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**Title: PREDICTORS OF POSITIVE GROWTH AFTER TRAUMATIC BRAIN
INJURY: A LONGITUDINAL STUDY**

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PREDICTORS OF POSITIVE GROWTH AFTER TBI

Abstract

Primary objective: To investigate long-term positive psychological growth in individuals with traumatic brain injury (TBI) and to relate growth to injury characteristics and early outcomes.

Research design: Longitudinal study.

Method and Procedure: Long-term follow-up of a group of TBI survivors recruited between 1991-1995. In 2004, 240 of the 563 original participants were invited to take part in a follow-up study. At follow-up, survivors completed the Positive Changes in Outlook Questionnaire (CiOP) along with a structured interview/questionnaire which permitted a Glasgow Outcome Scale (GOSE) score to be assigned.

Results: 165 TBI survivors completed both questionnaire and CiOP. 103(62%) participants had suffered severe TBI, 24(15%) moderate and 38(23%) mild. Mean length of follow-up was 11.5 years post-injury (range 9-25 years). On the GOSE at follow-up, 43(26%) had severe disability; 72(44%) moderate disability; and 50(30%) good recovery. Scores on the CiOP indicated positive psychological growth in over half of the sample, as evidenced by agreement with items such as “I don’t take life for granted anymore” and “I value my relationships much more now”. CiOP total scores did not correlate with any injury or early outcome variables. However, at long-term follow-up there was a negative correlation between positive growth and anxiety and depression.

Conclusion:

Survivors of mild, moderate and severe TBI showed evidence of long-term positive changes in outlook.

Keywords: *brain injury, outcome, follow-up, post-traumatic growth, trauma*

Introduction

There is a substantial literature regarding the problems associated with serious traumatic brain injury (TBI). Studies which have followed patients beyond one year post-injury indicate that these problems can be both persistent and disabling [1-5]. Even those deemed to have made a good recovery often have residual psychological or emotional deficits which prevent them from returning to pre-injury levels of functioning [6-8]. However, several researchers suggest that good long-term adjustment after brain injury is achievable, even after severe TBI [9-11]. In recent years, there has been a recognition that long-term adjustment does not necessarily mean simply returning to a level of functioning comparable to that experienced prior to the trauma, but that for some individuals recovery may involve going beyond their previous pre-trauma level of functioning. Consequently, researchers are now beginning to examine positive psychological outcomes after brain injury [12-14].

Positive psychological outcome has recently been explored by McGrath and Linley [15], who conducted the first systematic study into whether people with acquired brain injury (ABI) show evidence of psychological growth and positive changes. They studied a sample of 21 participants, the majority of whom had ABI of cerebrovascular origin and had all sustained very severe brain injury resulting in significant cognitive and physical deficits requiring long periods of in-patient rehabilitation. They found that scores on the Posttraumatic Growth Inventory [16] indicated high levels of positive change. Comparing the 10 participants in the early stages of recovery and resident in a rehabilitation unit (mean 7 months after injury) with the other 11

participants, matched with the first sample for age, sex, diagnosis, and disability level, and who had long since completed rehabilitation (mean 118 months after injury), it was found that the late sample achieved significantly higher scores in relation to life appreciation, relationships with others, and personal strength.

Subsequently, Powell et al [17] also found that positive growth appears to increase over time since TBI. In a cross-sectional study, Powell et al reported that patients 10 years post-TBI appeared to report a greater degree of post-traumatic growth than patients at 1-3 years post-TBI [17].

