

2015

## Validating measures of psychological flexibility in a population with acquired brain injury

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### Recommended Citation

Whiting, Diane L.; Deane, Frank P.; Ciarrochi, Joseph; McLeod, Hamish J.; and Simpson, Grahame K., "Validating measures of psychological flexibility in a population with acquired brain injury" (2015). *Faculty of Social Sciences - Papers*. 1900.  
<https://ro.uow.edu.au/sspapers/1900>

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### Abstract

This study presents preliminary validation data on both the Acceptance and Action Questionnaire—Acquired Brain Injury (AAQ-ABI) and the Acceptance and Action Questionnaire—II (AAQ-II). Data from 150 participants with ABI was subject to exploratory factor analysis on the AAQ-ABI (15 items). A subset of 75 participants with ABI completed a larger battery of measures to test construct validity for the AAQ-ABI and to undertake a confirmatory factor analysis (CFA) on the AAQ-II (7 items). Three meaningful factors were identified on the AAQ-ABI: Reactive Avoidance, Denial, and Active Acceptance. Reactive Avoidance demonstrated good internal and test–retest consistency ( $\alpha = .89$ ) and correlated in expected directions with other related measures including the AAQ-II. CFA of the AAQ-II did not provide a good fit but did have similar correlations with measures of psychological distress as found in prior non-ABI samples. The results suggest both measures can be used with individuals following an ABI but they index different facets of psychological flexibility. The AAQ-ABI appears to measure psychological flexibility about the thoughts and feelings relating to the brain injury itself while the AAQ-II measures psychological flexibility around general psychological distress. Future research could explore the additional 2 factors of the AAQ-ABI and use these measures in outcome studies that promote psychological flexibility in individuals with an ABI.

### Keywords

brain, population, injury, validating, measures, psychological, acquired, flexibility

### Disciplines

Education | Social and Behavioral Sciences

### Publication Details

Whiting, D. L., Deane, F. P., Ciarrochi, J., McLeod, H. J. & Simpson, G. K. (2015). Validating measures of psychological flexibility in a population with acquired brain injury. *Psychological Assessment*, 27 (2), 415-423.

## **Validating measures of psychological flexibility in a population with acquired brain injury**

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Running head: Measuring psychological flexibility after ABI

## **Abstract**

This study presents preliminary validation data on both the Acceptance and Action Questionnaire – Acquired Brain Injury (AAQ-ABI) and the Acceptance and Action Questionnaire – II (AAQ-II). Data from 150 participants with ABI was subject to exploratory factor analysis on the AAQ-ABI (15 items). A subset of 75 participants with ABI completed a larger battery of measures to test construct validity for the AAQ-ABI and to undertake a confirmatory factor analysis on the AAQ-II (7 items). Three meaningful factors were identified on the AAQ-ABI; reactive avoidance, denial, and active acceptance. Reactive avoidance demonstrated good internal and test-retest consistency ( $\alpha = .89$ ) and correlated in expected directions with other related measures including the AAQ-II. Confirmatory factor analysis of the AAQ-II did not provide a good fit but did have similar correlations with measures of psychological distress as found in prior non-ABI samples. The results suggest both measures can be used with individuals following an ABI but they index different facets of psychological flexibility. The AAQ-ABI appears to measure psychological flexibility about the thoughts and feelings relating to the brain injury itself while the AAQ-II measures psychological flexibility around general psychological distress. Future research could explore the additional two factors of the AAQ-ABI and utilize these measures in outcome studies that promote psychological flexibility in individuals with an ABI.

Keywords: Psychological flexibility, acquired brain injury, acceptance, acceptance and commitment therapy

The rehabilitation process after an acquired brain injury (ABI) is a challenging journey requiring adjustment to, and ultimately acceptance of, the changes that have occurred. An ABI encompasses any injury to the brain sustained after birth caused by a lack of oxygen, infection, disease, or a traumatic injury to the head. The injury can result in changes to personality, behaviour, physical and sensory abilities. In addition, cognitive impairments are well documented after a traumatic brain injury (Draper & Ponsford, 2008; Millis et al., 2001) but also occur in other acquired brain injuries including brain tumor (Taphoorn & Klein, 2004), stroke (Nys et al., 2005; Patel, Coshall, Rudd, & Wolfe, 2003) and hypoxia (Caine & Watson, 2000).

As a result of post injury changes, people with ABI often display high levels of psychological distress, which can present as depression (Bombardier et al., 2010), anxiety (Gould, Ponsford, Johnston, & Schönberger, 2011), irritability (Alderman, 2003) and anger (Baguley, Cooper, & Felmingham, 2006). In addition self-identity problems can develop (Myles, 2004) as the person struggles to come to terms with their post injury self. Hence, facilitating acceptance of emotional dysregulation and identity changes after an ABI is an important therapeutic outcome. However, acceptance is not a passive process. It requires an individual to develop *psychological flexibility*, operationalized as the ability to persist with and/or change behaviour that is consistent with personal values whilst allowing difficult thoughts or feelings to occur (Hayes, Strosahl, & Wilson, 2003). Interventions which foster acceptance of the post ABI changes may have relevance with this client group and as a by-product, alleviate symptoms of psychological distress.

