomly selected for detailed checking.

2.9.6 Treatment termination—If participants decide to withdraw from treatment before completing 8 therapy sessions, every effort is made to retain them and their SO, if any, in all remaining data collection phases (including the treatment enactment interview, for those who have attended 4 or more sessions). Participants for whom more than 28 days elapse between any two treatment sessions, or for whom more than 84 days (12 weeks) would be required to complete all sessions, are terminated from therapy sessions by investigators but asked to remain in data collection phases. (These arbitrary limits may be over-ridden in cases of extenuating circumstance.) The rationale for termination is that participants who receive the therapy at widely spaced or erratic intervals may not be expected to receive the same benefit as those who participate at the therapy intensity planned for the study.

3.0 Statistical methods

3.1 Hypothesis testing

In general, analyses will incorporate the intention-to-treat principle by including all randomized participants. The primary hypothesis is that there will be at least a 20% greater response rate in the ASMT group compared to the PRE group, where treatment response is defined as ≥ 1 standard deviation change in the direction of improvement from pre- to 1–2 week post-treatment (T3), on ≥ 1 of the following scales: State-Trait Anger Expression Inventory-Revised (STAXI-2) Trait Anger; STAXI-2 Anger Expression-Out; or the Brief Anger-Aggression Questionnaire (BAAQ). These measures and the magnitude of difference corresponding to clinically significant change were based on data from our pilot investigation (17). Meta-analyses of anger treatments in the general population have suggested about double the response rate with the targeted treatment (~2/3 in treated groups, ~1/3 in controls) (12, 60). We elect to use a more conservative 20% difference for the primary hypothesis because (1) we feel that a difference of that magnitude is clinically important; (2) the meta-analyses have mostly compared treated to untreated (e.g., wait-list) control conditions, and the PRE condition in this study may generate a more substantial treatment response than a no-treatment condition; (3) the meta-analyses have not included studies on populations with cognitive impairment (many have used college students), and it is reasonable to expect higher variability in participants with TBI. Moreover, we cannot expect as high a response rate for the ASMT as observed in the pilot study (82%) given the variability introduced by multiple therapists and a more diverse sample across the sites. Even if the response rate for the ASMT in the larger study is lower than observed in the pilot (e.g., 50%), and the PRE is associated with some degree of treatment response (e.g., 30%),

we feel that this degree of difference would warrant continued study of the ASMT treatment model as a potentially valuable addition to the clinical armamentarium. Thus, this hypothesis will be considered supported if the observed response rate with ASMT is at least 20 percentage points higher than that with the control treatment, PRE. We will also calculate a confidence interval on the difference in response rates. People who do not complete the assessment at post-treatment (T3) will be included in the analysis and counted as non-responders. A secondary analysis using binomial regression with a log link will examine the extent to which the treatment effect is modified by changes in concomitant treatments (e.g., antidepressants, beta blockers).

Secondary hypotheses concerning the trajectory and persistence of treatment effects will be examined using point estimates and confidence intervals on response rates and differences in response rates to determine if the treatment arms differ on treatment response after 4 weeks of treatment and 2 months after the end of treatment, respectively. Analysis within the subgroup of responders will be conducted to test the hypothesis that at least 50% of them will show the treatment response at T2 (halfway through treatment). We hypothesize that the rate of treatment response in ASMT will exceed that of PRE by at least 10% at T2 and at least 20% at T4.

Additional secondary hypotheses will be examined using mean differences, effect sizes, and confidence intervals to compare pre- to post-treatment (T1 to T3) changes and pre-to-follow-up changes (T1 to T4), respectively, between the ASMT and PRE groups on the SO ratings of participant anger on the 3 scales noted above; and to compare pre- to post-treatment changes between the ASMT and PRE groups on the BSI to examine differential effects on emotional outcomes. If warranted, secondary analyses of self-reported anger may also be conducted using mixed effects models to compare slopes of continuous data from the anger measures, in addition to the conservative use of dichotomized scores in the primary analysis.