Although positive change following trauma and adversity has been demonstrated for a wide range of clinical groups [18], the above results were surprising as due to the social, cognitive and emotional problems associated with ABI it seemed unlikely that such change would be markedly present in survivors. However, McGrath and Linley reported evidence of substantial positive psychological growth even among those who had suffered severe ABI [15]. But importantly, anxiety as measured by the Hospital Anxiety and Depression Scale (HADS) [19] was found to be significantly associated with post-traumatic growth, suggesting that the search for meaning is in itself inherently distressing and not indicative of overall positive functioning. This finding is in accord with other research which suggests that whereas the presence of meaning in life is related to increased well-being, the search for meaning is related to reduced well-being [20]. There is, however, a need to further substantiate these results as the sample in the McGrath and Linley study was small and highly selected [15], and the Powell study was not longitudinal [17]. The aims of the current study were to investigate long-term psychological growth in survivors of TBI, and to identify

the extent to which injury characteristics and early outcome measures predict long-term positive growth.

Methods

Background

A large multicentre study was carried out between 1991 and 1997 which investigated outcomes following rehabilitation for adults with TBI. This study followed patients for up to three years after recruitment, and found that many continued to have residual problems associated with the brain injury [21]. In the present investigation, a further follow-up of a sub-set of the original cohort was carried out at approximately 10 years post TBI to assess psychological growth.

Study sample

The 1991-7 cohort comprised of 563 adults aged 16 to 65 years at time of recruitment to one of 10 participating rehabilitation centres. Inclusion criteria: traumatic brain injury. Exclusion criteria: non-traumatic brain damage, including subarachnoid haemorrhage. The majority of patients (493, 88%) were injured between 1st June 1991 and 31st December 1994.

Acute injury data were collected by medical staff at the study centres. For rehabilitation units based in hospitals these were completed prospectively during the

acute treatment phase. For rehabilitation units separate from acute hospitals the data were collected retrospectively from patient medical notes including ambulance records and notes from intensive therapy units. The data collected included results of CT and/or MRI scans, Glasgow Coma Scale scores [22], loss of consciousness, neurosurgical intervention and duration post traumatic amnesia (PTA) where recorded. The GCS score used to assign severity was the worst score recorded within 24 hours of injury in the absence of neurosedation.

Injury severity was classified according to the criteria proposed by the Medical Disability Society [23]: *Mild* brain injury: an injury causing unconsciousness for 15 minutes or less, and/or a GCS of 13 to 15. *Moderate* brain injury: an injury causing unconsciousness for more than 15 minutes but less than 6 hours, or a PTA of less than 24 hours, and/or GCS of 9 to 12. *Severe* brain injury: an injury causing unconsciousness for 6 hours or more, or a PTA of 24 hours or more, and/or GCS of 6 to 8. *Very Severe* brain injury: an injury causing unconsciousness for 48 hours or more or a PTA of 7 days or more, and/or GCS of 3 to 5. In subsequent analyses the severe/very severe categories were amalgamated to form a 3-point scale of mild, moderate or severe TBI.

Characteristics of original cohort and follow-up

The majority of the study group had suffered a severe TBI (386, 69%), and three quarters were male (Table 1). All patients were followed-up at 2-6 months post-recruitment (mean= 20.3 months post-TBI, median = 7 months, mode = 3 months, SD=36.1).

Follow-up was by face-to-face interview in patients' homes. Interviews and questionnaires were structured. Patients and/or a family member were asked to report current problems, initially spontaneously and then prompted using a symptom checklist, and the number of different problems reported was recorded. The checklist domains included physical, mobility, cognitive, psychological, social and emotional status and health status, including occurrence of seizures or epilepsy. A range of assessment measures were carried out to coincide with the interviews.

Insert table 1 about here

Measures

i) Early outcome measures

Glasgow Outcome Scale Extended (GOSE)

The GOSE was used to measure overall recovery from brain injury, it takes account of physical, cognitive, psychological and social disability [24,25]. The GOSE uses an 8-point scale: 1 = death; 2 = vegetative state; 3 = severe disability (lower level); 4 = severe disability (higher level); 5 = moderate disability (lower level); 6 = moderate disability (higher level) , 7 = good recovery with minor deficits; 8 = complete recovery. All subjects were aged 16 or over at the time of GOSE assessment.