### **Acceptance and Commitment Therapy**

One of the main therapy approaches that focus on promoting psychological flexibility is Acceptance and Commitment Therapy (ACT) (Hayes et al., 2003). ACT is a third wave behavioural therapy that proposes when people engage in a narrow repertoire of behaviour in

order to manage or avoid difficult thoughts or experiences, they are demonstrating psychological *inflexibility* which, in turn, is associated with worse psychopathology (Kashdan & Rottenberg, 2010). Rather than addressing specific symptoms, ACT focuses more on promoting psychological flexibility by using principles from the underlying philosophy of functional contextualism (Hayes et al., 2003).

Functional contextualism from an ACT perspective involves analysis of internal (thoughts, feelings and memories) and/or external experiences (behaviours) within the context in which they occur. It proposes that by changing a person's relationship to their thoughts, the contingencies controlling behaviour are changed and more adaptive behavioural contexts can be created. For example, a major component of ACT focuses on activating behaviour that is consistent with personally held values. Another component involves being willing to allow difficult inner experience to occur (e.g., self-doubt), in the service of valued action. Hence, a behavioural context is created that promotes adaptive behavioural repertoires rather than focusing on removing maladaptive ones (e.g. changing negative self-concepts).

ACT may be particularly useful for addressing the mixed psychological distress presenting after a brain injury, where a major goal is to improve an individual's functioning and engagement in a meaningful life. In addition, ACT uses a mixture of written work, visual metaphors and experiential role plays allowing the therapist to work in novel ways to compensate for comprehension difficulties that may arise from the cognitive impairments presenting after an ABI. The suitability of this approach has been supported in two recent reviews examining the use of ACT with individuals with an ABI (Kangas & McDonald, 2011; Soo, Tate, & Lane-Brown, 2011).

### **Measuring Psychological Flexibility**

Despite suggestions that ACT may be effective in the treatment of psychological distress after an ABI, no measures of psychological flexibility have been validated with this client

group. To date, three different measures of psychological flexibility have been used in treatment studies with participants demonstrating cognitive impairment (Brown & Hooper, 2009; Pankey & Hayes, 2003) and only one of those with an ABI sample (Sylvester, 2011). These measures include a simple ACT process measure that utilised a Likert scale with items around defusion of psychotic symptoms and willingness to accept aversive emotions and take action to achieve behavioural goals (Pankey & Hayes, 2003). A modified version of the Acceptance and Action Questionnaire-9 (AAQ-9; Hayes et al., 2004) has also been administered. The researchers simplified the language of the AAQ-9 and used a five-point visual scale (sections in a pie chart) instead of a Likert scale (Brown & Hooper, 2009).

The third study developed a measure specifically to address the acceptance and avoidance of issues relating to an ABI, the Acceptance and Action Questionnaire-Acquired Brain Injury (AAQ-ABI; Sylvester, 2011). The AAQ-ABI comprises 15 items and is adapted from other measures of psychological flexibility (e.g., Acceptance and Action Questionnaire-II item: ‘I worry about not being able to control my worries and feelings’ translates to the AAQ-ABI item: ‘My worries and fears about my brain injury are true’). The items specifically focus on identifying thoughts, feelings and behaviours that may arise around functional disability occurring after an ABI. The AAQ-ABI was used as a process measure during an ACT intervention with individuals with an ABI (Sylvester, 2011), but the psychometric properties of the scale have not been evaluated. As such, it is not clear if it is an appropriate tool to assess psychological flexibility after an ABI.

In considering current measures of psychological flexibility, the Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004) is the most commonly used scale to measure this construct in ACT research. The latest version, the Acceptance and Action Questionnaire-II (AAQ-II) was developed to overcome reliability issues with the original AAQ and demonstrates superior psychometric properties over the earlier version across a range of

populations (Bond et al., 2011). The AAQ-II is considered a general measure of psychological flexibility relating to anxiety and depression but increasingly the measure has been adapted to assess psychological flexibility in the context of specific issues, whether psychological or situational. Focused measures related to psychological and health related conditions include weight related problems (Lillis & Hayes, 2008), diabetes (Gregg, Callaghan, Hayes, & Glenn-Lawson, 2007), pain (Hayes, Luoma, Bond, Masuda, & Lillis, 2006; McCracken, Vowles, & Eccleston, 2004) and tinnitus (Westin, Hayes, & Andersson, 2008).

Previous studies using the AAQ-II with various populations have found that low levels of acceptance or psychological flexibility are associated with high levels of psychological distress (e.g. Beck Depression Inventory scores) and behavioural ineffectiveness including avoidance (e.g. the White Bear Suppression Inventory scores; Bond et al., 2011; Wegner & Zanakos, 1994). This kind of psychological inflexibility relates to the avoidance of both internal and external experiences and is linked to a number of avoidance measures including avoidant coping (Hayes et al., 2004) and thought suppression (MacKenzie, 2008).