Other secondary analyses will compare ASMT and PRE groups on self- and other-ratings of behavioral function on the FrSBe, the SWLS score, and the GOSE. These analyses will be conducted primarily to develop hypotheses about domains that might be affected by treatment, and thus valuable to measure, in a larger trial of ASMT vs. PRE (should the primary hypothesis concerning superiority of ASMT be supported). Finally, we will conduct exploratory analyses of differences in response rates between the ASMT and PRE cases and confidence interval for subgroups defined by characteristics such as cognitive status, severity of pretreatment anger, presence/ absence of participating SO, etc. We recognize that the power for examining treatment response in sub-groups of participants will be low, and will use any findings primarily to inform the design of a larger trial of ASMT vs. PRE, should the primary hypothesis concerning superiority of the ASMT be supported.

3.1 Sample size

We have powered this study not to constitute a definitive trial of the superiority of ASMT compared to a more generic psychotherapy, but to serve as a developmental study that will inform decisions about how to proceed with testing or adapting the treatment model represented by ASMT. The decision as to whether to proceed with further development and

evaluation of ASMT will depend on whether the point estimate of the difference in response rates is at least 20 percentage points. With 99 cases (66 cases in the ASMT group and 33 in the PRE group) we expect the observed difference will be at least as large as 20% 90 percent of the time if the true difference is 30%. Conversely, we expect the observed difference will be at least this large only 8 percent of the time if the true difference is only 10%.

4.0 Other methodological concerns

4.1 Allocation masking

Since behavioral trials cannot use double or even single blinding (i.e., both the treater and the participant know what treatment the participant receives), it is crucial to minimize bias through use of blinded or masked outcome assessment (61). We use several procedures to keep outcome examiners masked to treatment allocation. Each site has a Study Coordinator who is the only person unmasked to treatment group. This person randomizes participants to treatment arms, and funnels all communication between the therapists and outcome data collector (e.g., about dates of sessions relevant to interim and post-treatment evaluations) so that they will not need to come in contact. Therapists and outcome data collectors are located in geographically separated offices and are subscribed to different list servers to avoid inadvertent transmission of participant information, or physical contact between outcome examiners and participants near therapists' offices. At the point of baseline assessment and randomization, participants and SOs are educated about the purpose of masking and asked not to reveal anything about their treatment or therapist when contacted periodically by the data collector. When the data collector does contact them for any evaluation, s/he begins by reading a script that reminds the respondent not to mention anything about the therapist or treatment that would break the mask.

To evaluate the success of masking precautions, data collectors complete a form after each evaluation which requires them to guess which treatment group the participant has been randomized to, and to rate the certainty of the guess. If the data collector becomes overtly unmasked by the participant or through an administrative error, this is documented for future use in analyses of outcome data.

4.2 Loss to follow-up

Loss to follow-up is minimized by using experienced outcome evaluators who work on flexible schedules so as to contact participants and SOs at the times most convenient for each. In general, a participant is not considered lost to a particular follow-up interval unless there has been failure to contact after no less than 4 attempts during normal business hours (at different times of the day), 4 attempts during weekday evenings (on different days of the week), 4 attempts during weekends, and additional attempts using ground mail, email, text messaging, and contacting close relatives of the participant.

4.3 Data quality procedures

All instruments requiring manual scoring, such as neuropsychological tests administered at baseline and emotional function measures administered via telephone at each evaluation interval, are scored and verified by two independent staff members. Similarly, all

instruments requiring manual conversions from raw scores to standardized scores are also converted and verified by two independent staff members. Prior to quarterly data submissions to the Data Coordinating Center, data entry at each site is checked for accuracy by an independent staff member comparing paper and electronic values of at least 10% of the cases entered. If any data entry errors are identified, 100% of the cases are reviewed and corrected as needed. In addition, a variety of error checks have been programmed into the database to ensure that data conforms to expected standards – i.e. values do not exceed established ranges, dates occur in a logical progression, etc.