Functional Assessment Measures (FIM+FAM)

The Functional Independence Measure (FIM) and Functional Assessment Measure (FAM) (FIM+FAM) measures the extent to which persons require help to perform activities of daily living [26]. On this scale, a score of 7 represents complete independence for a given item and a score of 1 represents complete dependence. It was scored by psychology and/or therapy staff at the study centres.

Hospital Anxiety and Depression Scale (HADS)

This questionnaire detects anxiety and depression in general medical outpatient populations, including community patients. Items are rated on a four-point scale ranging from absence of a symptom to maximum symptomatology. The scale provides a score for both anxiety and depression. The clinical significance of anxiety or depression is calculated on a scale whereby scores of 0-7 are non cases, 8-10 are borderline cases, and scores of 11-21 are cases [19].

Community Outcome Scale (COS)

The COS assesses the extent to which patients achieve community functioning following TBI and is based on the International Classification of Impairments, Disabilities and Handicaps (ICIDH) [4,27]. It contains 4 scales: mobility, occupation, engagement and social integration. A score of 0 represents no problems, on a scale increasing to 5 (worst problems), with a score of 6 representing patients not living in the community (e.g. in residential care). It was scored from interview data by researchers.

Early referral to rehabilitation: defined as referral to rehabilitation within 6-months of the TBI.

ii) Late outcome measures

At approximately 10 years post injury, study participants were assessed using a structured questionnaire. The questionnaire contained 7 domains: physical, mobility, cognitive, psychological, social, health and emotional status. It also incorporated the positive change scale (CiOP) of the Changes in Outlook Questionnaire [28].

Participants were also invited to take part in a face-to-face or telephone interview.

The GOSE was then re-assessed from the questionnaire and interview data.

Positive Changes in Outlook (CiOP)

The CiOP was designed to assess psychological change following trauma and adversity, and the scale has satisfactory psychometric properties [29]. The CiOP consists of 11 items (such as: "I value my relationships much more now") and is rated on a six-point scale: 1 = strongly disagree; 2 = disagree; 3 = disagree a little; 4 = agree a little; 5 = agree; 6 = strongly agree. There is a potential range of scores from 11 to 66, with higher scores indicating greater positive changes.

Research governance procedures

Each study site obtained local research ethics approval to take part in the study, and patients gave their witnessed, written and informed consent to participate. Consent was obtained from a relative for patients unable to give their own informed consent. Patient consent permitted future follow-up by the research team. In accordance with Research Governance guidelines, the ten-year follow-up was carried out by first contacting the general practitioners and/or hospital consultants for the original study group to establish whether it was appropriate to contact their patients. From the GP responses patients were contacted by letter inviting them to participate. Those who did not respond within one month were sent one reminder.

Statistics

All data were analysed using the statistical package for the social sciences (SPSS v. 14.01). Spearman's rho correlation coefficients were calculated for relations between independent variables. Analysis of variance (ANOVA) was carried out with Bonferroni's post-hoc test for multiple comparisons.

Results

10 Year Follow-Up

In 2004 GPs and/or hospital consultants involved in the care of the original study patients were contacted to establish if the patient was still known to them, if it was appropriate to carry out a follow-up and the patient's current whereabouts. Despite a

76% response rate from GPs (268 of 352 GPs responded), due to the lapse of time many patients were no longer known to the GP or unit. From these responses, 240 patients were invited to take part in the follow-up study and 181 responded (75.4%). Of these 174 (96.1%) filled in and returned detailed questionnaires, and just over half (95, 57.6%) were also interviewed. Nine individuals did not complete the CiOP and were excluded from subsequent analyses. Consequently, data on positive change were collected for 165 persons.

Patient characteristics

The characteristics of the 10-year follow-up group were broadly similar to those of the original cohort (Table 1). However, a higher proportion of females were followed-up (37% compared to 22.9%). Also, the 10-year group contained higher proportions of persons with mild TBI and those with other injuries sustained at the time of the TBI. In both the original and follow-up groups, approximately two-thirds had been referred for rehabilitation within 6 months of their TBI. Overall, the mean age at follow-up was 45.5 years (median = 43, SD=13.57, range 26 to 79).

