

Psychological Adaptation to Spinal Cord Injury

The contributions of sense of coherence and posttraumatic growth

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Abstract

This thesis investigated two concepts which have shown promise in accounting for psychological adaptation to spinal cord injury: sense of coherence and posttraumatic growth.

Paper one describes a systematic review which investigated the relationships between sense of coherence and physical and mental health outcomes in spinal cord injured individuals. Thirteen studies met criteria for the review. Their findings are summarised and critically appraised.

Paper two describes an investigation into predictors of posttraumatic growth following spinal cord injury. Relevant predictors were drawn from theoretical models of posttraumatic growth and from the literature pertaining to psychological adaptation to spinal cord injury. The findings of this study suggest that deliberate rumination, appraisals of disability, social support and core belief disruption help to account for the experience of posttraumatic growth following spinal cord injury.

Paper three provides a critical review of this project. The rationale for many of the decisions made is provided, alongside a contextualisation of the findings within their respective theoretical and empirical frameworks. Recommendations for clinical practice and service development are drawn from the studies. Future directions for research which arise from the current project are also discussed.

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Prepared in accordance with author guidelines for *Disability & Rehabilitation* (appendix I)

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The relationship between sense of coherence and mental and physical health outcomes in spinal cord injured individuals: a systematic review

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1. ABSTRACT

Study design: Systematic literature review.

Objectives: Sense of coherence (SOC) is operationalised as a relatively enduring tendency to view internal and external events as comprehensible, manageable and meaningful. It has been proposed to be a protective resource that facilitates the maintenance and development of mental and physical health in the context of significant stress. SOC has demonstrated consistent associations with a range of mental and physical health outcomes, including in populations with acquired physical disabilities. Spinal cord injury (SCI) is a condition which presents significant challenges to the affected individual’s mental and physical health and quality of life. This review aims to explicate and critically appraise the literature pertaining to the relationship between SOC and indices of mental and physical health in SCI populations.

Methods: A systematic literature review was conducted utilising five databases: PsycINFO, MEDLINE, SCOPUS, Citation Index of Nursing & Allied Health Literature (CINAHL) and Web of Science.

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Results: 1255 articles were identified, of which 13 met criteria for inclusion in the current review. Due to the diversity of designs employed, studies were assessed using the Quality Assessment Tool for Studies with Diverse Designs and a narrative synthesis of results was conducted.

Conclusion: There is good evidence of associations between SOC and measures of depression, anxiety and psychological adaptation in SCI individuals. The literature pertaining to SOC and physical health in this population is less conclusive due to a host of methodological limitations. Coping strategies and appraisals may offer potential intervention targets to improve SOC in SCI individuals.

Keywords: Spinal cord injury; sense of coherence; psychological adaptation; psychological resources

Implications for Rehabilitation:

- Sense of coherence is associated with improved mental health and quality of life in spinal cord injured populations.
- The relationship between sense of coherence and physical health outcomes remains unclear in this cohort.
- Appraisals and coping strategies are potential targets for interventions seeking to improve sense of coherence.

2. INTRODUCTION

2.1. Psychological sequelae of spinal cord injury

A substantial body of empirical literature has documented the negative impact that sustaining a spinal cord injury (SCI) may have on the affected individual's physical and mental health. This includes increased incidences of mental health problems [1], risk of drug and alcohol dependence [2], and elevated rates of suicide [3]. Approximately 30% of SCI individuals report experiencing abnormally high levels of negative psychological states [1] and studies have found that between 30 and 35% of SCI individuals experience clinically significant anxiety and depression one year post-injury [4]. In addition, studies have suggested that between 14 and 44% of SCI individuals experience significant PTSD symptomatology [5,6]. Furthermore, an up to five-fold incidence of suicide has been identified in SCI populations relative to the general population [7,8].

In addition to elevated rates of psychological distress, SCI individuals often experience a range of secondary health conditions (SHCs), with one study reporting that 95% of their sample had one SHC and 58% had three or more [9]. Common SHCs in this cohort include pressure sores [9–11], obesity [9], pain [9], urinary tract complications [9–11], spasticity [9,11,12], cardiac complications, [13] high blood pressure [13] and bowel dysfunction [14]. Pain appears to be particularly prevalent in SCI populations, with studies suggested that 26-96% of SCI individuals experience chronic pain [15]. SHCs are particularly relevant to the longer-term care of SCI individuals as this cohort has been consistently shown to have a reduced life expectancy relative to able-bodied controls [16], much of which is attributable to preventable SHCs [17].

2.2. The role of psychological resources in spinal cord injury

In contrast to the significant challenges imposed by SCI, research has shown that many SCI individuals demonstrate psychological resilience and appear to adapt successfully to their condition [18]. To account for this, a host of psychological resources have been investigated which appear to facilitate coping and adaptation to SCI [19–23]. The term psychological resources encompasses a broad range of personal attributes, skills, behaviours and coping strategies that may be deployed to successfully address challenges and cope with adversity [19]. For example, studies have suggested that social skills [23], self-efficacy [24], spirituality [25], optimism [26] and self-esteem [27] may all serve as psychological buffers against the previously identified deleterious outcomes in SCI populations. In addition, sense of coherence (SOC) has been proposed as one of the psychological factors which may potentially confer a protective advantage against poor physical and mental health outcomes following SCI [19,20].

2.3. Sense of coherence

Proposed by Antonovsky, the concept of SOC refers to a relatively stable tendency to view one's immediate context and events that happen as comprehensible, manageable and meaningful [28,29]. It broadly encompasses a dispositional orientation towards problem-solving difficulties using available resources [28–30]. SOC is based on salutogenesis, an approach to health promotion which focuses on identifying the factors which facilitate the development of health and well-being, rather than the traditional focus in medical science on epidemiology and disease [30]. Within the concept of salutogenesis, health is characterised as existing on a continuum from complete ill health, or dis-ease, to complete health, or ease. SOC is proposed to affect physical and mental health by influencing movement along this continuum at cognitive, behavioural and biological levels [29]. More specifically, SOC is proposed to exert its effect through perceptual and cognitive processes, health promoting behaviours and physiological arousal at the level of the immunological and endocrine systems [29]. These postulated mechanisms of action have subsequently received some empirical support. For example, Amirkham and Greaves found that undergraduate psychology students who scored higher on SOC perceived a greater number of hypothetical events to be meaningful and coherent than those who scored lower on SOC [31]. Additionally, participants in their study reported utilising more problem-solving and fewer avoidant coping strategies in their own lives [31]. At a physiological level, SOC has been found to moderate the relationship between negative affect and the activity of natural killer cells in the immune systems of healthy older adults exposed to a stressful situation [32].

SOC has consistently been found to be negatively associated with psychological distress and positively associated with quality of life (QOL) [33]. For example, in a large study based on data from a Canadian national population health survey, SOC was found to be strongly

negatively associated with depression and global distress [34]. Similarly, low SOC was found to be strongly associated with depression in spousal caregivers of people with Alzheimer's disease [35]. This relationship appears to be sufficiently robust that some authors have characterised major depression as a sudden breakdown in SOC [36]. Similarly, a systematic review of the QOL literature reported good evidence of a positive association between SOC and QOL, including longitudinal studies which suggest SOC is predictive of QOL [37].

Studies with diverse populations have demonstrated that SOC is associated with perceived health, to the extent that higher levels of SOC are associated with fewer health-related complaints [30]. However, there is a lack of consensus within the extant literature as to whether SOC is associated with the perceived or objective health [38]. Reviews of the literature have examined the relationship between SOC and health outcomes and found that SOC is positively associated with mental, but not physical, health [30,39]. However, some studies have reported contradictory findings. For example, in a large, well-controlled epidemiological study which utilised a UK sample, a strong SOC was found to be associated with a 30% reduction in all-cause mortality and mortality due to cancer and cardiovascular disease [40].

2.4. Sense of coherence and acquired physical disability

The majority of the previous literature has examined the role of SOC in coping with relatively transient stressors as opposed to chronic or ongoing conditions. However, SOC has also been shown to facilitate adaptive coping in populations affected by chronic illness and disability [41–45]. Lustig, Rosenthal, Strauser and Haynes found SOC to account for 77% of the variance in adjustment to disability in a sample of university students with a diverse range of learning, mobility and vision-related disabilities [41] In addition, Badura-Brzoza and colleagues reported

an inverse relationship of SOC with depression and anxiety in a sample of individuals who had either had limb amputation or spinal surgery [42].

Previous reviews have identified SOC as one of the factors which mediates the relationship between SCI and mental health outcomes [19–22]. However, a number of relevant studies have been published since these reviews [46–51]. This supports the rationale for an updated review. In addition, no review to date has focussed on the relationships between SOC and physical health outcomes in people who have experienced SCI. There is reason to believe that physical and mental health outcomes may be closely inter-related in this population. For example, difficulties with adjustment have been associated with self-neglect in SCI individuals, which in turn is associated with deleterious physical health outcomes [22,52]. Additionally, SOC has been demonstrated to be predictive of a favourable outcome following lower-back surgery [53] and has been found to explain a large proportion of the variance in depression in older adults with long-term SCI [54].

2.5. Current review

The current review aims to synthesise and critically appraise the current empirical literature which examines the relationships between the construct SOC and mental and physical health outcomes in SCI populations. The purposes of this review are twofold: (i) to identify the relationships between SOC and a host of mental health, physical health and QOL outcomes and (ii) to explore mechanisms by which SOC may exert its effect in SCI populations (e.g. through the use of coping strategies).

3. METHOD

3.1. Literature search

A systematic literature review was conducted in January 2018 using the following databases: PsycINFO, MEDLINE, SCOPUS, Citation Index of Nursing and Allied Health Literature (CINAHL) and Web of Science. Key search terms were used to identify relevant studies. These included synonyms for spinal cord injury (e.g. spin* trauma, spin* transection, tetraplegi*), SOC (e.g. salutogen*, life orientation) and psychological adaptation or physical health (e.g. psycho* adjustment, psycho* resources, health) (appendix II).

Two steps were taken to identify additional relevant studies which may have been omitted by the original search. The text and reference lists of the included studies were searched for additional relevant references. This has been found to enhance the coverage of database searches [55]. In addition, two experts in the field were sent a list of the included studies to determine if they were aware of any additional studies that met the inclusion criteria (appendix III).

3.2. Inclusion criteria

Studies which fulfilled the following criteria were included in the review: (i) published in a peer-reviewed journal; (ii) published in the English language; (iii) published between 1979 and the present day; (iv) sample consisted solely of people with a SCI or mixed samples where it was possible to isolate results for SCI participants; (v) employed a quantitative methodology; and (vi) utilised an established measure of SOC.

Antonovsky first proposed the concept of SOC in 1979 so this was chosen as a cut-off for inclusion [12]. To date, two validated measures of SOC exist – the 29-item Sense of Coherence scale (SOC-29) [28] and the 13-item Sense of Coherence scale (SOC-13) [56]. A systematic review of validation studies suggests that both scales are reliable, with Cronbach's α ranging from 0.70 to 0.95 across 124 studies for the SOCS-29 and from 0.70 to 0.92 across 127 studies for the SOCS-13 [57]. Only studies including one of these scales were included. No minimum age for participants was specified as research has suggested that age at onset of injury is not a significant predictor of long-term adaptation to SCI [58].

3.3. Quality assessment

The methodological quality of the identified studies was assessed using the Quality Assessment Tool for Studies with Diverse Designs (QATSDD) [59]. The QATSDD was selected due to its applicability to reviews which incorporate a range of designs and methodologies. It has been demonstrated to have good to substantial inter-rater reliability ($k = 51.7 - 100$) and good content validity [59]. The QATSDD has been used successfully in previous reviews across a broad spectrum of subjects, including acquisition of competence in cognitive behavioural therapy [60] and prognostic factors in Crohn's disease [61]. In line with previous reviews, the percentage totals were divided into separate categories for comparison purposes (0-49% = 'poor quality', 50-74% = 'moderate quality' and 75-100% = 'high quality') [59].

4. RESULTS

4.1. Search outcome

The systematic literature searches identified 1255 studies, of which 13 met inclusion criteria for the current review (Figure 1). These are summarised using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [62].

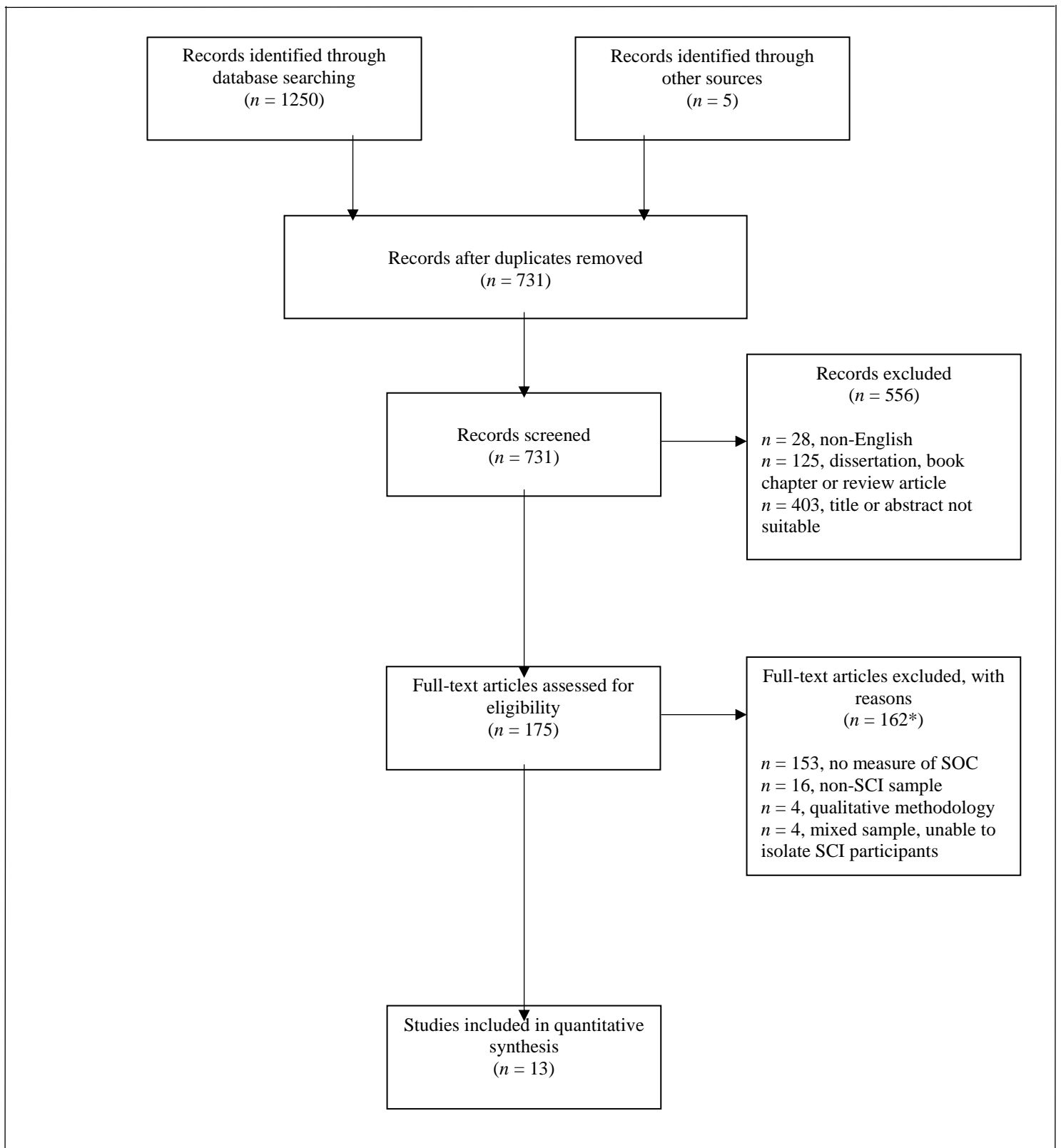


Figure 1. PRISMA flow diagram

*numbers add to more than 162 because some studies met multiple exclusion criteria

4.2. Characteristics of studies

Of the thirteen reviewed studies, nine employed cross-sectional designs; two employed longitudinal designs; one was a prospective observational study; and one was a prospective, controlled intervention study. The studies recruited participants from Switzerland ($n = 4$), Sweden ($n = 4$), the UK ($n = 3$), Ireland ($n = 3$), Germany ($n = 2$), the USA ($n = 2$), Austria ($n = 1$), Taiwan ($n = 1$) and Iran ($n = 1$). Two studies measured SOC but did not include it in any relevant analyses [46,47]. Consequently, these two studies will not be discussed further.

The results of the studies are discussed in relation to the associations between SOC and indicators of both mental and physical health and in the context of their methodological quality. A single study may be included in multiple sections as studies often examined a range of mental health, physical health and QOL variables. Tables 1 and 2 contain summaries of study characteristics and quality ratings.

It was not possible to conduct a meta-analysis due to the diversity of outcome variables studied and instruments employed. Instead, a narrative synthesis of the findings is used to integrate them.

A number of limitations in methodology and application of theory were evident in all or the majority of studies. For example, none of the included studies provided any evidence of user involvement in study design (see table 2). Additionally, only one study [48] provided evidence of addressing sample size and power considerations in their data analysis.

4.3. Inter-rater reliability

An independent rater replicated the quality assessment process with five randomly selected studies. This yielded a moderate level of inter-rater reliability ($k = .41$) [63,64]. Discrepancies were discussed and a consensus reached for all items. Five studies represents approx. 38% of the studies in the current review, which is in line with guidelines which suggest that a minimum of 10% of studies in a systematic review should be double-assessed [65].

4.4. Sense of coherence and mental health

Eight of the reviewed studies explored the relationships between SOC and mental health. Three of these were rated as being of ‘high’ methodological quality [50,67,70] and five were rated as ‘moderate’ [49,48,68,69,71] with quality ratings ranging from 57.1% [71] to 85.7% [67]. Sample sizes ranged from 20 [71] to 266 [67] participants.

Geyh and colleagues [49] examined the functioning of people with a SCI across a broad biopsychosocial framework based on the International Classification of Functioning, Disability and Health (ICF) [66]. More specifically, they investigated the relationships of self-esteem and self-efficacy with participation, defined as reintegration with normal daily activities, within the broader ICF framework. SOC was included as a psychological resource that may facilitate participation post-SCI. Significant positive correlations emerged between SOC and both self-efficacy and self-esteem. SOC was also found to be significantly negatively correlated with

Table 1. Summary of reviewed studies

Authors, year, title and country	Aims	Sample/Design	Method/Analysis	Results	QATSDD rating
Geyh, Nick, Stirnimann, Ehrat, Müller & Michel (2012) 'Biopsychosocial outcomes in individuals with and without a spinal cord injury', Switzerland [46]	(i) to compare whether SCI individuals differ from non-SCI controls in terms of a range of biopsychosocial variables (e.g. social support, secondary health conditions, pain, depression, SOC) (ii) to explore the differences between SCI individuals and controls	102 SCI individuals and 73 non-SCI matched controls Cross-sectional, controlled design	Participants completed a battery of self-report measures Between-group differences (SCI vs. non-SCI) were analysed with <i>t</i> -tests and Mann-Whitney <i>U</i> -tests. Classificatory logistic regression was used to explore between-group differences (SCI vs. non-SCI)	No significant between-group differences in SOC scores SOC not entered into regression model due to lack of between-group differences	59.5% (moderate)
Geyh, Nick, Stirnimann, Ehrat, Michel, Peter & Lude (2012) 'Self-efficacy and self-esteem as predictors of participation in spinal cord injury – an ICF-based study', Switzerland [49]	To investigate the relationship between self-efficacy and self-esteem with participation in an SCI population while taking into account relevant biological (e.g. health conditions), psychological (e.g. SOC) and social (e.g. social support) factors	102 SCI individuals Cross-sectional design	Participants completed a battery of self-report measures Bivariate Pearson's correlation coefficients were calculated between each of the variables	Significant positive correlations were found between SOC and age, participation, self-efficacy, self-esteem, task-orientated coping and avoidance-orientated coping Significant negative correlations were found between SOC and limitations imposed by health conditions and both depression and anxiety symptoms	66.7% (moderate)
Jørgensen, Iwarsson, Norin & Lexell (2016) 'The Swedish Aging with Spinal Cord Injury Study (SASCIS): Methodology and initial results', Sweden [47]	To investigate the factors associated with healthy aging in SCI	123 SCI individuals Cross-sectional cohort study	Data gathered from structured interviews and participant's medical records Participants were clustered into three groups based on injury severity for analysis Between-group differences analysed with Kruskal-Wallis		76.2% (high)

			test, Mann-Whitney <i>U</i> -test or...		
Jørgensen, Ginis, Iwarsson & Lexell (2017) 'Depressive symptoms among older adults with long-term spinal cord injury: Associations with secondary health conditions, sense of coherence, coping strategies and physical activity', Sweden [50]	The investigate the associations of sociodemographic, injury characteristics and modifiable variable (secondary health conditions, SOC, coping strategies and leisure-time physical activity) with depression in older adults (50 years +) who sustained a SCI at least 10 years previously	122 SCI individuals Cross-sectional design	Data gathered from structured interviews and participant's medical records Participants were clustered into three groups based on injury severity for analysis A multivariable linear regression was used to investigate the associations between the modifiable variables and depression	Modifiable factors accounted for 53% of the variance in depression scores, with SOC being the strongest explanatory factor	81% (high)
Kennedy, Lude, Elfström & Smithson (2010a) 'Cognitive appraisals, coping and QOL outcomes: A multi-centre study of spinal cord injury rehabilitation', UK, Switzerland, Germany and Ireland [67]	(i) to explore psychological responses, cognitive appraisals and coping styles in the 12 weeks following SCI (ii) to gather information about the psychological profiles newly-injured SCI patients across several European countries and compare differences between countries (iii) to investigate the contributions of cognitive appraisals and coping strategies to later well-being and QOL in SCI patients	266 SCI individuals Longitudinal, multiple wave panel design	Questionnaire measures were administered to participants at two time points: (i) as soon as possible (approx. six weeks) post-injury and (ii) twelve weeks later Differences between time points were measured using <i>t</i> -tests and Kruskal-Wallis tests, as appropriate Variables were analysed using stepwise hierarchical regression	SOC did not change significantly between the two time-points and there were no significant differences between countries A regression model which included SOC, perceived manageability and coping strategies explained 47% of the variance in functional independence and physical QOL, 50% of the variance in anxiety, 57% of the variance in depression and 58% of the variance in psychological QOL	85.7% (high)
Kennedy, Lude, Elfström & Smithson (2010b) 'Sense of coherence and psychological outcomes in people with spinal cord injury: Appraisals and	To investigate the relative contributions of SOC, appraisals and behavioural responses to psychological adjustment in people with SCI	237 SCI individuals Longitudinal, multiple wave panel design	Questionnaire measures were administered to participants six weeks, twelve weeks and one year post-injury	Significant negative correlations were found between SOC at six weeks and anxiety and depression at one year	73.8% (moderate)

behavioural responses', UK, Ireland, Sweden, Austria, Switzerland and Germany [68]			Data was analysed using Pearson correlations and hierarchical stepwise regression	<p>A significant positive correlation was found between SOC at six weeks and psychological QOL at one year</p> <p>Significant negative correlations were found between SOC at six weeks and 'threat' and 'loss' appraisals</p> <p>A significant positive correlation was found between SOC at six weeks and 'challenge' appraisals</p> <p>SOC at six weeks demonstrated significant positive correlations with 'acceptance' and 'fighting spirit' coping behaviours and a significant negative correlation with 'social reliance' coping behaviour</p>	
Kennedy, Nolan & Smithson (2011) 'Psychological adjustment to spinal cord injury in Ireland: QOL, appraisals and coping', Ireland [69]	To investigate the relationships of appraisals, coping and social support with mood and QOL in SCI individuals	25 SCI individuals Cross-sectional design	<p>Questionnaires were administered to participants at 12-weeks post-injury</p> <p>Pearson product-moment correlational analyses were used to investigate relationships between the variables</p> <p><i>t</i>-tests were used to investigate differences between those who scored vs. low on a given measure</p>	<p>SOC was negatively correlated with anxiety and depression</p> <p>Participants with high SOC scored higher on psychological, social and environmental QOL subscales</p>	69% (moderate)
Livneh & Martz (2014) 'Coping strategies and resources as predictors of psychosocial adaptation	To investigate the impact of coping resources and strategies on psychosocial adaptation to SCI	95 SCI individuals Cross-sectional design	Participants completed a battery of self-report measures sent via post	SOC was a significant predictor of psychosocial adaptation to SCI	92.9% (high)

