

**A Transdiagnostic Investigation of Emotional Distress after Traumatic Brain
Injury**

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Short title: Emotional distress following TBI.

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Abstract

Emotional distress after traumatic brain injury (TBI) often presents as a range of neurobehavioural and emotional reactions rather than distinct disorders. This study adopted a transdiagnostic approach with the aim of identifying psychological processes common to depression, anxiety and global distress after TBI. Fifty participants with TBI (aged 19-66 years, 12-65 months post-injury) completed measures of threat appraisals and avoidance behaviour (Appraisal of Threat and Avoidance Questionnaire), self-discrepancy (Head Injury Semantic Differential Scale III), emotion dysregulation (Difficulties in Emotion Regulation Scale), worry (Penn State Worry Questionnaire), negative self-focused attention (Self-Focus Sentence Completion) and emotional distress (Depression Anxiety Stress Scales and Brief Symptom Inventory). Significant correlations were found among the proposed transdiagnostic variables ($r_s = .29-.82$, $p < .05$). A principal components analysis revealed two underlying factors; 1) threats to self and 2) emotion dysregulation. Only the emotion dysregulation factor accounted for significant unique variance in levels of depression, anxiety and global distress ($sr^2 = .12-.17$). Such findings indicate the need for interventions to target difficulties in identifying and regulating emotions after TBI to facilitate emotional adjustment.

Key Words: traumatic brain injury, emotional distress, transdiagnostic perspective, emotional dysregulation

Introduction

Emotional disorders such as depression and anxiety represent a major cause of disability following traumatic brain injury (TBI) and are proposed to arise from an interplay of biological, psychological and social factors (Bombardier et al., 2010; Gould, Ponsford & Spitz, 2014; Whelan-Goodinson, Ponsford, Johnston & Grant, 2009; Ownsworth et al., 2011; Williams, Evans & Fleminger, 2003). Due to the complex aetiology of emotional disorders it can be challenging for clinicians to determine the optimal approach to intervention.

Clinicians and researchers typically draw upon the Diagnostic and Statistical Manual for Mental Disorders (DSM-V: APA, 2013) to inform diagnosis and treatment of mental health issues. The DSM adopts a system wherein disorders are grouped into diagnostic categories. However, limits have been identified in this system. For example, phenotypical similarities between categories can lead to high rates of comorbidity and misdiagnoses (Brown & Barlow, 2009; Watson, 2005). As such, research into alternative frameworks to understanding psychological disorders is required.

For more than a decade researchers and clinical psychologists have been promoting a transdiagnostic approach to understanding depression and anxiety within the general population (Allen, McHugh, & Barlow, 2008; Barlow, Allen, & Choate, 2004). The transdiagnostic approach endeavours to understand and/or treat processes associated with multiple psychological disorders (e.g., Barlow et al., 2004; Mansell, Harvey, Watkins, & Shafran, 2009), with the aim of developing more parsimonious conceptualisations of psychopathology (Nolen-Hoeksema & Watkins, 2011). Advocates of this approach suggest that there are common factors underlying anxiety and depression, and that these disorders may be part of the same fundamental emotional syndrome (Mansell, et al., 2009). This perspective may be highly relevant to the TBI

population, as emotional distress post-TBI often presents as a range (or syndrome) of neurobehavioural and emotional reactions (e.g., negative affect, worry, frustration and irritability), rarely fitting neatly into a diagnostic category (Fann, Uomoto, & Katon, 2000; Gould, Ponsford, Johnston, & Schönberger, 2011; Williams, et al., 2003).

Consistent with the tripartite model of depression and anxiety (Clark & Watson, 1991), global affective distress is important to include in a transdiagnostic framework.

There are many potential clinical benefits of adopting a transdiagnostic approach to investigate factors underlying depression, anxiety and global distress in the TBI population. In particular, a transdiagnostic framework of emotional adjustment may inform more unified treatment approaches that improve the efficacy, generalizability, and cost-effectiveness of treatments (Dozois, Seeds & Collins, 2009; Mansell, Harvey, Watkins & Shafran, 2008). A review of studies pertaining to emotional distress following TBI revealed three main lines of preliminary support for a transdiagnostic conceptualisation for TBI (Gordon & Ownsworth, 2010). First, comorbid anxiety disorders are found to be as high as 60-77% among individuals diagnosed with depression in the first year after TBI (Bombardier et al., 2010; Jorge et al., 2004; Jorge, Robinson, Starkstein & Arndt, 1993; Whelan-Goodinson et al., 2009). Furthermore, rates for comorbid depression and anxiety are far higher among TBI samples than the general Australian community; with 25-29% of individuals post-TBI presenting with comorbid depression and anxiety, compared to 1% 12 month prevalence rate within the Australian general population (Australian Bureau of Statistics, 2007; Gould et al., 2011; Whelan-Goodinson et al., 2009). Second, some interventions tailored to particular emotional disorders have demonstrated beneficial treatment effects for other comorbid disorders (e.g., Ashman et al. 2009; Hodgson, McDonald, Tate, & Gertler, 2005), suggesting that interventions specific to a disorder can more broadly impact on

mechanisms underlying emotional distress. Despite this, in a review of cognitive behavioural therapy for people with brain injuries of different aetiology, Waldron, Casserly and O'Sullivan (2013) suggested that interventions targeting a particular aspect of emotional adjustment (e.g., anger or coping) were usually effective for that particular outcome, but typically did not generalise to other emotional outcomes (e.g., depression or anxiety). However, due to lack of available research, their review did not include intervention studies that have adopted a transdiagnostic approach to treating emotional disorders after TBI, as informed by research investigating factors common to depression and anxiety. Third, in relation to this point, there is some initial empirical support for common psychological factors underlying depression and anxiety symptoms in the TBI population, which will now be reviewed.

Application of the Transdiagnostic Approach to Emotional Distress after TBI

Harvey, Watkins, Mansell and Shafran (2004) identified several transdiagnostic processes, including; selective attention (to both external and internal stimuli), interpretation biases, repetitive negative thinking and avoidance behaviours. Guided by these findings, variables for the current study were selected on the basis of their established role as transdiagnostic variables within the general clinical population and/or evidence of their relationship to emotional distress after TBI. Six psychological variables considered most relevant to emotional distress after TBI were as follows: threat appraisals, avoidance, self-discrepancy, difficulties with emotion regulation, repetitive negative thinking and negative self-focused attention. The rationale for the selection of each variable will now be presented.

Two main theoretical perspectives drawn upon to account for emotional distress after TBI include Lazarus and colleagues' Stress Appraisal and Coping theory (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986; Lazarus, 1993;

Lazarus & Folkman, 1984) and Goldstein's (1939, 1943) concept of 'catastrophic reaction' (Klonoff, Lage & Chiapello, 1993). The Transactional theory of Stress Appraisal and Coping (Lazarus & Folkman, 1984) contends that emotional distress arises when environmental demands are appraised as harmful or threatening and are perceived to exceed one's personal and social resources. Research in the general clinical population supports the role of cognitive appraisals as mediators between environmental stressors and emotional distress (Endler & Parker, 1989). The Stress Appraisal and Coping model is also highly relevant for people with TBI, as post-injury impairments may compromise their ability to achieve personal goals and draw upon personal and social resources to cope with stress (Ownsworth, 2014). In line with this model, research supports that threat appraisals regarding everyday situations are common after TBI and are related to anxiety and global distress (Kendall & Terry, 2009; Riley, Brennan & Powell, 2004).

Goldstein (1939, 1943) introduced the term "catastrophic reaction", to refer to extreme anxiety triggered by the experience of task difficulty or failure during activities that were easily managed prior to TBI. Difficulties on everyday tasks can pose a threat to one's sense of self. In effort to reduce anxiety about one's performance these situations may be avoided (Goldstein, 1943; Riley et al., 2004) However, avoidant coping contributes to self-limiting beliefs that restrict people from experiencing a sense of mastery and pleasure from activities (Ownsworth, 2014). Accordingly, avoidant coping has been found to be associated with emotional distress following TBI (Harvey & Bryant, 1998; Malia, Powell & Torode, 1995; Wood & Doughty, 2013). Research within the general clinical population also cites avoidance as a key factor associated with both depression and anxiety (e.g., Barlow et al., 2004; Harvey et al., 2004; Mansell et al., 2009).

