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# **Post-Traumatic Growth and Value-Directed Living after Acquired Brain Injury**

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## Abstract

Evidence indicates that traumatic events can be associated with positive change, termed “post-traumatic growth”. Although it has received limited research attention, there appears to be overlap between domains of post-traumatic growth and the concept of value-directed living. This study sought to explore the relationship between post-traumatic growth and value-directed living after acquired brain injury. Self-report questionnaires including the Posttraumatic Growth Inventory (PTGI), Valued Living Questionnaire (VLQ), Engaged Living Scale (ELS), Valuing Questionnaire (VQ), Hospital Anxiety and Depression Scale (HADS), World Health Organization Well-Being Index (WHO-5), Brief Resilience Scale (BRS), Trauma Screening Questionnaire (TSQ) and Glasgow Outcome Scale (GOS) were posted to 317 individuals who had experienced a head injury, stroke or subarachnoid haemorrhage in the previous 3-13 years, with a hospital admission of at least 7 days. Questionnaires were completed by 81 participants. Post-traumatic growth was significantly positively associated with two measures of value-directed living (VLQ,  $r = .269$ ; VQ,  $r = .215$ ). Higher levels of value-directed living were significantly associated with increased positive outcomes (wellbeing) and reduced negative outcomes (distress, post-traumatic stress symptoms). There was no significant association between post-traumatic growth and any of these outcomes. The association between post-traumatic growth and value-directed living indicates possible common underlying processes. Value-directed living appears to be a more useful concept, as it was associated with clinically relevant outcomes. It is recommended that value-directed living interventions are considered in brain injury rehabilitation.

Keywords: Post-traumatic growth; value-directed living; acquired brain injury; valued living

## Introduction

Over 40% of people admitted to hospital with an acquired brain injury (ABI) suffer long-term disability or life-long functional challenges (Corrigan et al., 2010; Jones et al., 2011). Understandably, research has traditionally focused on deficit, loss and impairment. However, recent research has considered positive psychological outcomes that can occur after ABI (e.g. Gould & Ponsford, 2015; Grace et al., 2015; Karagiorgou et al., 2018; Ownsworth & Fleming, 2011; Pais-Hrit et al., 2019) reflecting evidence from other populations that traumatic experiences can be associated with positive change, sometimes termed 'post-traumatic growth'.

Post-traumatic growth, defined as "the experience of positive change that occurs as a result of the struggle with highly challenging life crises" (Tedeschi & Calhoun 2004, p.1), has frequently been reported to occur following ABI (Collicutt McGrath & Linley, 2006; Grace et al., 2015; Hawley & Joseph, 2008; Ownsworth & Fleming, 2011; Powell et al., 2012). These findings are corroborated by the clinical experiences of many working in this area, and by qualitative evidence from people with brain injuries (Graff et al., 2018; Karagiorgou et al., 2018).

Aspects of the concept of post-traumatic growth, as manifested in increased appreciation of life, more meaningful interpersonal relationships, increased sense of personal strength, changed priorities, and a richer existential and spiritual life (Tedeschi & Calhoun, 2004), appear to have some overlap with that of value-directed living - the process of behaving in ways that support, or are in alignment with, one's chosen values. Similarly, some behaviours considered indicative of post-traumatic growth (e.g. spending more time with family and friends, changing career path, greater involvement in community groups, developing new hobbies/interests, increased appreciation of nature etc.) might be considered value-directed behaviours. Potentially, the key aspects of cognitive processing involved in post-traumatic growth may involve the individual reflecting on, and choosing to live more in alignment with, what is important to them (i.e. their values).

This leads us to question whether the most important aspects of what is considered post-traumatic growth, may in fact relate to increases in value-directed behaviour, instigated in response to the cognitive processing of a traumatic event. It is also possible that it may not be the cognitive processing of the trauma itself that promotes growth, but the break in routine enforced by the traumatic event, which provides an opportunity for reflection. If so, rehabilitation efforts might seek to facilitate value-directed living, via both cognitive and behavioural means. Gould and Ponsford (2015) note that changes in values may reflect conscious re-evaluation of priorities following the trauma, but it is possible that the values themselves do not change, but that the traumatic event causes the individual to reflect on those values and whether their current path is suitably aligned with them. Limitations imposed by a brain injury may restrict the viability of previous ways of living, prompting reflection and the need to find alternative ways of living that are more in alignment with an individual's values.

This has clinical relevance, for while there is substantial evidence that greater engagement in value-directed living is associated with increased psychological wellbeing and reduced distress (e.g. Cresswell et al., 2005; Paez-Blarrina et al., 2008; Trompetter et al., 2013), evidence of the association between post-traumatic growth and these outcomes is mixed (Grace et al., 2015; Zoellner & Maercker, 2006). Evidence of the relationship between post-traumatic growth and current functioning in ABI samples is similarly inconsistent (Kelly et al., 2018; Powell et al., 2012), whereas higher levels of value-directed living following ABI have been associated with improved functioning (Kelly et al., 2018; Pais et al., 2019). There is inconsistent evidence of the relationship between post-traumatic growth and symptoms of post-traumatic stress (Zoellner & Maercker, 2006), but recent research has indicated that value-directed living may moderate the relationship between post-traumatic stress symptoms and functional impairment (Donahue et al., 2017). It is noted that whilst a number of measures of value-directed living have been developed, evidence comparing the different measures in clinical samples is currently limited.