### **Purpose of the Study**

To date, none of the measures of psychological flexibility have been validated on a population with cognitive impairment. This is an important gap because the aftermath of ABI is marked by significant problems with psychological distress and behavioural and emotional functioning. These issues may hinder the rehabilitation process and psychological interventions which promote acceptance of these changes, such as ACT, might improve therapeutic outcome. This measure may also contribute to an improved ecological perspective of cognitive flexibility, traditionally measured by neuropsychological tests (Greve et al., 2002), as this is considered to be a component of psychological flexibility (Chawla & Ostafin, 2007; Kashdan & Rottenberg, 2010). Finally, this research addresses this gap by

undertaking a preliminary validation of two measures of psychological flexibility, the AAQ-II and the AAQ-ABI. The first step in the analysis involves an exploratory factor analysis (EFA) to determine the factor structure of the AAQ-ABI. Following this process, tests of construct validity (emotional distress and avoidance as supported in previous research) are performed on both the AAQ-II and AAQ-ABI to determine the appropriateness of each measure for people with an ABI.

## **Methods**

### **Participants**

This study involved 150 participants (116 males, 34 females) with an ABI who were recruited from the Liverpool Brain Injury Rehabilitation Unit, Sydney (LBIRU). The relatively low proportion of women reflects the fact that 117 participants had suffered a traumatic brain injury, which is more common in men. The sample size ensured a sufficient participant item ratio of 10:1 to conduct the EFA on the AAQ-ABI (15 items) (Streiner, 1994). The inclusion criteria included having sustained the ABI after the age of 17 years, currently being aged between 17 and 65 years and having sufficient language skills and cognitive ability to complete the measures. A total of 294 participants were screened of these, 26 (8.8%) declined to participate and 107 (36.4%) did not meet the study criteria. In addition to this, 11 (3.7%) were excluded when they were found to be feigning neuropsychological impairment on the Test of Memory Malinger (Tombaugh & Tombaugh, 1996) which is lower than rates reported in other head injury samples (Mittenberg, Patton, Canyock, & Condit, 2002; Moss, Jones, Fokias, & Quinn, 2003). Participants with dementia or other degenerative neurological illnesses (e.g. Parkinson's disease, multiple sclerosis) were also excluded ( $N = 2$ , 0.7%).

### **Measures**

The AAQ-ABI (Sylvester, 2011) is a questionnaire assessing psychological flexibility specifically relating to the acceptance and avoidance of thoughts and feelings that may arise as a result of an ABI. The scale comprises 15 items using a 5-point Likert scale (response format 0='not at all true' to 4='very true'). It has scores ranging from 0 to 60 with higher scores indicating greater levels of acceptance. The original developers were experts in either ACT or brain injury and they reviewed the items to ensure they correctly encapsulated the construct of the acceptance in an ABI population (DeVellis, 2003). In this study, the wording of one item received a minor revision to disambiguate its meaning (item 5 "My brain injury defines me" to "My brain injury defines me as a person"). The scores were reversed so higher scores were indicative of greater psychological inflexibility to ensure consistent scoring with the AAQ-II (Bond et al., 2011). Currently there are no validation data available on this measure, nor an analysis of its factor structure or clear reporting of how items were generated.

**Demographics.** Demographic and background information related to the participants' injuries and premorbid and current functioning were collected. Injury severity for individuals with a traumatic brain injury, was determined by the length of post-traumatic amnesia (PTA). A PTA of less than one hour is classified as *mild* TBI; 1-24 hours as *moderate*; 1-7 days as *severe* and greater than 7 days as *very severe* (Russell & Smith, 1961).

**Psychological Flexibility.** The AAQ-II (Bond et al., 2011) is a 7-item questionnaire utilising a 7-point Likert scale (response format, 1='never true' to 7 = 'always true') with scores ranging from 0 to 49, and higher scores indicative of greater psychological inflexibility or experiential avoidance. The AAQ-II is positively related to psychological distress including measures of depression and anxiety. Previous confirmatory factor analysis on three different samples supports a one-factor model with scores indicating good reliability and validity (Cronbach's alpha ranging from 0.78-0.88: Bond et al., 2011). The main difference

between the AAQ-ABI and the AAQ-II relates to specific references to brain injury in the items (e.g., AAQ-II item 1: 'It's OK if I remember something unpleasant', AAQ-ABI item 7: 'It is OK for me to feel different after my brain injury').

**Mood.** The Depression Anxiety and Stress Scales-21 (DASS-21) is a 21 item self-report measure that assesses depression, anxiety and stress over the previous week using a 4-point scale. The DASS-21 has good reliability for scores achieved on all three subscales with Cronbach's  $\alpha = 0.73-0.81$ , (Lovibond & Lovibond, 1995) and it has been shown to be a valid measure of depression, anxiety and stress in people with ABI (Ownsworth, Little, Turner, Hawkes, & Shum, 2008). Also the current factor structure of the DASS-21 has been recently been confirmed in a severe TBI population (Randall, Thomas, & Whiting, 2014) providing additional support for its use in a population with brain injury. In a sample of university students, scores on the subscales of the DASS showed a significant positive association with psychological inflexibility (Bond et al., 2011).