among people with spinal cord injury', USA [48]			Relationships between variables were investigated with bivariate correlational and multiple regression analyses	SOC also interacted significantly with engagement in the prediction of psychosocial adaptation to SCI	
Lustig (2005) 'The adjustment process for individuals with spinal cord injury: The effects of perceived premorbid sense of coherence', USA [70]	To investigate the relationship between perceived changes in sense of coherence pre- and post-injury with adjustment to SCI	48 SCI individuals Cross-sectional design	Participants completed a measure of SOC twice: once based on their perceived pre-injury SOC and once based on their post-injury SOC. They also completed a measure of adjustment to disability Correlational analyses were used to investigate the relationship between change in SOC score and adjustment	Perceived decrease in SOC correlated positively with shock, anxiety, depression, internal anger and external hostility. It correlated negatively with acknowledgement and adjustment Perceived increase in SOC correlated negatively with shock, anxiety, depression and internal anger.	76.2% (high)
Norrbrink Budh, Kowalski & Lundeberg (2006) 'A comprehensive pain management programme comprising educational, cognitive and behavioural interventions for neuropathic pain following spinal cord injury', Sweden [74]	To examine the impact of a multi-disciplinary pain management programme on a range of outcome measures, including SOC	27 SCI individuals in the intervention group; 11 SCI individuals in the control group Prospective, controlled, intervention study	Measures were completed at baseline, at 10-weeks (conclusion of group) and at three, six and twelve-month follow-ups The rank-invariant method was used to analyse changes in SOC scores between baseline and twelve-month follow-up	SOC significantly increased in the intervention group and decreased in the control group over time	64.3% (moderate)
O'Carroll, Ayling, O'Reilly & North (2003) 'Alexithymia and sense of coherence in patients with total spinal cord transection', UK [71]	To investigate the relationship between SOC and QOL following total spinal cord transection	20 individuals with total spinal cord transection/ tetraplegia and 20 age-, sex- and education-matched non-SCI controls Cross-sectional, controlled design	Participants completed a battery of self-report measures Between-group differences were analysed using <i>t</i> -tests. Correlation analyses were used to examine the relationship between SOC and QOL	No significant difference was found between SCI individuals and controls on total SOC score SOC correlated significantly and positively with QOL (physical capacity, psychological, social relationships and environment subscales) both with and without the effect of mood partialled out. This was the case in SCI	57.1% (moderate)

				participants but not in healthy controls	
Shakeri et al. (2016) 'Do spinal cord-injured individuals with stronger sense of coherence use different psychological defense styles?', Iran [51]	To investigate the impact of SOC on defence styles employed by SCI individuals	40 SCI individuals Cross-sectional design	Questionnaires were administered to participants via clinical interview The Mann-Whitney <i>U</i> -test and Kruskal-Wallis were used to compare categories of responses	SOC was significantly positively associated with the use of 'mature' defence styles, such as humour and suppression, and significantly negatively associated with the use of 'immature' defence styles, such as passive aggression, acting out, autistic fantasy, isolation and somatisation	66.7% (moderate)
Wu & Chan (2007) 'Psychosocial adjustment patterns of persons with spinal cord injury in Taiwan', Taiwan [74]	To investigate the adjustment patterns of individuals with SCI in Taiwan	102 SCI individuals Cross-sectional design	Participants were sent a battery of postal questionnaires Hierarchical cluster analyses were used to identify homogenous groups of participants. Discriminant analysis was used to determine whether the identified groups could be discriminated by demographic variables and/or SOC scores	Four groups were identified: (i) well adjusted, (ii) moderately adjusted, (iii) moderately adjusted and sexually inexperienced and (iv) poorly adjusted. Discriminant analyses found that the above order reliably differentiated participants based on SOC score	76.2% (high)

Table 2. QATSDD quality assessment ratings of reviewed studies (0 = not at all; 1 = very slightly; 2 = moderately; 3 = completely)

	Theoretical framework	Statement of aims/ objectives	Description of research setting	Sample size considered	Representative sample of target group	Description of data collection procedure	Choice of data collection tool(s)	Detailed recruitment data	Statistical analyses of data collection tool(s)	Fit between research question and method of data collection	Fit between research question and method of analysis	Justification for analytic method selected	Evidence of user involvement in design	Strengths/ limitations critically discussed
Geyh et al. (2012)	3	3	3	0	1	1	1	3	0	3	3	3	0	1
Geyh et al. (2012)	3	3	3	0	2	1	1	3	0	3	3	3	0	3
Jørgensen et al. (2016)	3	3	3	0	3	3	3	3	1	3	3	1	0	3
Jørgensen et al. (2017)	3	3	3	0	3	3	3	1	3	3	3	3	0	3
Kennedy et al. (2010a)	3	3	3	0	3	3	3	3	3	3	3	3	0	3
Kennedy et al. (2010b)	3	3	3	0	3	3	2	2	2	3	3	2	0	2
Kennedy et al. (2011)	3	3	3	0	1	3	3	0	1	3	3	3	0	3
Livneh & Martz (2014)	3	3	3	3	3	3	3	3	3	3	3	3	0	3
Lustig (2005)	3	3	3	0	1	3	3	3	3	2	3	3	0	2
Norrbrink Budh et al. (2006)	2	3	3	0	1	3	2	3	0	3	3	2	0	2
O'Carroll et al. (2003)	3	3	2	0	1	1	2	0	2	3	3	2	0	2
Shakeri et al. (2016)	2	2	3	0	1	3	3	1	3	3	3	2	0	2
Wu & Chan (2007)	1	3	3	0	1	3	3	3	3	3	3	3	0	3

anxiety and depression. However, this study was rated as being of ‘moderate’ quality and the findings should be interpreted in the context of several methodological limitations. The authors provided very limited rationale for the choice of data collection tools and no statistical assessment of the reliability and validity of the tools was employed. An additional, related limitation is the potential theoretical overlap between the ‘manageability’ component of SOC and self-efficacy. The significant correlations found between the two concepts may indicate that they are accessing similar underlying constructs. However, it is noteworthy that this correlation did not reach the level of multicollinearity.

Jørgensen and colleagues [50] examined the impact that modifiable factors, including SOC, SHCs and recreational physical activity, had on levels of depression in a cohort of older adults who had had a SCI for at least ten years. SOC was identified as the strongest predictor of level of depression in this study, with higher rates of SOC associated with lower levels of depression. While the methodological quality of this study was rated as ‘high’, the authors did not include any information about recruitment rates or the characteristics of participants who declined to take part. Consequently, the potential generalisability of the results was compromised.

Kennedy and colleagues [67] employed a longitudinal design to investigate the impact that early cognitive appraisals and the coping strategies used immediately post-injury had on psychological adjustment 12 weeks later. A regression model containing SOC, perceived manageability and coping strategies accounted for 50% of the variance in anxiety scores, 57% of the variance in depression scores and 58% of the variance in psychological QOL at a 12-week follow-up. This study was rated as ‘high’ methodological quality. A strength of this study is its use of a multi-centre recruitment strategy across four European countries, which supports the generalisability of the obtained findings. Additionally, the longitudinal design employed

allows inferences about causality to be drawn from their data. However, similar to other studies [e.g. 49], it is possible that some of the measures utilised may have actually accessed similar underlying concepts. This is particularly the case for perceived manageability due to its similarity to the manageability subscale of the SOC scale [56].

Kennedy, Lude, Elfström and Smithson [68] examined the relationships between SOC and psychological adaptation to SCI in a longitudinal design. They found that SOC measured six weeks post-injury was negatively associated with both depression and anxiety scores at one year post-injury and positively associated with psychological QOL at one year post-injury. In addition, a regression model that included SOC, appraisals and coping strategies at six-weeks post-injury accounted for 66.5% of the variance in depression and 37.7% of the variance in anxiety scores at one year post-injury. This study was rated as ‘moderate’ quality. Similar to Kennedy et al. [67], this study employed a multi-centre recruitment strategy across six European countries, which supports the generalisability of their findings. However, a limitation of this study is the reduced sample size at one year follow-up. While the authors comment on this in their discussion, they do not provide sufficiently detailed recruitment data to ascertain what the sample size at one year was and whether the participants who failed to respond at follow-up differed from those who took part in any meaningful ways. Consequently, conclusions based on this follow-up data should be approached with caution.

Kennedy, Nolan and Smithson [69] employed a cross-sectional design to investigate the relationships between SOC, QOL and mood following SCI in an Irish sample. They found that SOC was negatively associated with depression and anxiety and positively associated with psychological, social and environmental QOL. This study was found to be of ‘moderate’ quality and any inferences made from the results of this study should be interpreted in light of

its relatively small sample size ($n = 25$) and notable lack of detail in recruitment procedures. It is also the case that direction of causality cannot be inferred in this design. Consequently, the obtained findings do not preclude the possibilities that participants who experienced greater mood disturbance rated their SOC as being lower, or that participants who experienced better QOL due to extraneous variables rated their SOC as being higher.

Lustig [70] examined the relationship between perceived changes in SOC pre- to post-injury and mood following SCI. It was found that a perceived decrease in SOC following injury was associated with elevated levels of a range of distressing emotional sequelae, including anxiety, depression, shock, internal anger and external hostility. Moreover, a perceived increase in SOC was associated with decreased anxiety, depression, shock and internal anger. While the methodological quality of this study was rated as 'high', it was subject to several limitations which limit the conclusions that can be drawn from its findings. For example, participants were asked to complete the SOCS-29 [28] twice, firstly based on their current SOC and secondly based on their perceived pre-injury SOC. However, this order was not counterbalanced across participants. Consequently, it is possible that asking participants to first think about their current SOC primed them to give higher ratings on their pre-injury SOC. In addition, a significant number of participants were excluded due to significant missing data or because there was no perceived change in their SOC scores. No demographic information is provided on these participants. As a result, it is not possible to conclude with certainty whether the recruited sample is representative or whether those excluded differed from those included in any pertinent ways. Finally, the decision to have no minimum time elapsed since injury for recruitment means that it is not possible to say whether the obtained findings represent a stable or transient perceived change in SOC as the person adapts to their disability.

O'Carroll and colleagues [71] found that SOC correlated significantly and positively with psychological, social relationships and environment QOL subscales. This was the case both with and without the potentially confounding effect of mood partialled out. This study was rated as 'moderate' quality and was limited by the sparse information provided about the recruitment strategy employed. Coupled with an omission of demographic information about the sample or the target population, this makes it impossible to comment on the generalisability of the obtained findings.

Shakeri and colleagues [51] investigated the relationship between 'psychological defence styles' and SOC in an Iranian SCI sample. Associations between SOC and defence styles were discovered to the extent that stronger SOC was positively associated with 'mature defence styles' and negatively associated with 'immature defence styles'. This study was rated as 'moderate' quality and was subject to a number of limitations which impact on the conclusions that can be drawn from their findings. Primarily, this paper was limited by being poorly contextualised within existing theoretical frameworks. While it appears to draw on psychoanalytic theories of ego defence, this is not sufficiently delineated. Similarly, very limited reference is made to existing frameworks and evidence in relation to psychosocial adaptation to SCI. Additionally, very limited information is included about how the obtained sample compares to the target population, resulting in an inability to comment on the generalisability of the findings. Considered together, these limitations make it difficult to situate the findings of this study within the broader context of research in this area.

4.5. Sense of coherence and physical health

Four of the reviewed studies examined the relationship between SOC and physical health. One of these was rated as being 'high' quality [67] and three were rated as 'moderate' [49,71,74].

Quality ratings ranged from 57.1% [71] to 85.7% [67]. Sample sizes ranged from 20 [71] to 266 [67] participants.

Geyh and colleagues [49] found a significant negative correlation between SOC and self-reported limitations due to health conditions and a significant positive correlation between SOC and reintegration with normal daily activities. However, a bespoke measure was used to measure limitations due to health conditions. As a result, no comment on its reliability, validity or other psychometric properties can be made.

In the study rated as 'high' quality [67], Kennedy and colleagues found that a regression model which included SOC, perceived manageability and coping strategies explained 47% of the variance in functional independence and physical QOL. However, it should be noted that functional independence was measured using a self-report instrument. Previous studies have suggested that subjective reports of physical capabilities are subject to bias and may be discrepant from test-based measures [72]. Consequently, the instrument employed here may have provided biased estimates of functional ability.

O'Carroll and colleagues [71] found that SOC correlated with the physical capacity subscale of a QOL measure. A relative strength of this study is that the measure of physical capacity employed came from a validated questionnaire.

Norrbrink Budh and colleagues [73] investigated the impact of a pain management programme on a range of outcome measures, including SOC, in a sample of SCI individuals who experienced neuropathic pain. At a 12-month follow-up, SOC scores for participants in the intervention group had increased relative to baseline and to the control group. However, this

study was found to be of ‘moderate’ quality and the conclusions that can be drawn from it are limited by the small sample size ($n = 27$ intervention group; $n = 11$ control group) and the lack of randomised allocation to treatment and control groups. Consequently, the sample may not have been representative.

4.6. Sense of coherence, coping strategies and adaptation to disability

Livneh and Martz [48] investigated whether SCI individuals use of coping resources, including SOC, and coping strategies impacted on their subsequent psychosocial adaptation. They also examined whether the use of coping strategies moderated the effect of coping resources once the effects of anxiety and depression on psychosocial adaptation were controlled for. They found that SOC was a significant predictor of psychosocial adaptation to SCI and that SOC also interacted significantly with engagement coping in the prediction of psychosocial adaptation to SCI. This study was rated as being ‘high’ quality and had the highest percentage quality score of 92.9%. Particular methodological strengths of this study include its detailed recruitment data resulting in a clearly representative sample and attention to achieving adequate statistical power in its analyses, both of which support the generalisability of the obtained findings.

Geyh and colleagues [49] found significant positive correlations between SOC and both task-orientated and avoidance-orientated coping. This study was rated as being of ‘moderate’ methodological quality.

Kennedy, Lude, Elfström and Smithson [68] found significant negative correlations between SOC and ‘threat’ and ‘loss’ appraisals and a significant positive correlation between SOC and ‘challenge’ appraisals. They also found significant positive correlations between SOC and

‘acceptance’ and ‘fighting spirit’ coping behaviours and a significant negative correlation with SOC and ‘social reliance’ coping behaviour. This study was rated as being ‘moderate’ quality.

Wu and Chan [74] examined psychosocial adjustment to SCI among a community sample in Taiwan. They found that participants fell within one of four groups: well adjusted, moderately adjusted, moderately adjusted and sexually inexperienced and poorly adjusted. SOC score was found to be an accurate discriminator of adjustment group classification, suggested that there was an association between SOC and psychosocial adjustment. This study was rated as being of ‘high’ methodological quality. However, it was limited by its recruitment strategy, whereby the study was advertised through a single SCI advocacy organisation. Coupled with a lack of demographic comparison with the target population, it is not possible to determine whether the obtained sample is representative of the target population or differs from it in relevant ways.

In summary, there is good quality evidence to suggest that SOC is associated with improved mental health outcomes. Additionally, there is some good quality evidence that coping strategies and appraisals represent potential mechanisms through which SOC exerts its effect on mental health outcomes. At present, the evidence in relation to SOC and physical health is too limited to draw any firm conclusions. This is largely due to methodological limitations associated with the use of bespoke and self-report measures of physical health.

5. DISCUSSION

This review synthesised and critically evaluated the empirical literature on the relationship between SOC and physical and mental health outcomes in SCI populations. A number of conclusions can be drawn from the reviewed studies. In addition, the studies are discussed in relation to their methodological quality and relevant limitations are highlighted.

There is good evidence of an association between SOC and mental health outcomes in SCI populations based on research which is either of 'high' or 'moderate' methodological quality. Several of the studies reported negative associations between SOC and measures of depression and anxiety [49,50,67–70]. The non-experimental, cross-sectional designs employed by several of these studies mean that inferences about causality are impossible to draw [48,50,69,70]. However, the inclusion of two longitudinal studies, one rated as high quality and the other as moderate, suggests that there is a causal, rather than merely correlational, relationship between SOC and negative mood states such as anxiety and depression [67,68]. Only a single study investigated negative mood states other than depression and anxiety [70]. However, a host of methodological limitations with this study limit the conclusions which can be drawn from their findings. Finally, a single study investigated the relationship between SOC and psychological defence styles [51]. However, this study was poorly contextualised within available theoretical frameworks and, consequently, is difficult to integrate with other existing literature on this topic.

Studies relating to SOC and physical health suggested that SOC is related to greater functional independence and improved physical QOL [49,67,71,73]. However, the evidence base in this area consists of mostly moderate quality studies with numerous relevant methodological limitations. Of note, two of the studies employed subjective or bespoke, unvalidated measures of physical functioning [49,67]. Consequently, their findings may have been subject to the effects of reporting bias from participants. Additionally, the mostly cross-sectional designs employed, coupled with a lack of objective measurement of physical functioning across studies, raise the possibility that the direction of causality may plausibly have been the reverse (i.e. that levels of physical health and functioning influenced SOC ratings).

There is good evidence of a relationship between SOC and psychological adaptation to SCI [48,74]. Two studies demonstrated that SOC was associated with psychological adaptation to the extent that it predicted adaptation and was a significant discriminator of which adaptation cluster participants fell within. While one of these studies was limited by the representativeness of its sample, the other demonstrated careful consideration of the need to obtain a representative and appropriately powered sample. This suggests that the results obtained here are generalisable.

Two studies reported associations of SOC with coping strategies and appraisals [49,68]. Their findings are congruent with the proposed cognitive ‘comprehensibility’ component of SOC [28,29]. Both studies were rated as being of moderate quality. However, the correlational nature of one of the studies [49] makes inferences about causality impossible.

A number of limitations were noted within and across studies. None of the reviewed studies included any evidence of user involvement in design. It was also the case that only one study explicitly considered sample size and statistical power in the data analysis [48]. In addition, the utilisation of mainly cross-sectional designs presents difficulties inferring causality from the majority of the included studies.

5.1. Strengths and limitations of the current review

The current review provides an overview of the association of SOC with a range of mental and physical health outcomes following SCI. It includes a breadth of studies which employ a diversity of designs and outcome measures. It addresses an identified need within the extant literature for a comprehensive review of the relationship of SOC with both physical and mental

health outcomes following SCI. While the review was focussed in scope, it could be argued that firmer conclusions could be drawn had the review considered additional, relevant areas of acquired disability. For example, it may have been useful to include the literature in relation to SOC and disability arising from limb amputation within the current review.

5.2. Critique of quality assessment tool

The QATSDD identified several relevant methodological limitations both within and across the included studies. However, it was also subject to several limitations. For example, it does not include any assessment of risk of bias within studies. Additionally, it would benefit from an evaluation of the novelty or theoretical consistency of studies, which would allow comment to be made of how well a study sits within and/or contributes to the broader body of knowledge on a given topic within a subject area. This was particularly evident in relation to Shakeri and colleagues's study of the relationship between psychological defence styles and SOC [51].

5.3. Clinical implications

The identified relationships between SOC and measures of depression, anxiety and psychological adaptation suggest that interventions which bolster a person's SOC would likely impact positively on their mental health. There is some literature to suggest that SOC is amenable to intervention. For example, Weissbecker and colleagues found that participants with a diagnosis of fibromyalgia who attended a mindfulness-based stress reduction programme reported increases in SOC post-intervention relative to waiting list controls [75]. However, their analysis does not identify the mechanism by which this improvement operates.

Within the current analysis, the identified associations of SOC with appraisals and coping strategies offer a potential target for intervention.

The relationships highlighted above also suggest that screening for SOC may prove a useful method of identifying patients who are likely to require additional support.

5.4. Future research

Evidence of user involvement in design was a consistent limitation across studies. Future studies may consider involving service user groups in the piloting of studies in this area.

A common limitation of these studies was lack of representativeness in their samples. Future studies may address this utilising more diverse and representative samples or providing demographic information about how their sample compares to the target population to allow comparisons to be drawn.

In the reviewed literature, there was a distinct lack of intervention studies targeting the development of high SOC. While this is a critique that could be made of the field of SOC as a whole, the rehabilitation programmes which characterise SCI care in the post-acute phase may present an ideal opportunity to study whether SOC is amenable to intervention and, if so, the types of intervention that prove most efficacious.

Antonovsky proposed that SOC exerts its effect on health at perceptual, behavioural and biological levels [28,29]. However, the mechanisms which facilitate this effect in SCI populations remain unclear because many of the studies did not explore moderators and

mediators of the relationship between SOC and the identified outcomes. Future research specifically within the field of SCI and SOC as a whole may address this pertinent question.

It was unclear from the extant literature whether reported associations between SOC and physical health outcomes (e.g. functional independence) were indicative of objective differences in these areas. To address this limitation, future studies may employ informant-based measures (e.g. from a family member, medical professional, etc.) and objective assessments of functioning to complement self-report measures.

A significant gap in the current literature is an examination of the relationship between SOC and SHCs in SCI populations. This would seem a particularly pertinent topic to investigate given the relationship between SHCs and preventable mortality in this cohort [15,16]. Future studies may explore whether any identified differences in self-reported physical health as a function of SOC are reflected in objective measures of physical health, such as fewer SHCs, in SCI populations.

While the relationship between SOC and depression and anxiety appears to be well-supported in SCI populations, further research should investigate its relationship with PTSD symptomatology. This seems particularly pertinent as SOC's emphasis on comprehensibility appears to fit well with cognitive models of PTSD (e.g. Ehlers & Clark) [76].

The concept of SOC broadly would benefit from greater discrimination from other similar or overlapping concepts. For example, it has been suggested that the consistently high correlations reported between SOC and depression and anxiety are due to these concepts accessing similar underlying structures [77]. This critique could also be posited for the SCI literature, as studies

assess potentially overlapping concepts, such as SOC and perceived manageability and coping strategies [49].

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Posttraumatic Growth Following Spinal Cord Injury: The relationships between cognitive processes, social support, appraisals of disability, mood and well-being.

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1. Abstract

Objectives. In addition to a range of negative sequelae, emerging literature suggests that many spinal cord injured (SCI) individuals experience lasting positive psychological changes, termed posttraumatic growth (PTG), in the wake of their injury. This study investigated predictors of PTG in a community-dwelling SCI population. Potential predictor variables were drawn from theoretical models of PTG (e.g. Tedeschi & Calhoun, 1996; 2004) and the empirical literature on psychological adaptation to SCI.

Design. This study employed a cross-sectional survey design.

Methods. SCI individuals ($N = 63$; 24 male, 39 female) completed an online battery of questionnaires assessing core belief disruption; deliberate and intrusive rumination; social support; appraisals of disability; current mood; subjective well-being; and PTG. Data were analysed using correlation, regression and mediation analyses.

Results. Significant correlations were found of core belief disruption, deliberate rumination, social support, appraisals of disability, current mood and subjective well-being with PTG. A model which contained deliberate rumination, appraisal of disability, core belief disruption and social support accounted for 43.2% of the variance in PTG. Deliberate rumination mediated the effect of core belief disruption on PTG.

Conclusions. This study adds to the nascent body of empirical literature investigating predictors of PTG following SCI. It also supports the assertion that models of PTG predicated on core belief disruption and subsequent cognitive processing are applicable to SCI populations. Deliberate rumination, appraisals of disability and social support offer potential targets for interventions seeking to foster PTG in SCI individuals.

Keywords: Posttraumatic growth; spinal cord injury; deliberate rumination; appraisals of disability

Statement of contribution

What is already known on this subject?

- The predictive relationship between coping strategies and posttraumatic growth in spinal cord injured individuals has been well established.
- Previous research has supported the assertion that cognitive processes (e.g. core belief disruption, deliberate rumination) and social support are associated with posttraumatic growth. However, these variables have not been investigated in spinal cord injured individuals.

What does this study add?