Limited existing research on post-traumatic growth and value-directed living in ABI populations supports the notion that these processes may be related. Pais et al. (2019) found that value-directed living was strongly associated with improved functional and psychosocial outcomes in a TBI population, and observed that value-directed living was associated with “a distinct change in outlook” (p.635) - individuals living in accordance with their values reported increased positive psychological change and reduced negative outlook. Further research by Pais-Hrit et al. (2019) confirmed a small positive association between value-directed living and post-traumatic growth, as measured by the Changes in Outlook Questionnaire - Short Form (CiOQ-S; Joseph et al., 2006), leading them to suggest that the relationship between the two concepts is likely to be bi-directional.

Pais-Hrit et al. (2019) also found an association between cognitive and behavioural measures of post-traumatic growth. However, some behavioural indicators of post-traumatic growth (such as demonstrating care for family and friends; pursuing new interests/activities; and acting with consideration and kindness for others), may also be conceptualized as value-directed behaviours. Apparent similarity between the concepts of post-traumatic growth and resilience has been noted (Tedeschi & Calhoun, 2004), however it has been argued that resilience implies coping, and thus reduces the necessity for post-traumatic growth (Westphal & Bonanno, 2007). At a domain level, the items constituting the third factor (“Personal Strength”) of the Post-Traumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) appear to overlap with resilience conceptually, but it appears this has not previously been explored.

### ***Study Aims***

Theories of post-traumatic growth propose that cognitive appraisal processes enable the individual to re-build their world view, taking into account the traumatic experience, and thus enabling growth. These processes may also involve the individual reflecting on, and choosing to live more in alignment with, their values. Alternatively, it may be that some individuals use the break

from normality enforced by their traumatic event and injuries to reappraise their lifestyle and make adjustments aimed at living more in congruence with their values.

This study sought to explore the relationship between post-traumatic growth and value-directed living in people who had experienced an ABI, and how these variables related to other outcomes - wellbeing, resilience, functioning, distress and post-traumatic stress symptoms. It was hypothesized that there would be a significant positive association between post-traumatic growth and value-directed living, with value-directed living the stronger predictor of wellbeing, current functioning, and (inversely) of distress. Factor 1 ('Relating to Others'), 2 ('New Possibilities'), 4 ('Spiritual Change') and 5 ('Appreciation of Life') of the PTGI, were predicted to be more strongly associated with resilience, whilst Factor 3 ('Personal Strength') was predicted to be more strongly associated with value-directed living. It was hypothesized that value-directed living would be significantly negatively associated with symptoms of post-traumatic stress.

## Methods

### *Participants*

National Health Service (NHS) ethical approval was obtained. Participants were 81 people who had been admitted to the Aberdeen Royal Infirmary with an acquired brain injury (ABI). Demographic characteristics of the sample are presented in Table 1. Study inclusion criteria were: a) duration of hospital admission of at least 7 days (a proxy for moderate-severe injury); b) aged 16+ at time of injury; c) ABI occurred 3-13 years before participation in the study (a lower limit of 3 years was chosen as evidence indicates that post-traumatic growth only starts to become reliably evident a few years after injury (Powell et al., 2012); a 10 year time frame was selected as local prevalence data suggested this would provide a large enough sample; d) sufficient cognitive and English language ability to complete questionnaires (assessed via medical records). Methodological concerns regarding sample homogeneity, and ethical considerations (of potential distress) led to study exclusion criteria: a) co-morbid intellectual disability; b) current active severe psychiatric illness/difficulty (e.g. active psychosis, current severe depression etc., assessed via current medical records); c) any other neurological condition (e.g. brain tumour, Parkinson's disease, multiple sclerosis etc.); d) ABI due to anoxia or drug-related haemorrhage.

A prospective power analysis conducted using G\*Power (Faul et al., 2007) with a medium effect size ( $r \geq .5$ ) indicated that a sample size of 77 would have 80% power to detect the hypothesized associations ( $p < .05$ ).

### *Measures*

**Posttraumatic Growth Inventory.** The 21-item Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) is the most widely used measure of post-traumatic growth. Participants rate each item on a scale from 0 ('I did not experience this change as a result of my crisis') to 5 ('I



experienced this change to a very great degree as a result of my crisis'). An overall score and five domain scores (Relating to Others, New Possibilities, Personal Strength, Spiritual Change and Appreciation of Life) are calculated. The measure has been shown to have excellent internal consistency for the total scale and good internal consistency for the subscales, as well as acceptable test-retest reliability ( $r = .71$ ). Principal component analysis indicated eigenvalues greater than one for all five factors (Tedeschi & Calhoun, 1996). In this study, the composite score was used as an indicator of overall post-traumatic growth ( $\alpha = .93$  in this study), and subscale scores were used as measures of growth in the specific domains (factor 1:  $\alpha = .92$ ; factor 2:  $\alpha = .80$ ; factor 3:  $\alpha = .78$ ; factor 4:  $\alpha = .75$ ; factor 5:  $\alpha = .82$ ).