TBI can alter personal attributes and abilities that are closely tied to one's sense of self (Cantor et al., 2005; Gracey, Evans & Malley, 2009; Moldover, Goldberg & Prout, 2004). Many researchers have examined the impact of TBI on self-concept (e.g., Cantor et al., 2005; Carroll & Coetzer, 2011; Tyerman & Humphrey, 1984). For example, negative self-discrepancies or unfavourable comparisons between one's past and current self have been found to be related to higher levels of depression, anxiety, grief and global distress (Cantor et al., 2005; Carroll & Coetzer, 2011; Wright & Telford, 1996). These findings support that self-discrepancy or change in self-concept is an important transdiagnostic factor to investigate in relation to emotional distress after TBI.

Difficulties with emotion regulation are a well established transdiagnostic factor proposed to underlie depression and anxiety within the general clinical population (Aldao & Nolen-Hoeksema, 2010; Barlow et al., 2004; Lévesque et al., 2003; Trosper, Buzzella, Bennett & Ehrenreich, 2009). Emotion regulation broadly refers to the cognitive and behavioural processes employed in response to environmental demands to modify or regulate one's emotional experience (Campbell-Sills & Barlow, 2007; Gross, 1998). The development and maintenance of anxiety and depressive disorders has been attributed to poor awareness of one's emotions and maladaptive attempts to regulate negative emotions (Campbell-Sills & Barlow, 2007).

Problems with emotion regulation are considered core sequelae of TBI (Kersel, Marsh, Havill & Sleigh, 2001; Seel et al., 2003; Tateno, Jorge & Robinson, 2003). Difficulties with emotion regulation may arise from neurological damage and acquired cognitive deficits. For example, impairments in executive function such as response inhibition and rule breaking have been found to be related to a loss of emotional control and acting impulsively when feeling distress (Rochat, Ammann, Mayer, Annoni &

Linden, 2009; Tate, 1999). Notably, Cattran, Oddy and Wood (2011) found that self- and relative-rated emotional regulation difficulties were significantly related to depression and anxiety in a mixed brain injury sample. Further research focusing specifically on people with TBI is warranted.

Repetitive negative thinking, or frequent and persistent negative thoughts about personal concerns is considered a central feature of depression and anxiety within the general population (de Jong-Meyer, Beck & Riede, 2009; Dozois et al., 2009; Ehring & Watkins, 2008). Two main types of repetitive negative thinking include rumination and worry. These thought processes have been found to be significantly inter-related (de Jong-Meyer et al., 2009); however, rumination is more commonly associated with depression and worry is considered non-specific to depression and anxiety (Beck, Benedict, & Winkler, 2003). Further, although both types of negative repetitive thinking are common following TBI (Kreutzer, Seel & Gourley, 2001; Seel et al., 2003), the tendency to worry has more consistently been found to be related to both depressive and anxiety symptoms after TBI (Anson & Ponsford, 2006; Curran, Ponsford, & Crowe, 2000).

Selective attention refers to attention focused internally or on the external environment (Mansell et al., 2008). Self-focused attention refers to a bias towards attending to internal information (Harvey et al., 2004; Mansell et al., 2008). When self-focused attention leads to an evaluation process in which the current self is compared unfavourably to an ideal standard, negative affect typically arises (Duval & Wicklund, 1972). A number of sub-types of self-focus have been identified within the literature, including positive versus negative self-focus, and trait versus state self-focus. The Self-Focus Sentence Completion task is a commonly used measure of self-focused responding within the general and clinical population (e.g., Green, Sedikides, Saltzberg,

Wood, & Forzano, 2003; Woodruff-Borden, Brothers, & Lister, 2001), and was originally developed to assess egocentricity (Exner Jr, 1973). A meta-analysis by Mor and Winquist (2002) found that negative self-focused attention was consistently associated with both depression and anxiety in the general clinical population. Other researchers make a distinction between public and private self-focus; wherein private self-focus refers to egocentric goals and public self-focus is associated with self-consciousness (Carver & Scheier, 1987).

Seemingly in support of this notion, post-TBI personality change has been associated with an increase in self-focus, difficulty in taking the perspective of others, and egocentric interpersonal styles (Fleminger, 2008; McDonald, 2003; Santoro & Spiers, 1994). Within the TBI population a tendency for attention to be self-focused may be biologically or psychologically mediated (or potentially a combination of the two). Despite a lack of previous research on negative self-focused attention after TBI, it was considered a potential transdiagnostic variable related to emotional distress.

In summary, there is some initial support for a transdiagnostic framework of emotional distress after brain injury based on a synthesis of findings across studies (e.g., Anson & Ponsford, 2006; Cantor et al., 2005; Carroll & Coetzer, 2011; Cattran et al., 2011; Curran et al., 2000; Wood & Doughty, 2013). However, few studies have adopted a transdiagnostic approach and specifically examined variables associated with depression and anxiety symptoms post-TBI. Therefore, the main aim of this study was to investigate factors common to depression, anxiety and global distress in a post-acute TBI sample. It was hypothesised that higher levels of depression, anxiety and global distress would be significantly associated with greater threat appraisals, avoidance, negative self-discrepancies, difficulties with emotion regulation, repetitive negative thinking (i.e., worry), and negative self-focused attention. The relative importance of

these transdiagnostic variables to emotional distress was investigated as an exploratory component.

Method

Participants

Participants were recruited as part of a broader study investigating biopsychosocial transdiagnostic factors influencing emotional adjustment post-TBI. Participants were invited to participate from a pool of 142 individuals with TBI involved in a prospective longitudinal study of hospital transition outcomes (Nalder, Fleming, Foster, et al., 2012; Nalder, Fleming, Cornwell, et al., 2012). These individuals were recruited over a three year period (2008-2010) from a brain injury rehabilitation unit (BIRU) and acute neurosciences ward at a major metropolitan hospital in Brisbane, Australia. Inclusion criteria for the earlier project included: 1) medical diagnosis of TBI, 2) aged 18 to 65 years, 3) hospitalised for at least four days, 4) discharged to a home/community setting rather than another hospital or residential care facility, 5) displayed the cognitive capacity to provide informed consent, and 6) had sufficient communication skills to participate in an interview. Participants were eligible for the current study if: 1) their injury occurred at least 12 months prior, 2) they lived within a four hour drive of the metropolitan area to enable face-to-face assessment, and 3) they had the capacity to undertake psychological assessment (i.e., absence of very severe language, cognitive and/or behavioural disturbance).

Of the 142 participants with TBI, 50 agreed to participate in the current study. In terms of the 92 who did not participate; 42 were not contactable at their most recent address, 14 lived outside the geographical area, five were ineligible due to a history of severe behavioural disturbance, and 31 were eligible but declined to participate.

Participants in the current sample were significantly older ($p < .01$), were more likely to

be male ($p = .03$), and sustained significantly more severe injuries ($p < .001$) than the group of TBI individuals who did not take part in the study ($n = 92$). The groups did not differ in length of hospital stay, cause of TBI, or levels of depression and anxiety at discharge and six months post-discharge ($p > .05$). As shown in Table 1, participants in the current sample were typically male (72%), aged 19-66 years ($M = 42.3$, $SD = 13.7$), and sustained a severe TBI between 12 and 65 months prior to the study.

Insert Table 1 about here

Table 2 presents the neuropsychological profile of the TBI sample. As shown, participants' performance was highly variable. However, overall, the sample performed more poorly on a measure of global cognitive status than age-matched norms. In particular, on average, the TBI sample performed more than one standard deviation below the normative data for the total score on the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS: Randolphs, 1998), and on subscales measuring immediate memory and attention. In addition, the group generally performed more poorly than age-matched norms on tasks assessing verbal fluency (Controlled Oral Word Association Test [FAS: Benton & Hamsher, 1976]), divided attention, and alternating sequencing (Trail Making Test [TMT: Army Individual Test Battery, 1944]). However, on average, the performance of the TBI sample was within the "normal" range (i.e., within one standard deviation of the mean) for these tests of executive function. Errors on Trails B ranged from 0 to 5, with 30 (58%) individuals making no errors on the task.

Insert Table 2 about here.

Measures

Transdiagnostic Variables

The Appraisal of Threat and Avoidance Questionnaire (ATAQ: Riley et al., 2004) was specifically developed for the TBI population. It includes 36 appraisals across three categories; 1) Dealing with people (e.g., “Sometimes when I’m with people, I feel like I don’t fit in”), 2) Doing things (e.g., “I sometimes get upset or frustrated if I do things wrong”), and 3) Personal safety (e.g., “Sometimes I feel home is the only place where I am safe”). The ATAQ has demonstrated good internal consistency for each category and the total score ($\alpha = .73-.94$) (Riley et al., 2004). Participants are required to respond ‘yes’ or ‘no’ according to whether the statement applied to them during the previous month. If the participant responds ‘yes’, they are asked whether they avoided meeting people/going out/doing things (as appropriate) as a result of their appraisal (recorded as ‘yes’ or ‘no’ for each item). Affirmative answers are scored ‘1’ and negative answers are ‘0’, with higher overall scores indicating greater threat appraisals and avoidance.