- This is the first study to date to investigate the role of core belief disruption and subsequent cognitive processes in the experience of posttraumatic growth in a spinal cord injured sample.
- This is the first study to date to examine the relationship between appraisal of disability and posttraumatic growth.

2. Introduction

2.1. Psychological Sequelae of Spinal Cord Injury

Sustaining a spinal cord injury (SCI) can have a profound impact on the affected individual's physical health, social activity and occupational functioning (World Health Organisation, 2013). In addition, research has suggested that SCI individuals are at an increased risk of deleterious mental health outcomes, including elevated incidences of depression, anxiety and post-traumatic stress disorder (PTSD) symptomatology compared to able-bodied controls

(Craig, Tran & Middleton, 2009). This elevated incidence of negative psychological states also appears to hold relative to other patient groups, to the extent that SCI individuals have been found to have a 1.29-fold increased incidence of anxiety and depression compared to people with other health conditions (Lim et al., 2017). In contrast, longitudinal studies suggest that, while a minority of people experience pervasive mood disorder following SCI, the majority demonstrate psychological resilience (Bonanno, Kennedy, Galatzer-Levy, Lude & Elfström, 2012). Research on psychological adjustment to SCI has suggested that the level and extent of the injury plays little, if any, role in subsequent psychological adaptation and that psychological factors account for a much greater proportion of adjustment (Dijkers, 1997; Kalpakjian, et al., 2014; Orbann, 1986). Furthermore, many SCI individuals report lasting positive changes from their pre-injury state, often referred to as ‘posttraumatic growth’ (PTG, Griffiths & Kennedy, 2012; Kennedy, Lude, Elfström & Cox, 2013).

2.2. Posttraumatic Growth: Theory and models

Initially proposed by Tedeschi and Calhoun, the term PTG refers to positive psychological changes that occur in the aftermath of adversity or trauma and which represent a change over and above that of recovery to a pre-event state (Barskova & Oesterreich, 2009; Tedeschi & Calhoun, 1996; 2004). These changes have been postulated to occur across the domains of relationships with others, perceived new possibilities, spiritual changes, greater appreciation of life, enhanced self-understanding and improved personal strength (Tedeschi & Calhoun, 1996; 2004). A substantial body of literature now supports the assertion that many individuals experience PTG following traumatic events (Meyerson, Grant, Carter & Kilmer, 2011; Shand, Cowlshaw, Brooker, Burney & Ricciardelli, 2015).

Several explanatory models of PTG have been proposed (e.g. Joseph, Murphy & Regel, 2012; Schaefer & Moos, 1998; Tedeschi & Calhoun, 2004; Zoellner & Maercker, 2006). However, the model proposed by Tedeschi and Calhoun remains the best validated (Hallam & Morris, 2014; Kelly, Morris & Shetty, 2017). This model proposes that traumatic events challenge the assumptions a person holds about themselves, others and the world. PTG is proposed to arise when the person successfully adapts these challenged assumptions in a manner that facilitates a perceived deeper understanding of the self, others and/or the world (Tedeschi & Calhoun, 1996; 2004). Their model also asserts that deliberate, but not intrusive, rumination and social support facilitate the development of these more adaptive assumptions. Tedeschi and Calhoun's model has been supported in relation to a range of populations, such as natural disaster survivors (Taku, Tedeschi, Cann & Calhoun, 2014), stroke survivors (Kelly et al., 2017) and their carers (Hallam & Morris, 2014).

2.3. Posttraumatic Growth following Spinal Cord Injury

Qualitative studies suggest that people with a SCI experience many of the features of PTG documented elsewhere (Griffiths & Kennedy, 2012; Wang et al., 2017). For example, SCI participants in one study identified a greater appreciation of their personal relationships and other aspects of their health since their injury (Kennedy, Lude, Elfström & Cox, 2013). While there appears to be good evidence to suggest PTG does occur in SCI populations, only a small number of quantitative studies to date have investigated predictors of PTG in this population (e.g. January, Zebracki, Chlan & Vogel, 2015; Kalpakjian et al., 2014; Kunz, Joseph, Geyh & Peter, 2017; Pollard & Kennedy, 2007; Wang, Xie & Zhao, 2018; Znoj, 1999).

Kalpakjian and colleagues (2014) investigated the relationships between demographic variables, medical aetiology of injury (e.g. traumatically vs. non-traumatically acquired, extent

of injury, etc.) and current depression with PTG. Their model accounted for only 5% of the observed variance in PTG. In addition, they found that level of injury and traumatic aetiology were unrelated to PTG. This is in line with previous studies which have suggested that level and severity of SCI play little or no part in subsequent psychological adaptation (Sabour et al., 2015; Tavakoli et al., 2016). However, the authors interpreted this finding as evidence that models which are predicated on challenges to core beliefs (e.g. Janoff-Bulman, 1992; Tedeschi & Calhoun, 1996; 2004) are not applicable to SCI. This conclusion is unlikely to be valid as it erroneously assumes that traumatic aetiology is synonymous with extent of challenge to core beliefs. This assertion omits cognitive appraisal of the injury and is incongruous with the results of other studies. For example, it has been found that disability-specific appraisals are a better predictor of psychological distress than injury severity or functional impairment in people with a SCI (Martz, Livneh, Priebe, Wuermsler & Ottomanelli, 2005). In addition, studies of PTG in cancer survivors have found no relationship between illness severity and subsequent PTG (Barakat, Alderfer & Kazak, 2005; Morris & Shakespeare-Finch, 2011).

In a longitudinal study, Pollard and Kennedy (2007) found that the use of mental disengagement coping, use of active coping and depression at 12-weeks post-injury accounted for 48% of the variance in PTG at a 10-year follow-up. They suggested that the relationship between post-injury depression and subsequent PTG could be interpreted as depression being indicative of challenged core beliefs. Consequently, this study provides indirect support for the proposition that core belief disruption contributes to the experience of PTG in SCI.

2.4. Cognitive Processing, Rumination and Posttraumatic Growth

Within the PTG literature, the terms rumination and cognitive processing are used somewhat interchangeably. The term rumination is most often used to refer to a maladaptive and

unproductive preoccupation with past events. However, in this context it is used to refer to a process of contemplation, or intentional sense-making, which may be adaptive. Post-event rumination has been implicated in both theoretical models and empirical studies of PTG (Calhoun, Cann, Tedeschi & McMillan, 2000; Tedeschi & Calhoun, 1996; 2004). Models of psychopathology have demonstrated rumination to be a transdiagnostic maintaining factor across a number of mental health problems (Ehring & Watkins, 2008; McEvoy, Watson, Watkins & Nathan, 2013). However, it has been argued that current conceptualisations of rumination are too narrow (Smith & Alloy, 2009). Cann and colleagues propose that a form of persistent cognitive processing, or deliberate rumination, which consciously involves making sense of difficult experiences should be adaptive and postulate that this should be related to PTG (Cann et al., 2011). In support of this proposition, Stockton, Hunt and Joseph (2011) demonstrated that deliberate, but not intrusive, rumination was associated with PTG in a university student sample who reported on their cognitive processing following an adult-onset trauma. This relationship has also been found in physical health populations. For example, numerous studies have found that intrusive rumination is associated with distress, while deliberate rumination is associated with PTG in samples of cancer survivors (Chan, Ho, Tedeschi & Leung, 2011; Morris & Shakespeare-Finch, 2011). Within the field of acquired disability, Gangstad, Norman and Barton (2009) found that extent of cognitive processing correlated significantly with level of PTG in stroke survivors. In addition, a longitudinal study has found that levels of rumination five months post-stroke are predictive of levels of PTG six months later (Kelly et al., 2017). While there appears to be consistent support for the role of deliberate rumination in PTG, no study to date has examined this relationship in a SCI sample.

2.5. Appraisals of Disability and Posttraumatic Growth

Rates of PTG appear to be lower in SCI populations than in other physical health conditions, such as cancer (Cordova, Cunningham, Carlson & Andrykowski, 2001). It has been suggested that this may be due to a greater difficulty experiencing PTG from a traumatic event which precipitates the stress of a long-term, physically disabling condition compared to one which has remitted (Pollard & Kennedy, 2007). A significant body of empirical literature has investigated the relationship between disability-specific appraisals and adaptation to SCI. It has been found that disability-specific appraisals are a significant predictor of psychological adaptation to SCI (Martz et al., 2005). Furthermore, appraisals of disability have been found to account for 49.4% of the variance in functional independence following SCI (Kennedy et al., 2010). Intervention studies have demonstrated that facilitating positive reappraisal promotes adaptation to SCI (Kennedy, Duff, Evans & Beedie, 2003; King & Kennedy, 1999). Kennedy and colleagues (2003) found that a coping effectiveness psychoeducational group reduced depression and anxiety in a group of SCI participants by facilitating reappraisal of their injury and its consequences rather than by changing their use of coping strategies.

Relationships between appraisal processes and PTG have also been demonstrated in physical health populations. For example, positive reappraisal coping was found to correlate with 'benefit finding', a construct similar to PTG, in a sample of people with multiple sclerosis (Mohr et al., 1999). In addition, longitudinal studies have suggested that positive reappraisal is causally related to PTG (Lechner, Carver, Antoni, Weaver & Phillips, 2006). For example, Sears, Stanton and Danoff-Burg (2003) found that positive reappraisal coping predicted PTG at a 12-month follow-up in a sample of women with early-stage breast cancer.

The findings of previous studies, coupled with the well-documented role of appraisals in psychological adaptation to SCI, suggest a possible role for appraisals of disability in the genesis of PTG in SCI populations. However, this relationship has not previously been investigated.

2.6. Social Support and Posttraumatic Growth

Theoretical models and empirical studies have identified a positive relationship between social support and PTG (Hallam & Morris, 2014; Tedeschi & Calhoun, 2004). Social support has also been associated with life satisfaction and physical well-being (Rintala, Young, Hart, Clearman & Fuhrer, 1992), decreased depression (Elliot, Herrick, Witty, Godshall & Spuell, 1992) and decreased feelings of helplessness (Elfström, Kreuter, Rydén, Persson & Sullivan, 2002) in adults with a SCI. It is also the case that levels of social support have been shown to be positively associated with mental and physical health in SCI populations (Müller, Peter, Cieza & Geyh, 2012). Similarly, social support has been consistently demonstrated to be related to PTG in people with serious medical conditions (Barskova & Oesterreich, 2009).

McMillen and Cook (2003) investigated the relationship between social support and ‘positive by-products’ in adults with a SCI. They found that the ‘tangible support’ sub-scale of a social support measure was associated with positive by-products. However, these findings are limited in their applicability to PTG as the concept of ‘positive by-products’ contains several facets which are conceptually unrelated to PTG (e.g. material gain, increased closeness within the family, etc.). Consequently, the observed effect may not apply to PTG. In a qualitative study, Griffiths and Kennedy (2012) found that SCI individuals recognise social support as an important facilitator of positive psychological outcomes. However, the relationship between social support and PTG has not been previously examined in a SCI cohort.

2.7. Mood, Well-being and Posttraumatic Growth following Spinal Cord Injury

Mood disorder is an often-cited outcome of SCI (Kennedy & Rogers, 2000) and studies have suggested that, left unaddressed, the experience of depression post-SCI tends to be protracted (Saunders, Krause & Focht, 2012). It has also been found that SCI individuals report significantly lower quality of life than non-SCI matched controls (Post, van Dijk, van Asbeck & Schrijvers, 1998). The relationships between mood, well-being and PTG is complex (Helgeson, Reynolds & Tomich, 2006). For example, research has suggested that PTG and distress can co-exist (Cann, Calhoun, Tedeschi & Solomon, 2010). However, it is unclear what impact, if any, the enduring nature of SCI relative to other health conditions has on this relationship.

Wang, Xie and Zhao (2018) found negative correlations between PTG and current depression and anxiety. However, PTG did not significantly predict depression or anxiety in regression analyses. In addition, their design did not investigate factors which mediate the relationship between PTG and mood. Furthermore, no study to date has investigated the relationship between PTG and well-being post-SCI.

2.8. Current Study

A lack of validated explanatory models has been noted as a limitation within the extant literature on PTG following SCI (Pollard & Kennedy, 2007). In addition, existing models of PTG following SCI are limited by a failure to consider the relationships between cognitive processing of the traumatic event, social support, appraisals of disability and subsequent PTG, mood and well-being. Consequently, the current study will seek to empirically evaluate the relationships between core belief challenge; deliberate and intrusive rumination; social

support; current well-being; current mood; and appraisal of disability with the experience of PTG in a SCI population.

Based on previous literature, the current study will test the following hypotheses:

- H1 – Participants will report total PTG scores which differ significantly from zero (one tailed)
- H2 – Participants will report total PTG scores which are significantly lower than non-disabling physical health conditions (e.g. cancer)
- H3 – Participants will report total PTG scores which are not significantly different from other physically disabling physical health conditions (e.g. stroke)
- H4 – PTG will be positively correlated with core belief challenge (one-tailed)
- H5 – PTG will be positively correlated with deliberate rumination (one-tailed)
- H6 – PTG will be positively correlated with social support (one-tailed)
- H7 – PTG will be positively correlated with subjective well-being (one-tailed)
- H8 – PTG will be negatively correlated with mood (one-tailed)
- H9 – PTG will be negatively correlated with appraisals of disability (one-tailed)
- H10 – Intrusive rumination will be positively correlated with mood (one tailed)
- H11 – Variance in PTG will be explained by a significant regression model which includes core belief challenge, deliberate rumination, social support, appraisals of disability, subjective well-being and mood.
- H12 – The relationship between core belief challenge and PTG will be mediated by deliberate rumination.

3. Method

3.1. Ethical approval

The study was scrutinised and ethical approval granted by the School of Psychology Research Ethics Committee, Cardiff University (appendix IV).

3.2. Sample size calculation

An a priori sample size calculation was conducted using G*Power software, version 3.1 (Faul, Erdfelder, Buchner & Lang, 2009). Effect sizes for this calculation were based on studies which have examined similar models of PTG in related populations (e.g. stroke survivors, Kelly et al., 2017). These studies demonstrated correlation coefficients between PTG and relevant predictor variables between 0.41 and 0.58. Sample size calculations indicated that a sample size of between 14 and 33 participants would be sufficient to detect similar correlations in the present study. Based on Cohen (1988), a sample size of 41 for regression analyses would be sufficient to detect a similar effect size ($R^2 = 0.43$) for a regression model with 7 predictors, alpha of 0.05 and power of 0.8.

3.3. Recruitment

The study was advertised via the social media accounts and websites of several UK-based, SCI-specific charities and peer support organisations. Data were gathered online and was collected using Qualtrics, an online survey software package for which the School of Psychology, Cardiff University holds a licence. Participants were also given the option of contacting the researcher to request paper-based measures.

Inclusion criteria were that participants were aged 18 years or older and had acquired a SCI at least one year prior to their participation in the study. The one-year post-injury criteria was

based on research which suggests that individual fluctuations in psychological adjustment to SCI are relatively dynamic in the first year post-injury, but change little from one year onwards (Bonanno et al., 2012; Craig et al., 1994; Kennedy et al., 2012).

3.4. Consent and debriefing

Participants were provided with an information sheet, a consent form and a debriefing sheet with information about the study and relevant sources of support, should participants require them (appendix VI).

3.5. Measures

Participants completed the following measures (appendix VI).

Demographic questionnaire

A bespoke 8-item questionnaire was used to gather basic demographic information from participants (e.g. age, time since injury, level of injury, etc.).

The Core Beliefs Inventory (CBI)

The CBI (Cann et al., 2010) was used to measure the extent to which participant's core beliefs were challenged by the occurrence of their SCI. This is a 9-item measure of disruption in core beliefs following stressful or traumatic events with higher scores indicating greater challenge to core beliefs. It has been shown to have acceptable levels of construct validity and test-retest reliability and very good internal consistency (Cann et al., 2010). The CBI has not previously

been used in a SCI sample. However, it has been validated for use with adults undergoing treatment for leukaemia (Cann et al., 2010), which suggests it may be suitable for use in physical health populations.

The Event-Related Rumination Inventory (ERRI)

The ERRI (Cann et al., 2011) is a validated 20-item measure of post-event rumination. It contains two subscales: deliberate and intrusive rumination. It was used in this study to measure levels of deliberate and intrusive rumination following SCI. Participants were specifically requested to answer based on their rumination in the weeks immediately after they first learned they had a SCI. This was based on previous research which has found that rumination in the weeks following the traumatic event demonstrates stronger associations with PTG than rumination in the recent past (Calhoun et al., 2000). The ERRI was developed for use in PTG studies. Consequently, its use in the current study is supported on theoretical grounds. In addition, it has been used in similar studies which have examined rumination following trauma which occurred when the person was an adult (Stockton et al., 2011).

Hospital Anxiety and Depression Scale (HADS)

The HADS (Zigmond & Snaith, 1983) is a well-validated measure of anxiety and depression. It has been demonstrated to have a reliable two-factor structure, acceptable internal consistency and good concurrent validity when compared to other validated measures of mood disorder (Bjelland, Dahl, Tangen Haug & Neckelmann, 2002). The HADS has been validated in diverse populations (Bedford, Pauw & Grant, 1997; Dagnan, Chadwick & Trower, 2000; Moorey et al., 1991) including SCI (Müller, Cieza & Geyh, 2012; Woolrich, Kennedy & Tasiemski,

2006). It controls for the potentially overlapping effects of physical health problems and mood disorder by focusing on the affective and cognitive, rather than somatic, components of mood disorder (Johnston, Pollard & Hennessey, 2000). As a result, it is suitable for use in populations with high levels of comorbid physical health problems, such as SCI. It has been used extensively in previous studies with SCI populations (e.g. O'Carroll, Ayling, O'Reilly & North, 2003).

The Warwick Edinburgh Mental Well-being Scale (WEMWBS)

The WEMWBS (Stewart-Brown & Janmohamed, 2008) is a well-validated measure of subjective well-being. It has been shown to have sound psychometric properties, including good content validity, high test-retest reliability and low social desirability bias (Tennant et al., 2007). It has demonstrable reliability across cultures and age groups (Stewart-Brown et al., 2011). The short-form of the WEMWBS was used in this incidence, both pragmatically to reduce participant burden and because it has been shown to correlate significantly with the full-length version, while reducing redundancy among the items (Stewart-Brown et al., 2009).

Multidimensional Scale of Perceived Social Support (MSPSS)

The MSPSS (Zimet, Dahlem, Zimet & Farley, 1988) is a 12-item, validated scale which measures perceived social support from a significant other, family and friends on a seven-point Likert scale. It has demonstrated excellent internal consistency and good test-retest reliability in an older adult sample (Stanley, Beck & Zebb, 1998), high internal consistency and discriminant validity in an adolescent sample (Canty-Mitchell & Zimet, 2000), and good internal reliability and low social desirability bias in a student sample (Dahlem, Zimet &

Walker, 1991). It has been used in previous studies of PTG related to serious medical conditions, including cancer (Bozo, Gündoğdu & Büyükaşık-Çolak, 2009) and stroke (Kelly et al., 2017), suggesting it is suitable for use in physical health populations.

The Appraisals of Disability Primary and Secondary Scale (ADAPSS)

The ADAPSS (Dean & Kennedy, 2009) is a SCI-specific measure of appraisals of disability. It has six subscales: fearful despondency; overwhelming disbelief; determined resolve; growth and resilience; negative perceptions of disability; and personal agency. These subscales have been demonstrated to have acceptable to good internal consistency, with Cronbach's α ranging from 0.70 to 0.86 (Dean & Kennedy, 2009). The ADAPSS is scored on a six-point Likert scale. It consists of a six-item short form and 33-item long form. Items in each form are scored on a six-point Likert scale with higher scores corresponding with greater levels of negative appraisals. The scoring instructions recommend employing the short form as a screening measure, then administering the long form to participants who score above 22 on the short form (Dean & Kennedy, 2009). The short form was utilised in the current study to reduce participant burden. Data for the growth and resilience subscale was gathered, but was excluded from analyses to prevent it from creating an artificially high association with PTG.

The Posttraumatic Growth Inventory (PTGI)

The PTGI (Tedeschi & Calhoun, 1996) is a widely used, validated measure of PTG. It consists of 21-items which are measured on a six-point Likert scale. The PTGI consists of five subscales: relating to others, new possibilities, personal strength, spiritual change and appreciation of life (Tedeschi & Calhoun, 1996). However, confirmatory factor analysis suggests that these can be combined to measure a unitary construct (Linley, Andrews & Joseph,

2007). The total PTGI score has demonstrated excellent internal consistency ($\alpha = .90$) and acceptable test-retest reliability ($r = .71$; Tedeschi & Calhoun, 1996). The PTGI has been used across a range of previous studies (Hallam & Morris, 2014; Kelly et al., 2017). It was used here both to measure PTG and to facilitate comparison with other relevant studies.

4. Results

4.1. Response rate

Qualtrics recorded 130 viewings of the online survey. 62 of these did not result in any completed measures. Of the remaining 68, four were excluded based on significant missing data (three omitted one full questionnaire [the PTG-I] while one omitted two full questionnaires [the ADAPPS and PTG-I]). One participant was excluded because their SCI had occurred less than one year prior to them completing the measures (<4 months). This resulted in a final sample of 63 participants which constituted a response rate of 48.5%.

4.2. Participants and demographic information

63 participants (24 male, 39 female) were included in the analysis. Mean age of participants was 47.07 years ($SD = 12.02$; range = 20.42-76.75). Mean time since SCI was 13.47 years ($SD = 11.82$; range = 1.00-39.33). Mean age at injury was 33.60 years. Forty five participants were normally resident in the UK, 15 in the USA, one in New Zealand and one in Ireland. One participant listed their country of residence as both the UK and the USA.

Demographic information for the UK was sought for comparison purposes as that is where the majority of participants were normally resident. There is no published demographic

information for the UK as a whole. However, McCaughey and colleagues (2016) examined demographic trends of SCI in Scotland between 1994 and 2013. They found that between 73.3% and 76.7% of SCI individuals were male and that the mean age at injury was between 44.0 and 52.5 years (McCaughey et al., 2016). The gender distribution reported by McCaughey et al. (2016) is in line with worldwide epidemiological data, which suggests that the male to female ratio of SCI individuals is 3.8 to 1 (Wyndaele & Wyndaele, 2006).

4.3. Data quality checks

Completed measures were screened for missing data. Twelve missing values were identified through this procedure. These were spread evenly throughout the dataset (two in ERRI-I; three in ERRI-D; one in HADS; four in MSPSS; and two in PTG-I). These missing values were replaced with the mean score for the other scores within that subscale. Overall, missing data accounted for <1% of the dataset.

The minimum and maximum possible scores for each item were compared to those recorded to ensure that no data had been entered incorrectly. No incorrectly entered cases were identified through this procedure.

4.4. Data analysis and statistical software

A one-sample, independent *t*-test was used to test whether PTG scores were significantly different from zero and whether rates of PTG differed from other populations. Pearson's product-moment correlations were used to explore the relationships between the identified predictor variables and PTG. Multiple, linear regression was used to identify proportions of variance in PTG scores accounted for by the identified predictor variables. Mediation analyses

were used to investigate the potential mediation of the relationship between core belief disruption and posttraumatic growth by deliberate rumination.

Data were analysed using the Statistical Package for the Social Science (SPSS) version 21.0. Additional Custom Dialogues for PROCESS downloaded from (<http://afhayes.com/spss-sas-and-mplus-macros-and-code.html>) were used for mediation analyses.

As can be seen in table 1, all measures exceeded the minimum α level of .70 and the majority exceeded the more conservative minimum criteria of .80 (Lance, Butts & Michels, 2006).

Table 1. Psychometric measure scores

	<i>M</i>	<i>SD</i>	α
PTG-I	51.78	23.04	.93
CBI	25.65	12.98	.93
ERRI-I	17.70	9.51	.95
ERRI-D	17.08	7.14	.88
MSPSS	4.76	1.54	.95
ADAPSS	18.35	6.39	.73
HADS	13.81	8.28	.90
WEMWBS	22.62	4.57	.86

4.5. Hypotheses 1-3

Results of one-sample *t*-tests demonstrated that the mean PTG-I score was significantly different from zero ($t(62) = 17.84, p < .001$), that mean PTG-I scores were significantly lower than for cancer survivors ($t(62) = -2.29, p < .05$) and that mean PTG-I scores did not differ significantly from people who were an average of 11 months post-stroke ($t(62) = 0.09, p = .93$). A mean PTG rate of 58.43 for cancer survivors were taken from Sears, Stanton and Danoff-Burg (2003). A mean PTG rate of 51.53 for stroke survivors were taken from Kelly et al. (2017).