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item scale with two independent subscales of affective mood state, Positive Affect (PA) and Negative Affect (NA). Single word descriptors are used (e.g. inspired, proud, enthusiastic or ashamed, nervous, scared). Participants are required to rate the extent they have experienced the mood state over the past week using a 5-point Likert scale (response format, 1 = 'very slightly' to 5 = 'extremely'). High PA scores demonstrate the extent to which an individual experiences pleasure in their environment while high NA is indicative of distress and lack of engagement. Scores on the subscales have good internal reliability (Positive Affect  $\alpha = .88$ , Negative Affect  $\alpha = .85$ ) (Watson et al., 1988). The PANAS was selected as scores on the Negative affect subscale has been associated with psychological inflexibility in both cross sectional studies (Kashdan, Barrios, Forsyth, & Steger, 2006; Shallcross, Troy, Boland, & Mauss, 2010) and in experimental studies where increases in acceptance

(psychological flexibility) have resulted in lowered negative affect (Campbell-Sills, Barlow, Brown, & Hofmann, 2006; Twohig, Hayes, & Masuda, 2006).

**Threat Appraisal and Experiential Avoidance.** The Avoidance and Threat Appraisals Questionnaire (ATAQ; Riley, Brennan, & Powell, 2004) is a 36-item measure developed to identify specific threat appraisals and related avoidance that may occur after an individual experiences a traumatic brain injury (e.g. ‘Sometimes I worry I might get attacked and injured when I am out’). Participants are required to indicate whether in the previous month they have experienced that appraisal and if they have avoided something as a result of the appraisal. This yields two scores for total threat appraisal and total avoidance behaviour. The questionnaire demonstrates good internal reliability for scores on both indices (Cronbach’s  $\alpha$  being 0.92 and 0.94 respectively) (Riley et al., 2004). Avoidance of thoughts and memories that result in psychological distress are associated with psychological inflexibility (Hayes et al., 2006). Therefore it is expected that scores on the ATAQ will be positively related to scores on both the AAQ-II and AAQ-ABI.

### **Procedure**

Ethical approval was granted by the local health district Human Research Ethics Committee and informed consent was obtained from participants before administration of the measures. The first sample of 75 participants, who completed the full battery of tests, comprising the DASS-21, PANAS, ATAQ, AAQ-II and AAQ-ABI, was recruited when they attended a neuropsychological assessment at the Liverpool Brain Injury Rehabilitation Unit. The two measures of acceptance (AAQ-II and AAQ-ABI) were re-administered between 1-2 weeks later to assess test-retest reliability. The second sample of 75 participants was recruited from the active outpatient clients of the brain injury unit and completed the AAQ-ABI only, to meet the sample size requirements of the EFA and to reduce assessment burden on

participants. In addition, demographic information including injury information was collected for all participants from their medical file.

### **Data Analysis**

Data were entered and analysed using IBM SPSS version 22.0 (IBM Corp, 2013). The analysis of the AAQ-ABI involved an EFA using principal axis factoring followed by direct Oblimin rotation. The analysis of the AAQ-II involved a confirmatory factory analysis (CFA) examining the Chi-square statistic ( $\chi^2$ ) and four additional indicators of fit including the root-mean-square error (RMSEA), the standardised root-mean-square residual (SRMR), the comparative fit index (CFI), and the Non-Normed Fit Index (NNFI) (also known as the Tucker-Lewis Index TLI). Goodness of fit was explored using a two-index presentation format as suggested by Hu and Bentler (1999). Internal consistency was assessed using Cronbach's alpha and test-retest reliability employed intraclass correlations. Construct validity was undertaken using Spearman's rank correlation coefficient as the measures have ordinal data (Likert scales). To control for Type I error, arising from the multiple comparisons in testing construct validity, a Bonferonni correction was applied with alpha set at .001 with one-tailed testing.

## **Results**

### **Participant Characteristics**

All measures in the assessment battery were completed by participants ( $n = 150$ ) with the exception of a small amount of missing data ( $N = 3$ , 4%) on the AAQ-ABI and AAQ-II second administration for the test-retest reliability. Participants' ABI resulted from either a severe traumatic injury ( $N = 117$ ) that is with a period of posttraumatic amnesia (PTA) greater than one day), a brain tumor ( $N = 11$ ), a hypoxic injury ( $N = 9$ ) or a cerebrovascular accident (CVA:  $N = 13$ ). All participants showed some degree of cognitive impairment as measured on the Trail Making Test (Reitan, 1958) (Trails A z score  $M = -1.2$ ,  $SD = 1.71$ ; Trails B z score

M=-2.52, SD=3.52). The Trail Making Test is a recommended test of neuropsychological impairment for a brain injury population (Wilde et al., 2010). Participants were more likely to have been born in Australia and had a mean age of 38.12 years (SD = 13.74). This is older than the typical TBI population with the mean age being influenced on by the non-traumatic ABI participants who are usually older. A series of non-parametric comparisons between the traumatic brain injury group and those with other forms of ABI confirmed this and revealed age as the only significant difference between the groups, with the traumatic brain injury group being younger in age ( $z = 2.98, p < .01$ ; TBI 36.4 years  $\pm$  13.4 vs other ABI 44.4 years  $\pm$  13.2). Demographic information is detailed in Table 1.