The Head Injury Semantic Differential Scale (HISD) was originally developed by Tyerman and Humphrey (1984) to measure changes in self-concept following brain injury. The scale includes 18 adjective antonym pairs rated along a 7-point Likert scale (e.g., from “Greatly Bored” = 1 to “Greatly Interested” = 7 [HISD-III: Tyerman, 1997]). Scores range from 18 to 126, with higher scores indicating a more positive self-concept. Generally, the participant is asked to complete the scale three times; relating to their present (last two weeks), past (6 months prior to injury) and future selves (expectations for one year into the future). However, only ratings for present and past self were used in this study. A self-discrepancy score (i.e., present self – past) was calculated, wherein a negative score is indicative of a more positively viewed past- and more negatively viewed present self. The HISD-III has shown excellent internal consistency for past ($\alpha =$

.93) and present ($\alpha = .92$) self ratings and evidence of convergent validity (Carroll & Coetzer, 2011).

The Difficulties in Emotion Regulation Scale (DERS: Gratz & Roemer, 2004) is a 36 item questionnaire that assesses six factors pertaining to emotion regulation; 1) non-acceptance of emotional responses, 2) difficulties engaging in goal-directed behaviour when upset, 3) difficulties with impulse control, 4) lack of emotional awareness, 5) limited access to emotion regulation strategies, and 6) lack of emotional clarity. Participants indicate how often each statement (e.g., “When I’m upset, I feel out of control” and “When I’m upset, I believe that there is nothing I can do to make myself feel better”) applies to them currently along a 5-point Likert scale (“Almost never”: 0 - 10% = 1; to “Almost always”: 91 - 100% = 5). Higher scores indicate greater difficulties with emotion regulation. Although the DERS has demonstrated good internal consistency in an undergraduate student sample ($\alpha > .80$; Gratz & Roemer, 2004), it has not previously been used in TBI research. Internal consistency and test-retest reliability of the DERS was examined for the present sample.

The Penn State Worry Questionnaire (PSWQ: Meyer, Miller, Metzger & Borkovec, 1990) was used to assess negative repetitive thinking characterised by worry. The scale includes 16 items scored along a 5-point Likert scale (“Not at all typical of me” = 1 to “Very typical of me” = 5) with 5 items reversed scored. Items include statements such as: “My worries overwhelm me”, and “I find it easy to dismiss worrisome thoughts”. Scores range from 16 to 80, with higher scores indicating greater worry. Although, the PSWQ is not commonly used in TBI research (see Valera & Berenbaum, 2003) it has demonstrated good psychometric properties within the general population ($\alpha > .91$, test-retest; $r > .74$: Meyer et al., 1990).

The Self-Focus Sentence Completion (SFSC: Exner Jr, 1973) is a standardised projective measure of SFA, requiring participants to complete 30 self-referential sentence stems (e.g., including 'I', 'me', or 'my'). Each item is coded into one of six mutually exclusive categories, based upon the attentional focus of the response; 1) self-focus (e.g., I wish: "I was well again"); 2) self-focus: negative (e.g., I wish: "I was a better person"); 3) external world (e.g., I wish: "my parents would be flexible"); 4) external world: affective (e.g., I wish: "my mother would grow up"); 5) ambivalent (i.e., a response that contains both self and external world focus, e.g., I wish: "my father would visit and forgive me"); or 6) neutral (e.g., I wish: "this test was done": Exner Jr, 1973, p. 442). The SFSC has been used extensively in research regarding depression and anxiety among clinical and non-clinical samples (e.g., Green, Sedikides, Saltzberg, Wood, & Forzano, 2003; Woodruff-Borden, Brothers, & Lister, 2001). Although each category was coded, the category of interest for the current study was negative self-focused attention (i.e., statements that are clearly negative regarding the self, as defined by Exner Jr [1973]). The Appendix provides example responses of TBI participants that were coded as negative self-focused attention. Given the novel application of the SFSC to the TBI population, inter-rater reliability of scoring was examined within the current study.

Emotional Distress

Participants completed two measures of emotional distress, namely, the Depression Anxiety and Stress Scales 21 (DASS 21: Lovibond & Lovibond, 1995) and Brief Symptom Inventory 18 (BSI 18: Derogatis, 2001). The DASS 21 is a measure of negative emotional states based upon the original 42 item version (Lovibond & Lovibond). The DASS 21 includes three 7-item subscales; depression, anxiety, and stress. Participants rate the extent to which each item has applied to them over the past

week on a 4-point Likert scale (ranging from 0 = “Did not apply to me at all” to 3 = “Applied to me very much, or most of the time”). Item scores for each subscale are summed and multiplied by two to create a total subscale score. Higher scores indicate greater severity of emotional distress. Although the DASS 21 is commonly used in TBI research (e.g., Bradbury et al., 2008; Meares et al., 2006), only the depression subscale was used in analysis for the present study because it has better psychometric properties than the anxiety and stress scales (Dahm, Wong, & Ponsford, 2013; Ownsworth, Little, Turner, Hawkes & Shum, 2008). Example items include: “I couldn’t seem to experience any positive feeling at all”, and “I felt that life was meaningless”.

The BSI 18 was derived from the Symptom Checklist-90 (Derogatis, 1975) and includes three 6-item subscales; somatisation, anxiety, and depression. Each question requires participants to rate their level of distress over the past week. Scores are rated along a 5-point Likert scale (0 = “not at all” to 4 = “extremely often”), with higher scores indicating greater distress. Although *T* scores can be calculated for the BSI 18, these were developed for general community or cancer populations (Derogatis, 2001). Consistent with previous TBI research (Meachen, Hanks, Millis, & Rapport, 2008), continuous raw scores were used within the analyses, and *T* scores were used to identify the proportion of participants in the clinical range (Carlson et al., 2004). Subscale scores were combined to calculate an overall Global Severity Index (GSI) as a measure of general affective distress within the current study. The BSI 18 was used to measure anxiety because the items contain fewer musculoskeletal symptoms than the DASS which can confound measurement due to overlap with TBI sequelae. For example, anxiety items include questions regarding “nervousness or shakiness inside”, “suddenly scared for no reason”, and “feeling fearful”. The BSI 18 has good internal consistency for the anxiety subscale ($\alpha = .83$) and GSI ($\alpha = .91$: Meachen et al., 2008) in TBI

research, and was recommended as a core measure of psychological status for the TBI population (Wilde et al., 2010).

Procedure

Ethical clearance was granted by both hospital and university human research ethics committees. Demographic and injury-related data were collected via medical reports and self-report respectively. Potential participants were identified by the research assistants from the earlier project, and were invited to take part in the study by mail. After participants provided informed consent, data were collected over two sessions (Median interval = 14 days). Session one included psychological and neuropsychological tests administered at the person's home or workplace. The neuropsychological tests were administered as part of a broader project investigating biopsychosocial transdiagnostic factors; the results for which are not reported within the current study. Session two included a set of questionnaires that were completed either over the telephone or face-to-face at the individuals' home. Self-report questionnaires were completed independently or read aloud by the researcher, dependent upon the participant's preference.

Data Analysis

As the current study was exploratory, correlations were employed as the main approach to statistical analysis. An a priori power calculation was conducted using G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009). Previous research investigating associations between similar psychological variables and emotional distress (e.g., Anson & Ponsford, 2006; Cattran et al., 2011) indicated medium to large effect sizes (i.e., $r = .30-.50$). Based on an expected medium to large effect size ($r = .4$), the power calculation indicated that a minimum sample of 44 participants was required to achieve power of .80 for two-tailed correlation analyses. In addition, a minimum participant to

variable ratio of 10:1 was adopted for the regression analyses (Ownsworth & McKenna, 2004). Alpha was set at $p < .05$ as the risk of Type II error was considered as important to minimise as Type I; however, due to the large number of variables examined the effect sizes were also taken into consideration in the interpretation of results.

Prior to the analyses, all variables were examined for accuracy of data entry, missing values, and assumptions of inferential statistics (Tabachnick & Fidell, 2007). A Missing Values Analyses identified missing data for one case on the SFSC (2%), for three cases (6.0%) on the FAS and injury severity, and for two cases on premorbid mental health history (4.0%). These missing data occurred at random, Little's Missing Completely At Random test, $\chi^2(67) = 0.00, p = 1.0$. Missing data were imputed using the Multiple Imputation method with five imputations as recommended by Rubin (1996; see also Sinharay, Stern & Russell, 2001), with results reported using pooled data when supported by the software. Alternatively, a single imputed data set was applied. Descriptive analyses and Cronbach's alpha were calculated for all measures. A test-retest reliability analysis of the DERS and interrater reliability analysis of the SFSC was also conducted.