4.6. Hypotheses 4-10

Significant positive correlations were found between PTG and core belief disruption ($r = .314$, $p = .006$), deliberate rumination ($r = .408$, $p < .000$), social support ($r = .295$, $p = .009$) and well-being ($r = .259$, $p = .020$).

A significant positive correlation was found between intrusive rumination and current mood ($r = .358$, $p = .002$).

Significant negative correlations were found between PTG and mood ($r = -.277$, $p = .014$) and appraisals of disability ($r = -.373$, $p = .001$).

A summary of correlation coefficients can be found in table 2.

4.7. Hypothesis 11

Hierarchical, or blockwise, entry was used to enter independent variables into the regression model. The decision to use this method was based on the substantial theoretical importance of the selected variables. Variables were entered into the regression model hierarchically, in order of both their theoretical importance and the magnitude of their correlation coefficients with PTG.

Deliberate rumination was entered first, due to its strong theoretical importance, use in previous, related studies (e.g. Hallam & Morris, 2014; Kelly et al., 2017) and its high demonstrated correlation with PTG in this study. Appraisals of disability was entered next due to its strong empirical support as a psychological resource in the adaptation to SCI literature (Chevalier, Kennedy & Sherlock, 2009; Peter, Müller, Cieza & Geyh, 2012) and high

	Age	Time	CBI	ERRI-I	ERRI-D	MSPSS	HADS-Tot	WEMWBS	ADAPSS
Age									
Time	.335**								
CBI	-.006	.157							
ERRI-I	.107	.093	.563***						
ERRI-D	.054	-.116	.582***	.485***					
MSPSS-Tot	-.077	.020	-.074	-.113	.088				
HADS-Tot	-.062	-.194	.444***	.358**	.212*	-.260*			
WEMWBS	-.027	.328**	-.185	-.158	-.064	.224*	-.799***		
ADAPSS	-.156	-.190	.280**	.274*	.116	-.187	.718**	-.506***	
PTG-I	-.017	.126	.314**	.018	.408***	.295**	-.277**	.259*	-.478***

Table 2. Correlation coefficients

*Correlation is significant at the 0.05 level (one-tailed)

**Correlation is significant at the 0.01 level (one-tailed)

***Correlation is significant at the 0.001 level (one-tailed)

correlation with PTG in this study. Core belief disruption was entered next, followed by social support, then mood and, finally, subjective well-being.

Deliberate rumination was added first and accounted for 16.7% of the variance in PTG scores. Appraisals of disability accounted for an additional 17.9% of the variance. The addition of core belief disruption added 4.5% to the model and social support added a further 4.1%. The addition of current mood and subjective well-being did not add significantly to the variance explained by the model. The final model (Model 4, table 3) accounted for 43.2% of the variance in PTG scores ($R^2 = .432$, $F_{4,58} = 11.02$, $p < .000$).

4.8. Hypothesis 12

Mediation analysis which included core belief disruption, PTG and deliberate rumination produced a significant model ($F(1, 61) = 31.22$, $p < .000$, $R^2 = .34$).

The total direct effect of core belief disruption on PTG was significant ($B = .56$, $SE(B) = .22$, $p = .01$) but was no longer significant once the mediating effect of deliberate rumination was controlled for ($B = .20$, $SE(B) = .26$, $p = .43$).

The total indirect effect of core belief disruption through deliberate rumination (5,000 bootstrap samples) was .35 (Boot $SE = .17$; 95% confidence interval = .04 –.72).

	<i>R</i> ²	<i>B</i>	<i>Std. Error B</i>	<i>β</i>
Step 1	.17			
Constant		29.26	6.98	
ERRI-D		1.32	.38	.41**
Step 2	.35			
Constant		53.41	8.68	
ERRI-D		1.48	.34	.46
ADAPSS		-1.67	.42	-.43***
Step 3	.39			
Constant		53.07	8.40	
ERRI-D		.99	.40	.31*
ADAPSS		-1.92	.42	-.48***
CBI		.48	.23	.27*
Step 4	.43			
Constant		36.79	11.39	
ERRI-D		.87	.40	.27*
ADAPSS		-1.77	.42	.45***
CBI		.53	.23	.30*
MSPSS		3.13	1.52	.21*
Step 5	.45			
Constant		35.92	11.30	
ERRI-D		.87	.40	.27*
ADAPSS		-1.23	.56	-.31*
CBI		.63	.23	.36**
MSPSS		2.71	1.53	.18
HADS		-.62	.43	-.22
Step 6	.46			
Constant		49.98	25.92	
ERRI-D		.87	.40	.27*
ADAPSS		-1.16	.57	-.29*
CBI		.67	.25	.38**
MSPSS		2.73	1.54	.18
HADS		-.92	.66	-.33
WEMEBS		-.54	.89	-.11

Table 3. Summary of regression models

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

5. Discussion

The current study investigated the occurrence of PTG in a community-dwelling sample of SCI individuals. It examined whether models of PTG which are based on core belief disruption and subsequent cognitive processing are applicable to SCI populations. The relationships between PTG and core belief disruption, deliberate rumination, appraisals of disability, social support, mood and well-being were investigated. All six proposed variables were found to correlate with PTG. A regression model which included deliberate rumination, appraisals of disability, core belief disruption and social support accounted for 43.2% of the variance in PTG scores. Mediation analyses found that deliberate rumination significantly mediated the relationship between core belief disruption and PTG.

As predicted, participants reported levels of PTG which were significantly different from zero. In addition, levels of PTG reported in this study were significantly lower than those found in a cancer population, but did not differ significantly from a stroke population. This supports the assertion that the relatively enduring nature of SCI relative to other conditions may pose additional difficulties in experiencing growth.

In line with previous research (Morris & Shakespeare-Finch, 2011), deliberate rumination was found to have the strongest correlation with PTG in the current study. In the regression model, it was found to account for 16.7% of the variance in PTG scores. While a significant proportion of the variance, this is less than estimates in other, similar models. For example, Kelly et al. (2017) found that rumination accounted for 37% of the variance in PTG in stroke survivors. However, they employed a longitudinal design, while the current study employed a cross-sectional design. The rigour of longitudinal designs may account, at least in part, for the observed discrepancy in findings.

The identified relationship between appraisals of disability and PTG suggests that participants who reported more maladaptive appraisals of their disability experienced lower levels of PTG. This relationship accounted for an additional 17.9% of the variance in PTG when included in the regression model. Of note, this finding occurred with the growth subscale of the ADAPSS removed. Consequently, it cannot be explained as simply being due to correlations between similar constructs. This finding appears to be novel within the literature concerning PTG in populations with physically disabling conditions. However, it is congruent with the adaptation to SCI literature, where post-injury appraisals have been highlighted as a key psychological resource which facilitates successful adaptation (Kennedy, Kilvert & Hasson, 2016).

A positive relationship was identified between core belief disruption and PTG and its inclusion in the regression model accounted for an additional 4.4%. Mediation analyses found that deliberate rumination mediated this relationship to the extent that, when it was controlled for, the relationship between core belief disruption and PTG was no longer statistically significant. These relationships between core belief disruption, deliberate rumination and PTG are inconsistent with the conclusions of Kalpakjian and colleagues (2014) and support the assertion that their study erroneously conflated injury severity and traumatic aetiology with extent of disruption to core beliefs.

The current study identified a positive relationship between social support and PTG. This is consistent with Tedeschi and Calhoun's (1996, 2004) model of PTG and with previous studies in related populations which have identified social support as a consistent correlate of PTG in physical health populations (Barskova & Oesterreich, 2009). The inclusion of mood and subjective well-being in the regression model did not account for any additional variance in

PTG. This is perhaps due to current mood, well-being and PTG all being outcomes of the adaptation process, rather than being causally related to one another.

Considered together, the findings of the current study demonstrate that models of PTG predicated on core belief disruption and subsequent cognitive processing are applicable to SCI population. In line with other studies, rates of PTG were found to be lower in this cohort than other serious health conditions which are not physically disabling. This suggests that SCI individuals encounter particular challenges experiencing growth as a result of their condition. Finally, appraisals of disability were found to be an important component of post-SCI, disability-specific cognitive processing.

5.1 Clinical implications

The results of the current study suggest that rumination, appraisals of disability and social support may offer potential intervention targets to foster growth in individuals following SCI. PTG also appears to be associated with favourable mental health outcomes, such as improved mood and subjective well-being.

The relationship between deliberate, but not intrusive, rumination and PTG supports the view of other researchers that rumination is a multi-faceted concept which has both adaptive and adverse aspects (Smith & Alloy, 2009). Consequently, interventions which target post-SCI rumination may be effective in fostering PTG by addressing intrusive rumination and facilitating deliberate attempts at sense-making. A number of suitable interventions have been identified in other populations, including expressive writing (Stockton, Joseph & Hunt, 2014) and mindfulness-based stress reduction (Garland, Carlson, Cook, Lansdell & Speca, 2007; Labelle, Lawlor-Savage, Campbell, Faris & Carlson, 2015).

Disability-specific appraisals were found to be the greatest predictor of PTG in the current analysis. This is congruent with previous intervention studies which have found that facilitating the development of more adaptive disability-specific appraisals is associated with successful psychosocial adaptation to SCI (King & Kennedy, 1999). This finding provides a rationale for targeting maladaptive appraisals during rehabilitation interventions.

The association between social support and PTG found in this study is in line with the idea of an “expert companion” (Calhoun, Tedeschi, Cann & Hanks, 2010). Calhoun and colleagues (2010) propose that this “expert companion” may facilitate PTG by listening to attempts to make sense of challenged core beliefs, while helping the person to tolerate the elevated distress which is likely to accompany this. Services may be able to foster PTG in individuals who do not have access to social support through peer-mentoring interventions. This is in line with research which has demonstrated the role of such interventions in facilitating positive rehabilitation outcomes (Sherman, DeVinney & Sperling, 2004). In addition, this suggests a role for clinicians in training peer-support workers how to facilitate PTG.

The finding that current mood and well-being correlated with PTG but did not significantly contribute to the regression model suggests that the three constructs are not causally related. However, this association suggests that the development of PTG is associated with other, adaptive mental health outcomes. As a result, a focus on growth in services may have the additional benefit of promoting mental health.

5.2. Limitations of the current study

This study was subject to several limitations, including its cross-sectional design, potential issues with the recruitment strategy employed, deviations of the obtained sample from demographic information of the SCI population and drawbacks of the psychometric measures employed.

The use of a cross-sectional design limits the ability of the current study to draw firm conclusions about direction of causality. Studies in other populations that have employed longitudinal designs (e.g. Kelly et al., 2017) have also identified a similar relationship between deliberate rumination and PTG to that identified here. However, these studies have found deliberate rumination to account for a greater proportion of the variance in PTG than that observed in the current study. Consequently, the cross-sectional design employed may have led to an underestimation of the effect of this important variable.

It is also the case that the retrospective nature of the measures employed may have biased participants answers on some measures. For example, it may be that case that participant's current mood may have impacted on their reports of core belief disruption and subsequent rumination following their injury. This interpretation would be consistent with previous research pertaining to autobiographical memory biases in depression (Kuyken & Dalgleish, 1995; Williams & Scott, 1988). In addition, the measure of perceived social support employed asked about current, rather than historical, social support. It was assumed that social support is a relatively consistent and durable construct which is maintained across time. However, the relatively long mean time since injury (> 13 years) may mean that this is not necessarily the case. Finally, the removal of the ADAPPS growth subscale means that comparisons of the

results of the current study with other studies which have used the ADAPSS will not be possible.

An additional limitation was the recruitment strategy employed. Recruiting participants via online forums and through social media accounts may have resulted in recruitment bias whereby participants who took part differed from the population in meaningful ways. For example, it may be the case that participants recruited online are relatively younger, better educated and less unwell than people in the UK SCI population as a whole. Conversely, it may be the case that individuals who make use of online forums have access to less immediate social support. However, it should be noted that previous studies have suggested that online recruitment can result in more diverse and representative samples being obtained (Casler, Bickel & Hackett, 2013).

A further limitation of this study is that the sample is not fully representative. The proportion of female to male participants is different to epidemiological estimates for SCI populations (McCaughey et al. 2016; Wyndaele & Wyndaele, 2006). While the results for PTG obtained here are similar to those found in other studies of disabling conditions (e.g. Kelly et al., 2017), it is also possible that they may represent an overestimation for the SCI population, as meta-analyses have suggested that females report more PTG than males (Vishnevsky, Tedeschi & Calhoun, 2010).

Finally, the current study is limited by a lack of data on participants who viewed the survey but did not complete any measures. It is not possible to comment on whether the obtained results would generalise to those who chose not to take part or whether they differed from those who did in relevant ways.

5.3. Future research

Future studies may elucidate the relationships between rumination and coping strategies employed, as these have been found to account for a significant amount of the variance in PTG in SCI populations (Pollard & Kennedy, 2007). It may be the case that post-injury rumination mediates coping strategy development and deployment.

To build on the findings of the current study, future studies may examine the relationships between rumination, PTG and posttraumatic stress disorder (PTSD) in SCI populations. This would be in line with research that has suggested that ‘positive rumination’ is associated with PTG while ‘negative rumination’ is associated with PTSD symptoms in cancer survivors (Chan et al., 2011).

Future SCI studies may consider building on the relationship between appraisals and PTG identified here. Specifically, they may consider whether positive appraisals of disability reflect a coping strategy, as has been documented elsewhere. For example, Widows and colleagues found that use of positive reinterpretation coping predicted PTG in a group of people receiving bone marrow transplantation for cancer (Widows, Jacobsen, Booth-Jones & Fields, 2005). While the short-form of the ADAPSS was used in the present study, future studies may consider employing the full version. This would allow researchers to identify which specific categories of appraisals are associated with PTG.

The finding that current mood and well-being did not add significantly to the regression model gives a rationale for studying the relationships between these variables utilising longitudinal designs. Such studies may help delineate the variables which mediate the relationship between PTG and the identified favourable mental health outcomes.

A number of possible intervention studies arise from these results. For example, researchers may investigate whether the identified links between rumination, appraisals of disability and PTG are amenable to intervention. Similarly, it may prove fruitful to examine whether interventions aimed at developing social support networks (e.g. peer mentoring, Ljungberg, Kroll, Libin & Gordon, 2011) also promote PTG. It is worth noting that a dearth of intervention studies has been noted as a limitation across the PTG literature, regardless of population (Calhoun & Tedeschi, 2000). Consequently, the addition of intervention studies would be useful not just to SCI rehabilitation, but within the field of PTG as a whole.

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Critical Review

Word count: 9,636

1. Introduction

This review will introduce the context of the systematic review and empirical paper. It will discuss the decision-making that underpinned both papers at key stages, including generating the research topic, methodological considerations and interpretation of findings. A critique of this process will be provided and directions for future research discussed. Finally, the findings of both papers will be contextualised within the extant literature on psychological adaptation to spinal cord injury (SCI).

2. Decision to undertake research into psychological adaptation to spinal cord injury

Prior to commencing clinical training, one of my previous clinical roles was as a healthcare assistant on a neurosurgical ward. This role involved supporting people in the acute phase immediately following a brain or spinal injury. I was always struck by the psychological adaptation process to disability which appeared to begin almost immediately following injury. During my clinical training, I have become particularly interested in the topics of trauma and recovery from trauma broadly. My own personal opinion is that the focus on 'Posttraumatic Stress Disorder' (PTSD) in psychology and psychiatry has led to a narrow focus on what constitutes trauma. I believe that this is in line with recent research which suggests that trauma and adversity constitute transdiagnostic factors which are involved in the aetiology of a host of mental health problems, rather than being specific to those diagnosed with PTSD (Faravelli et al., 2010).

My attendance at the European Spinal Psychologists Conference in Oxford in April 2017 gave me an opportunity to immerse myself in current research in this area. I was particularly interested in presentations on predictors of posttraumatic growth in spinal cord injured (SCI) individuals. In addition, attending this conference gave me the opportunity to discuss some of my ideas with the psychologists working in this area to get an idea of their clinical relevance.

The current research project offered me the opportunity to explore my interests in trauma, recovery and neuropsychological rehabilitation in greater depth.

3. Decision to undertake a systematic review into sense of coherence and spinal cord injury

When I first came to read the literature concerned with psychological adaptation to SCI and with PTG in particular, I became aware that there was a small body of quantitative literature in this area which had not been systematically reviewed at that point. Throughout my consideration of potential systematic review topics I was keen to ensure that I was making a novel contribution to the existing evidence base. To avoid replication of similar work being conducted elsewhere, I checked my ideas against PROSPERO, the international prospective register of systematic reviews. Through this process, I discovered that a trainee clinical psychologist attached to another programme was conducting a systematic review into predictors of PTG following SCI. Following this, I considered conducting a meta-synthesis of the qualitative literature on PTG following SCI. This initially appeared to be a valuable potential contribution to knowledge in this field, due to the number of studies available and the absence of a specific review on this topic. However, following a search of the literature, I identified a similar review which had considered the qualitative literature concerning the

occurrence of PTG in SCI and other serious medical conditions, such as cancer, kidney failure and rheumatoid arthritis (Hefferon, Grealy & Mutrie, 2009). Following scoping searches of the literature, I concluded that a sufficient number of additional relevant studies had not been done since the publication of this review and that another, similar review would add little to the current state of knowledge in this area.

To identify a gap in the evidence base, I decided to consider the literature pertaining to psychological adaptation to SCI more broadly. From this, I identified the concept of sense of coherence (SOC) and its relevance to psychosocial adaptation to SCI. A number of reviews had considered the relationship between SOC and psychological adaptation to SCI alongside other psychological resources (Chevalier, Kennedy & Sherlock, 2009; Peter, Müller, Cieza & Geyh, 2012; Post & van Leeuwen, 2012; van Leeuwen, Kraaijeveld, Lindeman & Post, 2012). However, scoping searches demonstrated that none of the previous reviews coverage had not been exhaustive and, additionally, that none of them had considered the relationship between SOC and physical health in a SCI population. Its proposed relationship with physical health is a theoretically important conceptual component of SOC (Eriksson & Lindström, 2006). Consequently, I consulted with my supervisor and we decided that systematically reviewing and appraising the quality of research in this area would be a viable and useful option.

3.1. Search terms and databases

3.1.1. Search terms

In creating my search terms, I sought to achieve a mix of sensitivity and specificity to identify all of the relevant studies while not returning an unmanageable number of references. To do so, I first did scoping searches of the literature. I reviewed the vocabulary and key terms used in the resulting papers. I also identified papers through the reference lists of these studies. I

then refined my search terms in light of this new information. I followed this iterative process until the addition of new search terms stopped adding additional relevant studies to the results. Certain terms were also excluded because they returned an unmanageable number of results. For example, the inclusion of the search term “adaptation” returned a very high number of irrelevant results. It was subsequently replaced with the term “psycho* adaptation”, which returned fewer irrelevant results. “psycho*” was included rather than “psychological” as the term “psycho*” encompassed both psychological and psychosocial adaptation. From my reading of the studies identified in the scoping searches, I ascertained that many papers did not refer to SOC by name. Rather, they referred to it within the broader category of psychological resources, so this term was included.

3.1.2. Databases

The relationship between SOC and physical and mental health outcomes in SCI populations is of relevance to several different disciplines, including psychology, neurology, neurosurgery, rehabilitation medicine, nursing, occupational therapy and physiotherapy. I aimed to reflect this diverse mix of disciplines in my choice of databases. This was to ensure I accessed all relevant papers, while minimising repetition where possible. I chose search engines with a broad scope, while aiming to omit as much redundancy as possible. PsycINFO focusses on research in psychology and the social sciences. MEDLINE accesses research published in biomedical journals. Web of Science and SCOPUS search the abstracts of scientific journals and conference proceedings more broadly rather than being specific to healthcare. The Citation Index of Nursing & Allied Health Literature (CINAHL) focusses on journals which publish research relevant to nursing and allied health professionals.

3.2. Inclusion and exclusion criteria

The following inclusion criteria were applied to studies in the current review: 1) published in a peer-reviewed journal; 2) published in the English language; 3) published between 1979 and the present day; 4) sample consisted solely of people with a SCI; 5) employed a quantitative methodology; and 6) utilised an established measure of SOC.

I chose the criteria that studies had to include one of the very few recognised measures of SOC. This was to focus on this specific theoretical area and to avoid conflating the concept of SOC with other, similar concepts, such as orientation to life (Scheier & Carver, 1985).

I chose to only look at quantitative studies because I was interested in predictors and correlates of SOC. Though I chose to employ this criteria, it is noteworthy that only four qualitative studies were excluded from the search results. Of these, none examined the concept of SOC specifically so they would have been excluded based on other criteria anyway.

3.3. Choice of quality assessment tool

I first considered using one of the checklists developed by the Critical Appraisal Skills Programme (CASP). However, a limitation of the CASP checklists is that they are design-specific (e.g. randomised controlled trials, cross-sectional, case control, etc.). However, the studies identified for this review covered a range of designs, including cross-sectional, longitudinal and intervention studies. While I could have used different CASP checklists for the different designs, a drawback of this approach was that this would limit the potential to compare and contrast the methodological quality of the studies against one another using common criteria. A further critique of the CASP is that its 'yes', 'can't tell', 'no' quality

assessment ratings allow for little grading in terms of each rating. This may mean that it lacks the ability to distinguish the various different extents to which certain criteria can be met.

I then considered the QATSDD (Sirriyeh, Lawton, Gardner & Armitage, 2012), which is designed for use across multiple different designs. I looked at the EQUATOR Network (Enhancing the Quality and Transparency of Health Research), American Educational Research Association (AERA) and the liv.ac.uk website to see if the QATSDD matched the criteria set out by the recommended reporting guidelines. The QATSDD appeared to fit the criteria set out here.

3.3.1. Strengths of the QATSDD

The 4-point Likert scale adopted by the QATSDD was felt to be an advantage of this measure. In contrast to CASP checklists, the QATSDD allows for criteria to be partially met which allows for more nuanced judgements to be made about the quality of studies.

In addition, the clear guidance given for each rating point on the Likert scale minimises subjectivity and allows for transparency in how decisions about scoring are reached. This latter point has been highlighted as a key component required to maintain the integrity of a systematic review (Boland, Cherry & Dickson, 2014).

3.3.2. Limitations of the QATSDD

A number of limitations of the QATSDD arose during the current review. Of note, it omits contextualisation within the broader context of research in the target area. This is somewhat

captured by the first item (reference to theoretical basis). However, this is only partially the case because no item includes any measure of whether a given study builds logically and coherently on previous work in the area. This was particularly evident with assessing Shakeri et al. (2016), which employed theoretical concepts which were difficult to situate within the broader psychosocial adaptation to SCI literature. Consequently, it is possible for a study to be rated as being of high quality, while adding little to the current state of knowledge on a topic.

It is also the case that the QATSDD applies a numerical rating but is not based on an interval scale. Consequently, individual items which may have the same numerical weighting may not be equally important in terms of considering the methodological quality of a study.

3.4. Decision to conduct a narrative synthesis

In terms of synthesising the findings of the systematic review, I chose to conduct a narrative synthesis. This was because the studies employed diverse methodologies and outcome variables, making a meta-analysis impossible. For example, trying to focus on specific outcome measures, such as the HADS, narrowed the scope and number of studies too much to be useful. However, narrative synthesis has been found to be a useful approach for translating the findings of a body of research into implications for clinical practice and policy development (Popay et al., 2006). This was deemed to be appropriate for the current review as it would likely be applicable to rehabilitation practice broadly.

3.5. Inter-rater reliability

As recommended by the tools authors, inter-rater reliability was established through an iterative process in which reviewers rated the studies independently, then compared notes explaining why they selected the scores they did to resolve any disagreements. The authors of

the QATSDD note that that disagreements are expected in any measure employing a Likert scale, as some subjective judgement is inevitable (Sirriyeh et al., 2012). However, the use of an independent rater was a useful exercise to highlight areas where I may have been overly liberal or conservative in applying certain criteria. It is likely that this exercise improved the quality appraisal of the included studies.