Outcomes at first follow-up

Interviews and assessments were carried out at approximately 6 months post-recruitment. The length of time between the TBI and interview/assessment ranged from 2 months to 127 months (mean = 15.1, median = 6, SD=22.35). Table 2 shows the results of assessments and the mean number of problems reported at first

interview by severity group. Table 3 shows the GOSE category scores by severity group for first and final follow-up. At first follow-up, the GOSE showed 76 persons (46%) to have severe disability; 76 (46%) had moderate disability; and 13 (8%) had made a good recovery. Severe disability was most prevalent within the severe TBI group.

An ANOVA compared means and found significant differences between groups for the GOSE ($F = 39.42$, $df=2$, $p=0.0001$); the FIM ($F = 4.25$, $df=2$, $p=0.02$); and the FAM ($F = 3.58$, $df=2$, $p=0.03$). The Bonferroni post-hoc test showed significant differences in GOSE scores between the mild and moderate ($p = 0.001$), mild and severe ($p = 0.001$), and moderate and severe groups ($p = 0.02$). There was a significant difference between the moderate and severe groups on the FIM ($p = 0.04$), but differences were non-significant on the FAM.

Outcomes at 10 year follow-up

The length of time between the TBI and 10 year follow-up ranged from 9 to 25 years (mean = 11.5, median = 11, $SD=2.64$). The questionnaires contained sufficient detail to permit scoring of the GOSE, and results are shown in Tables 2 and 3. All severity groups showed small improvements on GOSE scores between 6-month and 10-year follow-ups. On the GOSE at final follow-up, 43 (26%) had severe disability; 72 (44%) had moderate disability; and 50 (30%) had made a good recovery (Table 3).

An ANOVA found significant differences between severity groups on the GOSE at 10-years ($F = 7.14$, $df=2$, $p=0.001$), and the Bonferroni test showed these to be between the mild and severe groups ($p = 0.001$).

Respondents were also asked to rate their general health on a scale of 1 to 10 (1 = very poor and 10 = excellent health). There were no significant differences between severity groups (Table 2).

Insert tables 2 and 3 about here

Anxiety and depression

Interviewees were assessed using the HADS at approximately six months post-recruitment. At 10 year follow-up the HADS was not used, instead the questionnaire asked respondents if they had experienced feelings of anxiety or depression in the past 4 weeks either 'not at all', 'occasionally', 'often' or 'most of the time'. For the purpose of analysis, 'often' and 'most' were merged into one category of 'frequently'.

Table 4 presents the results by severity group. The HADS Anxiety and HADS Depression scores were strongly correlated with scores on the 10-year anxiety and depression questions. Anxiety at 6 months and at 10 years: 0.5 ($p=0.0001$); Depression at 6 months and at 10 years: 0.4 ($p=0.0001$). At 6 months post-recruitment, approximately one third of respondents demonstrated clinically significant anxiety. At 10-year follow-up, approximately one quarter of respondents reported frequent anxiety.

Insert table 4 about here

Positive changes in outlook

Each item on the CiOP is rated on a six-point scale ranging from strongly disagree (1) to strongly agree (6); thus a score of 4 or above on each item signifies agreement with that item and can therefore be used to indicate a positive change in outlook. Averaged over all CiOP items, the mean score was 4.02 (SD: 1.0), and 52% of the TBI survivors scored ≥ 4.0 which indicates positive growth.

Mean scores on the 11 individual CiOP items for each severity group are shown in Table 5.