**Valued Living Questionnaire.** The Valued Living Questionnaire (VLQ; Wilson et al., 2010) assesses valued living in two parts. In the first, participants rate the importance of each of 10 life domains, on a scale from 1 (not important) to 10 (very important). In the second part, they rate how consistent their actions have been with their values in each domain during the past week, on a scale from 1 (completely inconsistent) to 10 (completely consistent). A composite score is generated by calculating the mean of the products of the importance and consistency scores for each item. Internal consistency of the composite score is reported to be excellent (VanBuskirk et al., 2012), with good test-retest reliability ( $r=.74$ ) and validity (Cotter, 2011). In this study, the overall composite score was used as an indicator of valued living ( $\alpha = .90$ ).

**Engaged Living Scale – Valued Living Subscale.** The Engaged Living Scale (ELS; Trompetter et al., 2013) measures valued living at a global (rather than domain-specific) level. Participants are asked to rate statements using a 5-point Likert scale from “completely disagree” to “completely agree”. The 10-item Valued Living subscale measures “the recognition and knowledge of personal values and undertaking behavioural actions congruent with these values” (Trompetter et al., 2013, p.1238), and has shown good internal consistency ( $\alpha = .86$ ), and good construct validity (moderate to

high correlations with expected measures) in research with both clinical and non-clinical samples (Trompetter et al., 2013). In the current study, the Valued Living subscale had an  $\alpha = .93$ .

**Valuing Questionnaire – Progress in Valued Living subscale.** The Valuing Questionnaire (VQ; Smout et al., 2014) is a global rather than domain-specific measure of valued living. Participants rate the extent to which they lived by their values during the previous week, on a scale from 0 (completely untrue) to 6 (completely true). It was designed to be easy to complete, for use in clinical and research settings (Smout et al., 2014). The Progress in Valued Living subscale comprises 5 items. Smout et al. (2014) report that the measure showed good internal consistency ( $\alpha = .81$ ) and convergent validity. In this study, the Progress in Valued Living score was used as an indicator of valued living ( $\alpha = .83$ ).

**World Health Organization Well-Being Index.** The 5-item WHO Wellbeing Index (WHO-5; 1998) is a widely used measure of subjective wellbeing. Systematic review by Topp et al. (2015) concluded that the psychometric validity of the WHO-5 is high. Mean scores on this measure across European population samples range from 53.7-70.1 (Topp et al., 2015). In the current study, the total score on the WHO-5 was used as an indicator of wellbeing ( $\alpha = .91$ ).

**Glasgow Outcome Scale – postal version.** The Glasgow Outcome Scale (GOS; Jennett & Bond, 1975) is the most widely used scale for the assessment of functional outcome after head injury (Wilson et al., 1998). Although generally administered as an interview, a postal version of the scale also provides reliable outcome data (Wilson et al., 2002). For the postal version, participants rate their level of functioning in six areas of living (home, shopping, travel, work, social activities, relationships). The lowest level of functioning across the six areas indicates the individual's overall outcome category. In this study, the outcome categories used were Good Recovery, Moderate Disability and Severe Disability. The measure demonstrated good internal consistency in the current sample ( $\alpha = .78$ ).

**Hospital Anxiety and Depression Scale.** The 14-item Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) has been widely used in other studies of post-traumatic growth. For both scales, the authors of the measure suggest that mild, moderate and severe symptoms are indicated by scores of 8-10, 11-15 and 16+ respectively (Snaith & Zigmond, 1994). Evaluation of the psychometric properties indicate good internal consistency for both anxiety ( $\alpha = .76$ ) and depression ( $\alpha = .80$ ) subscales (Mykletun, Stordal & Dahl, 2001), and for a combined overall 'distress' score ( $\alpha = .86$ ; Crawford et al., 2001). Review of the psychometric properties of the HADS in a TBI population concluded that it was a reliable measure of distress for this population (Whelan-Goodinson, Ponsford & Schonberger, 2009). In the current sample, the summed overall distress score had an  $\alpha = .92$ , whilst subscales were anxiety:  $\alpha = .89$ ; depression:  $\alpha = .85$ .

**Trauma Screening Questionnaire.** This is a 10-item measure (Brewin et al., 2002) of re-experiencing and arousal. Participants indicate if they have experienced any of the symptoms in the past two weeks, with a 'yes/no' response. The measure has been validated within dependent samples, and is reported to demonstrate similar or superior specificity and sensitivity to lengthier measures (e.g. PCL-C, Weathers et al., 1991; PSS-SR, Foa et al., 1993; PDS, Foa et al., 1997), with an overall efficiency rating of 0.90 – 0.92 (Brewin, 2005). There is strong evidence that endorsing six or more items on the scale is associated with a likely diagnosis of PTSD (Brewin et al., 2002). In this study, the total score on this measure was used as an indicator of severity of symptoms of post-traumatic stress. 'Yes' responses were scored 2, 'No' responses were scored 1, creating a minimum possible score of 10 and maximum score of 20. The measure demonstrated good internal consistency in the current sample ( $\alpha = .82$ ).