Insert Table 1 about here

### **Data and Item Level Screening: AAQ-ABI**

Individual items on the AAQ-ABI were examined in the first instance to review skewness and unbalanced distributions (Clark & Watson, 1995). A number of the items had unbalanced distributions (for example: item 11, ‘Other people make it hard to accept myself’ and item 13, ‘I often pretend I don’t have a brain injury’) where the majority of participants endorsed ‘not at all true’ (item 11 = 58%; item 13 = 49.2%). However, these were still retained due to the small item pool and with clinical populations there is a greater tendency to have unbalanced distributions (Clark & Watson, 1995). Inspection of frequencies found none of the 15 items had a restricted range such that none of the items had more than 90% of responses falling on any two points of the Likert scale (Streiner, 1993).

### **Factor analysis**

**Exploratory Factor Analysis of the AAQ-ABI.** The 15 items of the AAQ-ABI were subjected to an EFA using principal axis factoring followed by direct Oblimin rotation using IBM SPSS Version 22 (IBM Corp, 2013), as it is anticipated there would be some correlation

between the factors (Costello & Osborne, 2005). This analysis resulted in three factors with eigenvalues greater than 1.0 which accounted for 44.82% of the variance, the first factor accounted for 32.2% of the variance, the second factor 7.96% of the variance and the third factor 4.66% of the variance. This was supported by a review of the Scree plot which indicated a two or three factor solution. The pattern matrix for the EFA is displayed in Table 2.

Insert Table 2 about here

Inspection of the pattern matrix was undertaken and suggested three factors. Items that performed poorly were excluded including items with a loading of less than .4 and also items that loaded equally on more than one factor (Costello & Osborne, 2005). This removed two items (items 12 & 15) and left factors two and three with only two items each. All three factors were interpretable, Factor one appeared to represent 'reactive avoidance' of emotions arising from the ABI; Factor two, 'denial' of the ABI and; Factor three, 'active acceptance' of the ABI itself. Further analyses were undertaken on all three factors. The same extraction and rotation was run again on the remaining 13 items. These three factors accounted for 47.01% of the variance (Factor one = 35.43%, Factor two = 6.65%, Factor three = 5.01%) with the following Cronbach's alpha coefficients; Factor one .89, Factor two .38 and Factor three .46. Small or no correlations existed between each factor score, -.27 between Factor one 'reactive avoidance' and Factor two 'denial', .29 between Factor one and Factor three 'active acceptance' and no correlation -.02 between Factors two and three. The mean scores for the sample on the three factors were; Factor one  $M = 12.61$  ( $SD = 9.32$ ), Factor two  $M = 3.46$  ( $SD = 2.46$ ) and Factor three  $M = 3.10$  ( $SD = 2.10$ ).

**Confirmatory Factor Analysis of the AAQ-II.** Before conducting a CFA, all data, including all item scores and the AAQ-II total score, were tested for normality. Only item-5 fell outside the acceptability ranges for skewness (Clark & Watson, 1995). A CFA was run on

the 7 items of the AAQ-II with SPSS Amos Version 22 (IBM Corp, 2013). Using Hu and Bentler's (1999) two index presentation strategy, the current one-factor model of the AAQ-II was not a good fit for this ABI sample. All measures of fit with the exception of Standardised Root Mean Square (SRMR), fell outside recommended guidelines (Table 3). Scores on the AAQ-II demonstrated high internal consistency (Cronbach's  $\alpha=.90$ ). The AAQ-II mean score for this sample ( $n=75$ ) was  $M = 20.16$  ( $SD = 10.18$ ).

Insert Table 3 about here

### **Test – Retest Reliability AAQ-ABI and AAQ-II**

Test-retest reliability was undertaken on both measures after a 7-14 day ( $M=9.74$ ,  $SD=3.23$ ) interval between the two test occasions. A high degree of reliability was found between scores on Factor one (reactive avoidance) of the AAQ-ABI between the two time points, with an ICC coefficient of .92 (95% CI = .86 to .95). Scores on the other two factors were not as reliable over the two time points (Factor two – Denial: ICC = .75, 95% CI = .60-.85; Factor three- Active acceptance: ICC =.68, 95% CI = .49-.80). The scores on the AAQ-II also had good test-retest reliability (AAQ-II: ICC = .86, 95% CI = .78 - .91).

### **Relationship with Age**

The relationship between age and both the AAQ-ABI (three factors) and the AAQ-II was explored as earlier analysis had indicated that participants with an injury from a trauma were significantly younger than participants with a brain injury from other sources (CVA, BT or hypoxic). Factor two of the AAQ-ABI (Denial of the ABI), had an inverse relationship with age ( $r_s = -.33$ ,  $p = .003$ ) such that as age increased denial decreased. This relationship with age was not present on any of the other subscales on the AAQ-ABI or the AAQ-II.

### **Construct Validity**

**Psychological Flexibility.** There was a moderate to strong positive relationship between AAQ-II Factor one scores and the AAQ-ABI but this was at a low enough level to indicate

they are not measuring exactly the same construct (see Table 4). Factor two and three scores of the AAQ-ABI were not significantly correlated with scores on the AAQ-II.