4.4 Risk management

Considering the topic of the study, the target population, and the possibility that participants may experience untoward emotional or behavioral events during the trial, we have several protocols in place for risk management. Any participant who expresses suicidal ideation during the screening/ baseline evaluation is excluded or deferred from the trial and referred to urgent care as appropriate. For those who are enrolled in the trial, reports of ideation regarding self-harm or harm to others are evaluated per a standard protocol with back-up from study psychologists/ psychiatrist. We monitor for Adverse Events (AE) and Serious Adverse Events (SAE) throughout the trial. For SAE, we adhere to a standard definition used in medical trials, i.e., any event for which the outcome is death, hospitalization, life-threatening (i.e., person is at risk of death at the time of the event), disability and/or incapacity, or the event requires intervention to prevent those outcomes. It was more challenging to define and monitor non-serious AE, as in medical trials these often refer to physical side effects or illness episodes. For this psychologically oriented trial, we elected to define AE as self-reported Emergency visits, arrests, episodes of violence, or thoughts of harming self or others. These are queried at each data collection episode and each therapy session and, if endorsed, evaluated as to seriousness, duration, resolution date if any, and possible relationship to study procedures. Withdrawal from therapy sessions and/ or from the study at large is also considered an AE. We consult semi-annually with an independent Safety Monitor, a psychologist with expertise in the topic who examines unblinded AE and SAE reports, to ensure that our documentation and resolution of such events is adequate and that no treatment arm is disproportionately associated with events of concern.

5. Discussion

We have presented a multi-center randomized controlled trial of a psychoeduational treatment program addressing problematic anger and irritability in people with chronic (at least 6 months) TBI. This specialized treatment, termed Anger Self-Management Training, is novel because it accommodates significant cognitive deficits that co-occur with TBI, acknowledges the multiple reasons for anger in this population, and offers a treatment program that can stand alone, serve as an adjunct to medications, or be incorporated into a comprehensive treatment program for TBI. The development of this treatment was motivated by the paucity of approaches to post-traumatic anger that are feasible and acceptable for the large numbers of community-dwelling people with TBI who experience this persistent cluster of symptoms, and the negative consequences thereof. Strengths of the approach presented here include its emphasis on skill-building rather than suppression of

behavior; the lack of a prerequisite level of critical self-mindfulness as needed for CBT; and the focus on *self*-management of problematic symptoms rather than control by others. Our hope is that this approach will enhance the resilience, emotional independence, and interpersonal problem-solving abilities of persons with anger/ irritability related to TBI.

Notable features of this trial include the use of fidelity assessment in real time for therapist supervision, with positive effects on fidelity in subsequent sessions; and the use of a structurally equivalent comparison condition. As both the ASMT and PRE conditions were developed specifically for the study, the resulting study design is not only demanding in its ability to assess the potential benefits, if any, of anger-specific treatment but also the potential role and comparative efficacy of "nonspecific" supportive strategies for assisting this population. In this respect, the PRE condition was developed as a credible alternative to the ASMT with a level of equipoise rarely examined, having its own philosophy, manual, and training procedures. Since we are measuring explicitly the expectancy of change and satisfaction associated with the comparison treatment, from both the providers' and participants' points of view, we anticipate being able to draw powerful conclusions as to its perceived credibility. We also anticipate novel findings from the phase devoted to treatment enactment in daily life, which is challenging to measure yet remains a crucial construct for evaluating the practical value of various strategies and components as well as the real-life generalization and durability of treatment effects (47).

Limitations of the trial have been noted, although its implementation remains in progress. One of three sites withdrew from the trial due to difficulties with enrolling participants who were willing and able to attend 8 in-person therapy sessions. With the increased emphasis on telephone and web-based therapies, a logical extension of the protocol presented here may well be adaptation to distance media.

Whatever the outcome of this trial, our hope is that the lessons learned will help to satisfy an unmet need for survivors of TBI: to understand and deal with the emotional changes and challenges that face them.