**Brief Resilience Scale.** The Brief Resilience Scale (BRS, Smith et al., 2008) is a 6 item self-report measure of resilience, using a 5-point Likert scale. It has demonstrated good internal consistency ( $\alpha = .80 - .91$ ), and test-retest reliability of .69 (1 month) and .62 (3 month) (Smith et al., 2008). Other authors also report good reliability ( $\alpha = .93$ , Amat et al. 2014). A resilience score is

calculated by dividing the total score by the number of items answered. The measure's authors have suggested that low, normal and high levels of resilience are indicated by scores of 1.00 - 2.99, 3.00 - 4.30 and 4.31 – 5.00, respectively (Smith et al., 2013). The measure demonstrated good internal consistency in the current sample ( $\alpha = .87$ ).

**Demographic information.** Questions regarding current employment status, marital status and level of education. Participants were also asked to indicate “if someone has helped you to answer the questions” (answered ‘yes’ or ‘no’).

### ***Procedure***

NHS Grampian Health Intelligence Service extracted records of all patients admitted between 1<sup>st</sup> February 2005 and 31<sup>st</sup> January 2015, with a diagnosis of Traumatic Brain Injury (TBI, ICD10: S06 Intracranial Injury), Stroke (ICD10: I61 Intracerebral haemorrhage; I62 Other nontraumatic intracranial haemorrhage; I63 Cerebral infarction), or Subarachnoid haemorrhage (SAH, ICD10: I60), with a hospital admission of at least 7 days. Records were screened by MB and CT to identify individuals who met the study's criteria, with potential participants contacted subject to approval by the Consultant Clinical Neuropsychologist (for TBI patients) and Clinical Lead for Neuropsychology in Stroke (for Stroke and SAH patients). See Figure 1.

[figure 1 here]

Packs containing an information sheet, consent form, questionnaire booklet and an addressed, pre-paid return envelope were posted to 317 potential participants.

### ***Data analysis***

Distributions of scores for all measures were examined visually using histograms; box and whisker plots were used to check for outliers; and Z scores of skewness and kurtosis were calculated. Normality was also assessed using the Kolmogorov-Smirnov (KS) test. Although some measures had

skewed distributions, given the reasonably large sample size, parametric analyses were deemed sufficiently robust (Field, 2013). Correlations between post-traumatic growth, measures of value-directed living, post-traumatic stress symptoms and resilience were assessed using Pearson's  $r$  correlations. Although uncorrected results are reported, corrections for multiple comparisons (Bonferroni) were applied and the effect of this considered in relation to each research question. Data used for multiple regression analysis were checked for autocorrelation, multicollinearity and homogeneity of variance and linearity. Multiple regressions were completed to assess the ability of value-directed living measures to predict post-traumatic growth, and the ability of post-traumatic growth and value-directed living measures to predict wellbeing, current functioning and distress. Reliability statistics were calculated using Cronbach's alpha.

Effect sizes were considered small, medium or large at around  $r \geq .3$ ,  $\geq .5$  and  $\geq .7$  respectively (Cohen, 1988). Mean score substitution was applied where fewer than 20% of items were missing at random for any individual on any one scale. Missing data were not substituted in the VLQ because the pattern of missing items suggested some items were deliberately incomplete rather than missed in error.

## Results

### *Sample characteristics*

In terms of cause of injury, the most common cause was sub-arachnoid haemorrhage (42%), followed by stroke (ischaemic and haemorrhagic) (30%), and TBI (28%), with the ABI occurring a mean of 76 months (approximately 6 years) prior to the study. On average, participants had a hospital admission of 20 days. The sample was predominantly male (64%), with a mean age of 60 years. At the time of the study, most participants were retired (43%) or in paid employment (38%). Demographic characteristics of our sample are presented in Table 1.

[Table 1 here]

### *Study variables*

PTGI total scores ranged from 0 to 92 out of 105 ( $M = 47.95$ ,  $SD = 23.75$ ). The items with the highest average score pertained to having “a greater appreciation for the value of my own life” (item 2) and being more aware that “I can count on people in times of trouble” (item 6). The mean score on the VQ (Progress domain) was 20.53 ( $SD = 6.58$ ). “I felt like I had a purpose in life” (item 9) and “I made progress in the areas of my life I care most about” (item 5) were the items with the highest average score. ELS (Valued Living domain) scores ranged from 15-50 ( $M = 37.62$ ,  $SD = 8.02$ ), with little variation in the average rating of each item. On the VLQ ( $M=52.28$ ,  $SD = 23.10$ ), the domains with the highest mean scores for importance rating were Family (other than marriage or parenting), Marriage/intimate relationships and Parenting. Mean score, standard deviation and range for all measures are presented in Table 2.

[Table 2 here]

### *Associations between the Psychological Variables*

**Post-traumatic growth and value-directed living.** Post-traumatic growth was significantly correlated with value-directed living, as measured by the VLQ ( $r = .269$ ,  $N = 63$ ,  $p = .016$ ) and the VQ

( $r = .215$ ,  $N = 77$ ,  $p = .030$ ), higher levels of post-traumatic growth being significantly associated with higher levels of value-directed living. The association between post-traumatic growth and value-directed living as measured by the ELS was not significant ( $r = .130$ ,  $N = 80$ ,  $p = .125$ ). The association with the VQ was no longer significant when a Bonferroni correction ( $\alpha_{\text{altered}} = .05/3$ ) was applied. At a factor level, PTGI Factors 1 (Relating to Others), 2 (New Possibilities) and 5 (Appreciation of Life) significantly positively correlated with the VLQ and VQ (higher levels of post-traumatic growth in these domains were significantly associated with higher levels of value-directed living); no factors were significantly correlated with the ELS (Table 3). When a Bonferroni correction was applied ( $\alpha_{\text{altered}} = .05/3$ ) the associations of factors 1 and 5 with the VLQ remained significant, and only factor 5 remained significantly associated with the VQ.