Insert Table 4 about here

**Psychological Distress.** High psychological inflexibility as assessed by both the AAQ-ABI Factor one and the AAQ-II were associated with high levels depression, anxiety, stress and negative affect. Table 4 details the correlations of the AAQ-ABI (3 Factors) and AAQ-II with other psychological measures. Positive affect had a moderate inverse relationship with psychological inflexibility. Threat appraisal and behavioural avoidance as measured by the ATAQ, demonstrated a moderate to strong positive relationship, with both measures. Overall the AAQ-ABI Factor one had slightly stronger relationships in the hypothesised direction than did the AAQ-II. The other two factors of the AAQ-ABI had different and smaller correlations with other measures compared to both Factor one of the AAQ-ABI and the AAQ-II (see Table 4).

**AAQ-ABI partial correlations with psychological distress.** As there were significant relationships between the measures of psychological distress and both measures of psychological flexibility, we examined the association between the AAQ-ABI Factor one and measures of psychological distress (DASS-21, PANAS, ATAQ), whilst controlling for general psychological flexibility (AAQ-II). Significant partial correlations between Factor one of the AAQ-ABI with measures of psychological distress (DASS-21, PANAS, ATAQ) are present when the impact of general psychological flexibility (AAQ-II) is controlled (see Table 4).

## Discussion

The main focus of this study was to assess the psychometric properties of the AAQ-ABI to explore its use with individuals who have an ABI. We also assessed the widely used AAQ-II. This is the first validation of two ACT-based measures of psychological flexibility in an ABI population and the preliminary findings appear promising. The EFA of the original 15-item

AAQ-ABI revealed three subscales comprising of 13 items. Scores on the first factor “reactive avoidance” had good internal and test-retest reliability, and good construct validity. They were also highly correlated to scores on a measure of avoidance of thoughts and feelings associated with the brain injury (ATAQ), providing evidence of convergent validity. Although scores on the AAQ-ABI-Reactive Avoidance subscale were strongly correlated with scores on the AAQ-II, the magnitude of the correlation suggested both measures may be capturing different aspects of psychological flexibility. Partial correlations confirmed that scores on the AAQ-ABI were significantly related to scores on the other measures (e.g., psychological distress) even when the effects of the AAQ-II were controlled. This suggested unique variance was being captured by the AAQ-ABI.

The other two factors (denial and active acceptance), only had two items each but were retained due to their descriptive clarity and because they appeared to be conceptually different to factor one. Factor two appeared to capture denial of the injury and demonstrated a moderate positive relationship with measures of psychological distress. Factor three appeared to represent a more active acceptance as demonstrated by its relationship with positive mood. Both factors in their current form had poor reliability and factors with fewer than three items are often excluded due to their weak and unstable structure (Costello & Osborne, 2005). Thus, we can only recommend that factor one, “reactive avoidance” be used clinically with factors two and three being retained for research and future item generation efforts.

The AAQ-II is a general measure of psychological flexibility and is meant to be relevant to a wide range of contexts and disorders. This measure has previously performed well in assessing psychological inflexibility across a range of samples including undergraduate students, substance abuse outpatients, and employees of a UK retail bank (Bond et al., 2011). However, confirmatory factor analysis in the current study indicated that the one factor model of the AAQ-II is not a good fit in an ABI population. Despite this, the AAQ-II had similar

correlations with other measures in our ABI sample compared to those found in other populations (Bond et al., 2011). In addition, scores on the AAQ-II had good test-retest reliability in individuals with an ABI.

In comparing the two measures, scores on the AAQ-ABI had slightly stronger associations with psychological distress and avoidance when compared to the AAQ-II, providing additional support for the premise that psychological flexibility is somewhat context dependent (Hayes et al., 2003). The decision to use the AAQ-ABI or the AAQ-II in an ABI population requires consideration of the targeted outcome. If the outcome is to measure processes of change relating to acceptance of feelings that may arise after an ABI, the ABI specific measure may be more appropriate as has been indicated with other adaptations in clinical health populations (for example diabetes and tinnitus: Gregg et al., 2007; Westin et al., 2008). Population specific measures are also more likely to reveal significant mediational effects of psychological flexibility in clinical interventions when compared to general measures (Ciarrochi, Bilich, & Godsell, 2010). However, if improvement in general psychological flexibility is the target then the AAQ-II may be the better choice. There is little difference in the length of the Reactive Avoidance scale (9 items) of the AAQ-ABI compared to the AAQ-II (7 items) but the 5-point response scale used in the AAQ-ABI is likely to reduce cognitive demand (Weijters, Cabooter, & Schillewaert, 2010) compared to the AAQ-II's 7-point scale.