3.6. Challenges encountered and how these were overcome

Several challenges were encountered and subsequently addressed during the systematic review process. These included the conceptual overlap between SOC and other, related concepts; whether to include non-SCI participants in studies; and decisions pertaining to whether or not a particular presentation met the criteria for SCI.

Within the literature, SOC demonstrates some considerable conceptual overlap with other constructs. These include dispositional optimism (Gustavsson-Lilius, Julkunen, Keskivaara, Lipsanen & Hietanen, 2012), self-efficacy (Davidson, Feldman & Margalit, 2012), locus of control (Sullivan, 1993), meaning-making (Roepke, Jayawickreme & Riffle, 2014) and orientation to life (Geyer, 1997; Kivisild et al., 2014). The stipulation that studies must include a recognised measure of SOC helped in part to resolve this difficulty. In addition, it was helpful to refer to the three components of the SOC construct: comprehensibility, manageability and meaningfulness. Some of the previously mentioned constructs are similar to isolated components of SOC. For example, both self-efficacy and locus of control are similar to manageability, while meaning-making is similar to comprehensibility. However, none of the overlapping constructs encapsulate the three criteria that comprise the whole SOC construct. To ensure that relevant studies were not erroneously excluded often required that the full text

version be considered. This is reflected in the relatively large number of full texts included in the PRISMA flow diagram.

A further challenge encountered was that several studies included SCI participants alongside other disabling conditions (e.g. congenital disability, Ravesloot, Seekins & Young, 1998). It was not always possible to isolate results solely for the SCI participants. I looked to the evidence base for guidance about whether I should include diverse samples in my review. As a result, I identified that a range of condition-specific factors are likely to be implicated in the experience of psychological adaptation to disability (Barskova & Oesterreich, 2009). Consequently, it was decided to include only studies which exclusively recruited SCI participants or those that recruited mixed samples in which SCI participant's results could be isolated. As a result, post-hoc inclusion criteria was added, specifying that studies needed to have recruited solely SCI participants or that it needed to be possible to isolate the results for SCI participants.

A related challenge encountered was whether to include or exclude certain papers from the review. This was the case for studies whose participants were broadly within the population of spinal injury, but either their injury did not have spinal cord involvement or involved the spinal cord but was degenerative in nature. Through discussion with my supervisor, it was decided that the important component of the injury was the spinal cord, not simply the spine. Consequently, the decision was taken to exclude studies where participants had a spinal injury that did not involve the spinal cord. In addition, a body of research was identified which examined SOC in people experiencing lumbar spinal stenosis (LSS, Pakarinen et al., 2017; Sinikallio et al., 2017). Through discussion with my supervisor, it was decided that several factors distinguished the LSS population from the broader population of SCI individuals. These

include length of time required for rehabilitation, level of functional ability maintained and implications for social and occupational functioning following injury. As a result, the decision was made to exclude these studies from the review.

3.7. Contextualisation of findings and implications for theory

The findings of the current review add to the indeterminate findings in relation to the role played by SOC in adaptation to SCI and acquired physical disability more broadly. They also contribute to the wider literature concerning psychological resources in SCI (e.g. Peter, et al., 2012) and the factors which promote mental health and quality of life in this cohort (Clayton & Chubon, 1994; van Leeuwen et al., 2012).

The predominant focus of the extant evidence base on psychological adaptation to SCI has been concerned with coping strategies (Galvin & Godfrey, 2001). However, the findings of the current review add to the existing evidence base suggesting that other factors are also important in the adaptation process. Specifically, the current review adds to current knowledge pertaining to the relationship between SOC and physical and mental health outcomes (e.g. Amirkhan & Greaves, 2003; Eriksson & Lindström, 2006; Lindström & Eriksson, 2005).

The current review highlighted evidence of an association between SOC and mental health outcomes in SCI individuals based on the findings of a number of well-designed studies (e.g. Jørgensen, Ginis, Iwarsson & Lexell, 2017; Kennedy, Lude, Elfström & Smithson, 2010a). These findings are congruent with previous reviews, which have identified positive, predictive relationships between SOC and both mental health and QOL across multiple populations (Eriksson & Lindström, 2006; 2007). These findings are of relevance to mental health outcomes following SCI more broadly, as this population have been demonstrated to experience elevated levels of psychological morbidity (Craig, Tran & Middleton, 2009).

In line with similar reviews (Eriksson & Lindström, 2006; Flensburg-Madsen, Ventegodt & Merrick, 2005), this review found some evidence of an association between SOC and self-reported physical health. This finding has been reported elsewhere in the physical health literature. For example, Chumbler et al. (2013) found that SOC was associated with better general health and pain self-efficacy, but not severity or level of disability, in a population of primary care patients with chronic musculoskeletal pain.

It is unclear from the extant literature whether SOC is associated with objective or subjective improvements in health (Eriksson & Lindström, 2006; Flensburg-Madsen, Ventegodt & Merrick, 2005). The findings of the current review lend some tentative support to the argument that SOC is associated with self-reported physical health in SCI populations. However, it is not possible to draw conclusions pertaining to its relationship with objective physical health in this cohort.

Several of the studies reported associations between SOC and the use of particular coping strategies (Kennedy, Lude, Elfström & Smithson, 2010b; Geyh et al., 2012; Livneh & Martz, 2014). This is in line with the assertion that SOC exerts its effect, at least in part, via a behavioural mechanism (Amirkhan & Greaves, 2003; Antonovsky, 1979; 1987). This finding contributes to the evidence base as there is currently a lack of studies investigating the mechanisms through which SOC exerts its effect.

3.8. Implications of findings for clinical practice and service development

The findings of the current systematic review are of relevance to clinical practice in a number of ways. These include applications in interventions to address mental health problems in this cohort, multidisciplinary promotion of physical health and at the level of service delivery.

3.8.1. Clinical implications

The well-documented association between SOC and mental health outcomes is of relevance to clinicians seeking to promote mental health in this cohort. The relationship between SOC and depression is particularly relevant to rehabilitation interventions, given the potential of depression to impact adversely on rehabilitation outcomes, including pain (Cairns, Adkins & Scott, 1996).

In line with the above, some evidence exists to suggest that SOC is amenable to intervention. Kähönen, Näätänen, Tolvanen and Salmela-Aro (2012) found that levels of SOC increased in participants in a group-based intervention. Their participants were public sector employees. However, some research has also considered clinical populations. For example, Langeland and Wahl (2009) found that social support was associated with SOC in a population of participants with mental health problems who were under the care of a community mental health team.

Research has suggested that the majority of SCI individuals adapt successfully to their condition (Bonanno, Kennedy, Galatzer-Levy, Lude & Elfström, 2012). However, a subset of individuals may experience pervasive mood disorder as a result of their injury, either immediately or of delayed onset (Bonanno et al., 2012; Kennedy & Rogers, 2000). Furthermore, research has suggested that left unaddressed, the experience of depression

following SCI may be chronic (Kennedy & Rogers, 2000). While psychometric tools exist to assess for current depression in this cohort (e.g. HADS, Müller, Cieza & Geyh, 2012), there is a lack of available tools to screen for those who are likely to experience depression in the longer term. The evidence of a longitudinal association between SOC and depression identified in this review suggests that the sense of coherence scale (Antonovsky, 1993) may be a suitable screening tool for identifying individuals likely to require additional psychological support in the longer term. This assertion is supported by the findings of several studies. For example, Luutonen, Sohlman, Salokangas, Lehtinen and Dowrick (2011) found that a weak SOC was predictive of depression at 1 and 9-year follow-ups. Conversely, having a strong SOC has been identified as a protective factor against depression in people with rheumatoid arthritis (Büchi et al., 1998). Finally, levels of SOC have been demonstrated to increase during recovery from depression (Skärsäter, Langius, Ågren, Häggström & Dencker, 2005).

3.8.2. Service implications

The focus of the current review was on SOC experienced by individuals following SCI. However, salutogenesis, the concept which underpins SOC may also be of relevance to rehabilitation services. Salutogenesis is defined as the study of factors which promote the development and maintenance of health and well-being (Antonovsky, 1979; 1987). This concept offers an approach to health promotion which is relevant to SCI rehabilitation and self-management programmes. This is particularly the case in light of the significant comorbidities experienced by this cohort. A salutogenic focus of factors that maintain health and well-being, as opposed to the traditional medical focus on addressing discrete disease entities, may help SCI individuals to maintain their health and well-being. There is some research to support the role of salutogenesis in health-promoting behaviour. For example, it has been found that higher

levels of SOC are associated with healthier lifestyle choices independently of socioeconomic status in a large community sample (Wainwright et al., 2007).

3.9. Further research

A number of directions for future research arise from the current review. These include more methodologically robust studies examining the relationship between physical health and SOC, studies identifying the mechanisms through which SOC exerts its effect on physical and mental health outcomes, and studies investigating the extent to which SOC is amenable to intervention.

The current review identified several consistent methodological limitations in the literature concerning the relationship between SOC and physical health in SCI populations. These include the use of unvalidated, bespoke and self-report measures which are open to the effects of reporting bias. Moreover, the lack of longitudinal studies makes it impossible to draw firm conclusions about direction of causality in some studies. Consequently, future studies should consider employing longitudinal designs and objective measures of physical health and disability to identify whether reports of improved health correspond with the results of objective measures. Such studies may focus on some of the more prevalent secondary health conditions (SHCs) in SCI populations, such as pressure sores, urinary tract infections, bowel dysfunction and pain (Anson & Shepherd, 1996; Tate et al., 2016). Previous reviews have found associations between SOC and perceived, but not actual, health (Flensburg-Madsen, Ventegodt & Merrick, 2005). However, the relationships between mood, self-management and physical health in SCI populations supports the assertion that SOC may exert an indirect effect on health in this cohort (Pang et al., 2009).

A limitation within the field of SOC as a whole is a dearth of studies examining the mechanisms through which SOC exerts any identified effect on physical and mental health. While the current review offers some limited evidence that appraisals and coping strategies may mediate this effect in SCI. Future studies may consider examining the psychoneuroimmunological mechanisms through which SOC exerts its effect. Such an examination would be in line with Antonovsky's assertions about SOC (Antonovsky, 1979, 1987).

A similar limitation within the SOC literature is a lack of intervention studies investigating whether SOC is amenable to intervention. Previous research has suggested some potential interventions which may be applicable to this cohort. For example, Langeland and Wahl's (2009) research into the relationship between social support and SOC may be relevant to peer-support interventions in SCI (e.g. Sherman, DeVinney & Sperling (2004). However, these have not yet been evaluated in SCI populations.

4. Decision to undertake empirical paper in the area of posttraumatic growth and spinal cord injury

I had previously encountered research on the topic of PTG when completing my undergraduate psychology degree. This contributed to my interest in trauma and recovery from trauma and informed my decision to pursue research in this area.

4.1. Choice of methodology

I initially considered making use of a qualitative methodology, such as grounded theory or interpretive phenomenological analysis (IPA), or a mixed-methodology such as Q-methodology. However, qualitative approaches are more useful for generating an initial theory

where one does not exist (Denzin & Lincoln, 2005). Through my reading within the fields of PTG, psychological adaptation to serious medical conditions and specific literature pertaining to psychological adaptation to SCI, I found that existing relevant models and theories existed (e.g. Tedeschi & Calhoun, 1996; 2004). The gap in the research literature appeared to be in determining which components of these models applied to SCI and what condition-specific-components may need to be added (Barskova & Oesterreich, 2009). In addition to this, there were already several qualitative studies within this field utilising similar methodologies (e.g. Griffiths & Kennedy, 2012; Kennedy, Lude, Elfström & Cox, 2013; Wang et al., 2017). I was keen to avoid redundancy in my choice of methodology and to ensure that my own research made an original and meaningful contribution to the evidence base.

4.2. Choice of psychometric measures

While the inclusion of mood and well-being measures is of less theoretical importance than the other measures (e.g. rumination, core belief disruption, appraisals, etc.) they were included to allow comment to be made on the clinical relevance of the obtained findings and also to demonstrate that the independent variables were uniquely associated with PTG rather than solely improved mood or well-being.

In addition, the growth subscale of the ADAPPS was removed for the purposes of statistical analyses to prevent this from biasing the correlations and making the association between appraisals and PTG appear greater than it was. While it may have been a better idea to utilise a different measure of appraisals, a strength of the ADAPSS was its focus on SCI-specific appraisals and validation within this population.

The use of the HADS and the MSPSS total scores as composite measures of mood and social support, rather than their individual subscales, is supported by the high Cronbach's α scores achieved in this study ($\alpha = .90$ and $\alpha = .95$). This suggests that the scales were internally reliable measures of mood and social support. In addition, the HADS was deemed to be superior to other validated measures of mood, such as the patient health questionnaire (PHQ-9), due to its extensive previous use in SCI populations (Woolrich, Kennedy & Tasiemski, 2006).

4.3. Ethical considerations

4.3.1. Informed consent

Prior to completing the measures, participants were presented with an information sheet outlining the purpose of the study and what it would require of them, followed by a consent form (appendix VI). Due to the relative complexity of accessing and completing the study materials online, it was assumed that participants who successfully did so were capable of providing informed consent. An important consideration here was to ensure that the materials provided to participants were sufficiently detailed to allow them to understand the purpose and requirements of the study, but also reasonably accessible to avoid excluding participants who may not be used to the language frequently employed in research studies.

4.3.2. Confidentiality

To ensure confidentiality was maintained appropriately throughout the study, procedures were implemented in line with the Data Protection Act (1998), the British Psychological Society Code of Human Research Ethics (BPS, 2014) and the British Psychological Society Code of Ethics and Conduct (BPS, 2009).

All data was anonymised by removing all person identifiable information and using numerical identifiers instead. Data gathered via Qualtrics was stored on a secure server which only the lead researcher had access to. No data was gathered via paper questionnaires. However, the procedure put in place for this eventuality was that such data would be stored on an excel spreadsheet which would be password protected. Data will be stored for a minimum of five years.

4.3.3. Potential adverse consequences

It was acknowledged that participants in this study would, by definition, have experienced a significant injury which they were likely to have found traumatic (Lude, Kennedy, Evans, Lude & Beedie, 2005). Consequently, it was necessary to ensure that participation in this study did not provoke significant distress in participants. To safeguard against this, participants were informed in the information sheet that they could withdraw from the study at any point. In addition, participants were provided with a debriefing sheet which detailed sources of support which they may avail of if their participation in the study provoked significant distress in them while taking part or at a later time-point. The debriefing sheet also provided details of the lead researcher and the academic supervisors email addresses, should participants wish to make contact to discuss their participation in the study or any consequences that arose as a result of their participation. No participants contacted either the lead research or the academic supervisor during the course of the study.

4.4. Recruitment

Participants were recruited through the social media profiles of a number of SCI-specific charities and organisations, including Back Up Trust, Aspire, the Spinal Injuries Association

and Spinal Research UK (appendix IV). The decision to make use of charities as opposed to recruiting through an NHS setting was based on the remit of this project. PTG is proposed to arise through spontaneously occurring processes that do not necessarily require clinical intervention (Tedeschi & Calhoun, 1996; 2004). It was decided that participants recruited through an NHS setting may be receiving additional input which may influence their experience of psychological adaptation and subsequent growth. Additionally, SCI individuals who were currently within a rehabilitation facility would be unlikely to fulfil the one year post-SCI criteria, as rehabilitation routinely lasts an average of between six and 12 months (NSCISB, 2012). Additionally, individuals currently involved in rehabilitation would be likely in the process of adapting to their injury, meaning that PTG may not have had the opportunity to fully occur. Finally, it was reasoned that individuals who were regularly attending an NHS outpatient service may differ from the general SCI population in a number of ways. For example, they may represent the subsection of the population who require more intensive support. These concerns reflect the relatively little that is known about the impact of the prolonged rehabilitation period following SCI on an individual's potential PTG trajectory. In light of these concerns, it was decided that recruiting a community sample via relevant charities would be more likely to yield a representative sample.

Inclusion criteria included that the person should have sustained a spinal cord injury when they were an adult and at least one year previously. The decision to utilise a one year post-SCI inclusion criteria was arguably overly cautious, as previous studies have documented PTG occurring in the weeks following a trauma and remaining stable 12 months later (Linley & Joseph, 2004). Similar findings have been found in stroke survivors (Kelly et al., 2017). However, this criteria was based on the psychological adaptation to SCI literature and was intended to reflect the significant adjustment and rehabilitation period which follows the

occurrence of a SCI. This rehabilitation period ranges from three to six months and is substantially longer than other physical health problems (NSCISB, 2012).

Following an initial period of recruitment which resulted in fewer completed sets of measures than expected, my supervisor and I discussed the likely reasons for this and how best to overcome them. We reasoned that psychological adaptation and PTG had become popular research areas within the field of SCI and that it may be that the SCI community were growing used to seeing multiple requests for participation in studies. It was decided to offer an incentive to take part in the form of a prize draw for Amazon vouchers. A total of £140 in vouchers (1 X £50 and 6 X £15) was offered. This was in line with guidance from Cardiff University ethics committee which states that where a financial reward for participation is offered, it should be commensurate with the effort of participation. In this case, it was estimated that approx. 60 to 70 participants would be recruited, meaning participants had approx. a 10% chance of being awarded a voucher. An ethics amendment request was completed for this purpose and was subsequently granted (appendix IV).

4.5. Data analysis

4.5.1. Data quality checks

Whole measures were missing from three participant's responses. The measures were presented in the same sequence each time, with the PTG-I presented last. Consequently, this measure was the one missing from each of these responses. As PTG-I was the dependent variable, it was deemed appropriate to exclude all measures for these participants from the analysis.

4.5.2. *T-test*

The one-sample, independent *t*-test is a parametric test which has the following assumptions:

1) data are measured on an interval or ratio scale, 2) data are independent, 3) there are no significant outliers in the data and 4) data are normally distributed.

The PTG-I measures PTG at the interval level and scores were independent of each other as they came from unrelated participants. A box plot was visually analysed to assess for outliers in the data (appendix VII). This demonstrated no significant outliers. A Kolmogorov-Smirnov test was used to assess whether the PTG-I data was normally distributed. This test was non-significant ($D(63) = .082, p = .200$), indicating that the data were not significantly non-normally distributed. Based on this information, all four assumptions were deemed to have been met.

4.5.3. *Correlational analysis*

Pearson's product-moment correlation is a parametric test which is subject to the following assumptions: 1) data are measured on an interval or ratio scale, 2) data are normally distributed, 3) the relationship between independent and dependent variable is linear, 4) homoscedasticity and 5) there are no significant outliers in the data.

The following checks were applied to the data:

1) All the questionnaires employed measured data on an internal or ratio scale.

2) Kolmogov-Smirnov tests were used to assess whether the distribution of data was normal.

Data for the following variables was normally distributed: age ($D(63) = .104, p = .088$),

ERRI-I ($D(63) = .108, p = .065$), ERRI-D ($D(63) = .061, p = .200$), ADAPSS ($D(63) = .104, p = .090$), HADS total ($D(63) = .096, p = .200$), WEMWBS ($D(63) = .083, p = .200$) and PTG-I ($D(63) = .082, p = .200$).

Data for the following variables was not normally distributed: time since SCI ($D(63) = .178, p < .001$), CBI ($D(63) = .129, p = .011$) and MSPSS total ($D(63) = .121, p = .023$).

3) Scatterplots were used to visually inspect the relationship between each of the putative predictor variables and PTG (appendix VII). The distribution of the data points for each pair of variables appeared to be linear in nature.

4) Scatterplots were visually inspected and no heteroscedasticity was noted (appendix VII).

5) Boxplots were used to inspect the data for outliers (appendix VII). No significant outliers were noted using this procedure.

Based on this above information, assumptions one, three, four and five were fully met and assumption two was partially met.

4.5.4. Regression analysis

Multiple regression is a parametric statistic which is subject to a number of a priori and post-hoc assumptions which must be met.

A priori assumptions

A priori assumptions include 1): participants are independent of one another; 2) Data are measured at the interval or ratio level and are unconstrained; 3) linear relationships exist between independent and dependent variables; 4) no perfect relationships, or multicollinearity, exist between independent variables; and 5) independent variables are uncorrelated with external variables.

The following checks of these assumptions were applied to the data:

- 1) All participants in this study were independent of one another.

- 2) All psychometric scales employed measured data on at least an interval level. Data were visually inspected with their respective minimum and maximum possible scores to ensure they were not constrained. No cases of constrained data were identified through this procedure and this assumption was deemed to be met.

- 3) As previously discussed, scatterplots of the relationship between each independent variable and the dependent variable were visually inspected and the relationship between each independent variable and the dependent variable were found to be linear in appearance.

- 4) The variance inflation factor (VIF) is a measure of linear relationship between predictor variables, also known as multicollinearity (Field, 2009). Myers (1990) suggested that a VIF value greater than 10 is likely to indicate multicollinearity. VIF values obtained in the current

regression model ranged from 1.06 to 1.64, indicating no multicollinearity in the model (appendix VII).

5) All measured variables which were shown to be correlated with the independent variables were included in the regression analysis. As a result, no correlation with external variables which was within the scope of the study was observed.

Based on this information, all five a priori assumptions were deemed to have been met.

Post-hoc assumptions

Regression analysis is subject to the following post-hoc tests: 1) Homoscedasticity, which refers to residual terms being roughly the same at each level of a given predictor variable; 2) normally distributed errors, which means that residuals in the model should be normally distributed with a mean value of zero; and 3) independent errors, which means that for any two observations, residual terms should be uncorrelated.

The following checks of post-hoc assumptions were conducted:

1) To assess for heteroscedasticity, a scatterplot was produced of the standardised residuals against the standardised predicted values (appendix VII). Data points in this scatterplot were evenly dispersed around zero, indicating homoscedasticity (Field, 2009).

2) A histogram and normal probability plot were produced to check the distribution of the residuals (appendix VII). The histogram demonstrated a normal distribution and the residuals

appeared to adhere well to the normal probability plot, indicating that the residual were normally distributed.

3) The Durbin-Watson test is a test of whether the residuals within a regression model are independent (Durbin & Watson, 1951). It has been suggested that values of greater than three or less than one on this test indicate that residuals may be correlated and, therefore, lack independence. The value obtained for the current model was 1.98, indicating that residuals were independent in this regression model.

Based on this information, all three post-hoc assumptions were deemed to have been met.

4.5.5. Mediation analyses

Mediation analyses were carried out in line with the procedure outlined by Baron and Kenny (1986). In line with this procedure, the predictive relationship between the independent and dependent variables was assessed first, then the relationship between the independent variable and the proposed mediator and, finally, the relationship between the proposed mediator and the dependent variable was assessed when the effect of the independent variable was controlled for.

Strategy for dealing with non-normal data

While it has been argued that data should be normally distributed for the use of Pearson's correlation coefficient, a number of investigators have demonstrated that Pearson's correlation coefficient is highly robust to violations of this assumption, provided the variables are

independent (Edgell and Noon, 1984; van den Brink, 1988). As all the variables were independent and the majority were normally distributed, it was decided to use Pearson's correlation coefficient. However, Kendall's tau was also calculated for the variables which violated the assumption of normality to ensure the use of Pearson's correlation coefficient did not bias the results. Kendall's tau was used because of the numbers of tied ranks, or cases with the same value, in the dataset.

Results for Kendall's tau indicated significant positive correlations between PTG-I and both CBI ($r_{\tau} = .20, p < .05$) and MSPSS ($r_{\tau} = .18, p < .05$) scores. This suggests that the use of Pearson's correlation coefficient did not erroneously display associations between either CBI or MSPSS and PTG-I.

Familywise error rate

The familywise error rate refers to an elevated risk of making a type 1 error when making multiple comparisons using the same dataset (Field, 2009). Bonferroni corrections were considered as a strategy to manage the familywise error rate in the correlation analyses. However, these have been found to be overly conservative and to diminish statistical power to detect genuine effects, particularly with relatively small sample sizes (Bland & Altman, 1995, Nakagawa, 2004; Narum, 2006; Perneger, 1998). Consequently, the conventional significance level of $p < 0.05$ was used for each of the correlational analyses.