[Table 3 here]

**Value-directed living and post-traumatic growth as predictors of current functioning, distress and wellbeing.** Pearson correlations (Table 4) indicated that the post traumatic growth measure was not significantly correlated with distress or wellbeing. It was modestly correlated with current functioning, with greater levels of growth associated with poorer functioning (although this was no longer significant when a Bonferroni correction ( $\alpha_{\text{altered}} = .05/4$ ) was applied). In contrast, the value-directed living measures were all strongly inversely correlated with distress and strongly positively correlated with wellbeing, with two of the three measures significantly positively correlated with current functioning. Thus higher levels of value-directed living were associated with lower levels of distress, higher levels of wellbeing and better current functioning.

[Table 4 here]

As the PTGI was not correlated with measures of distress or wellbeing, no further analyses were conducted to determine whether post-traumatic growth or value-directed living were stronger predictors of distress or wellbeing. As both the PTGI and value-directed living measures were significantly correlated with current functioning, the PTGI and the ELS (the most predictive of the value-directed living measures) were then entered together into a linear regression as predictors of

current functioning. This model was statistically significant ( $F(2, 77) = 11.24; p < .001$ ), with PTG and ELS together explaining 23% of variance in current functioning. Beta values indicate that the ELS was more predictive of current functioning than the PTGI (see Table 5).

[Table 5 here]

Overall, measures of value-directed living predicted current functioning, wellbeing and distress. The ELS was the best predictor of current functioning. The VLQ was the best predictor of distress and wellbeing, though a significant proportion of participants (21%) did not fully complete the VLQ measure. The Valuing Questionnaire Progress subscale had broadly comparable high correlations with wellbeing, whilst being fully completed by nearly all participants. For each outcome, the most predictive value-directed living measure was a stronger predictor of the outcome than the PTGI.

**Post-traumatic growth, value-directed living and post-traumatic stress symptoms.** There was a significant negative Pearson's correlation between post-traumatic stress symptoms and all measures of value-directed living (VLQ:  $r = -.597, N = 61, p < .001$ ; ELS:  $r = -.378, N = 75, p = .001$ ; VQ:  $r = -.399, N = 74, p < .001$ ), higher levels of value-directed living being significantly associated with lower levels of post-traumatic stress. These associations remained significant when a Bonferroni correction for multiple comparisons was applied ( $\alpha_{\text{altered}} = .05/3$ ). There was no significant correlation between post-traumatic stress symptoms and post-traumatic growth ( $r = .01, N = 74, p = .934$ ). Higher levels of symptoms of post-traumatic stress were associated with lower levels of value-directed living, whilst there was no association between levels of post-traumatic stress and post-traumatic growth.

**Post-traumatic growth, value-directed living and resilience.** Results indicate that none of the factors of the PTGI were significantly related to resilience, whilst all the measures of value-directed living were significantly positively associated with resilience (Table 6), with higher levels of value-directed living significantly associated with higher levels of resilience.



[Table 6 here]

## **Discussion**

Given the apparent overlap between behavioural aspects of post-traumatic growth and value-directed living, this study sought to examine the association between these two variables, and how they each related to a range of outcomes. It was found that post-traumatic growth was significantly (though modestly) associated with two measures of value-directed living. Higher levels of value-directed living were significantly associated with increased positive outcomes (wellbeing, resilience) and reduced negative outcomes (distress, post-traumatic stress symptoms), whilst post-traumatic growth was not related to any of these outcomes.

### ***Post-traumatic growth***

Whilst the current findings are in line with the mixed evidence in the existing literature (e.g. Zoellner & Maercker, 2006; Grace et al., 2015), it has been noted that the post-trauma trajectory of someone who has had an ABI may differ significantly from other types of trauma (Grace et al., 2015). It is known that ABI can be associated with impaired insight (Worthington & Wood, 2008) and this may have affected responses. There is evidence that the relationship between distress and post-traumatic growth is moderated by time after the traumatic event (Helgeson et al., 2006), so the wide variation in time elapsed since injury of the current study may have obscured any relationship. Examination of this relationship was beyond the scope of the current research, but might usefully be explored by future research.

Use of the PTGI to measure post-traumatic growth may also be a factor in the lack of associations between growth and other variables. Pais-Hrit et al. (2019) found that the Changes in Outlook Questionnaire (CiOQ; Joseph et al., 2006) had better validity than the PTGI in a TBI sample, although the PTGI is an established measure of post-traumatic growth that has been widely used with ABI samples. The measurement of post-traumatic growth, especially in an ABI population, is complex and likely to benefit from further research.