Pearson product-moment correlations were used to examine associations between the proposed transdiagnostic variables and measures of emotional distress. Consistent with the approach of Rutterford and Wood (2006), a principal components analysis was conducted as a data reduction technique and to examine the underlying factor structure of the transdiagnostic variables. Standardised Z scores were created for each measure and used within the principal component analysis. Hierarchical regression analyses were conducted to investigate the relative importance of the transdiagnostic factors in accounting for levels of emotional distress whilst controlling for relevant covariates.

Results

Descriptive Statistics

Table 3 presents the descriptive statistics and reliability coefficients for all variables. All measures demonstrated adequate to excellent internal consistency across all subscales and total scores (Robinson, Shaver & Wrightsman, 1991). Of the 50 participants who completed the DERS at the initial assessment, 31 (62%) completed the DERS on a second occasion, with an interval of 7-21 days ($M = 12.77$, $SD = 4.42$) after the initial administration. There was no difference ($p > .05$) between individuals who were re-administered the DERS and those who were not on levels of depression (DASS 21), anxiety and global distress (BSI 18), and initial DERS scores. Test-retest reliability was adequate for the DERS total ($r_{xx} = .84$, $p < .001$) and four subscales: Strategies, Goals, Impulse, and Non-Acceptance (all $r_{xx} \geq .77$, $p < .001$). However, reliability for the Clarity ($r_{xx} = .67$) and Awareness ($r_{xx} = .55$) subscales was lower than the typically accepted range (Tate, 2010). In regards to the SFSC, there was moderate to substantial inter-rater agreement, Kappa = .61 ($p < .001$) (Landis & Koch, 1977).

Insert Table 3 about here

Level of depressive symptoms on the DASS 21 was in the clinical range (i.e., “mild” to “very severe”; Lovibond & Lovibond, 1995) for 38% of the sample. Using the recommended cut-off of $T \geq 63$ on the BSI (Derogatis, 2001), 10% of the sample were in the clinical range for anxiety and global distress. On the ATAQ, 45 (90%) individuals reported threat appraisals about “Doing Things”, with 20 (44%) of these reporting associated avoidance behaviours. Forty-two (84%) participants reported threat appraisals regarding “Dealing with People”, and 24 (57%) reported associated avoidance behaviours. In relation to Personal Safety, 31 (62%) individuals reported threat appraisals, with 18 (58%) reporting avoidance behaviours. Overall, 47 (94%)

individuals reported at least one threat appraisal, with 30 (64%) of these individuals reporting at least one related avoidance behaviour. Only the total scores (i.e., threat appraisals and avoidance) were used in the analyses. On the HISD III participants typically viewed their present self as more negative than their pre-injury self. Overall, 33 (66%) individuals reported a decrease in their self-concept ($M_{\text{change}} = -23.00$, $SD = 11.08$). In contrast, 17 (34%) individuals viewed their current self as more positive compared to their pre-injury self ($M_{\text{change}} = 15.41$, $SD = 16.34$). The overall DERS was lower, but comparable to a community sample of adult males ($n = 97$, $M = 80.66$, $SD = 18.79$). In regards to the subscales, the TBI sample reported greater difficulties with non-acceptance, but reported fewer difficulties on the goals, awareness and strategies subscales (Gratz & Roemer, 2004). On the PSWQ, the TBI sample reported a comparable level of worry to a community sample ($n = 244$; $M = 42.2$, $SD = 11.5$, range = 18 - 76) (Gillis, Haaga, & Ford, 1995). Scores on the SFSC indicated highly elevated negative self-focus scores (i.e., more than 3 standard deviations above the mean) in comparison with community norms (Exner Jr, 1973). The Appendix provides illustrative examples of negative self-focus statements provided by the TBI participants.

Associations between Transdiagnostic Variables and Emotional Distress

An initial investigation of potential covariates identified a significant correlation between older age and depressive symptoms ($r = .29$, $p < .05$). Further, individuals residing within the metropolitan area reported significantly more depressive symptoms than individuals living outside the metropolitan area ($r = .33$, $p < .05$). Shorter duration of time since injury was significantly associated with greater anxiety ($r = -.31$, $p < .05$) and global distress ($r = -.34$, $p < .05$). There were no other significant associations between demographic and injury characteristics and emotional distress ($p > .05$). Table 4

presents the correlations between transdiagnostic variables and measures of emotional distress.

Insert Table 4 about here

As shown in Table 4, higher levels of depression, anxiety and global distress were significantly related to greater overall difficulties with emotion regulation (total DERS, $p < .001$) and increased difficulties with accepting emotional responses, engaging in goal-directed behaviour when upset, controlling impulses and accessing emotion regulation strategies, and lack of emotional clarity ($p < .05$, medium to large effect sizes). Lack of emotional awareness on the DERS was not significantly related to any measure of emotional distress ($p > .05$). Higher levels of emotional distress on all three measures was also related to increased threat appraisals and avoidance on the ATAQ ($p < .05$), with medium effect sizes. In regards to the HISD III, poorer past self-concept was related to greater anxiety and global distress ($p < .05$, medium effect size). Further, a poorer perception of current self was related to greater emotional distress on all three measures ($p < .01$, medium to large effect sizes). However, there were no significant associations between self-discrepancy and emotional distress. On the PSWQ greater worry was significantly related to increased levels of depression, anxiety and global distress ($p < .05$), representing medium effect sizes. Finally, a higher level of negative self-focused attention was significantly associated with increased anxiety and global distress ($p < .05$, medium effect sizes), but not depression ($p > .05$).

Factors Underlying the Transdiagnostic Variables

As shown in Figure 1, most transdiagnostic variables were significantly inter-related with moderate to large coefficients. As one exception, the association between negative self-focused attention and self-discrepancy was not significant ($r = -.19$, $p > .05$). Due to this finding, the association between present self-concept and negative

self-focused attention was also investigated. Results revealed a significant negative association ($r = -.42, p = .002$) between these variables.

Insert Figure 1 about here

Ten items derived from the transdiagnostic variables were entered into the principal components analysis, based on a recommended minimum of five participants per item (Hair Jr, Black, Babin, Anderson & Tatham, 2006). These items included standardised Z scores for the following: ATAQ threat appraisals and avoidance, HISD-III present self-concept and self-discrepancy, the four subscales of the DERS (non-acceptance, goals, impulse, and strategies) with both adequate internal consistency ($\alpha > .70$) and test-retest reliability ($r_{xx} > .70$), PSWQ total negative repetitive thinking, and SFSC negative self-focus. Bartlett's (1954) test of sphericity was significant ($p < .001$), and the Kaiser Meyer Olkin measure of sampling adequacy was good (.82) (Kaiser, 1974), indicating a principal components analysis was appropriate. To allow for the dimensions of the psychological variables to be correlated an oblique rotation was performed. Eigenvalues ≥ 1 was adopted as the criterion for factor extraction (Hair Jr, Anderson, Tatham & Black, 1998). Initial inspection of communalities revealed that only 32.8% of the variance in negative self-focused attention was extracted within the final solution. As Hair Jr, et al. (2006) recommended a minimum communality of $h^2 = 0.5$, the analysis was re-run excluding this variable, which was entered separately in later analyses.

The subsequent principal components analysis yielded a two factor solution which accounted for 68.90% of the variance. Table 5 presents the items, obliquely rotated salient factor loadings (≥ 0.40), and communalities (h^2) for the solution. Factor one was labelled Threats to Self and accounted for 55.28% of the variance. Factor two

was labelled Emotion Dysregulation and accounted for 13.62% of the variance. The factor scores were used in subsequent analyses.

Insert Table 5 about here

Associations between Transdiagnostic Factors and Emotional Distress

Table 6 presents the bivariate correlations between the psychological factors (Threats to Self and Emotion Dysregulation), negative self-focused attention, and measures of emotional distress. Significant large positive correlations were evident between emotion dysregulation and emotional distress across all three outcome measures ($p < .001$). There were also medium significant positive correlations between Threats to Self and all three measures of emotional distress ($p < .05$). As previously outlined, negative self-focused attention was significantly correlated with levels of anxiety and global distress ($p < .05$) representing medium effect sizes. There was no correlation between negative self-focused attention and depression ($p > .05$).