Acknowledgments

This research is supported by the National Institutes of Health (NICHD/NCMRR) grant #1RO1HD061400 and by a grant from the Moss Rehabilitation Research Institute Peer Review Committee. We thank Sureyya Dikmen, PhD, Nancy Temkin, PhD, and Thomas Novack, PhD for their assistance in developing the trial protocol. Cindy Harrison-Felix, PhD, David Mellick, and Christopher Cusick contributed substantially to the plans for data quality assurance.

REFERENCES

1. Deb S, Lyons I, Koutzoukis C, Ali I, McCarthy G. Rate of psychiatric illness 1 year after traumatic brain injury. American Journal of Psychiatry. 1999; 156(3):374–378. [PubMed: 10080551]
2. Kim S, Manes F, Kosier T, Baruah S, Robinson R. Irritability following traumatic brain injury. Journal of Nervous and Mental Disease. 1999; 187(6):327–335. [PubMed: 10379719]
3. van Zomeren AH, van den Burg W. Residual complaints of patients two years after severe head injury. Journal of Neurology, Neurosurgery and Psychiatry. 1985 Jan; 48(1):21–28.
4. Hanks RA, Temkin N, Machamer J, Dikmen SS. Emotional and behavioral adjustment after traumatic brain injury. Archives of Physical Medicine and Rehabilitation. 1999; 80(9):991–997. [PubMed: 10488997]

5. Delmonico RL, Hanley-Peterson P, Englander J. Group psychotherapy for persons with traumatic brain injury: Management of frustration and substance abuse. Journal of Head Trauma Rehabilitation. 1998; 13(6):10–22. [PubMed: 9885315]
6. Kim E, Lauterbach EC, Reeve A, Arcinegas DB, Coburn KL, Mendez MF, et al. Neuropsychiatric complications of traumatic brain injury: A critical review of the literature (A report by the ANPA committee on research). Journal of Neuropsychiatry and Clinical Neurosciences. 2007; 19(2):106–127. [PubMed: 17431056]
7. Wheaton P, Mathias JL, Vink R. Impact of pharmacological treatments on cognitive and behavioral outcome in the postacute stages of adult traumatic brain injury: a meta-analysis. J Clin Psychopharmacol. 2011 Dec; 31(6):745–757. [PubMed: 22020351]
8. Fleminger S, Greenwood RRJ, Oliver DL. Pharmacological management for agitation and aggression in people with acquired brain injury. Cochrane Database of Systematic Reviews. 2006; (3):CD003299. [PubMed: 17054165]
9. Hammond FM, Bickett AK, Norton JH, Pershad R. Effectiveness of amantadine hydrochloride in the reduction of chronic traumatic brain injury irritability and aggression. J Head Trauma Rehabil. 2014 Sep-Oct;29(5):391–399. [PubMed: 24263176]
10. Silver, J.; Arciniegas, DB. Pharmacotherapy of neurospsychiatric disturbances. In: Zasler, ND.; Katz, DI.; Zafonte, RD., editors. Brain Injury Medicine: Principles and Practice. New York: Demos; 2007. p. 963-993.
11. Alderman N. Contemporary approaches to the management of irritability and aggression following traumatic brain injury. Neuropsychological Rehabilitation. 2003; 13:211–240. [PubMed: 21854335]
12. Deffenbacher JL, Oetting ER, DiGiuseppe RA. Principles of empirically supported interventions applied to anger management. The Counseling Psychologist. 2002; 30(2):262–280.
13. DiGiuseppe R, Tafrate RC. Anger treatment for adults: A meta-analytic review. Clinical Psychology: Science and Practice. 2003; 10(1):70–84.
14. Medd J, Tate R. Evaluation of an anger management therapy programme following acquired brain injury: A preliminary study. Neuropsychological Rehabilitation. 2000; 10(2):185–201.
15. Aboulafia-Brakha T, Greber Buschbeck C, Rochat L, Annoni JM. Feasibility and initial efficacy of a cognitive-behavioural group programme for managing anger and aggressiveness after traumatic brain injury. Neuropsychol Rehabil. 2013; 23(2):216–233. [PubMed: 23259694]
16. Walker AJ, Nott MT, Doyle M, Onus M, McCarthy K, Baguley IJ. Effectiveness of a group anger management programme after severe traumatic brain injury. Brain Inj. 2010; 24(3):517–524. [PubMed: 20184408]
17. Hart T, Vaccaro M, Hays C, Maiuro R. Anger self-management training for people with traumatic brain injury: A preliminary investigation. Journal of Head Trauma Rehabilitation. 2012; 27:113–122. [PubMed: 21407088]
18. Bushnik T. Introduction: The Traumatic Brain Injury Model Systems of Care. Archives of Physical Medicine and Rehabilitation. 2003; 84(2):151–152. [PubMed: 12601643]
19. Teasdale G, Jennett B. Assessment of coma and impaired consciousness: A practical scale. Lancet. 1974; 2(7872):81–84. [PubMed: 4136544]
20. Spielberger, C. State-Trait Anger Expression Inventory - Revised. Lutz, FL: Psychological Assessment Resources, Inc.; 2000.
21. Maiuro R, Vitaliano P, Cahn T. A brief measure for the assessment of anger and aggression. Journal of Interpersonal Violence. 1987; 2(2):166–178.
22. Sheehan D, Lecrubier Y, Sheehan K, Amorim P, Janavs J. The Mini-International Neuropsychiatric Interview (MINI): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. Journal of Clinical Psychiatry. 1998; 59:22–33. [PubMed: 9881538]
23. WHO ASSIST Working Group. [updated 2002; cited 2010] The Alcohol, Smoking and Substance Involvement Screening Test. 2002. Available from: http://www.who.int/substance_abuse.
24. Hart T, Dijkers M, Whyte J, Braden C, Trott C, Fraser R. Vocational interventions and supports following job placement for persons with traumatic brain injury. Journal of Vocational Rehabilitation. 2010; 32(3):135–150.