In our study post-traumatic growth was a significant independent predictor of level of current functioning (the extent to which an individual can live independently or needs assistance), with higher levels of post-traumatic growth modestly associated with poorer functioning. Consistent with some other research from ABI samples (e.g. Silva et al., 2011), this finding provides some support for the notion that the greater disruption caused by a higher level of impairment and the consequent struggle to accommodate this may be more likely to trigger the cognitive processes leading to post-traumatic growth, although this requires further longitudinal research. It is also possible that the relationship between impairment and post-traumatic growth is not causal, but is mediated by other unknown variables.

### ***Value-directed living***

The current study found that all three measures of value-directed living were significantly positively associated with well-being and resilience, and significantly negatively associated with trauma symptoms and distress. Some degree of divergence in the findings and the relatively modest intercorrelations between the value-directed living measures suggests the measures may be assessing different aspects of value-directed living. In particular, whilst the VQ and VLQ presented a similar pattern of associations with the PTGI, the ELS did not, suggesting this measure may assess a different aspect of the construct. It has previously been suggested that research on value-directed living is limited by some inconsistency in the definition and measurement of the construct (Serowik et al., 2018).

Consistent with previous research (Kelly et al., 2018; Pais et al., 2019), living more in alignment with one's values was associated with improved functioning. Pais et al. (2019) note that the direction of causality is unclear, and suggest that individuals experiencing lower levels of functional impairment may have fewer barriers to living in alignment with their values.

The pattern of missing items on the VLQ suggests that some domains were not considered relevant by participants – items relating to parenting, work and education were each not completed

by 7-11% of participants. This may be an artefact of the mean age of the sample (60.48 years), for whom these domains may have been perceived as less relevant. The actual or perceived lack of relevance of some value domains resulted in complete data being unavailable for over 20% of the sample, which has serious implications for the use of the VLQ in research.

### ***Relationship between post-traumatic growth and value-directed living***

Although the associations between post-traumatic growth and value-directed living were small, the significant associations between some factors of the PTGI and value-directed living, even when Bonferroni corrections were applied, support the notion that some of the domains in which post-traumatic growth is measured (interpersonal relationships, philosophy of life and view of self) could overlap with values. This suggests that in these domains reported 'post-traumatic growth' may be an indication that individuals are living in alignment with their values.

Although post-traumatic growth and value-directed living may have some underlying common processes, in this study they were associated with different outcomes. Post-traumatic growth is largely a cognitive construct, whilst value-directed living involves cognitive (awareness of values) and behavioural elements (engaging in value-aligned behaviours). It is possible that the inclusion of a behavioural component, or the combination of cognitive and behavioural components, may account for the difference in outcomes associated with the two concepts.

Tedeschi and Calhoun (2004) propose that the traumatic event shatters an individual's view of the world, and that post-traumatic growth occurs as a consequence of the cognitive processes of rebuilding this and integrating the traumatic event. It is possible that this shattering of world-view promotes reflection on what is important in life, and that this reflection can lead to behavioural change (i.e. value-directed living). If so, thinking about one's values and choosing behaviours that are consistent with the values does not need to be prompted by trauma or injury, but could be facilitated by other means.

### ***Clinical and Research Implications***

This study builds on the work of Pais-Hrit et al. (2019), which examined the relationship between post-traumatic growth and value-directed living, by also considering how each of these concepts relate to other clinically important outcomes. In this study, higher levels of value-directed living were associated with increased positive outcomes (wellbeing) and reduced negative outcomes (distress, post-traumatic stress symptoms). There was no association between post-traumatic growth and any of these outcomes. This suggests that interventions aimed at improving outcomes after brain injury may benefit from focusing on the promotion of value-directed living rather than post-traumatic growth. In view of the changes in functional ability often experienced after brain injury, interventions focused on helping individuals to find new ways to behaviourally enact their values may be of particular clinical benefit. For example, an individual who was no longer able to play football with their children due to physical consequences of their ABI, could find an alternative behaviour (e.g. playing board games) to support the same value – Family or Parenting. The period following a brain injury, which may involve adjustment to functional changes and likely involves a break from the tasks of normal life, may present a particularly opportune time to reflect on values and consider behavioural changes in relation to these.

Consistent with Pais-Hrit et al. (2019), the current study found evidence of an association between post-traumatic growth and value-directed living in an ABI sample. Longitudinal research could examine how the processes develop and interact over time. The current study's finding that value-directed living was associated with positive rehabilitation outcomes indicates the importance of value-directed living interventions in terms of improving outcomes for this population. Future research could usefully evaluate the effectiveness of strategies aimed at promoting value-directed living in brain injury survivors.

### ***Strengths and limitations of this study***

Although missing items meant that for some analyses the sample size was reduced to 61, this seems unlikely to have had a substantial impact on findings as related effect sizes in practice were either quite large or quite small. Most associations remained significant even when a conservative correction for multiple comparison (Bonferroni) was applied. A key constraint is the cross-sectional data of the current project, with longitudinal studies needed to help evaluate the directionality of effects.

The sample, which consists of patients admitted to a single hospital in North East Scotland, may be considered to limit the generalizability of the findings. Future research should seek to replicate the findings across more geographically diverse samples. It was not possible to compare the demographic information of respondents and non-respondents, so it is possible that the results are biased towards higher functioning individuals, with better reading and writing abilities, who were more likely to complete and return the questionnaires. Also, as a direct measure of injury severity was not available (duration of hospital admission of at least 7 days was used as a proxy for moderate – severe injury), it was not possible to explore associations between different levels of severity and outcomes.