Insert Table 6 about here

Depression

The regression analysis for level of depression controlled for age and metropolitan area. In step 1, 26.4% of the variance was accounted for by these variables, $F_{chg}(2, 46) = 8.25, p = .001$. Threats to Self and Emotion Dysregulation accounted for an additional 33.1% of the variance in depression symptoms, $F_{chg}(2, 44) = 17.94, p < .001$. Emotion Dysregulation independently accounted for a significant 16% of the variance in depression $\beta = .45, p < .001$. Threats to Self independently accounted for a significant 6% of the variance in depression $\beta = .29, p = .01$.

Insert Table 7 about here

Anxiety

Factors related to level of anxiety were examined in a regression analysis controlling for time since injury. As shown in Table 8, time since injury accounted for 9.2% of the variance in step 1, $F_{chg}(1, 48) = 4.84, p = .033$. In step 2, Threats to Self, Emotion Dysregulation, and negative self-focused attention accounted for an additional, significant 39.0% of the variance in anxiety symptoms, $F_{chg}(3, 45) = 11.29, p < .001$. Only Emotion Dysregulation accounted for a significant proportion of unique variance (17.1%) in anxiety symptoms, $\beta = .51, p < .001$. There was no significant independent association between Threats to Self or negative self-focused attention and anxiety.

Insert Table 8 about here

Global Distress

For global distress, one participant was identified as an influential point of leverage and was excluded from the regression analysis. As shown in Table 9, in step 1, 12.7% of the variance in global distress was accounted for by time since injury, $F_{chg}(1, 47) = 6.86, p = .01$. In step 2, Threats to Self, Emotion Dysregulation and negative self-focused attention accounted for an additional, significant 42.9% of the variance in global distress, $F_{chg}(3, 44) = 14.19, p < .001$. Emotion Dysregulation accounted for significant unique variance (11.8%) in global distress, $\beta = .42, p = .001$. Further, Threats to Self independently accounted for significant variance (7.4%) in global distress, $\beta = .31, p = .009$. There was no significant independent association between negative self-focused attention and global distress.

Insert Table 9 about here

In summary, Emotion Dysregulation was significantly and uniquely related to levels of depression, anxiety and global distress. Threats to Self was significantly and uniquely related to levels of depression and global distress, but not anxiety.

Discussion

This study aimed to identify psychological factors common to depression, anxiety and global distress following TBI. An investigation of the proposed transdiagnostic variables revealed two underlying factors, namely, threats to self and emotion dysregulation. Individuals reporting greater threats to self experienced more negative self-discrepancy (pre-injury vs. present), poorer current self-concept and increased threat appraisals, avoidance behaviours, and negative repetitive thinking (see Figure 1). Those reporting higher levels of emotion dysregulation had difficulty accepting their emotions, limited access to emotional regulation strategies and difficulties with impulse control and engaging in goal-directed behaviour when upset (See Table 5). Overall, the study provided some support for the transdiagnostic framework, with the emotion dysregulation factor found to be independently related to levels of depression, anxiety and global distress. The threats to self factor was independently related to depression and global distress, but not anxiety.

In support of the hypothesis, most of the DERS subscales and the emotion dysregulation factor were significantly related to all indices of emotional distress. However, the DERS Awareness subscale was not significantly associated with the measures of emotional distress. It is noteworthy that this subscale demonstrated low test-retest reliability ($r_{xx} = .55$), suggesting that people's responses were not stable across the two administrations of the DERS. Items from the Awareness subscale assess people's capacity to reflect upon and attend to their emotional experience (e.g., "When I'm upset, I take time to figure out what I'm really feeling"). Similarly, the low test-retest reliability ($r_{xx} = .67$), for the Clarity subscale (e.g., "I am clear about my feelings") suggests that people with TBI may have difficulty reporting on the clarity of their emotions. The validity of self-reports of emotional awareness may be compromised by

cognitive deficits common after TBI, such as impaired self-awareness and social cognition (McDonald et al., 2014; Ownsworth, 2014). Nonetheless, the reliability analysis and significant positive associations with emotional distress indicated that the DERS provide meaningful information regarding people's ability to accept their emotional responses, access emotion regulation strategies, engage in goal-directed behaviour and control impulses when upset. Further, the emotion dysregulation factor significantly accounted for variance in levels of depression, anxiety and global distress.

Inspection of the item content of the four DERS subscales that loaded on the emotion dysregulation factor indicated that these predominantly measure peoples' beliefs regarding their ability regulate their emotions and behaviours (e.g., Goals: "When I'm upset, I have difficulty getting work done"; Impulse: "When I'm upset, I have difficulty controlling my behaviours"; and Strategies: "When I'm upset, I believe that there is nothing I can do to make myself feel better"). Therefore, emotion dysregulation as measured in the present study may reflect self-efficacy regarding the ability to manage one's emotions and behaviours when feeling upset. TBI has been found to contribute to the development of self-limiting beliefs regarding the ability to exert control over situations in one's life (Moore & Stambrook, 1995; Ownsworth, 2014). Consistent with this view, Cicerone and Azulay (2007) found that self-efficacy regarding the ability to manage post-injury impairments was significantly associated with life satisfaction after TBI. However, these researchers did not assess emotional distress. Further, Wood and Rutterford (2006) found that poorer global self-efficacy was significantly related to greater depression and lower life satisfaction for individuals with long-term (10-31 years) TBI. Therefore, people's beliefs regarding their ability to manage negative emotions appear to be closely related to their emotional distress.

According to neuroimaging research, various cortical and subcortical regions are involved in emotion regulation processes (see meta-analysis by Kohn, Eickhoff, Scheller, Laird, Fox & Habel, 2014). Cognitive neuroscience theories propose that our emotional response to internal and external events is mediated by physiological and cognitive appraisal processes (see Gross & Thompson, 2007; Lieberman, 2007). Emotion regulation skills such as impulse control and cognitive reappraisal are commonly impaired after TBI (Rochat et al., 2009; Salas, Gross, Rafal, Viñas-Guasch, & Turnbull, 2013; Tate, 1999). Deficits in higher order cognitive functions (e.g., response inhibition, cognitive flexibility and error self-regulation) after TBI are likely to compromise the ability to control impulses when upset and to reappraise emotional events. Given that emotion dysregulation emerged as a transdiagnostic factor related to emotional distress, it is a priority for future research to examine cognitive impairments underlying emotion dysregulation and determine whether such deficits predispose people to developing depression and anxiety post-TBI.

Threats to self emerged as second key factor underlying the proposed transdiagnostic variables. Although related to emotion dysregulation, threats to self made a unique contribution in accounting for levels of depression and global distress, but not anxiety. The threats to self factor incorporated global perceptions of emotional and behavioural attributes (HISD III present self), discrepancies between past and present self on these attributes, appraisals of threat regarding everyday situations and related avoidance behaviours and negative repetitive thinking. In parallel with previous research, a more positive view of self (i.e., self-concept) was related to lower levels of emotional distress (Cooper-Evans et al., 2008; Vickery, Gontkovsky & Caroselli, 2005). In contrast to other studies (Carroll & Coetzer, 2011; Tyerman & Humphrey, 1984; Wright & Telford, 1996), self-discrepancy (i.e., differences between present- and past

self-concept) was not significantly related to emotional distress. Interestingly, within the current study, poorer past (pre-injury) self-concept was associated with increased anxiety and global distress. This finding is unlikely to arise from the influence of pre-injury history of psychological problems, as this variable was not significantly related to current emotional distress. The tendency for people experiencing greater emotional distress to view both their past and present self in a negative light could account for the non-significant association between self-discrepancy and emotional distress. These novel findings raise the question of what retrospective ratings of premorbid self actually reflect in terms of motivated constructions of one's past self (Ownsworth, 2014). Both overly positive and overly negative retrospective views of premorbid self can influence the degree of self-discrepancy reported and hence associations with emotional distress. It was noteworthy that 34% of participants reported positive changes in their self-concept since the TBI. It would be beneficial for future research to investigate factors that facilitate improved self-concept following TBI, such as coping style and social support (McGrath & Linley, 2006; Silva, Ownsworth, Shields, & Fleming, 2011). However, as highlighted by the present findings, it is important to consider factors influencing retrospective ratings of self-concept when interpreting changes in self-concept.

The significant associations between threat appraisals and avoidance and emotional distress are in accord with previous findings within the general clinical (Folkman et al., 1986; Harvey et al., 2004; Lazarus, 1993; Mansell et al., 2009), and TBI literature (Goldstein, 1943; Kortte, Wegener & Chwalisz, 2003; Malia et al., 1995). The findings also support the utility of the ATAQ for assessing unhelpful appraisals and coping behaviours that contribute to emotional distress after TBI. In addition to these processes, worry loaded onto the threats to self factor and was related to each measure

of emotional distress. This supports the view that worry is common to different aspects of emotional distress, rather than being unique to anxiety (see also Anson & Ponsford, 2006; Curran et al., 2000).