Screening for outliers

The dataset was screened for outliers to ensure no cases were biasing the regression model. Two strategies for addressing outliers were considered: to examine the error in the model or to utilise statistical tests to identify cases which had an unusual level of influence over the parameters of the regression model. It was decided to utilise statistical tests to identify cases which had an undue influence on the regression model. The rationale for this choice was that the lack of defined cut-off scores to identify outliers when utilising error within the regression model as a gauge makes this process somewhat subjective (Field, 2009). A range of statistics which examine the residuals in the regression model to identify outliers. Three were employed here. These are Cook's distance, leverage and Mahalanobis distances.

Cook's distance is a residual statistic which assesses the extent to which individual cases influence the regression equation. Cook and Weisberg (1982) suggested that values above 1 indicate that a case may be exerting an undue influence on the regression equation. Within the current analysis, Cook's values in the range of <.000 to .280 were identified. As none of these values exceeded 1, it appeared that no individual cases were exerting an undue influence on the regression equation.

Leverage is a measure of how much the predictive relationship between an individual case and the dependent variable differs from the predicted value for that case in the regression equation. It ranges from 0 to 1. The formula $(k + 1)/n$ is used to identify the average leverage value (Field, 2009). In this analysis, $(k + 1)/n = 0.127$. Stevens (2002) has suggested that average leverage values which are three times the average are likely to be exerting an undue influence on the regression equation. In this analyses $3(k + 1)/n = 0.381$ and leverage values ranges from .015

to .369. As a result, no case was identified as having an undue influence on the regression equation.

Mahalanobis distances measures the amount by which a case differs from the mean score for that measure. Utilising the criteria devised by Barnett & Lewis (1978), a cut-off of Mahalanobis distance = 24.32 was used to identify cases which differed from their respective mean to a problematic extent. In the current analyses, the values obtained for this statistic ranged from 0.953 and 22.882. Consequently, it was decided that no case differed from its respective mean to a problematic extent.

4.6. Contextualisation of findings and implications for theory

4.6.1. Posttraumatic growth in spinal cord injury

The findings of the current study support the assertion made elsewhere (e.g. Pollard & Kennedy, 2007) that models of PTG which are based on the idea of challenged core assumptions and subsequent cognitive processing are applicable to SCI populations. In addition, the current findings contribute to current knowledge, both of PTG following SCI and PTG following acquired physical disability. Prior studies in relation to PTG following SCI have focussed on the relationships between coping strategies and PTG in SCI. Coping strategies are of crucial importance to the field of psychological adaptation to SCI as a whole (Galvin & Godfrey, 2001; Kennedy, Lowe, Grey & Short, 1995; Kennedy et al., 2000; Livneh, 2000). However, studies examining the relationship between coping strategies and PTG have often found coping strategies to account for a relatively small proportion of the variance in PTG scores. For example, January, Zebracki, Chlan and Vogel (2015) found cognitive coping to account for 17% of the variance in PTG. The addition of behavioural coping and avoidance

coping did not add significantly to the variance accounted for by their model. Similarly, Znoj (1999) found coping strategies to account for 12% of the variance in ‘stress-related growth’, which is conceptually very similar to PTG. These results suggest that coping strategy use is relevant to PTG, but that a large proportion of the variance remains unaccounted for. The inclusion of appraisals and deliberate rumination accounted for approx. 35% of the variance in PTG scores in the current study.

More broadly, the current study contributes towards the condition-specific models of PTG which have been highlighted as a need within the literature (Barskova & Oesterreich, 2009). It may be the case that these findings are of relevance to PTG following other physically-disabling conditions. This assertion is supported by the finding that PTG scores in the current sample were significantly lower than those found elsewhere for cancer survivors but were not significantly different from those found for stroke survivors.

4.6.2. Psychological adaptation to spinal cord injury

The findings of the current study can also be conceptualised within existing models of neuropsychological rehabilitation. For example, the “Y-shaped” process model of rehabilitation postulates that rehabilitation involves a reconciliation of ideas about a pre-injury self with the reality of ongoing impairment or disability (Gracey, Evans & Malley, 2009). The authors of this model propose that reducing this discrepancy involves a period of actively identifying the limits of one’s abilities. This is then proposed to facilitate the development of a new, more adaptive self-representation and the associated possibility for psychological growth (Gracey, Evans & Malley, 2009). While this model arose from the acquired brain injury literature, it also has relevance to the current study. For example, deliberate rumination may

correspond with the period of actively identifying the limitations imposed by one's disability. In addition, the resolution of the discrepancy between pre- and post-injury self could be conceptualised as a disruption and subsequent adaptation of one's core beliefs.

Furthermore, the findings of the current study add to the emerging body of literature which supports the assertion that the majority of SCI individuals appear to demonstrate psychological resilience and adapt successfully to their condition (Bonanno et al., 2012; Guest, Craig, Tran & Middleton, 2015).

4.7. Implications of findings for clinical practice and service development

The findings of the current study provide clinically-relevant information about the occurrence of PTG in a SCI population as well as information about the relative contributions of ruminative processes, appraisals and social support. These variables offer potential targets for clinical interventions.

4.7.1. Posttraumatic growth and spinal cord injury

The finding that participants experienced PTG adds to the extant evidence base which suggests that PTG may be one outcome of SCI (Pollard & Kennedy, 2007; Znoj, 1999). This suggests that clinicians should recognise PTG as one potential psychological outcome of SCI which may occur instead of or in addition to the deleterious outcomes identified elsewhere (e.g. Craig, Tran & Middleton, 2009). While the majority of previous studies have investigated the occurrence of PTG spontaneously and without specific clinical intervention, there is a small number of studies which suggest that levels of PTG may be amenable to intervention. For

example, mindfulness-based interventions have some limited evidence of efficacy (Garland, Carlson, Cook, Lansdell & Speca, 2007).

4.7.2. Rumination

The identified relationship between deliberate rumination and PTG found in the current study offers a potential target for therapeutic intervention. The association between deliberate, but not intrusive, rumination and PTG supports the assertion that rumination following a traumatic event may not necessarily be indicative of mood disorder but may instead be adaptive (Cann et al., 2011). Moreover, the finding that deliberate rumination mediated the relationship between core belief disruption and PTG supports previous studies which have postulated that a period of deliberate contemplation and sense-making is required to adapt challenged assumptions. These findings suggest that clinicians should be skilled in differentiating deliberate from intrusive rumination. This may facilitate the appropriate choice of intervention, while also avoiding the unintentional inhibition of adaptive attempts at sense-making.

The correlation between intrusive rumination and current mood suggests that decreasing intrusive rumination may be a useful intervention target in its own right, whether or not the ultimate goal is the development of PTG. However, it should be noted that causation cannot be inferred from this correlational analysis. It could conceivably be the case that participants who were currently experiencing elevated distress were more likely to remember intrusive than deliberate rumination following their injury. Indeed, this interpretation would be consistent with previous research pertaining to autobiographical memory biases in depression (Kuyken & Dalgleish, 1995; Williams & Scott, 1988).

4.7.3. Appraisals of disability

The finding that appraisals of disability accounted for the greatest amount of the variance in PTG scores (17.9%) suggests that interventions which target this area may also foster PTG. Existing interventions have been shown to facilitate the development of more adaptive appraisals. For example, the coping effectiveness training group developed by Kennedy has been demonstrated to facilitate the development of more adaptive appraisals of disability in SCI individuals (King & Kennedy, 1999).

4.7.4. Social support

The correlation between social support and PTG identified here offers an additional avenue by which indirect interventions may be delivered. For example, previous research has suggested that both peer-mentoring and having a current live-in partner are associated with improved rehabilitation outcomes (Sherman, DeVinney & Sperling, 2004). This is congruent with the idea of an “expert companion” who can foster PTG by listening to attempts to make sense of challenged appraisals, while tolerating the elevated distress which is likely to accompany this process (Calhoun, Tedeschi, Cann & Hanks, 2010). Services may facilitate PTG by providing peer-mentoring interventions which encourage the reflection and sense-making characteristic of deliberate rumination.

4.8. Future research

The current study supports the assertion that SCI populations experience PTG to a lesser extent than other physical health populations (Pollard & Kennedy, 2007). This may be due in part to the enduring nature of SCI relative to other health conditions. However, it may also be due to

other aspects of acquired physical disability, such as being visibly different to others. Future studies may investigate the factors which underpin this effect.

The current study was limited by the retrospective nature of some of the measures (e.g. CBI, ERRI). As previously mentioned, this may have led to memory biases based on current mood. Future studies may avoid this limitation by employing longitudinal designs which examine whether the style of thinking engaged in after injury predicts later incidences of PTG.

Within the field of PTG broadly there is a dearth of studies investigating whether PTG is amenable to intervention. A result of this is that interventions which may facilitate the development of PTG remain somewhat speculative. However, the current study offers further evidence to suggest that rumination and disability-specific appraisals may offer beneficial targets for interventions that seek to foster PTG. Future research may evaluate both direct and indirect intervention programmes, such as therapeutic interventions targeting ruminative processes, peer-mentoring interventions and mindfulness-based groups, to evaluate their impact on subsequent levels of PTG in SCI populations. Finally, intervention studies which target appraisal processes should be investigated to identify any additional effect they may have on the development of PTG.

The findings of the current study suggest that Tedeschi and Calhoun's (1996; 2004) model of PTG is applicable to SCI populations. Future studies may investigate whether the findings of previous research can be accounted for by this model. For example, Kunz, Joseph, Geyh and Peter (2017) identified a moderating effect of posttraumatic depreciation (PTD), defined as negative changes in the same domains as PTG, on mental and physical health outcomes in an SCI sample. This may be synonymous with the occurrence of core belief disruption and a

subsequent period of deliberate rumination identified by the current study. This would be in line with the findings of Cann, Calhoun, Tedeschi & Solomon (2010), who found that PTG is associated with increased life satisfaction and meaning in life only when it is accompanied by high levels of PTD. It could be hypothesised that this is because PTD is indicative of greater levels of core belief challenge and subsequent deliberate rumination. It is also in line with the finding of Pollard and Kennedy's (2007) that initial depression is associated with PTG at a 10 year follow up.

Future research may examine the differential trajectories between PTG and PTSD following SCI, and the roles played by deliberate and intrusive rumination in these two different trajectories. In addition, future studies may investigate factors which mediate the relationship between PTG and well-being documented here.

5. Competence development

Conducting the large scale research project equipped me with a number of skills and competencies which will be applicable to my career as a clinical psychologist. These include, knowledge of how to conduct research with a clinical population, and the associated factors that need to be considered; critical appraisal skills; the ability to test a psychological theory; and the ability to translate research findings into clinically-relevant recommendations.

Throughout the research process, I was keen to ensure that all aspects of recruitment and data collection gave due care and attention to the potentially vulnerable group from which participants were being recruited. I was aware that asking participants to answer questions which required them to recall the weeks following their injury was likely to provoke some distress. While I believed the research to be of merit, I also sought to balance this with an

ethical value base whereby the minimal possible distress was elicited in participants and, should participants experience distress as a result of their participation, that information was available about appropriate forms of support. Similarly, the decision to offer participants the opportunity to be sent a summary of the findings of the research was felt to be an acknowledgement of their contribution to knowledge in this field.

There is a growing awareness of the need for clinical psychologists to be critical consumers of research, to provide research and evaluation expertise to teams and to contribute to the existing evidence base (BPS, 2007). Throughout this project, my ability to critically appraise and evaluate research was developed. This was most relevant in conducting the systematic review. However, both the generation of a research question for the empirical paper and the translation of the findings into clinically-relevant recommendations required an ability to appraise and evaluate both previous literature and the current study.

Both the systematic review and empirical paper involved applying and testing the predictions of various different theories, including theories pertaining to psychological adaptation to SCI, and models of PTG and SOC. This skill will be of use in my future career, both in the context of developing future research projects and of applying relevant theory and models in my clinical work.

A final crucial stage in the research process was the translation of the obtained findings into clinically-relevant recommendations to inform practice. This is a key skill for a scientist-practitioner seeking to ensure clinical practice and services are led by the best available knowledge.

Finally, writing to the standard expected of peer-reviewed journals developed my understanding of the tenacity and rigour that is required to develop a research question into a published piece of work.

6. Dissemination of findings

A range of dissemination strategies were employed to ensure that the current findings were available to relevant stakeholders (e.g. service users, clinicians, academics). These included sending a summary of the findings to interested participants, presentation at relevant conferences and submission for publication in peer-reviewed journals.

6.1. Dissemination to participants

Participants in the study were offered the option of having a summary of the findings emailed to them. This required participants to supply their email address, which was securely stored in a password-protected document on a secure server which was only accessible to the principal investigator and academic supervisor. Fifty four participants opted to have this summary sent to them. This summary was sent to participants once data had been analysed and they had the opportunity to ask any questions that they wanted to about the findings via email.

6.2. Conferences

At the time of writing, the empirical paper component of this project has been accepted for an oral presentation at the European Health Psychology Society annual conference which is due to be held in Galway, Ireland in August 2018. It is also intended that a summary of the project

encompassing both papers will be submitted for an oral presentation at the European Spinal Psychology Association's (ESPA) biannual conference in Zurich, Switzerland in April 2019.

6.3. Journals

The findings of both papers are of relevance to multidisciplinary rehabilitation interventions. Journals were chosen based on their relevance to this field and their scope to reach a range of rehabilitation professionals.

'Disability and Rehabilitation' was chosen to submit the systematic review to. This journal has a multidisciplinary focus which may allow the findings of the review to inform practice across rehabilitation professions. In addition, this journal seeks to publish research which is of relevance to service delivery and policy in this field. It is hoped that publishing the current review in such a journal may maximise the possibility of the findings to influence service delivery more broadly.

'Rehabilitation Psychology' was chosen to submit the empirical paper to. This journal seeks to publish research which is of relevance to the field of rehabilitation psychology broadly, including disability, chronic illness and combat-related difficulties, such as posttraumatic stress. The findings of this paper may be of interest to professionals working with SCI individuals and to those working in the field of acquired physical disability more generally. As a result, it was deemed to be appropriate to submit to a journal with a more wide-ranging scope than one of the SCI specific journals (e.g. 'Spinal Cord', 'Topics in Spinal Cord Injury Rehabilitation', etc.).

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Below are examples:

Example 1: Leprosy

Leprosy is a disabling disease which not only impacts physically but restricts quality of life often through stigmatisation.

Reconstructive surgery is a technique available to this group.

In a relatively small sample this study shows participation and social functioning improved after surgery.

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Exercise is an effective means of improving health and well-being experienced by people with multiple sclerosis (MS).

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Rehabilitation Psychology®

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Rehabilitation Psychology

University of Washington School of Medicine

Department of Rehabilitation Medicine, Box 359612

Harborview Medical Center

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Seattle, WA 98104-2499

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The cover letter should identify the type of submission category and include

a statement of compliance with APA ethical standards in the conduct of the work reported in the manuscript

a statement that the manuscript or data have not been previously published and that they are not presently under consideration for publication elsewhere

a statement that all listed authors have contributed significantly to the work submitted for consideration

a statement that the paper has been seen and approved by all authors

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Should be accurate, descriptive, and no longer than 12 words. If the report is a clinical trial or a brief report this should be included in the title.

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All manuscripts must include a structured abstract containing a maximum of 250 words typed on a separate page (page 2 of the manuscript). Abstracts must contain a brief statement about each of the following:

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Research Method/Design - including the number and type of participants

Results

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After the abstract, please supply up to five keywords.

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At the start of each paper the authors should provide 2-3 bullet points, with the header "Impact", that states what the current paper adds to the literature and one to two practice or policy implications the findings. This is not a statement of the conclusions, rather a thoughtful series of statements highlighting the novel contribution of the work and translation of the findings for practice or policy. This section should be no more than 200 words.

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It is important that readers have an accurate understanding of the data source the study is based on. Please include details in the Methods section as to the source of the data for this study.

If the study is based on original data collected for the purpose of testing the hypotheses in this manuscript, please make a statement to that effect. If the paper is based on secondary data analyses of data collected for another purpose please

indicate that in the Methods.

If the data set used in this manuscript was also used in previous publications, please include these citations when describing the Methods in this submission.

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Hughes, G., Desantis, A., & Waszak, F. (2013). Mechanisms of intentional binding and sensory attenuation: The role of temporal prediction, temporal control, identity prediction, and motor prediction. *Psychological Bulletin*, 139, 133–151. <http://dx.doi.org/10.1037/a0028566>

Authored Book:

Rogers, T. T., & McClelland, J. L. (2004). *Semantic cognition: A parallel distributed processing approach*. Cambridge, MA: MIT Press.

Chapter in an Edited Book:

Gill, M. J., & Sypher, B. D. (2009). Workplace incivility and organizational trust. In P. Lutgen-Sandvik & B. D. Sypher (Eds.), *Destructive organizational communication: Processes, consequences, and constructive ways of organizing* (pp. 53–73). New York, NY: Taylor & Francis.

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The minimum line weight for line art is 0.5 point for optimal printing.

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Appendix II – Search terms

Spinal cord injuries	Sense of coherence
Spinal cord injur*	Sense of coherence
Spinal cord transection	Coherence
Spin* lesion	Salutogen*
Spin* trauma	Psycho* adjustment
Acquired paralysis	Psycho* adaptation
Tetraplegi*	Psycho* resources
Quadriplegi*	Psycho* issues
Paraplegi*	Phys* health
Tetraparesis	Life orientation
Quadriparesis	Comprehensibility
Paraparesis	Manageability
Traumatic disabilit*	Meaningfulness
Acquired physical disabilit*	General resistance resources

Appendix III - Email to experts

Brian O' Ceallaigh

Reply all

Wed 23/05, 07:44

Duff Jane (Bucks Healthcare) <Jane.Duff@buckshealthcare.nhs.uk>

SoC and SCI papers.docx

114 KB

Download

Save to OneDrive - Cardiff University

Dear Jane,

I hope you are well. I am a trainee clinical psychologist conducting my research into psychological adaptation to SCI.

As part of this I have conducted a systematic review looking at the relationship between sense of coherence and physical and mental health outcomes in SCI.

As a final quality check, I am contacting experts in the field to see if I have missed any relevant studies. Would you be so kind as to look at the attached list and let me know if there are any relevant studies you are aware of which I may have missed?

Many thanks,

Brian O' Ceallaigh

Brian O' Ceallaigh

Reply all

Wed 23/05, 07:28

Magnus.elfstrom@mdh.se

SoC and SCI papers.docx

114 KB

Download

Save to OneDrive - Cardiff University

Dear Magnus,

I am a final year trainee clinical psychologist at Cardiff University in the UK. I am conducting my research project on psychological adaptation to SCI and as part of this I am conducting a systematic review looking at the relationship between sense of coherence and physical and mental health outcomes in spinal cord injured people. As a final quality check, I am sending a list of the identified studies to experts in the field to see if they are aware of any relevant studies that I have missed. Would you be so kind as to look at the attached list and let me know if there are any relevant studies that you are aware of that I have missed?

Many thanks,

Brian O' Ceallaigh

Magnus Elfström
<magnus.elfstrom@mdh.se>

Hello again Brian,

I have had a look at the list and do not have any further suggestions.

Best regards,

Magnus Elfström

Associate professor (Reader) and Senior lecturer of psychology

Mälardalen University

School of Health, Care and Social Welfare
Department of Psychology

Tel: +46 (0)16 15 37 88



Mobile: +46 (0)73 270 88 46

magnus.elfstrom@mdh.se

www.mdh.se



Appendix IV – Ethical approval, ethics amendment and emails from recruiting charities

Ethics Feedback - EC.17.10.10.4956R

P

psychethics

Reply all

Tue 07/11/2017, 13:08

Brian O' Ceallaigh;

Jennifer Moses

Inbox

Dear Brian,

The Ethics Committee has considered your revised project proposal: *Posttraumatic growth and spinal cord injury (EC.17.10.10.4956R)*.

The project has now been approved.

Please note that if any changes are made to the above project then you must notify the Ethics Committee.

Best wishes,
Mark Jones

School of Psychology Research Ethics Committee

Cardiff University
Tower Building
70 Park Place
Cardiff
CF10 3AT

Tel: +44(0)29 208 70360
Email: psychethics@cardiff.ac.uk
<http://psych.cf.ac.uk/aboutus/ethics.html>

Prifysgol Caerdydd
Adeilad y Tŵr
70 Plas y Parc
Caerdydd
CF10 3AT

Ffôn: +44(0)29 208 70360
E-bost: psychethics@caerdydd.ac.uk

psychethics

Mon 05/03, 12:36

Dear Brian,

The **Ethics** Committee has considered the amendment to your PG project proposal: Posttraumatic growth and spinal cord injury (EC.17.10.10.4956RA).

The amendment has been approved.

Please note that if any changes are made to the above project then you must notify the **Ethics** Committee.

Best wishes,
Mark Jones

School of Psychology Research **Ethics Committee**

Cardiff University
Tower Building
70 Park Place
Cardiff
CF10 3AT

Tel: +44(0)29 208 70360
Email: psychethics@cardiff.ac.uk
<http://psych.cf.ac.uk/aboutus/ethics.html>

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70 Plas y Parc
Caerdydd
CF10 3AT

Ffôn: +44(0)29 208 70360
E-bost: psychethics@caerdydd.ac.uk

Beth Scrimshaw <Beth@backuptrust.org.uk>

Reply all

Fri 04/08/2017, 09:50

Brian O' Ceallaigh

Inbox

Hi Brian,

Yes as long as you have ethical approval and I can see that then its fine for us to advertise on our social media.

Get in touch when you have it all sorted.

Thanks

Beth

BC

Brian O' Ceallaigh

Fri 04/08/2017, 09:26

Hello Beth,

Thanks so much for getting in touch. Apologies for the late reply. I have spent the last few months refining the study. I am currently going through the final stages of seeking ethical approval from the university ethics committee. I am hoping to begin advertising my study and recruiting participants in early September.

If possible, it would be great to advertise the study through Back UpTrust's website. What I had in mind was a brief advertisement about the study with a link that takes participants to a series of short questionnaires that can be completed online. Do you think this is something Back Up Trust would be able to be involved in?

Many thanks,

Brian

From: Laura Haynes <laura.haynes@aspire.org.uk>
Sent: 07 August 2017 16:00:27
To: Brian O' Ceallaigh
Subject: RE: Spinal Injury Research

Hi Brian,

I'd be happy to promote this on social media for you, if you want to send me the details...

Best, Laura

Laura Haynes
Communications Manager

Aspire – supporting people with spinal cord injuries
A Sunday Times Top 100 Not for Profit Organisation to work for



T 020 8420 8957

W www.aspire.org.uk



Aspire, Aspire Leisure Centre, Wood Lane, Stanmore, Middlesex HA7 4AP

Association for Spinal Injury Research, Rehabilitation and Reintegration
Registered Charity no. 1075317. Scottish Registered Charity no. SC037482.
Registered Company no. 3744357.

From: Brian O' Ceallaigh [mailto:OCeallaighBC@cardiff.ac.uk] **Sent:** 04 August 2017 09:20 **To:** Laura Haynes **Subject:** Spinal Injury Research

Hello Laura,

I came across your contact details on the Aspire website, where I understand you are Press & Media Officer. I am a Trainee Clinical Psychologist working clinically in the NHS in Wales and completing my doctoral research in Cardiff University. My research is looking at psychological recovery from spinal cord injury. More specifically, I am looking at post-traumatic growth, the experience of lasting positive change following a traumatic experience.

I was hoping it might be possible to raise awareness my study through your website. What I had in mind was a brief advertisement which contains a link that takes interested people to a series of short questionnaires. Do you think that is something Aspire would be happy to help promote?

Kind regards,

Brian O' Ceallaigh

Appendix V – Recruitment ad



Posttraumatic Growth and Spinal Cord Injury



What?

- I am Trainee Clinical Psychologist at Cardiff University, conducting research with people with spinal cord injuries. The project will examine 'posttraumatic growth', or lasting positive psychological changes following difficult events.

Why?

- Little is known about psychological adaptation to spinal cord injury. This is especially the case for positive psychological changes.
- It is hoped that the findings of this research will help inform psychological therapies for people with a spinal cord injury.