Although ‘sufficient cognitive ability’ was an inclusion criterion, nearly 15% of the sample had help in completing the questionnaires and in addition to cognitive consequences of the brain injury, around 25% of the sample left education prior to the age of 16. Whilst impairments in cognition, educational level and/or insight may have had an effect on responses, this was deemed preferable to a more restricted sample that would be less representative of the sample population. As participants completed self-report measures without guidance from a clinician, it is possible that lack of familiarity with abstract concepts (e.g. values), potentially compounded by the possible presence of cognitive difficulties, could also have impacted responses.

## ***Conclusion***

This study found that whilst post-traumatic growth was modestly associated with some measures of value-directed living, value-directed living appears to be a more useful concept, as it was significantly associated with clinically relevant outcomes. This may be a consequence of value-directed living encompassing both cognitive and behavioural elements (reflecting on values and behaving consistently with them). It is recommended that interventions aimed at promoting value-directed living are considered in the rehabilitation of people with acquired brain injuries.

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## Tables and Figures

**Table 1**

*Characteristics of the sample.*

<b>Characteristics</b>	<b>Mean (SD)</b>	<b>Range</b>
<b>Age (years)</b>	60.48 (12.72)	28-86
<b>Duration of Admission (days)</b>	19.68 (17.81)	7-111
<b>Months since ABI</b>	76.43 (26.91)	43-133
		<b>N (%)</b>
<b>Gender</b>	Male	52 (64.2)
	Female	29 (35.8)
<b>Acquired Brain Injury type</b>	Sub-Arachnoid Haemorrhage	34 (42)
	Stroke *	24 (29.6)
	Traumatic Brain Injury	23 (28.4)
<b>Marital status</b>	Married / civil partnership	54 (66.7)
	Divorced / separated	11 (13.6)
	Single	9 (11.1)
	Widowed	7 (8.6)
<b>Education level**</b>	Trade / Technical / Vocational qualification	26 (32.1)
	No school / left school before age 16	21 (25.5)
	College qualification	15 (18.5)
	Undergraduate qualification	11 (13.6)
	Postgraduate qualification	7 (8.6)
<b>Employment status</b>	Retired	35 (43.2)
	Paid employment	31 (38.3)
	Unable to work due to ABI	6 (7.4)
	Unable to work for other reason	4 (4.9)
	Voluntary work	4 (4.9)
	Student	1 (1.2)
<b>Had help completing questionnaires</b> (e.g. from friend / relative / carer)	No	69 (85.2)
	Yes	12 (14.8)

\* *Ischaemic and haemorrhagic (excluding sub-arachnoid haemorrhage)*

\*\**N=80, 1 case missing data. Categories are ordered by increasing frequency.*

**Table 2***Mean score, standard deviation and range for all measures.*

	<b>N *</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Range</b>
<b>Post Traumatic Growth Inventory (PTGI) total score</b>	80	47.95	23.75	0-92
<b>PTGI factor 1</b>	80	18.16	10.11	0-35
<b>PTGI factor 2</b>	80	8.96	6.13	0-20
<b>PTGI factor 3</b>	80	9.74	5.19	0-19
<b>PTGI factor 4</b>	81	1.15	1.55	0-5
<b>PTGI factor 5</b>	81	9.09	4.40	0-15
<b>Valuing Questionnaire - Progress domain</b>	78	20.53	6.58	0-30
<b>Engaged Living Scale - Valued Living domain</b>	81	37.62	8.02	15-50
<b>Valued Living Questionnaire - composite score</b>	64	52.28	23.10	4-96
<b>WHO Wellbeing Index (WHO-5) - composite score</b>	81	58.12	26.13	4-100
<b>Trauma Screening Questionnaire - total score</b>	75	12.72	2.66	10-19
<b>Hospital Anxiety and Depression Scale (HADS) - total score</b>	80	11.89	8.64	0-32
<b>HADS Anxiety scale</b>	80	6.49	4.72	0-18
<b>HADS Depression scale</b>	80	5.40	4.55	0-18
<b>Brief Resilience Scale - composite score</b>	81	3.26	0.87	1.50-5.00
<b>Glasgow Outcome Scale</b>	81	Good recovery: N= 31 (38.3%) Moderate Disability: N= 16 (19.8%) Severe Disability: N= 34 (42%)		

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\* where N<81, this is due to cases being excluded due to missing items.