Consistent with Clark and Watson's (1991) tripartite model, which proposes that depression and anxiety possess both unique and shared component processes, the threats to self factor was more closely related to depression and global distress than anxiety. This may in part be due to statistical reasons whereby emotion dysregulation accounted for most of the variance within each model and was significantly associated with the threats to self factor ($r = .43$), wherein 18.5% of the variance was shared. However, an alternative explanation relates to conceptual differences between these factors and how emotional distress was assessed. In particular, the threats to self factor may represent a similar construct to Gracey and colleagues' (2008) "Experience of self in the world" theme, wherein sense of self is based on the meaning derived from social and activity contexts. Negative self-appraisals regarding personal abilities or performance (e.g., poorer self-concept, greater worry, sense of threat) are likely to contribute to maladaptive self-schemas, such as a sense of worthlessness or meaninglessness. Similar self-related cognitions are assessed by depression items of the DASS 21 (e.g., "I felt that I had nothing to look forward to"), and global distress items on the BSI 18 ("Feelings of worthlessness"), but not the BSI 18 anxiety subscale.

As a further novel finding of the current study, negative self-focused attention was significantly related to levels of anxiety and global distress but not depression. This contrasts with Mor and Winquist's (2002) meta-analysis, which reported a significant association between negative self-focused attention and depression. Notably, these researchers made a distinction between public and private self-focus. Private self-focus refers to egocentric goals (Carver & Scheier, 1987), and is more strongly associated

with depression than anxiety (Mor & Winquist, 2002). Consistent with the notion of private self-focus, the SFSC was originally designed as a measure of egocentricity (Exner Jr, 1973). However, it is possible that the SFSC tapped individuals' concerns regarding others' impressions of them, or self-consciousness (i.e., public self-focus) (Carver & Scheier, 1987). In contrast to private self-focus, public self-focus has been found to be more strongly related to anxiety than depression (Mor & Winquist, 2002). As shown in the Appendix , many statements indicate self-consciousness regarding personal appearance and/or concern regarding the impressions of others. As such, it may be beneficial for future research to investigate the impact of both private and public self-focused attention on emotional adjustment following TBI.

Limitations and Future Research Recommendations

The main limitations of this study relate to the sample, design and self-report methodology. Given the recruitment process employed, there may be a sampling bias in terms of participant characteristics. Compared to the broader consecutively recruited TBI sample, the current sample was significantly older and included more males and a higher proportion of people with severe TBI. Notably, the present sample did not differ in levels of emotional distress from the broader sample and rates of pre-morbid psychological distress were comparable to those reported within other TBI studies (Bombardier et al., 2010; Whelan-Goodinson et al., 2009). Nonetheless, caution is needed in generalising the findings to the broader TBI population.

A further key study limitation is that the cross-sectional design does not allow inferences regarding the direction of association between the transdiagnostic factors and emotional distress. It is plausible that many of these relationships are bi-directional or mutually enhancing. For example, threat appraisals may lead to the development of depressive symptoms; however, depressive symptoms may increase threat appraisals.

As such, the role of threats to self and emotion dysregulation in the development and/or maintenance of emotional distress after TBI needs to be investigated longitudinally.

It is also important to acknowledge the potential influence of method variance in the current study due to reliance upon self-report measures. Method variance occurs when the relationship observed between measures is better accounted for by factors specific to the method of measurement rather than the construct of interest (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). Within the current study it is possible that common scale formats (e.g., self-report Likert scales) artificially inflated the covariance between these measures. This may be particularly the case in the present study due to the multiple approaches to statistical analysis used which increases the likelihood of false positives. Hence, when assessing two constructs with the same method, biases which may be common to both constructs (e.g., negativity biases) may exaggerate the association between these variables (Spector, 2006). However, Spector (2006) noted that if common scale format is a major issue within a research design, significant correlations should be observed among all variables assessed using the common method, which was not the case within this study.

In addition, due to the reliance on self-report data from people with TBI, the results may be confounded by cognitive impairment and lack of insight (Ownsworth, 2014). Furthermore, other models of emotion regulation have been used to understand this phenomenon following acquired brain injury (e.g., Salas, Gross & Turnbull, 2014; Falquez, et al., 2014). The model by Gratz and Roemer (2004) used to guide the current study has traditionally been tested using self-report (i.e., the DERS). The present study provides preliminary support concerning the utility of the DERS for assessing emotion regulation after TBI. However, the application of alternative models of emotion regulation (e.g., Gross's process model; Gross & Thompson, 2007; Salas et al., 2013) to

investigate the transdiagnostic influence of emotion dysregulation would be beneficial. In particular, emotion dysregulation could be examined using a combination of approaches such as self- and relative reports (e.g., Cattran et al., 2011), behavioural observation and physiological indicators of people's capacity to regulate their emotions (e.g., Krpan, Stuss & Anderson, 2011; Falquez, et al., 2014). Furthermore, it is important for future research to examine which aspects of neuropsychological functioning are most strongly related to emotion regulation difficulties post-TBI, as well as other key transdiagnostic variables (e.g., threat appraisals and avoidance).

Overall, this research provides preliminary support for a transdiagnostic approach to understanding emotional distress after TBI. In particular, the study highlighted the central role of people's beliefs regarding their ability to influence their emotional and behavioural responses. Guided by these initial findings, prospective longitudinal research could investigate the prognostic significance of early post-injury emotion dysregulation for long-term emotional adjustment. Such research could also seek to determine the influence of premorbid, neuro-cognitive and psychosocial factors on emotion regulation skills after TBI.

Clinical Implications

The current findings indicate that a working model of emotion regulation following TBI may help clinicians to conceptualise factors involved in the development and maintenance of emotional distress following TBI, and subsequently inform intervention approaches. Further empirical support for the role of emotion dysregulation as a transdiagnostic factor in the development of emotional distress after TBI would help to develop such a model to guide psychological interventions focusing on emotion regulation skills as a core treatment component.

There are several psychotherapeutic intervention frameworks wherein the development of adaptive emotion regulation skills represents a key component of treatment, including: the cognitive and behavioural based Unified Protocol for Emotional Disorders (Allen et al., 2008), Dialectical Behaviour Therapy (DBT: Linehan, 1993), Acceptance and Commitment Therapy (ACT: S. C. Hayes, Strosahl, & Wilson, 2012), and Compassion Focused Therapy (CFT: P. Gilbert, 2010). These therapies aim to reduce maladaptive emotion regulation strategies (e.g., unhelpful avoidant coping), and encourage the use of adaptive emotion regulation skills (e.g., reappraisal, self-soothing, and mindfulness). Furthermore, many of these therapies include a strong behavioural component, encouraging the practice of emotion regulation skills, which in turn is likely to influence the individuals' self-efficacy regarding their ability to apply these strategies in everyday contexts.

There is a growing body of evidence supporting the use of these therapy interventions across a broad range of disorders within the general clinical population. For example, mindfulness-based therapy interventions have demonstrated moderate to large effect sizes for reducing depression and anxiety symptoms across a range of psychological disorders and medical conditions ($n = 1,140$: Hedges' g 0.59 to 0.97) (for a meta-analytic review, see Hofmann, Sawyer, Witt, & Oh, 2010).

Clinical research within the brain injury population provides preliminary support for interventions targeting emotion regulation skills. For example, building on a series of pilot studies (Bédard et al., 2003; 2005), Bédard and colleagues' (2014) conducted a randomised controlled trial of a 10-week mindfulness-based group cognitive therapy intervention for people with TBI. Intervention components included meditation, yoga and breathing exercises and training in awareness of feelings and thoughts, acceptance, and staying in the present and daily meditation homework exercises. A significantly

greater reduction in depressive symptoms was found for the treatment group relative to controls at post-intervention. There was also evidence that these gains were maintained at follow-up. No significant improvements in mindfulness were found, and other aspects of emotional well-being (e.g., anxiety) were not assessed.

A case study by Ashworth, Gracey, and Gilbert (2011) provided initial support for the utility of CFT post-TBI, wherein statistically reliable reductions in depression and anxiety, as well as improved self-esteem and reduced internalised anger were reported after 18 sessions of CFT. Further supporting the potential utility of CFT, Shields and Ownsworth (2013) reported clinically significant reductions in depression and anxiety symptoms following 10 sessions of therapy with a 48 year old woman following stroke. Therapy predominantly drew upon the CFT framework, but was also integrated with traditional CBT, cognitive rehabilitation, and other third wave cognitive behavioural strategies (e.g., mindfulness). Taken together, these studies provide preliminary support for interventions targeting emotion regulation skills as a core therapeutic component, following brain injury. However, they also highlight the need for further controlled intervention studies that follow Consort guidelines (Schulz et al., 2010) for high quality trials.