Who?

- I am interested in hearing from people from anywhere in the world, who have a spinal cord injury that happened as an adult and at least one year ago.



Participation would involve completing a series of questionnaires. If you would like to take part, please copy and paste the following link into your browser:
https://cardiffunipsych.eu.qualtrics.com/jfe/form/SV_4JdYcqZF4xcL4fX

If you would refer to complete paper copies of the questionnaires, please contact Brian on
OCeallaighBC@cardiff.ac.uk

Thank You

PARTICIPANT INFORMATION SHEET

Study: Posttraumatic growth following spinal cord injury.

Researcher: Brian O' Ceallaigh

You are being invited to take part in a research project that is being undertaken as part of a Doctorate in Clinical Psychology. Please read the information below carefully before deciding whether to take part. If you have any questions, please contact the researcher.

Why is the study being done?

This study will look at the relationship between different types cognitive processing, thoughts about disability, social support and the experience of posttraumatic growth in adults following a spinal cord injury. The findings of the study will be used to further our understanding of how certain factors may facilitate psychological adaptation to spinal cord injury.

Do I have to take part?

No, it is your choice whether to participate or not. If you do decide to take part you are free to change your mind and withdraw from the study at any time.

What I will happen if I decide to take part?

If you want to participate in this study, you will be invited to ask the researcher any questions you may have and will be asked to sign a consent form.

You will be asked to fill in 6 questionnaires. The first will gather some background information about you that will be non-identifiable. The second will ask you questions about the extent to which your injury impacted on your beliefs about yourself, others and the world. The third will ask you questions about the types of thinking you engaged in following your injury. The fourth will ask you questions about your social support. The fifth will ask you about your thoughts about your disability. The sixth will be a measure of posttraumatic growth.

Once you have completed the tasks you will be given an opportunity to ask any questions you may have. The total time taken to complete the study will be approximately 30 minutes.

What are the possible disadvantages of taking part?

There are minimal anticipated disadvantages to participating in the study. You will be asked to give half an hour of your time. There is a small possibility that some of the questions posed to you by the questionnaires may be distressing, as they ask you about the thoughts you had around the time of your injury. If this happens, you are free to withdraw from the study and/or speak to the researcher or research supervisor conducting the study.

What are the possible benefits of taking part?

Although you may not benefit personally from the study, your participation will contribute to a study that may improve our understanding of the factors that facilitate psychological adaptation to spinal cord injury.

What will happen to the information I provide?

All information which is collected about you during the course of the research is strictly confidential. Only the consent form will contain identifiable information. However, this

will be solely accessible to the researcher and will be stored separately from your other data, in a locked filing cabinet. All other information you provide will be completely anonymous and stored in a separate locked filing cabinet. The information will be kept for 12 months.

What will happen when the study ends?

The results of the study will be written up and submitted to Cardiff University to partially fulfil the requirements for a Doctorate in Clinical Psychology. A report may also be sent to a peer-reviewed journal for publication. You will not be identified in any report or publication that follows this study.

Who has reviewed the study?

The study has been reviewed and approved by an ethics committee panel at Cardiff University.

Contact for further information?

If you would like any further information or have any queries please contact:

Researcher: Brian O Ceallaigh (Trainee Clinical Psychologist/Postgraduate student)

Email: OCeallaighBC@cardiff.ac.uk

Tel: 02920 870582

Research Supervisor: Dr Jenny Moses (Consultant Clinical Psychologist/Academic Director)

Email: Jenny.Moses@wales.nhs.uk

Tel: 02920 870582

Thank you for taking the time to read this information sheet.

Participant Consent Form

Posttraumatic growth following spinal cord injury.

Participant Identification Number: _____

Research Team:

Principal Investigator

Name: Brian O' Ceallaigh
Role: Trainee Clinical Psychologist
Email: OCeallaighBC@cardiff.ac.uk
Telephone: 02920 870582
Address: South Wales Doctoral Programme in Clinical Psychology, 11th Floor, School of Psychology, Tower Building, 70 Park Place, Cardiff, CF10 3AT.

Academic Supervisor

Name: Dr Jenny Moses
Role: Consultant Clinical Psychologist/Academic Director
Email: Jenny.Moses@wales.nhs.uk
Telephone: 02920 870582
Address: South Wales Doctoral Programme in Clinical Psychology, 11th Floor, School of Psychology, Tower Building, 70 Park Place, Cardiff, CF10 3AT.

Clinical Supervisor

Name: Dr Susanna Moss
Role: Highly Specialist Clinical Psychologist
Email: Susanna.Moss@wales.nhs.uk
Telephone: 02920 415415
Address: The Welsh Spinal Cord Injury Rehabilitation Centre, Rookwood Hospital, 18-20 Fairwater Road, Llandaff, Cardiff, CF5 2YN.

Posttraumatic growth following spinal cord injury.

Please initial each of the following statements if you agree:

	Please initial
1. I confirm that I have read and understood the information sheet (Version 1.0) for the above named study.	
2. I have been given the opportunity to ask any questions, and have had any questions answered to my satisfaction.	
3. I understand that taking part in the study will have no impact on my care and treatment either positively or negatively, presently or in the future.	
4. I understand that my participation is voluntary and that I am free to withdraw from participating in the study at any time, without giving any reason, and without my care and treatment being affected.	
5. I understand that relevant sections of the data collected during the study may be looked at by members of a Cardiff University research team and from regulatory authorities.	
6. I understand that information I give may be published as part of the project, but that all of my information will be anonymised and it will not be possible for me to be identified by this information. I give consent for anonymous information to be published in the study write-up.	
7. I consent to completing seven questionnaires: a questionnaire collecting demographic and other information; a measure of posttraumatic growth (positive changes occurring after your experience of spinal cord injury); a questionnaire about the ways I thought about the experience of my injury after it occurred; a measure of the beliefs I hold about myself, others and the world; a measure of social support; a measure of my current mood; and a measure of well-being.	
8. I agree to take part in the above study.	

Signature of Participant: _____

Date: _____

Signature of Researcher: _____

Date: _____

Demographic Questionnaire

Posttraumatic growth following spinal cord injury.

1. Name:

2. Date of Birth:

3. Gender:

Male

Female

4. Ethnicity:

British

Irish

Any other white background

Chinese

Indian

Pakistani

Bangladeshi

Any other Asian background

Caribbean

African

Any other black background

White and/or black Caribbean

White and/or black African

White and/or black Asian

Any other mixed background

Any other ethnic background

5. What country are you normally resident in?

6. When did your spinal cord injury occur (try to give a month and year)?

7. What is the level of your spinal cord injury?

8. Is your injury complete or incomplete? Complete

Incomplete

Posttraumatic growth following spinal cord injury

Debriefing Information Sheet

Thank you very much for taking part in this study. The study aimed to investigate factors which influence the experience of posttraumatic growth, the feeling of lasting positive change, following spinal cord injury.

The questionnaires that you completed asked you to think about the thinking you engaged in around the time of your injury, your thoughts about your spinal cord injury, as well as the social support you have available to you. This may have been difficult or upsetting for you to think about. This is understandable and you may feel low or upset following your participation in this study. If you do feel low or upset, here are some sources of support that you may consider calling upon:

- Your friends or family may be able to provide some immediate support.
- Dr Jenny Moses, Consultant Clinical Psychologist, can also be contacted for support following this study (tel: 02920 870582).
- Your GP is also a potential source of support. They may be able to signpost you to additional support should you feel low or upset for longer than you feel comfortable with.
- There are also a number of organisations and charities which provide support. You may find some of these helpful.

SIA - The Spinal Injuries Association (www.spinal.co.uk)

The Spinal Injuries Association is a national charity which aims to help people with a spinal cord injury to live well. They also provide a telephone counselling service.

Telephone: 0800 980 0501 (open from 11am to 1pm and 2pm to 4:30pm, Monday to Friday).

The Samaritans (www.samaritans.org)

The Samaritans is a national charity and the co-ordinating body for the 201 Samaritans branches across the UK. The Samaritans aims to help alleviate emotional distress and has a helpline which is open 24 hours a day for anyone in need.

Telephone: 08457 909090.

The Samaritans also has a Welsh Language Line: 0300 123 3011 (open from 7pm to 11pm only, 7 days a week).

If you have any further questions in relation to this study please contact me on the details below.

Contact details:

Name: Brian O' Ceallaigh

Email: OCeallaighBC@cardiff.ac.uk

Tel: 02920 870582 (Mon-Fri 9am-5pm)

Address: Doctorate in Clinical Psychology, 11th Floor, Tower Building, School of Psychology, 70 Park Place, Cardiff, CF10 3AT

If you have any concerns that you would like to raise about the research you can also contact my academic supervisor:

Contact details:

Name: Dr Jenny Moses

Email: Jenny.moses@wales.nhs.uk

Tel: 02920 870582

Address: Doctorate in Clinical Psychology, 11th Floor, Tower Building, School of Psychology, 70 Park Place, Cardiff, CF10 3AT.

Thank you again for taking the time to participate in this study.

Post Traumatic Growth Inventory

Client Name: Today's Date:

Indicate for each of the statements below the degree to which this change occurred in your life as a result of the crisis/disaster, using the following scale.

0 = I did not experience this change as a result of my crisis.

1 = I experienced this change to a very small degree as a result of my crisis. 2 = I experienced this change to a small degree as a result of my crisis.

3 = I experienced this change to a moderate degree as a result of my crisis. 4 = I experienced this change to a great degree as a result of my crisis.

5 = I experienced this change to a very great degree as a result of my crisis.

Possible Areas of Growth and Change	0	1	2	3	4	5
1. I changed my priorities about what is important in life.						
2. I have a greater appreciation for the value of my own life.						
3. I developed new interests.						
4. I have a greater feeling of self-reliance.						
5. I have a better understanding of spiritual matters.						
6. I more clearly see that I can count on people in times of trouble.						
7. I established a new path for my life.						
8. I have a greater sense of closeness with others.						
9. I am more willing to express my emotions.						
10. I know better that I can handle difficulties.						
11. I am able to do better things with my life.						
12. I am better able to accept the way things work out.						
13. I can better appreciate each day.						
14. New opportunities are available which wouldn't have been otherwise.						
15. I have more compassion for others.						
16. I put more effort into my relationships.						
17. I am more likely to try to change things which need changing.						
18. I have a stronger religious faith.						
19. I discovered that I'm stronger than I thought I was.						
20. I learned a great deal about how wonderful people are.						
21. I better accept needing others.						

Core Beliefs Inventory

Some events that people experience are so powerful that they 'shake their world' and lead them to seriously examine core beliefs about the world, other people, themselves and their future.

Please reflect upon the event about which you are reporting and indicate the extent to which it lead you to seriously examine each of the following core beliefs.

1. Because of the event, I seriously examined the degree to which I believe things that happen to people are fair.
2. Because of the event, I seriously examined the degree to which I believe things that happen to people are controllable.
3. Because of the event, I seriously examined my assumptions concerning why other people think and behave the way they do.
4. Because of the event, I seriously examined my beliefs about my relationships with other people.
5. Because of the event, I seriously examined my beliefs about my own abilities, strengths and weaknesses.
6. Because of the event, I seriously examined my beliefs about my expectations for the future.
7. Because of the event, I seriously examined my beliefs about the meaning of my life.
8. Because of the event, I seriously examined my spiritual or religious beliefs.
9. Because of the event, I seriously examined my beliefs about my own value or worth as a person.

Responses are on a six-point scale (0-5):

- | | |
|---|------------------------|
| 0 | not at all |
| 1 | to a very small degree |
| 2 | to a small degree |
| 3 | to a moderate degree |
| 4 | to a great degree |
| 5 | to a very great degree |

The Event-Related Rumination Inventory

Intrusive items

After an experience like the one you have reported, people sometimes, but not always, find themselves having thoughts about their experience even though even though they don't try to think about it. Indicate for the following items how often, if at all, you had the experiences described during the weeks immediately after the event.

I thought about the event when I didn't mean to.

Thoughts about the event came to mind and I could not stop thinking about them.

Thoughts about the event distracted me or kept me from being able to concentrate.

I could not keep images or thoughts about the event from entering my mind.

Thoughts, memories, or images of the event came to mind even when I did not want them.

Thoughts about the event caused me to relive my experience.

Reminders of the event brought back thoughts about my experience.

I found myself automatically thinking about what had happened.

Other things kept leading me to think about my experience.

I tried not to think about the event, but could not keep the thoughts from my mind.

Deliberate items

After an experience like the one you reported, people sometimes, but not always, deliberately and intentionally spend time thinking about their experience. Indicate for the following items how often, if at all, you deliberately spent time thinking about the issues indicated during the weeks immediately after the event.

I thought about whether I could find meaning from my experience.

I thought about whether changes in my life have come from dealing with my experience.

I forced myself to think about my feelings about my experience.

I thought about whether I have learned anything as a result of my experience.

I thought about whether I have learned anything as a result of my experience.

I thought about whether the experience has changed my beliefs about the world.

I thought about what the experience might mean for my future.

I thought about whether my relationships with others have changed following my experience.

I forced myself to deal with my feelings about the event.

I deliberately thought about how the event had affected me.

I thought about the event and tried to understand what had happened.

Responses are on a four-point scale (0-3):

0 not at all

1 rarely

2 sometimes

3 often

Multidimensional Scale of Perceived Social Support (Zimet, Dahlem, Zimet & Farley, 1988)

Instructions: We are interested in how you feel about the following statements. Read each statement carefully.

Indicate how you feel about each statement.

Circle the “1” if you Very Strongly Disagree

Circle the “2” if you Strongly Disagree

Circle the “3” if you Mildly Disagree

Circle the “4” if you are Neutral

Circle the “5” if you Mildly Agree

Circle the “6” if you Strongly Agree

Circle the “7” if you Very Strongly Agree

There is a special person who is around when I am in need.

1 2 3 4 5 6 7

There is a special person with whom I can share my joys and sorrows.

1 2 3 4 5 6 7

My family really tries to help me.

1 2 3 4 5 6 7

I get the emotional help and support I need from my family.

1 2 3 4 5 6 7

I have a special person who is a real source of comfort to me.

1 2 3 4 5 6 7

My friends really try to help me.

1 2 3 4 5 6 7

I can count on my friends when things go wrong.

1 2 3 4 5 6 7

I can talk about my problems with my family.

1 2 3 4 5 6 7

I have friends with whom I can share my joys and sorrows.

1 2 3 4 5 6 7

There is a special person in my life who cares about my feelings.

1 2 3 4 5 6 7

My family is willing to help me make decisions.

1 2 3 4 5 6 7

I can talk about my problems with my friends.

1 2 3 4 5 6 7

The Appraisals of Disability: Primary and Secondary Scale (ADAPSS)

This scale was developed by Dr Rachel Dean and Professor Paul Kennedy, National Spinal Injuries Centre, Stoke Mandeville Hospital, Buckinghamshire Hospitals NHS Trust and The Oxford Doctoral Course in Clinical Psychology, University of Oxford.

paul.kennedy@hmc.ox.ac.uk

SHORT FORM

NAME: DATE:

We are interested in the thoughts people have about their spinal cord injury. Using the following scale, rate the extent to which the following statements reflect your current perceptions of your injury by circling your responses.

Since my injury life is more frightening for me.	STRONGLY DISAGREE 1	MODERATELY DISAGREE 2	MILDLY DISAGREE 3	MILDLY AGREE 4	MODERATELY AGREE 5	STRONGLY AGREE 6
I cannot believe this has happened to me.	STRONGLY DISAGREE 1	MODERATELY DISAGREE 2	MILDLY DISAGREE 3	MILDLY AGREE 4	MODERATELY AGREE 5	STRONGLY AGREE 6
I will continue to live my life to its full capacity.	STRONGLY DISAGREE 1	MODERATELY DISAGREE 2	MILDLY DISAGREE 3	MILDLY AGREE 4	MODERATELY AGREE 5	STRONGLY AGREE 6
I am going to miss out on so many aspects of my life.	STRONGLY DISAGREE 1	MODERATELY DISAGREE 2	MILDLY DISAGREE 3	MILDLY AGREE 4	MODERATELY AGREE 5	STRONGLY AGREE 6
This experience has made me a stronger person.	STRONGLY DISAGREE 1	MODERATELY DISAGREE 2	MILDLY DISAGREE 3	MILDLY AGREE 4	MODERATELY AGREE 5	STRONGLY AGREE 6
There are many things that I can do to change my situation.	STRONGLY DISAGREE 1	MODERATELY DISAGREE 2	MILDLY DISAGREE 3	MILDLY AGREE 4	MODERATELY AGREE 5	STRONGLY AGREE 6

TOTAL =

SCORES ABOVE 22: ADMINISTER ADAPSS LONG VERSION

Hospital Anxiety and Depression Scale (HADS)

Tick the box beside the reply that is closest to how you have been feeling in the past week.
Don't take too long over you replies: your immediate is best.

D	A		D	A	
		I feel tense or 'wound up':			I feel as if I am slowed down:
	3	Most of the time	3		Nearly all the time
	2	A lot of the time	2		Very often
	1	From time to time, occasionally	1		Sometimes
	0	Not at all	0		Not at all
		I still enjoy the things I used to enjoy:			I get a sort of frightened feeling like 'butterflies' in the stomach:
0		Definitely as much		0	Not at all
1		Not quite so much		1	Occasionally
2		Only a little		2	Quite Often
3		Hardly at all		3	Very Often
		I get a sort of frightened feeling as if something awful is about to happen:			I have lost interest in my appearance:
	3	Very definitely and quite badly	3		Definitely
	2	Yes, but not too badly	2		I don't take as much care as I should
	1	A little, but it doesn't worry me	1		I may not take quite as much care
	0	Not at all	0		I take just as much care as ever
		I can laugh and see the funny side of things:			I feel restless as I have to be on the move:
0		As much as I always could		3	Very much indeed
1		Not quite so much now		2	Quite a lot
2		Definitely not so much now		1	Not very much
3		Not at all		0	Not at all
		Worrying thoughts go through my mind:			I look forward with enjoyment to things:
	3	A great deal of the time	0		As much as I ever did
	2	A lot of the time	1		Rather less than I used to
	1	From time to time, but not too often	2		Definitely less than I used to
	0	Only occasionally	3		Hardly at all
		I feel cheerful:			I get sudden feelings of panic:
3		Not at all		3	Very often indeed
2		Not often		2	Quite often
1		Sometimes		1	Not very often
0		Most of the time		0	Not at all
		I can sit at ease and feel relaxed:			I can enjoy a good book or radio or TV program:
0		Definitely	0		Often
1		Usually	1		Sometimes
2		Not Often	2		Not often
3		Not at all	3		Very seldom

Please check you have answered all the questions

Below are some statements about feelings and thoughts.

Please tick (✓) the box that best describes your experience of each over the **last 2 weeks**

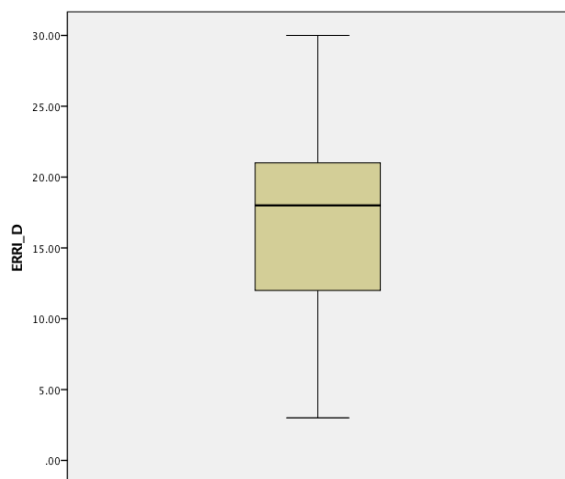
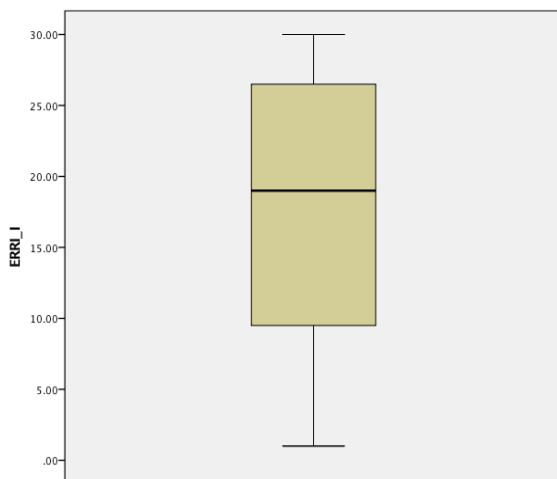
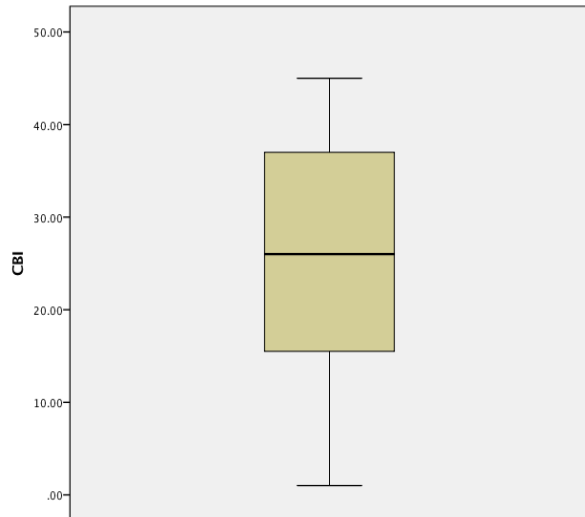
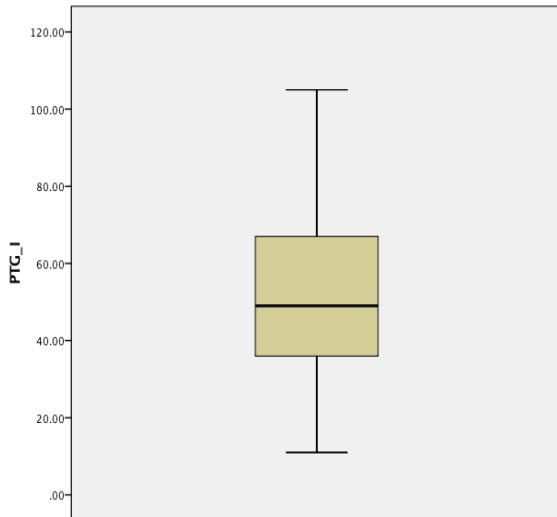
STATEMENTS	None of the time	Rarely	Some of the time	Often	All of the time
I've been feeling optimistic about the future	1	2	3	4	5
I've been feeling useful	1	2	3	4	5
I've been feeling relaxed	1	2	3	4	5
I've been feeling interested in other people	1	2	3	4	5
I've had energy to spare	1	2	3	4	5
I've been dealing with problems well	1	2	3	4	5
I've been thinking clearly	1	2	3	4	5
I've been feeling good about myself	1	2	3	4	5
I've been feeling close to other people	1	2	3	4	5
I've been feeling confident	1	2	3	4	5
I've been able to make up my own mind about things	1	2	3	4	5
I've been feeling loved	1	2	3	4	5
I've been interested in new things	1	2	3	4	5
I've been feeling cheerful	1	2	3	4	5