For the whole study group, there was most agreement with statements 1, 2 and 9:

- 1. "I don't take life for granted anymore" (mean = 4.62)
- 2. "I value my relationships much more now" (mean (4.72)
- 9. "I no longer take people or things for granted" (mean 4.33)

For the whole study group, there was most disagreement with statements 7 and 8:

- 7. "I'm a more understanding and tolerant person now" (mean = 3.50)
- 8. "I have a greater faith in human nature now" (mean = 2.99)

An ANOVA was carried out on the mean scores for each item for mild, moderate and severe groups. The Bonferroni post-hoc test detected significant differences between the mild and moderate group for the following items: 2 (I value my

relationships much more now); 7 (I'm a more understanding and tolerant person now); 8 (I have a greater faith in human nature now); 10 (I value other people more now) and 11 (I am more determined to succeed in life now); and between the moderate and severe group for item 11. No significant differences were observed between the mild and severe group. It should be noted that the mean scores of the moderate group may have been affected by small numbers.

Insert table 5 about here

Predictors of positive growth

Correlations were computed to test for association between scores on the CiOP and injury characteristics and with outcomes measured at 6 months post-recruitment (Table 6). When total CiOP scores were analysed across all severity groups no significant correlations were found, the only variable approaching significance was early referral to rehabilitation ($p=0.07$). When severity groups were analysed individually, age at injury and time between injury and final follow-up were positively associated with total CiOP for the mild group only ($r = +0.49$, $p<0.01$ and $r = +0.33$, $p<0.05$).

Correlations were then computed between CiOP scores and anxiety, depression and general health at 10 year follow-up. When analysed across all severity groups the CiOP was negatively associated with both anxiety and depression. When severity groups were analysed separately, depression was negatively correlated with CiOP

for the moderate ($r = -0.46$) and severe ($r = -0.24$) groups ($p < 0.05$), but did not reach significance for the mild group ($r = -0.29$).

All of the above injury and outcome variables were then compared with individual CiOP items. Correlations significant at the 1% level were:

Age at injury with item 6 (I look upon each day as a bonus) ($r = +0.24$);

GOSE at 6 months with item 3 (I feel more experienced about life now) ($r = +0.21$);

Post-traumatic epilepsy with item 11 (I am more determined to succeed in life now) ($r = -0.21$);

Early referral to rehabilitation with item 11 ($r = -0.23$);

Anxiety at 10 years with item 5 (I live every day to the full now) ($r = -0.28$) and with item 11 ($r = -0.32$);

Depression at 10 years with item 5 ($r = -0.41$), item 7 (I'm a more understanding and tolerant person now) ($r = -0.23$), and item 11 ($r = -0.37$);

General health at 10 years with item 3 ($r = +0.26$) and item 11 ($r = +0.24$).

Insert table 6 about here

Discussion

The results of this study provide further evidence that survivors of brain injury are capable of positive growth. Half of the study group demonstrated positive change in outlook on the CiOP. Contrary to what might be expected, there were no significant differences between those with mild and severe injury. It was noted that those with moderate injury often scored lower on the CiOP. Possibly, those with moderate

injuries struggle to find positive meaning because their identity is affected similarly to the more severe group while their role in life remains relatively unaffected similar to the mild group. However, such suggestions remain speculative due to the small number of participants in the moderate group, and may be a focus for future research.

A strength of the study is its relatively large overall sample size and the ability to test for association between variables measured several years apart. However, it should be emphasised that the original data were not collected with this purpose in mind and the present study was an opportunistic investigation of growth-related processes.

Scores on the CiOP as a whole were negatively correlated with anxiety and depression at the 10 year follow-up, this suggests that a positive outlook was associated with low anxiety and depression. However, there was no correlation between CiOP and HADS at 6 months post-recruitment. McGrath and Linley found a positive association between HADS anxiety and the Post-traumatic Growth Inventory (PtGI) [15], and postulated that psychological distress may even be a catalyst for positive psychological change. Our own results suggest that, in the longer term, higher levels of growth seem to be associated with better psychological adjustment. Consistent with recent research [20], it is possible that this contradiction is because of the different time frames of the two studies. It is likely, given the time frame of our study, that high scores on the CiOP indicate the presence of meaning, whereas in the McGrath and Linley study which studied survivors at a time closer to the event, scores indicated the ongoing search for meaning.