It is noteworthy that the current study provided empirical support for both shared (e.g., emotion dysregulation) and unique (e.g., appraisals/avoidance and negative self-focused attention) factors related to depression, anxiety and global distress. As such, it is likely that interventions that are additionally designed to focus on unique factors related to specific disorders will demonstrate more effective results (Waldron et al., 2013).

Conclusion

Overall, this study provides preliminary support for the utility of a transdiagnostic framework for understanding emotional distress after TBI. Although threats to self and negative self-focused attention were related to different indices of emotional distress, emotion dysregulation demonstrated more robust independent associations with depression, anxiety and global distress. Prospective longitudinal research is needed to clarify the nature of this relationship to help guide the focus of clinical interventions.

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Appendix

*Illustrative Examples of Negative Self-Focus Statements from the Self-Focus Sentence**Completion Task*

TBI Participant	Statement (sentence stem: “response”).
PartNo_2	It’s hardest for me: “to accept myself now”.
PartNo_4	The worst thing about me: “is that my words can bite”.
PartNo_5	When I look in the mirror: “it cracks”.
PartNo_9	I wonder: “what it would be like not to be me”.
PartNo_11	My appearance: “I’m very unattractive, and feel very unhealthy, and I cover up my body”.
PartNo_15	My father: “doesn’t like me”.
PartNo_19	It upsets me when: “I’m left out”.
Partno_23	If only I would: “be more confident at work”.
PartNo_25	The worst thing about me: “is my looks, that’s just the first thing that comes to mind”.
PartNo_30	I always wanted: “to change my person, but I cannot”.
PartNo_40	Friends: “I don’t have enough of them”.
PartNo_41	I guess I’m: “insecure”.
PartNo_49	I am: “struggling with work”.
PartNo_50	If I had my way: “I wouldn’t have had the accident, and I wouldn’t be so aggressive, and intolerant, and I would be happier”.
PartNo_12	I am: “basically useless”.
PartNo_28	I’m at my best: “when I shut up, when I’m asleep”.

Table 1

Demographic and Injury-Related Characteristics of the TBI Sample (n = 50)

Variable	M (SD), range; N (%)
Age (years)	42.3 (13.66), 19-66
Gender (male)	36 (72%)
Education (years)	13.17 (3.12), 6-21
Country of birth	
Australia	39 (78%)
New Zealand	2 (4%)
Africa	3 (6%)
South America	2 (2%)
Papua New Guinea	1 (2%)
United Kingdom	1 (2%)
Israel	1 (2%)
Thailand	1 (2%)
Relationship status (at injury)	
Married	22 (44%)
In a relationship	10 (20%)
Single	18 (36%)
Relationship status (current)	
Married	20 (40%)
In a relationship	14 (28%)
Single	16 (32%)
Previous history of mental health concerns ^a	26 (52%)
Resides in metropolitan area ^b	26 (52%)
Time Since Injury (months)	36.58 (13.5), 12-65

Table 1 (Continued)

Variable	M (<i>SD</i>), range; N (%)
Occupational status (at injury)	
30 + Hrs per week	39 (78%)
<30 Hrs per week	7 (14%)
Student	2 (4%)
Unemployed	2 (4%)
Occupational status (current)	
30 + Hrs per week	23 (46%)
<30 Hrs per week	12 (24%)
Student	1 (2%)
Unemployed	14 (28%)
Length of hospital stay (days)	66.80 (51.85), 6-189
GCS (initial)	10.31 (4.2), 3-15
PTA (days)	30.34 (25.2), 0.5-123
Cause of Injury	
Traffic related	24 (48%)
Fall	12 (24%)
Assault	5 (10%)
Sporting injury	8 (16%)
Other (unknown)	1 (2%)

^a A positive history of mental health problems was recorded if the individual endorsed the question, "Was there a time in your life prior to your accident, in which something bothered you to the extent that it caused you significant distress, or impacted on your work, studies, family or social life, or another important area for you?" (American Psychiatric Association, 2004)

^b Metropolitan area of is based upon definitions within the Australian standard geographical classification (Australian Bureau of Statistics, 2011).

GCS = Glasgow Coma Scale; PTA = Post Traumatic Amnesia.

Table 2
Summary of the Neuropsychological Profile of the TBI sample

Cognitive Assessment	Raw Scores		Age-Adjusted (Normative) ^a	
	Mean (<i>SD</i>)	Range	Mean (<i>SD</i>)	Range
RBANS: Immediate Memory (Index Score)	--	--	84.51 (19.49)	40 – 126
RBANS: Visuospatial (Index Score)	--	--	91.10 (17.28)	62 – 126
RBANS: Language (Index Score)	--	--	93.63 (14.30)	51 – 132
RBANS: Attention (Index Score)	--	--	83.09 (18.99)	49 – 138
RBANS: Delayed Memory (Index Score)	--	--	90.29 (15.71)	56 – 134
RBANS: Total (Index Score)	--	--	84.60 (14.37)	55 – 120
FAS (Total correct / Z Score)	33.98 (10.98)	12 – 71	-.78 (1.09)	-4.52 – 2.45
FAS (Total errors / Z Score)	2.82 (2.35)	0 – 11	-.60 (1.42)	-5.50 – 1.09
TMT – A (Total Seconds / Z Score)	29.73 (13.43)	13 – 72	.12 (1.25)	-3.48 – 1.93
TMT – B (Total Seconds / Z Score)	68.07 (27.54)	21.80 – 133.90	.08 (1.22)	-3.80 – 2.32
TMT – B minus A (Z Score)	--	--	-.47 (1.51)	-5.44 – 1.77
TMT – B/A (%) (Z Score)	--	--	-.17 (1.19)	-3.12 – 2.50

Note: RBANS = Repeatable Battery for the Assessment of Neuropsychological Status; FAS = Controlled Oral Word Association Test; TMT = Trail Making Test

^a Sources for normative data include: RBANS (Randolphs, 1998), FAS (Raskin & Rearick, 1996; Tombaugh, Kozak, & Rees, 1999) and TMT (Spreen & Strauss, 1998; Strauss, Sherman, & Spreen, 2006).

Table 3

Summary of Descriptive Data and Cronbach's Alpha for Measures of Transdiagnostic Variables and Emotional Distress (n = 50)

Scale	Mean (SD)	Range	Cronbach's alpha
Difficulties in Emotion Regulation Scale			
Non-Acceptance	12.32 (6.16)	6 – 30	.90
Goals	12.48 (5.28)	5 – 23	.87
Impulse	11.08 (5.18)	6 – 29	.89
Awareness	14.74 (5.59)	6 – 28	.81
Strategies	13.30 (4.69)	8 – 28	.76
Clarity	10.14 (3.90)	5 – 19	.72
Total	74.06 (22.20)	37 – 128	.93
Appraisal of Threat and Avoidance Questionnaire			
Dealing with People			
Threat	6.60 (5.87)	0 – 20	.92
Avoidance	2.44 (4.39)	0 – 18	.93
Doing Things			
Threat	3.76 (2.42)	0 – 7	.83
Avoidance	1.20 (2.04)	0 – 7	.89
Personal Safety			
Threat	2.04 (2.31)	0 – 8	.82
Avoidance	.94 (1.80)	0 – 8	.85
Total			
Threat	12.08 (9.33)	0 – 32	.94
Avoidance	4.58 (7.56)	0 – 32	.96
Head Injury Semantic Differential Scale –III			
Past Self	105.24 (14.92)	58 – 126	.87
Present Self	95.30 (19.80)	50 – 126	.92
Discrepancy ^a	-9.94 (22.48)	-57 - 66	--
Penn State Worry Questionnaire	42.86 (14.60)	16 – 76	.93
Self-Focus Sentence Completion			
Negative Self-Focus	4.96 (3.28)	1 – 13	--
Depression Anxiety and Stress Scales 21			
Depression subscale	7.32 (7.86)	0 – 34	.89
Brief Symptom Inventory 18			
Anxiety subscale	3.18 (3.70)	0 – 20	.81
Global Severity Index	9.24 (8.84)	0 – 49	.90

^a A negative discrepancy score indicates that the individual views their past self as more favourable than their present self.