25. Hart T, Benn EK, Bagiella E, Arenth P, Dikmen S, Hesdorffer DC, et al. Early trajectory of psychiatric symptoms after traumatic brain injury: relationship to patient and injury characteristics. J Neurotrauma. 2014 Apr 1; 31(7):610–617. [PubMed: 24237113]
26. Wechsler, D. Wechsler Abbreviated Scale of Intelligence (WASI). San Antonio, TX: Harcourt Assessment, Inc.; 1999.
27. Rey, A. L'examen Clinique en Psychologie. Paris: Presses Universitairies de France; 1964.
28. Reitan, RM.; Wolfson, D. The Halstead-Reitan Neuropsychological Test Battery. Tuscon, AZ: Neuropsychology Press; 1985.
29. Burgess, PW.; Shallice, T. The Hayling and Brixton Tests: Test Manual. Bury St Edmunds, UK: Thames Valley Test Company; 1997.
30. Wilkinson, GS.; Robertson, GJ. Wide Range Achievement Test 4 professional manual. Lutz, FL: Psychological Assessment Resources; 2006.
31. LaBrie JW, Quinlan T, Schiffman JE, Earleywine ME. Performance of alcohol and safer sex change rulers compared with readiness to change questionnaires. Psychology of Addictive Behaviors. 2005; 19(1):112–115. [PubMed: 15783287]
32. Blanchard EB, Jones-Alexander J, Buckley TC, Forneris CA. Psychometric properties of the PTSD Checklist (PCL). Behav Res Ther. 1996 Aug; 34(8):669–673. [PubMed: 8870294]
33. Taft CT, Creech SK, Kachadourian L. Assessment and treatment of posttraumatic anger and aggression: a review. J Rehabil Res Dev. 2012; 49(5):777–788. [PubMed: 23015585]
34. Babor, TF.; Higgins-Biddle, JC.; Saunders, JB.; Monteiro, M. AUDIT: The Alcohol Use Disorders Identification Test. 2nd Edition ed. World Health Organization; 2001.
35. Taylor GJ, Bagby RM, Parker JDA. The 20-Item Toronto Alexithymia Scale: IV. Reliability and factorial validity in different languages and cultures. Journal of Psychosomatic Research. 2003; 55(3):277–283. [PubMed: 12932803]
36. Sherer M, Boake C, Levin E, Silver BV, Ringholz GM, High WM. Characteristics of impaired awareness after traumatic brain injury. Journal of the International Neuropsychological Society. 1998; 4:380–387. [PubMed: 9656611]
37. Yang CC, Hua MS, Lin WC, Tsai YH, Huang SJ. Irritability following traumatic brain injury: divergent manifestations of annoyance and verbal aggression. Brain Inj. 2012; 26(10):1185–1191. [PubMed: 22571629]
38. Hart T, Sherer M, Whyte J, Polansky M, Novack TA. Awareness of behavioral, cognitive, and physical deficits in acute traumatic brain injury. Archives of Physical Medicine and Rehabilitation. 2004; 85(9):1450–1456. [PubMed: 15375815]
39. Hart T, Whyte J, Polansky M, Millis S, Hammond FM, Sherer M, et al. Concordance of patient and family report of neurobehavioral symptoms at 1 year after traumatic brain injury. Archives of Physical Medicine and Rehabilitation. 2003; 84(2):204–213. [PubMed: 12601651]
40. Burkhardt, F.; Polzehl, T.; Stegmann, J.; Metze, F., editors. Detecting real life anger. IEEE International Conference on Acoustics, Speech, and Signal Processing; Taipei, Taiwan. 2009.
41. Eckhardt C, Norlander B, Deffenbacher J. The assessment of anger and hostility: A critical review. Aggression and Violent Behavior. 2004; 9:17–43.
42. Derogatis, L. Brief Symptom Inventory (BSI): Administration, Scoring and Procedures Manual. 4th ed.. Minneapolis, MN: NCS Pearson, Inc.; 1993.
43. Wilde EA, Whiteneck GG, Bogner J, Bushnik T, Cifu DX, Dikmen S, et al. Recommendations for the use of common outcome measures in Traumatic Brain Injury research. Archives of Physical Medicine and Rehabilitation. 2010; 91:1650.e17–1660.e17. [PubMed: 21044708]
44. Grace, J.; Malloy, PF. Frontal Systems Behavior Scale (FrSBe): Professional Manual. Lutz, FL: Psychological Assessment Resources, Inc.; 2001.
45. Wilson J, Pettigrew L, Teasdale G. Structured interviews for the Glasgow Outcome Scale and the Extended Glasgow Outcome Scale: Guidelines for their use. Journal of Neurotrauma. 1998; 15(8): 573–585. [PubMed: 9726257]
46. Diener ED, Emmons RA, Larsen RJ, Griffin S. The Satisfaction With Life Scale. Journal of Personality Assessment. 1985; 49(1):71–75. [PubMed: 16367493]