Injury variables and outcomes at 6 months were associated, albeit weakly, with positive changes in outlook. CiOP items were positively correlated with age at injury, and early referral. This may reflect a general tendency for older persons to score more highly on psychological well-being. Early referral may be important because of the associated social and psychological support processes.

There was most disagreement with statements representing personal tolerance and faith in other people (CiOP items 7 and 8). This is consistent with previous research which indicates that brain injury is associated with irritability, a 'short-fuse', and poor social integration [2,9,30,31].

Determination to succeed in life (CiOP 11) was correlated with early depression and post-traumatic epilepsy. It may be that people who suffered particular adversity early after their TBI became more determined to succeed. This is consistent with the work of others who have reported higher levels of psychological functioning and personal development as a result of overcoming adversity (see Linley and Joseph [18] for a review).

It should be noted that all of the participants in this study had received some rehabilitation, as all were initially recruited by rehabilitation centres. Consequently, their capacity for positive growth may have been enhanced by the rehabilitation they received. However, other researchers have detected positive growth among a more general population of persons with head injury [17]. This capacity for psychological growth should be borne in mind when planning rehabilitation interventions.

Limitations

The CiOP provides a rating of perceived change attributed to the traumatic event. As noted by McGrath and Linley [15], people with ABI are thought to be particularly vulnerable to problems with self-awareness, so interpreting scores on such measures requires caution.

A smaller proportion of the severely injured group reported depression at 6-months post-recruitment than at 10 years post-recruitment. This may be due to limited insight regarding their condition. Also, in the severe group, fewer patients completed the HADS at 6-months as many were incapable of doing so due to their mental or physical state at the time.

Of the original study cohort, fewer than half were traced approximately 10 years later. It is possible that those who were not traced had different outcomes and a different outlook on life to those who were. However, three quarters of those contacted responded to the follow-up invitations, and the majority took part in the study.

In conclusion, these results lend weight to the observation that positive changes are not uncommon in TBI patients. However, injury variables and outcomes at 6 months were poor predictors of positive changes in outlook.

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Table 1 Characteristics of original cohort and 10-year follow-up group

Variable	Original cohort n = 563	10-year follow-up group n = 165
<i>Gender: number male (%)</i>	441 (77.1%)	104 (63%)
<i>Age at injury (years)</i>		
Mean	32.7 years	34.0 years
Median	30	31
SD	12.98	13.82
Range	4-66	13-66
<i>Injury severity</i>		
Mild (%)	62 (11%)	38 (23%)
Moderate (%)	115 (20%)	24 (14.5%)
Severe (%)	386 (69%)	103 (62.4%)
<i>Mechanism of injury</i>		
Road traffic accident (%)	321 (57%)	96 (58.5%)
Fall (%)	106 (19%)	33 (20.1%)
Assault (%)	87 (15.5%)	14 (8.5%)
Sporting (%)	15 (2.7%)	7 (4.2%)
Industrial/occupational (%)	17 (3%)	4 (2.4%)
Other (%)	17 (3%)	11 (6.7%)
<i>Other injuries at time of TBI</i>	219 (38.9%)	100 (60.6%)
<i>Referred to rehabilitation <6 months post-TBI</i>	359 (63.8)	109 (66.1%)