Table 4

Correlations between Transdiagnostic Variables and Measure of Emotional Distress

	DASS – D	BSI – A	BSI – GSI
Difficulties in Emotion Regulation Scale			
Non-Acceptance	.41**	.39**	.36*
Goals	.54***	.52***	.53***
Impulse	.43**	.48***	.48***
Awareness	.11	-.05	.07
Strategies	.58***	.61***	.57***
Clarity	.44**	.40**	.41**
Total	.57***	.54***	.55***
Appraisal of Threat and Avoidance Questionnaire			
Threat Appraisals	.37**	.48***	.47***
Avoidance	.25	.47**	.38**
Head Injury Semantic Differential Scale – III			
Past ^a	.25	.33*	.31*
Present	-.57***	-.41**	-.48***
Discrepancy	-.21	-.13	-.21
Penn State Worry Questionnaire			
	.37**	.42**	.41**
Self-Focus Sentence Completion			
Negative Self-Focus	.26	.35*	.38**

Note. DASS – D = Depression Anxiety and Stress Scales – Depression subscale; BSI – A = Brief Symptom Inventory - Anxiety subscale; BSI – GSI = Brief Symptom Inventory- Global severity Index

^aThe results for HISD-III Past self are based upon a reflected square root transformation. Therefore, higher scores indicate poorer self-concept.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Table 5

Principal Components Analysis for Transdiagnostic Variables: Obliquely Rotated Salient Factor Loadings (≥ 0.40), and Communalities (h^2) for the Two Factor Solution ($n = 50$)

Item	Measure	Threats to		h^2
		Self	Emotion Dysregulation	
Self-Discrepancy	HISD-III	-.95	--	.76
Present Self-Concept	HISD-III	-.85	--	.80
Total Avoidance Behaviours	ATAQ	.68	--	.59
Total Threat Appraisals	ATAQ	.64	--	.69
Total Worry	PSWQ	.58	--	.55
Non-Acceptance	DERS	--	.82	.57
Strategies	DERS	--	.80	.78
Impulse	DERS	--	.75	.74
Goals	DERS	--	.66	.71
Eigenvalues		4.97	1.23	
% Variance Explained		55.28	13.62	

Note: HISD-III = Head Injury Semantic Differential Scale – III; ATAQ = Appraisal of Threat and Avoidance Questionnaire; PSWQ = Penn State Worry Questionnaire; DERS = Difficulties in Emotion Regulation Scale

Table 6

Summary of Correlations between Psychological Variables and Measure of Mood

	Threats to Self	Emotion Dysregulation	Negative SFA	DASS - D	BSI - A	BSI - GSI
Threats to Self	--	.43**	.38**	.37*	.43**	.46**
Emotion Dysregulation	--	--	.42**	.53***	.62***	.56***
Negative SFA	--	--	--	.26	.39**	.41**

Note. SFA = self-focused attention; DASS – D = Depression Anxiety and Stress Scales – Depression subscale; BSI – A = Brief Symptom Inventory, Anxiety subscale; BSI – GSI = Brief Symptom Inventory, Global severity Index.

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Table 7

Hierarchical Regression of Factors Related to Level of Depression

Variables	ΔR^2	<i>B</i>	<i>SE (B)</i>	95% <i>CI (B)</i>		β	<i>sr</i> ² (%)
				Lower	Upper		
Step 1	.26						
Age		.04	.02	.01	.08	.34**	11.9
Metropolitan Area		1.35	.43	.49	2.20	.40**	15.9
Step 2	.33						
Age		.02	.01	-.004	.05	.17	2.6
Metropolitan Area		.73	.34	.05	1.42	.22*	4.2
Threats to Self		.51	.19	.12	.91	.29*	6.4
Emotion Dysregulation		.77	.18	.40	1.14	.45***	16.3

Note: R^2 at Step 2 = 0.595; * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$.

Table 8

Hierarchical Regression of Factors Related to Level of Anxiety

Variables	ΔR^2	<i>B</i>	<i>SE (B)</i>	95% <i>CI (B)</i>		β	<i>sr</i> ² (%)
				Lower	Upper		
Step 1	.09						
Time Since Injury		-.003	.001	-.006	.000	-.30*	9.2
Step 2	.39						
Time Since Injury		-.001	.001	-.003	.001	-.10	0.8
Threats to Self		.03	.02	-.01	.06	.18	2.6
Emotion Dysregulation		.07	.02	.03	.11	.51***	17.1
Negative Self-Focused Attention		.02	.02	-.03	.06	.09	0.6

Note: R^2 at Step 2 = 0.482; * $p \leq .05$, *** $p \leq .001$.

Table 9

Hierarchical Regression of Factors Related to Level of Global Distress

Variables	ΔR^2	<i>B</i>	<i>SE (B)</i>	95% <i>CI (B)</i>		β	<i>sr</i> ² (%)
				Lower	Upper		
Step 1	.13						
Time Since Injury		-.003	.001	-.01	-.001	-.36*	12.7
Step 2	.43						
Time Since Injury		-.001	.001	-.003	.000	-.16	2.3
Threats to Self		.04	.01	.01	.07	.31**	7.4
Emotion Dysregulation		.05	.01	.02	.08	.42**	11.8
Negative Self-Focused Attention		.02	.02	-.01	.06	.14	1.5

Note: R^2 at Step 2 = 0.556; * $p \leq .05$, ** $p \leq .01$

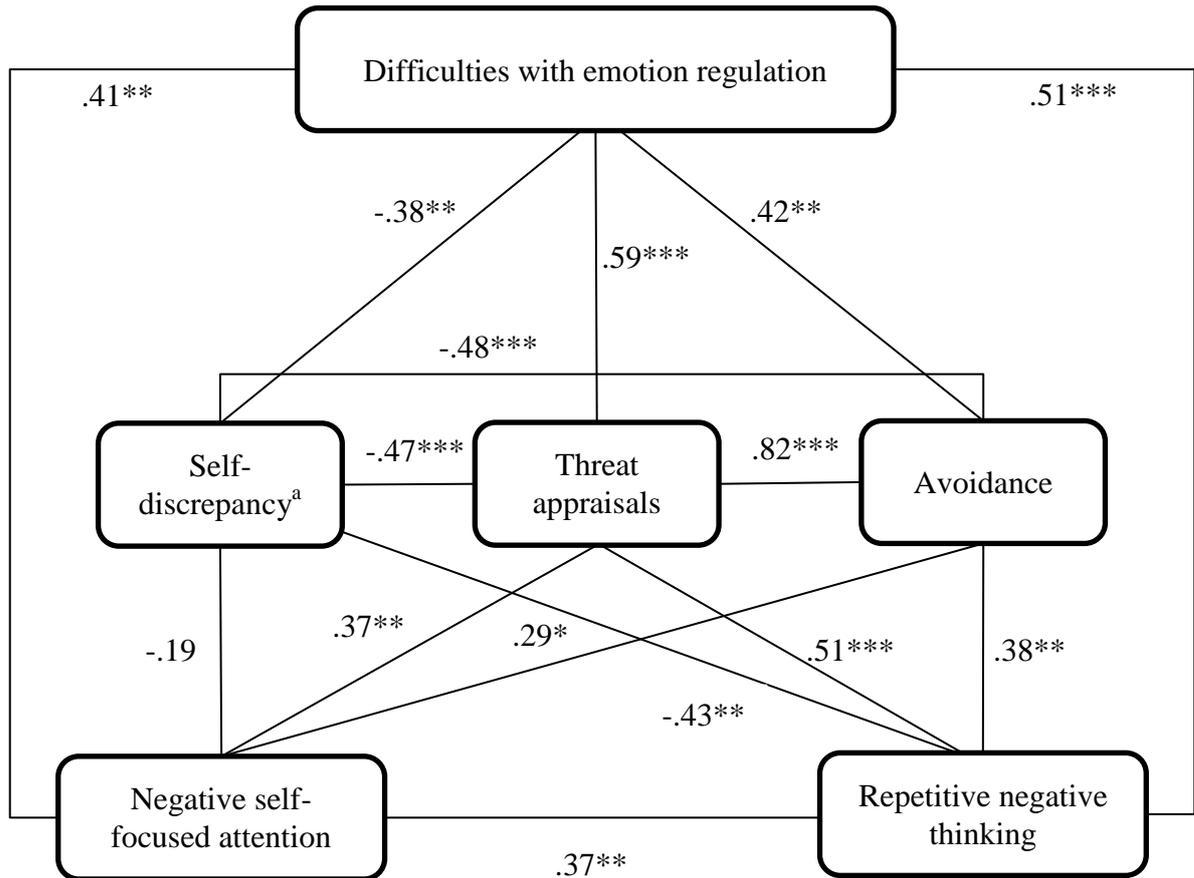


Figure 1

Associations among proposed transdiagnostic variables (* $p < .05$, ** $p < .01$, *** $p < .001$)