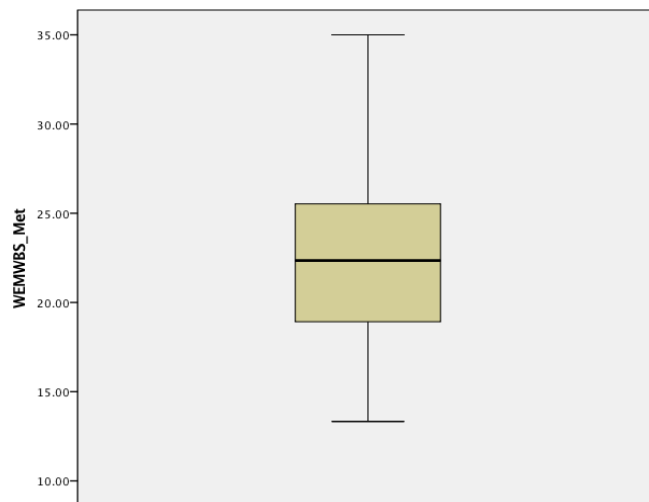
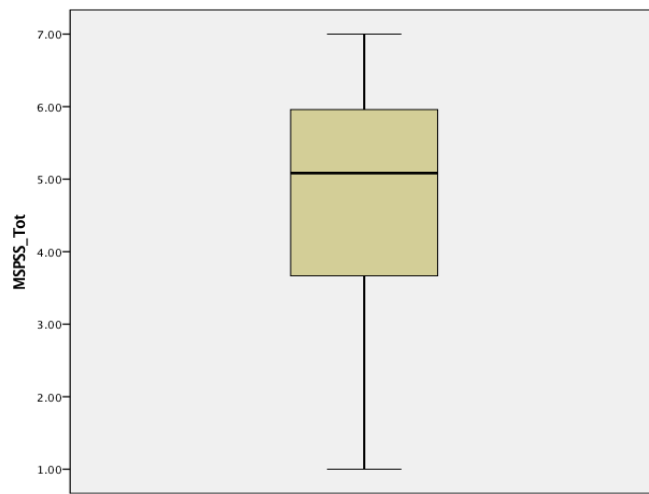
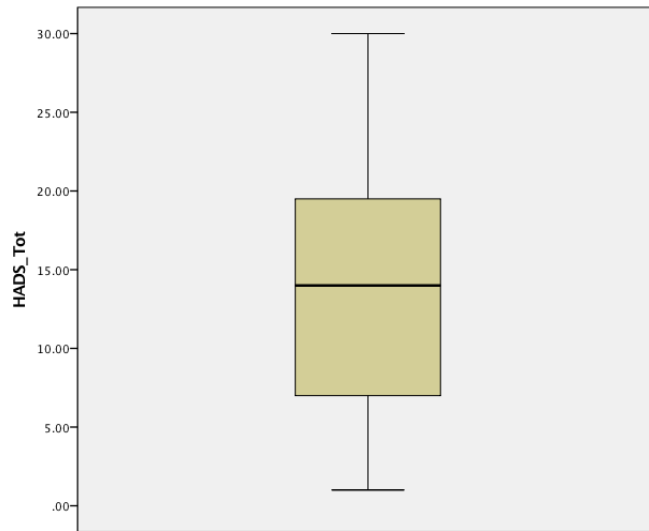
© WEMWBS

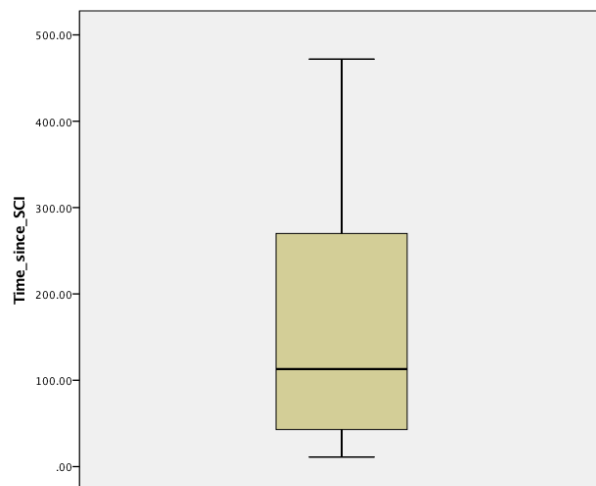
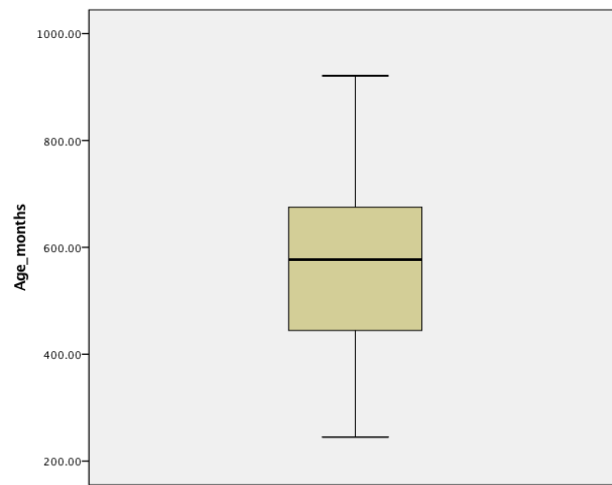
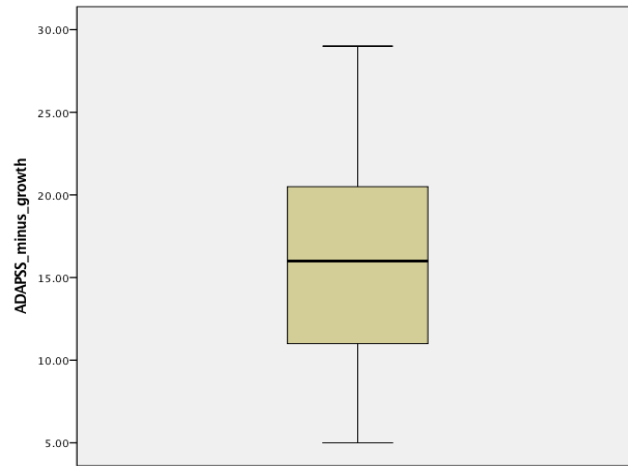
Warwick-Edinburgh Mental Well-being Scale (WEMWBS) © NHS Health Scotland, University of Warwick and University of Edinburgh, 2006, all rights reserved.

Appendix VII – SPSS output

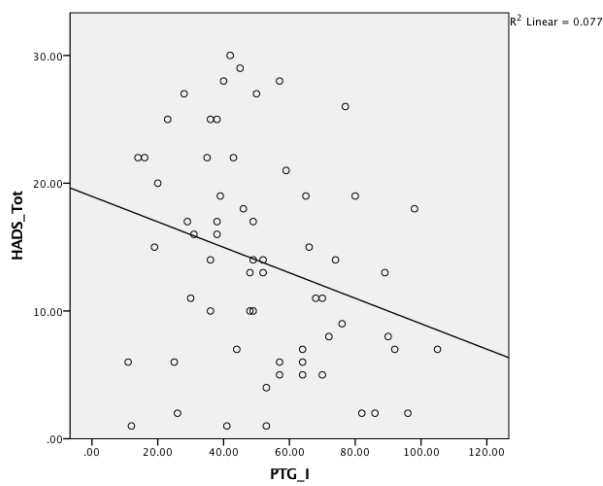
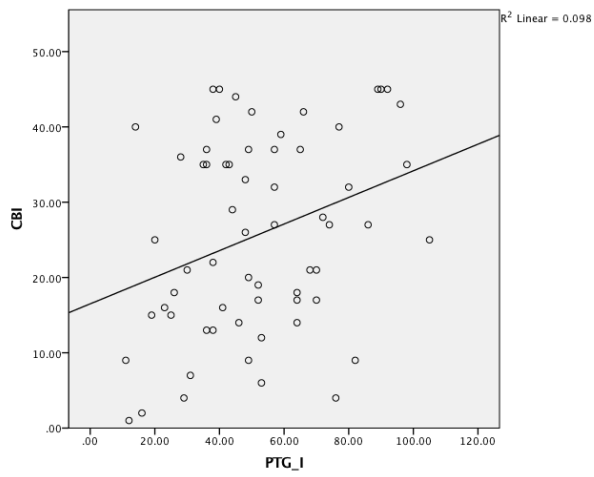
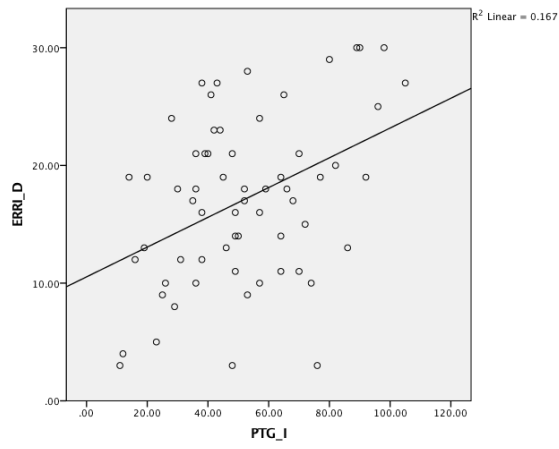
Boxplots

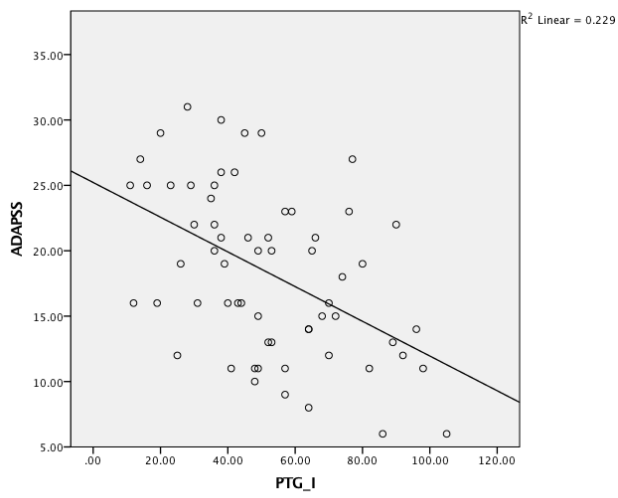
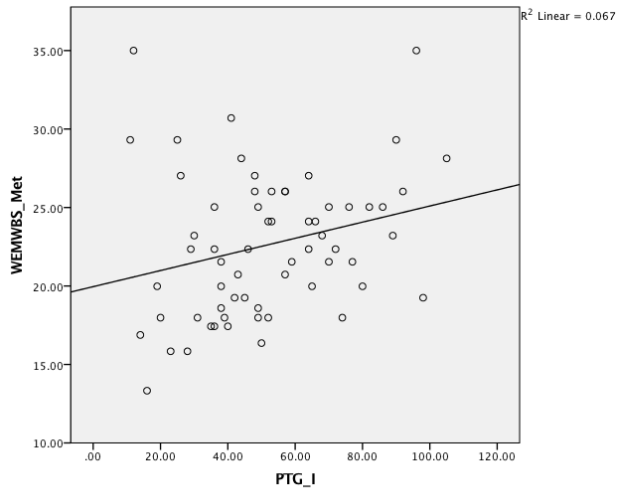




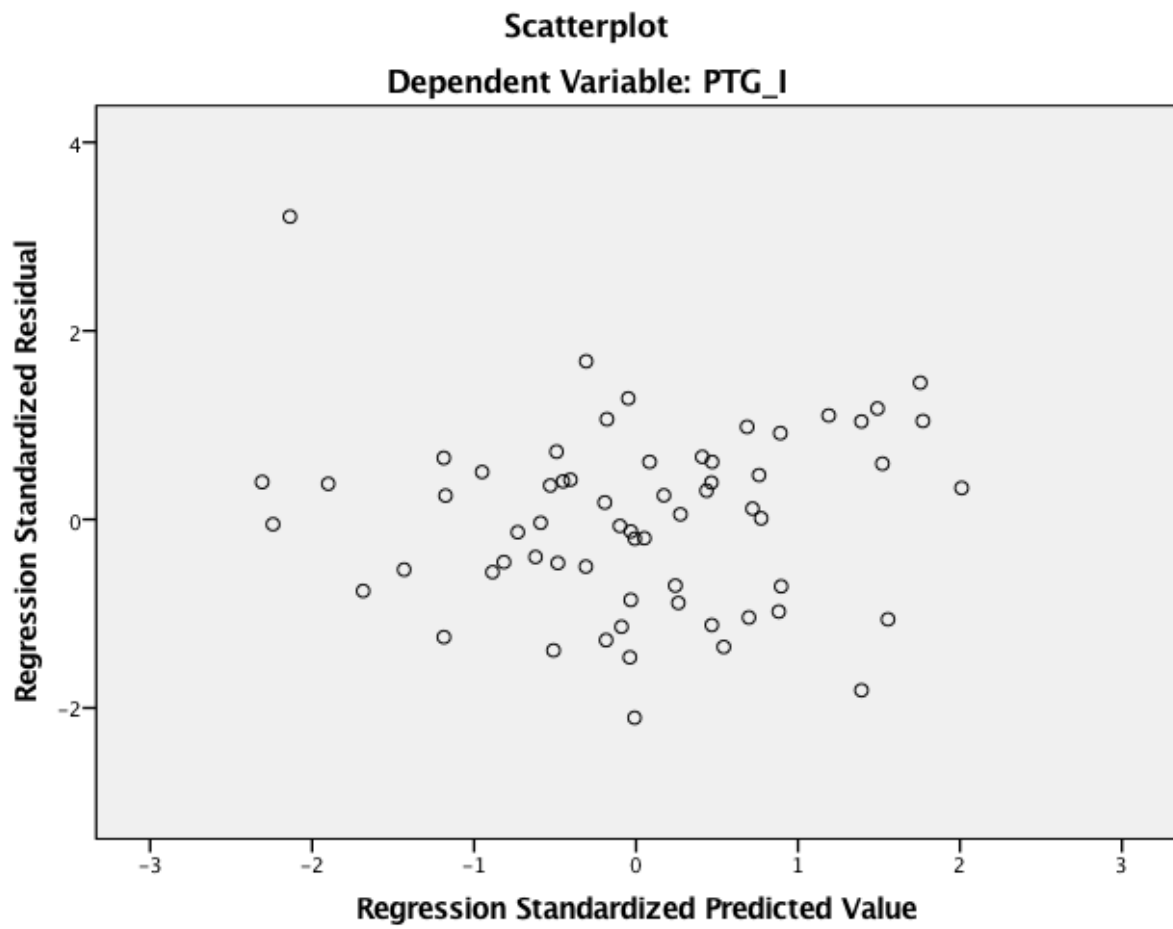


Scatterplots

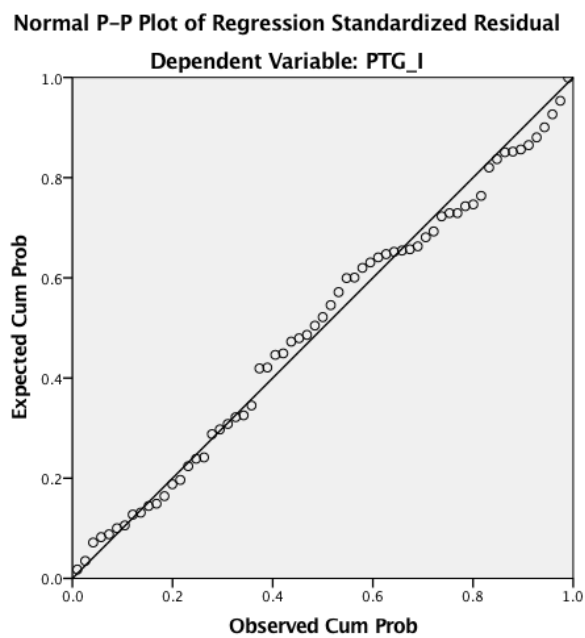
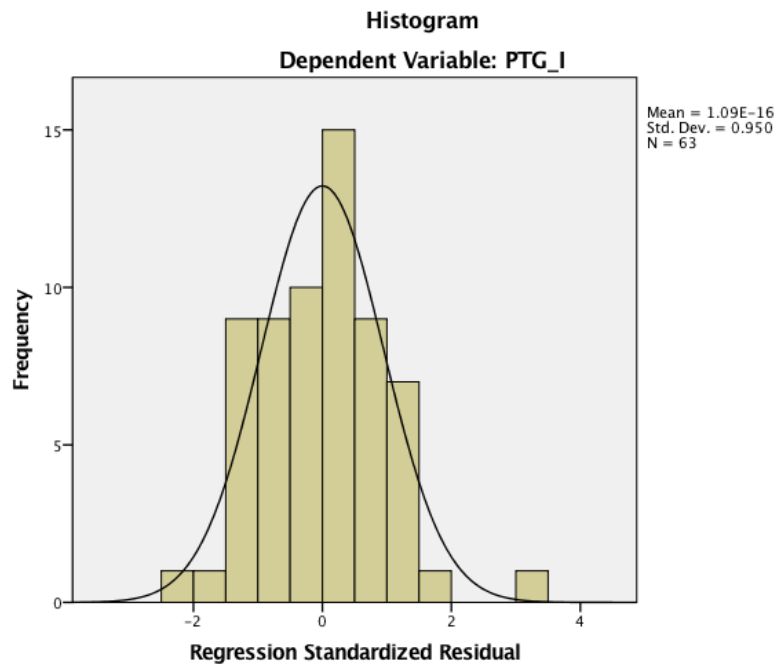




Scatterplot to check assumption 6: Homoscedasticity



Histogram and scatterplot to check assumption 7: Normal distribution of residuals



t-tests output

One-Sample Test						
	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
PTG_I	17.839	62	.000	51.77778	45.9759	57.5797

One-Sample Test						
	Test Value = 51.53					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
PTG_I	.085	62	.932	.24778	-5.5541	6.0497

One-Sample Test						
	Test Value = 58.43					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
PTG_I	-2.292	62	.025	-6.65222	-12.4541	-.8503

Correlation output (Kendall's Tau)

Correlations						
	PTG_I	MSPSS_Tot	CBI			
Kendall's tau_b	PTG_I	Correlation Coefficient	1.000	.179*	.201*	
		Sig. (1-tailed)	.	.021	.011	
		N	63	63	63	
	MSPSS_Tot	Correlation Coefficient	.179*	1.000	-.121	
		Sig. (1-tailed)	.021	.	.085	
		N	63	63	63	
	CBI	Correlation Coefficient	.201*	-.121	1.000	
		Sig. (1-tailed)	.011	.085	.	
		N	63	63	63	
Spearman's rho	PTG_I	Correlation Coefficient	1.000	.251*	.288*	
		Sig. (1-tailed)	.	.024	.011	
		N	63	63	63	
	MSPSS_Tot	Correlation Coefficient	.251*	1.000	-.168	
		Sig. (1-tailed)	.024	.	.094	
		N	63	63	63	
	CBI	Correlation Coefficient	.288*	-.168	1.000	
		Sig. (1-tailed)	.011	.094	.	
		N	63	63	63	
*. Correlation is significant at the 0.05 level (1-tailed).						

Regression output

Model Summary ^a										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics	Durbin-Watson				
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.408 ^a	.167	.153	21.20146	.167	12.203	1	61	.001	
2	.588 ^b	.346	.324	18.94533	.179	16.394	1	60	.000	
3	.625 ^c	.390	.359	18.43833	.045	4.345	1	59	.041	
4	.657 ^d	.432	.393	17.95482	.041	4.220	1	58	.044	
5	.672 ^e	.452	.404	17.78797	.020	2.093	1	57	.153	
6	.675 ^f	.455	.397	17.88805	.004	.364	1	56	.549	1.984
a. Predictors: (Constant), ERRI_D										
b. Predictors: (Constant), ERRI_D, ADAPSS_minus_growth										
c. Predictors: (Constant), ERRI_D, ADAPSS_minus_growth, CBI										
d. Predictors: (Constant), ERRI_D, ADAPSS_minus_growth, CBI, MSPSS_Tot										
e. Predictors: (Constant), ERRI_D, ADAPSS_minus_growth, CBI, MSPSS_Tot, HADS_Tot										
f. Predictors: (Constant), ERRI_D, ADAPSS_minus_growth, CBI, MSPSS_Tot, HADS_Tot, WEMWBS_Met										
g. Dependent Variable: PTG_I										

Mediation output

Run MATRIX procedure:

***** PROCESS Procedure for SPSS Version 3.00 *****

Written by Andrew F. Hayes, Ph.D. www.afhayes.com
Documentation available in Hayes (2018). www.guilford.com/p/hayes3

Model : 4
Y : PTG_I
X : CBI
M : ERRI_D

Sample
Size: 63

OUTCOME VARIABLE:
ERRI_D

Model Summary

R	R-sq	MSE	F	df1	df2	p
.5818	.3385	34.2299	31.2177	1.0000	61.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	8.8746	1.6431	5.4012	.0000	5.5891	12.1602
CBI	.3199	.0572	5.5873	.0000	.2054	.4343

OUTCOME VARIABLE:
PTG_I

Model Summary

R	R-sq	MSE	F	df1	df2	p
.4189	.1754	452.1956	6.3835	2.0000	60.0000	.0031

Model

coeff	se	t	p	LLCI	ULCI
-------	----	---	---	------	------

constant	27.7171	7.2609	3.8173	.0003	13.1929	42.2412
CBI	.2041	.2558	.7979	.4281	-.3076	.7159
ERRI_D	1.1022	.4654	2.3684	.0211	.1713	2.0331

***** TOTAL EFFECT MODEL *****

OUTCOME VARIABLE:

PTG_I

Model Summary

R	R-sq	MSE	F	df1	df2	p
.3136	.0984	486.3657	6.6546	1.0000	61.0000	.0123

Model

	coeff	se	t	p	LLCI	ULCI
constant	37.4986	6.1935	6.0545	.0000	25.1138	49.8834
CBI	.5567	.2158	2.5797	.0123	.1252	.9882

***** TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y **

Total effect of X on Y

Effect	se	t	p	LLCI	ULCI	c_ps	c_cs
.5567	.2158	2.5797	.0123	.1252	.9882	.0242	.3136

Direct effect of X on Y

Effect	se	t	p	LLCI	ULCI	c'_ps	c'_cs
.2041	.2558	.7979	.4281	-.3076	.7159	.0089	.1150

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
ERRI_D	.3525	.1733	.0401	.7211

Partially standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
ERRI_D	.0153	.0070	.0020	.0298

Completely standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
ERRI_D	.1986	.0916	.0241	.3886

Appendix VIII – Acceptance Notification for European Health Psychology Society Conference

EHPS 2018, 21 - 25 Aug 2018

32nd Annual Conference of the European Health Psychology Society

May 9th, 2018

Acceptance Notification

Dear Brian O Ceallaigh,

Many thanks for your submission to the EHPS conference in Galway, entitled *Postrumatic growth following spinal cord injury: the relationships between cognitive processes, social support and mood.*. More than 940 abstracts were reviewed by the track chairs and the Scientific Committee. We are pleased to inform you that your submission has been accepted as **oral presentation**.

We are sending this **notification** to you as presenter. Please inform your co-authors about the decision and the conference information below.

The provisional scientific programme will be published in due course on the conference website: www.ehps2018.net. This will include the day and time of your presentation. Please bear in mind that your presentation may be scheduled at any time between Wednesday 22nd August at 9 am in the morning and Friday 25th August at 10.30 am in the morning. Due to the large number of submissions, individual requests for presentations on specific days or times **will not be considered unless there are exceptional circumstances**.

Please register and pay by 15th June 2018 to be included in the programme.

As a presenter you must register for the conference and pay by Friday 15th June, which is the deadline for the early bird reduced rate. If you fail to register and pay by this date, we will have to remove your presentation from the conference programme and your abstract from the abstract book. Please also encourage your colleagues who are attending the conference to register by this date in order to benefit from the early bird reduced rate.

As Galway is very busy in August we would encourage delegates to book as early as possible to ensure that you secure accommodation that meets your needs and budget.

The abstract submission website and registration website use separate authentication details. You will need to create a new account to register for the conference, but you may reuse the same details as when you created your abstract submission account if you so wish.

Please email info@easyconferences.org immediately if you do not plan to attend the conference and let us know who will present on your behalf, including their affiliation, country and email address.

Presentation requirements and abstract

We will email you information about the presentation requirements and technical facilities in due course. Your abstract will be available to the conference attendants in electronic format and will be included in a supplemental issue of the *European Health Psychologist*.

Conference website

Our website www.ehps2018.net will be continuously updated with details about the scientific programme, social activities, registration, accommodation and travel to Galway, Ireland.

Conference workshops

Please visit [our](#) website for information about the conference workshops which will take place on Tuesday 21st August.

Meet the Expert

These are one-to-one sessions where PhD students and early career researchers can discuss ideas, ask questions, and network with experts in the field in a friendly and relaxed environment. Please see www.ehps.net/create for more information, including how to apply to attend a session.

Thank you again for your submission and we look forward to seeing you at the conference.

Kind regards,

David Hevey

Chair of the Scientific Committee