47. Bellg AJ, Borrelli B, Resnick B, Hecht J, Minicucci DS, Ory M, et al. Enhancing treatment fidelity in health behavior change studies: Best practices and recommendations from the NIH Behavior Change Consortium. Health Psychology. 2004; 23(5):443–451. [PubMed: 15367063]

48. Robb SL, Burns DS, Docherty SL, Haase JE. Ensuring treatment fidelity in a multi-site behavioral intervention study: implementing NIH Behavior Change Consortium recommendations in the SMART trial. Psychooncology. 2011 Nov; 20(11):1193–1201. [PubMed: 22012943]

49. Eames, P. Organic bases of behavior disorders after traumatic brain injury. In: Wood, R., editor. Neurobehavioral Sequlae of Traumatic Brain Injury. Hove, UK: Psychology Press; 1990. p. 410-432.

50. Galski T, Palasz J, Bruno RL, Walker JE. Predicting physical and verbal aggression on a brain trauma unit. Archives of Physical Medicine and Rehabilitation. 1994; 75(4):380–383. [PubMed: 8172494]

51. Whyte, J.; Ponsford, J.; Watanabe, T.; Hart, T. Traumatic Brain Injury. In: Frontera, WR., editor. Delisa's Physical Medicine and Rehabilitation: Principles and Practice. 5th ed.. Philadelphia: Lippincott Williams & Wilkins; 2010. p. 575-623.