### **Limitations and Further Research**

At this stage, the AAQ-II is the more extensively validated and refined measure used to assess changes in psychological flexibility in ACT treatment trials. In contrast, the AAQ-ABI is a new measure that had a number of limitations in its early conception. The development of the AAQ-ABI did not follow the most conceptually, robust process nor in the recommended order (DeVellis, 2003). Firstly, there was a relatively small item pool generated when good

scale development recommends a large item pool be generated based on sound conceptual foundation (Worthington & Whittaker, 2006). The procedure used for generating items for the AAQ-ABI included revision of items from other measures of acceptance including the earlier 10-item version of the AAQ-II (Bond et al., 2011). This is one strategy suggested in scale development (Streiner & Norman, 2008) but it is also recommended that more than one process is used to generate items in order to achieve good scale development (Clark & Watson, 1995). A larger item pool may have resulted in more robust second and third factors which appear to have some initial face validity but would benefit from further development. Despite these limitations, the current study has systematically evaluated the AAQ-ABI and found Factor One “Reactive avoidance” to be psychometrically sound and likely to capture aspects of psychological flexibility in an ABI population albeit in those with sufficient cognitive capacity to complete self-report measures.

There are a number of steps still required in order to complete the validation process in an ABI population for both of these measures. One approach would be to undertake an ACT intervention with individuals experiencing an ABI and administer both measures to assess change. The 15-item AAQ-ABI has been previously used as a process measure in a small unpublished study and detected a significant increase in psychological flexibility from pre to post intervention but this improvement was not sustained at the one month follow up (Sylvester, 2011). It would be anticipated the AAQ-ABI will be more sensitive to relevant areas of change than the AAQ-II, as the questions are targeted directly toward thoughts and feelings that may arise as a result of an ABI. It is recommended that future research also test the sensitivity of the AAQ-ABI and AAQ-II to changes over a longer period than the one to two week test retest time frame that was undertaken in this study. Finally, it may be useful to further explore the “denial” and “active acceptance” factors on the AAQ-ABI, by generating additional items and undertaking further factor analysis and construct validity assessment. In

a clinical context, denial amongst individuals with ABI is often observed and commonly associated with impairments in self-awareness, a prevalent and often impeding factor in successful rehabilitation after an ABI (Prigatano, 2005). Thus, there is potentially high clinical utility for the “denial” factor in the AAQ-ABI.

The sample used in this study was generally older than a typical TBI population due to the inclusion of non-traumatic ABI and this was indicated by the statistical significant difference between the mean age of participants with a TBI and those with a non-traumatic ABI. Furthermore, exploratory correlations indicated that age had a significant inverse relationship to scores on the “denial” factor. This relationship has been demonstrated previously where older people had more accurate self-awareness than younger people and it was suggested that they may have developed better coping strategies and overall psychological functioning with age (Sherer et al., 2003).

Both the AAQ-II and AAQ-ABI provide a measure of psychological flexibility in a population who typically demonstrate impairments in their cognitive flexibility (Heled, Hoofien, Margalit, Natovich, & Agranov, 2012). As it is proposed that a component of psychological flexibility is cognitive flexibility (Chawla & Ostafin, 2007; Kashdan & Rottenberg, 2010), undertaking further research into the relationship between the AAQ-ABI and AAQ-II and neuropsychological measures of cognitive flexibility may contribute to our understanding of both these constructs in an ABI population. One criticism of neuropsychological tests is their low ecological validity (Burgess et al., 2006) because individuals who perform poorly on testing, are often still able to function effectively in a familiar environment. As both the AAQ-II and AAQ-ABI items address an individual’s relationship to their thoughts and experiences contextually, these measures may provide a complementary source of information to neuropsychological testing in individuals with an ABI.

## **Conclusions**

The study provides preliminary validation of two measures of psychological flexibility for individuals with an ABI. Scores on both the AAQ-ABI and AAQ-II had satisfactory internal consistency, good reliability across time, in addition to having expected relationships with theoretically-relevant constructs. This suggests that both measures are appropriate for measuring psychological flexibility in an ABI population. If treatment is specifically targeting acceptance towards thoughts and feelings around the changes occurring after an ABI, then the AAQ-ABI questions may be more relevant to this context than a general measure like the AAQ-II (Bond et al., 2011). The ABI specific measure may also contribute to our understanding of how interventions that promote psychological flexibility work as has been demonstrated with other population specific measures (Gregg et al., 2007; Lillis, Hayes, Bunting, & Masuda, 2009). The study provided further support that psychological flexibility has some situational specificity and that psychological *inflexibility* is associated with great psychopathology. In addition, these measures of psychological flexibility may augment neuropsychological assessment for individuals with an ABI, particularly measures of cognitive flexibility, by providing a measure of flexibility that is specific to the ABI context.

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Table 1: Demographic Variables

| Variable                   | Total Participants<br>(n=150) | TBI<br>(n=117) | Other ABI<br>(n=33) |
|----------------------------|-------------------------------|----------------|---------------------|
|                            | Mean (SD) / Number(%)         |                |                     |
| Gender                     |                               |                |                     |
| Male                       | 116 (77.3%)                   | 97 (83%)       | 19 (58%)            |
| Female                     | 34 (22.7%)                    | 20 (17%)       | 14 (42%)            |
| Age (years)                | 38.1 (13.7)                   | 36.5 (13.4)    | 44.4 (13.2)         |
| Born in Australia          |                               |                |                     |
| Yes                        | 100 (66.7%)                   | 80 (68.4%)     | 20 (60.1%)          |
| No                         | 50 (33.3%)                    | 37 (31.6%)     | 13 (39.9%)          |
| Education (years)          | 11.6 (2.2)                    | 11.3 (2.0)     | 11.6 (2.3)          |
| Time since injury (months) | 15 (6-39)                     | 32.8 (34.4)    | 27.5 (38.6)         |
| PTA (months)               |                               | 32.6 (38.8)    | N/A                 |