**Table 3***Pearson correlations between post-traumatic growth and value-directed living.*

		<b>Value-directed living</b>			
		Valuing Questionnaire - Progress	Engaged Living Scale - Valued Living	Valued Living Questionnaire	
<b>Post-Traumatic Growth</b>	PTGI composite score	r	<b>.215*</b>	.130	<b>.269*</b>
		p	<b>.030</b>	.125	<b>.016</b>
		N	<b>77</b>	80	<b>63</b>
	PTGI factor 1 Relating to Others	r	<b>.223*</b>	.133	<b>.288*</b>
		p	<b>.026</b>	.120	<b>.011</b>
		N	77	80	63
	PTGI factor 2 New Possibilities	r	<b>.193*</b>	.152	<b>.231*</b>
		p	<b>.047</b>	.089	<b>.034</b>
		N	77	80	63
	PTGI factor 3 Personal Strength	r	.109	.016	.093
		p	.172	.445	.233
		N	77	80	63
	PTGI factor 4 Spiritual Change	r	-.047	.082	.063
		p	.341	.233	.312
		N	78	81	64
PTGI factor 5 Appreciation of Life	r	<b>.314**</b>	.151	<b>.333**</b>	
	p	<b>.003</b>	.089	<b>.004</b>	
	N	78	81	64	

**Table 4**

*Pearson Correlations between Value-Directed Living and Post-Traumatic Growth, and measures of Distress, Wellbeing and Current Functioning*

		Valued Living Questionnaire	Engaged Living Scale – Valued Living	Valuing Questionnaire - Progress	Post Traumatic Growth Inventory
Distress (HADS Total)	r	<b>-.635</b>	<b>-.526</b>	<b>-.458</b>	.058
	N	<b>63</b>	<b>80</b>	<b>77</b>	79
	p	<b>&lt;.001</b>	<b>&lt;.001</b>	<b>&lt;.001</b>	.613
HADS Anxiety	r	<b>-.557</b>	<b>-.433</b>	<b>-.374</b>	.142
	N	<b>63</b>	<b>80</b>	<b>77</b>	79
	p	<b>&lt;.001</b>	<b>&lt;.001</b>	<b>.001</b>	.213
HADS Depression	r	<b>-.624</b>	<b>-.549</b>	<b>-.486</b>	-.037
	N	<b>63</b>	<b>80</b>	<b>77</b>	79
	p	<b>&lt;.001</b>	<b>&lt;.001</b>	<b>&lt;.001</b>	.744
Wellbeing (WHO-5)	r	<b>.659</b>	<b>.531</b>	<b>.626</b>	.103
	N	<b>64</b>	<b>81</b>	<b>78</b>	80
	p	<b>&lt;.001</b>	<b>&lt;.001</b>	<b>&lt;.001</b>	.361
Current Functioning (GOS)	r	<b>-.331</b>	<b>-.358</b>	-.187	<b>.278</b>
	N	<b>64</b>	<b>81</b>	78	<b>80</b>
	p	<b>.008</b>	<b>.001</b>	.101	<b>.013</b>

**Table 5**

*Regression - ELS and PTGI as predictors of current functioning.  $R^2 = .226$*

Model	Unstandardized Coefficients		Standardized Coefficients	Sig.
	B	Std. Error	Beta	
(Constant)	3.083	0.454		
PTGI total score	0.012	0.004	.328	.002
ELS Valued Living domain	-0.044	0.011	-.389	.001

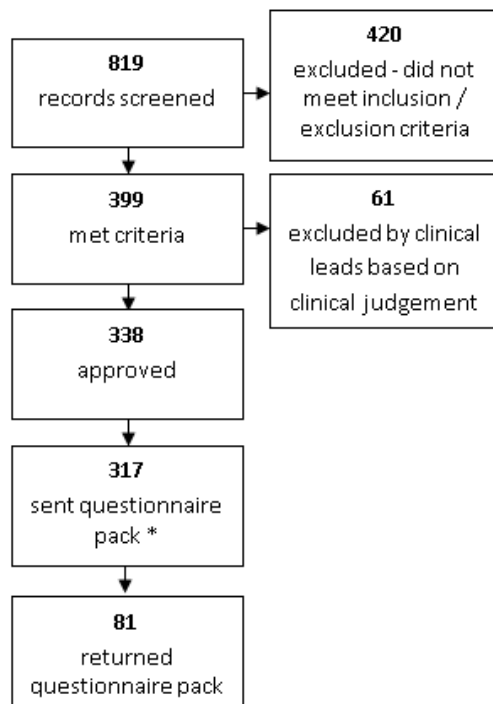


**Table 6***Correlations between PTGI factors, value-directed living and resilience*

		<b>Resilience</b>	
<b>Post-Traumatic Growth</b>	PTGI factor 1	Pearson Correlation	-.021
	Relating to Others	Sig. (1-tailed)	.426
		N	80
	PTGI factor 2	Pearson Correlation	-.117
	New Possibilities	Sig. (1-tailed)	.150
		N	80
	PTGI factor 3	Pearson Correlation	-.088
	Personal Strength	Sig. (1-tailed)	.218
		N	80
	PTGI factor 4	Pearson Correlation	-.144
	Spiritual Change	Sig. (1-tailed)	.100
		N	81
	PTGI factor 5	Pearson Correlation	-.065
	Appreciation of Life	Sig. (1-tailed)	.283
		N	81
<b>Value-directed Living</b>	Valuing Questionnaire - Progress	Pearson Correlation	.296**
		Sig. (1-tailed)	.005
		N	76
	Engaged Living Scale - Valued Living	Pearson Correlation	.419**
		Sig. (1-tailed)	.000
		N	81
Valued Living Questionnaire	Pearson Correlation	.392**	
	Sig. (1-tailed)	.001	
	N	64	

**Figure 1**

*Record screening procedure*



*\*21 were not contacted as it was predicted that required sample size would be attained by contacting 317 people.*