52. Hart T, Seignourel PJ, Sherer M. A longitudinal study of awareness of deficit after moderate to severe traumatic brain injury. Neuropsychological Rehabilitation. 2009; 19(2):161–176. [PubMed: 18609008]

53. Hart T, Jacobs H. Rehabilitation and management of behavioral disturbances following frontal lobe injury. Journal of Head Trauma Rehabilitation. 1993; 8(1):1–12.

54. Dayus B, van den Broek M. Treatment of stable delusional confabulations using selfmonitoring training. Neuropsychological Rehabilitation. 2000; 10(4):415–427.

55. Schloss P, Thompson C, Gajar A, Schloss C. Influence of self-monitoring on heterosexual conversational behaviors of head trauma youth. Applied Research in Mental Retardation. 1985; 6:269–282. [PubMed: 4037786]

56. Kennedy MR, Coelho C, Turkstra L, Ylvisaker M, Moore Sohlberg M, Yorkston K, et al. Intervention for executive functions after traumatic brain injury: A systematic review, meta-analysis and clinical recommendations. Neuropsychological Rehabilitation. 2008; 18(3):257–299. [PubMed: 18569745]

57. Hart T, Fann J, Novack T. The dilemma of the control condition in experience-based cognitive and behavioral treatment research. Neuropsychological Rehabilitation. 2008; 18(1):1–21. [PubMed: 17852761]

58. Schnurr PP. The rocks and hard places in psychotherapy outcome research. J Trauma Stress. 2007 Oct; 20(5):779–792. [PubMed: 17955539]

59. Mohr DC, Spring B, Freedland KE, Beckner V, Arean P, Hollon SD, et al. The selection and design of control conditions for randomized controlled trials of psychological interventions. Psychother Psychosom. 2009; 78(5):275–284. [PubMed: 19602916]

60. Beck R, Fernandez E. Cognitive-behavioral therapy in the treatment of anger: A meta-analysis. Cognitive Therapy and Research. 1998; 22(1):63–74.

61. Wood L, Egger M, Gluud LL, Schulz KF, Juni P, Altman DG, et al. Empirical evidence of bias in treatment effect estimates in controlled trials with different interventions and outcomes: meta-epidemiological study. BMJ. 2008 Mar 15; 336(7644):601–605. [PubMed: 18316340]

Table 1

Schedule of assessments.

	T1 (Baseline)	T2 (Interim): After Session 4	T3 (Post Treatment) : After Session 8- Primary Outcome	T4 (Follow-up): 2 months after T3
Demographic information on P and SO; information on severity and type of TBI	X			
Cognitive status (IQ, memory, executive function, reading level): WASI, TMT, Brixton, WRAT-4	X			
Anger, both self- and SO-reported: STAXI-2 and BAAQ	X	X	X	X
Emotional status (other than anger): BSI	X		X	X
PTSD: PCL-C	X			
Alexithymia: TAS-20	X			
Frontal/ executive behavior, both self- and SO-reported: FrSBe	X		X	X
Readiness to change	X			
Alcohol use: AUDIT	X			
Medications & other concurrent treatments	X	X	X	X
Global functional status: GOS-E	X			
Satisfaction with life: SWLS	X		X	X

P = participant; SO = significant other; TBI = traumatic brain injury

Table 2

Treatment components of the ASMT and PRE treatment arms.