*Note.* PTA = Posttraumatic Amnesia

Table 2. Pattern Matrix of the Exploratory Factor Analysis (n = 150)

| Item No.        |  | Factor       |             |             |
|-----------------|--|--------------|-------------|-------------|
|                 |  | 1            | 2           | 3           |
| 5               | My brain injury defines me as a person   | <b>.814</b>  | -.133       | .147        |
| 9               | My worries and fears about my brain injury are true                                  | <b>.778</b>  | .204        | .093        |
| 2               | I hate how my brain injury makes me feel about myself                                | <b>.765</b>  | .041        | -.033       |
| 3               | I need to get rid of my anxiety about my brain injury                                | <b>.762</b>  | .002        | .157        |
| 4               | I stop doing things when I feel scared about my brain injury                         | <b>.760</b>  | .011        | .077        |
| 11              | Other people make it hard for me to accept myself                                    | <b>.595</b>  | .016        | -.066       |
| 14              | Most people are doing better than me   | <b>.583</b>  | .013        | -.296       |
| 8               | I would give up important things in my life if I could make the brain injury go away | <b>.571</b>  | .197        | -.129       |
| 6               | I am moving forward with life  | <b>-.467</b> | .260        | .288        |
| 13              | I often pretend that I don't have a brain injury                                     | .247         | <b>.503</b> | -.334       |
| 10              | I try not to think about having a brain injury                                       | .151         | <b>.477</b> | -.011       |
| 15 <sup>a</sup> | Even with my brain injury I can do good work   | <b>-.409</b> | <b>.467</b> | .208        |
| 12 <sup>b</sup> | I don't need to be ashamed of my brain injury  | -.123        | .305        | .239        |
| 1               | I do things I care about even when I feel upset about my brain injury                | .040         | .152        | <b>.594</b> |
| 7               | It is OK for me to feel different after my brain injury                              | .065         | -.085       | <b>.477</b> |

*Note.* Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. Rotation converged in 17 iterations.

<sup>a</sup> Item 15 excluded due to loading on two factors. <sup>b</sup>Item 12 excluded due to factor loading <.4

Table 3: Confirmatory factory analysis results for the AAQ-II in an ABI sample (n = 75)

| Model      | $\chi^2$ | df | RMSEA<br>( $\leq .06$ ) | SRMR<br>( $\leq .09$ ) | CFI<br>( $\geq .95$ ) | NNFI<br>( $\geq .95$ ) |
|------------|----------|----|-------------------------|------------------------|-----------------------|------------------------|
| ABI (N=75) | 46.22**  | 14 | .176                    | .065                   | .890                  | .835                   |

*Note.* RMSEA = root-mean-square error of approximation; SRMR = standardised root-mean-square; CFI = comparative fit index; NNFI = non-normed fit index; values in parentheses define good model fit for the respective fit index (Hu & Bentler, 1999).

\*\* $p < .001$

Table 4: Correlation matrix ( $r_s$ ) of AAQ-ABI and AAQ-II with other measures (n = 75)

|                           | AAQ-ABI                       |               |                              | AAQ-II | AAQ-ABI<br>(RA)<br>(Control<br>variable-<br>AAQ-II) |
|---------------------------|-------------------------------|---------------|------------------------------|--------|---|
|                           | Reactive<br>Avoidance<br>(RA) | Denial<br>(D) | Active<br>Acceptance<br>(AA) |        |   |
| Psychological Flexibility |                               |               |                              |        |   |
| - AAQ-ABI (RA)            |                               |               |                              |        |   |
| - AAQ-ABI (D)             | .28                           |               |                              |        |   |
| - AAQ-ABI (AA)            | .18                           | .11           |                              |        |   |
| - AAQ-II                  | .70**                         | .20           | .06                          |        |   |
| Depression (DASS-21)      | .67**                         | .26           | .15                          | .67**  | .39**   |
| Anxiety (DASS-21)         | .63**                         | .44**         | .21                          | .55**  | .53**   |
| Stress (DASS-21)          | .64**                         | .30           | .08                          | .58**  | .36**   |
| Positive Affect (PANAS)   | -.35**                        | -.10          | .37**                        | -.27   | -.16  |
| Negative Affect (PANAS)   | .74**                         | -.27          | .11                          | .70**  | .54**   |
| Appraisal Threat (ATAQ)   | .66**                         | .28           | -.02                         | .63**  | .50**   |
| Avoidance (ATAQ)          | .72**                         | .40**         | .06                          | .62**  | .51**   |

*Note.* AAQ-ABI = Acceptance and Action Questionnaire-Acquired Brain Injury; AAQ-II = Acceptance and Action Questionnaire-II; DASS-21 = Depression Anxiety Stress Scale-21; PANAS = Positive Affect, Negative Affect Scale; ATAQ = Appraisal Threat and Avoidance Questionnaire; AAQ-ABI (RA) = Reactive Avoidance factor.

\*\* $p < .001$