Treatment Component	Anger Self-Management Training	Personal Readjustment and Education
Core Philosophy	Anger is a normal, adaptive emotion that becomes harder to manage after TBI. Self-management may be strengthened by learning strategies to bolster key executive functions: self-awareness and problem-solving. These skills help P to recognize when anger is triggered, and to choose a reasoned response from an enhanced behavioral repertoire.	People with TBI do not receive adequate education or emotional support, leading to inhibition of natural coping mechanisms. Receiving information, emotional support, and opportunities to ventilate feelings in a warm, permissive atmosphere can help restore P's ability to cope with problems.
Session 1	Introduction to program content; education about anger (normalization); discussion of specifics of P's anger responses; introduction of Balance Sheet, listing "reasons" for P's anger in (−) column and existing Calming Strategies/supports in the (+) column (as techniques are learned throughout program, they are successively added to (+) column).	Introduction to program content; education about TBI and the changes it may lead to; reassurance that recovery may continue over a long period of time. Explanation of "ripple effects" of TBI through 3 circles of life, each of which requires its own adjustment process: the Inner Circle (self, including emotional changes), Middle Circle (relationships with others), and Outer Circle (functioning in the wider community).
Session 2	Education about self-monitoring; reformulation of anger as a cue, not a solution; discussion of P's characteristic anger cues in body/behavior; introduction of Other Feelings that accompany threats leading to anger, e.g., shame, fear, confusion.	Inner Circle I: Education about cognitive changes: Attention, memory, and executive function. T leads p in exercise to prompt discussion of cognitive changes experienced by P as well as areas that are more intact.
Session 3	Practice in identifying Other Feelings as signals of anger and using them to communicate more effectively (versus communicating with anger).	Inner Circle II: Education about emotional changes and why there may be under- or over-reaction to events. T invites P to ventilate feelings in supportive environment and reinforces value of putting feelings into words.
Session 4	Training and practice in how to read anger signals as a cue to initiate the Time Out technique, a key problem-solving algorithm allowing P to "slow down the action" and formulate a reasoned response.	Middle Circle I: Education about TBI and how it changes family relationships, for better or worse (and sometimes both). Discussion of role changes, guilt, and communication issues, and process of "normal" family adjustments to life changes..
Session 5	Training and practice in use of Mirror Technique, a method of replacing negative with positive communication to defuse anger situations.	Middle Circle II: Friendships, their normal cycle, and how they can be affected by TBI. P completes sociogram analyzing changes in social relationships, including positive ones.
Session 6	Training and practice in Active Listening, a technique to enhance understanding of the viewpoints of others and to avoid non-constructive argument.	Outer Circle I: Discussion of meaning of "community" and how P sees his/her belongingness, participation, and contribution as having changed, and not changed, since TBI. Discussion of changes in roles, if any.
Session 7	Self-assessment and consolidation of skills: P completes self-assessment of progress, evaluates own strengths and weaknesses related to program content, and reviews/practices techniques felt to be most in need f shoring up.	Outer Circle II: P completes self-assessment of progress to date; T prompts discussion of activities out in the community and how these may have been affected by TBI, as well as self-assessment of most fulfilling activities.
Session 8	Review and relapse prevention: Final review of skills and concepts covered in program; discussion of likely pitfalls for future and how they might be handled or circumvented; planning for generalization of learned skills to various situations.	Review of information and topics discussed in program, with emphasis on how P's situation has not changed (or changed for the better) since TBI and affirmation of ways in which P and SO have been able to adjust and cope with changes.
Weekly assignments	Completion of Anger Logs (introduced in Session 1) to record key triggers, bodily/ behavioral responses, other key data on incidents occurring between sessions; reviewed at start of Sessions 2–7	Completion of Personal Events Diary (introduced in Session 1) to record any (not necessarily related to anger) salient events and associated thoughts/ feelings between sessions; reviewed at start of Sessions 2–7
Involvement of SO, if any	SO participates in portions of Sessions 1, 4, and 8, and provides brief telephone feedback privately to the T between Sessions 6 and 7, to complete a brief progress assessment parallel to the P's self-assessment.	SO participates in portions of Sessions 1, 4, and 8, and provides brief telephone feedback privately to the T between Sessions 6 and 7, to complete a brief progress assessment parallel to the P's self-assessment.

Treatment Component	Anger Self-Management Training	Personal Readjustment and Education
Proscribed elements	Topics or concerns not covered in treatment manual; T reminds P that program is focused on anger-related issues and encourages P to seek other help for different issues.	Directive counseling or giving of advice; T must not suggest specific strategies but may encourage P to create and try things on his/her own using his/her own best ways to adjust.

P= participant; T = therapist; SO= significant other