Table 2 Outcomes at 6 months and 10 years post-recruitment

	Mild	Moderate	Severe
6 months post-recruitment			
Time post-injury (months)			
Mean	4.65	13.67	19.83
Median	3.0	8.0	9.00
SD (range)	4.63 (2 – 27)	17.92 (2 – 84)	26.22 (2 – 127)
GOSE * Mean (SD, n)	5.74 (1.14, 39)	4.80 (1.11, 20)	4.14 (0.85, 99)
FIM * Mean (SD, n)	6.17 (1.70, 12)	6.24 (0.70, 21)	5.32 (1.62, 92)
FAM Mean (SD, n)	6.83 (0.58, 12)	6.90 (0.30, 21)	6.20 (1.44, 92)
COS Mean (SD, n)	3.09 (1.79, 11)	2.75 (1.43, 20)	3.36 (1.29, 95)
Number of problems presented Mean (SD, n)	12 (6.40, 12)	10.77 (8.32, 22)	13.46 (7.25, 105)
10 years post-recruitment			
Time post-injury (years)			
Mean	10.63	11.17	11.93
Median	10	11	11
SD (range)	0.94 (9-14)	1.71 (10-17)	3.12 (9-25)
GOSE * Mean (SD, n)	6.16 (1.24, 38)	5.88 (1.33, 24)	5.29 (1.28, 103)
Health status Mean (SD, n)	6.7(2.18, 37)	6.48 (2.31, 23)	6.84 (1.95, 99)

* denotes significant differences between severity groups at the <0.05 level.
SD = standard deviation.

Table 3 Glasgow Outcome Scale Scores at 6 months and 10 years post-recruitment

GOSE Score	Mild (n = 38)	Moderate (n = 24)	Severe (n = 103)
6 months post-recruitment			
Severe Disability	5 (13.2%)	8 (33.3%)	63 (61.2%)
Moderate Disability	23 (60.5%)	14 (58.3%)	39 (37.9%)
Good Recovery	10 (26.3%)	2 (8.3%)	1 (1%)
Total	38 (100%)	24 (100%)	103 (100%)
10 years post-recruitment			
Severe Disability	5 (13.2%)	5 (20.8%)	33 (32%)
Moderate Disability	17 (44.7%)	11 (45.8%)	44 (42.7%)
Good Recovery	16 (42.1%)	8 (33.3%)	26 (25.2%)
Total	38 (100%)	24 (100%)	103 (100%)

Table 4 Anxiety and Depression at 6 months and 10 years post recruitment

	Mild	Moderate	Severe
6 months post-recruitment			
HADS (n)*	8	12	58
<i>Anxiety</i>			
Cases	2 (25%)	4 (33.3%)	19 (32.8%)
Borderline	2 (25%)	1 (8.3%)	10 (17.2%)
Non-cases	4 (50%)	7 (58.3%)	29 (50%)
<i>Depression</i>			
Cases	3 (37.5%)	3 (25%)	10 (17.2%)
Borderline	0	0	17 (29.3%)
Non-cases	5 (62.5%)	9 (75%)	31 (53.4%)
10 years post-recruitment			
<i>Anxiety(n)</i>	38	24	99
Frequent	8 (21.1%)	6 (25%)	21 (21.2%)
Occasional	17 (44.7%)	12 (50%)	38 (38.4%)
None	13 (34.2%)	6 (25%)	40 (40.4%)
<i>Depression (n)</i>	38	24	103
Frequent	6 (15.8%)	10 (41.7%)	22 (21.4%)
Occasional	20 (52.6%)	9 (37.5%)	44 (42.7%)
None	12 (31.5%)	5 (20.8)	37 (35.9%)

*Note: not all participants completed a HADS questionnaire at 6 months.

Table 5 Mean scores on Positive Changes in Outlook Questionnaire

CiOP Items	Mild	Moderate	Severe
	N=38	N=24	N=103
	Mean(SD)	Mean(SD)	Mean(SD)
1. I don't take life for granted any more	4.89 (1.11)	4.42 (1.61)	4.67 (1.32)
2. I value my relationships much more now *	5.08 (1.10)	4.12 (1.73)	4.73 (1.43)
3. I feel more experienced about life now	4.71 (1.14)	3.96 (1.65)	4.07 (1.60)
4. I don't worry about death at all any more	4.05 (1.75)	3.58 (2.06)	4.0 (1.64)
5. I live every day to the full now	3.97 (1.65)	3.21 (1.47)	4.03 (1.64)
6. I look upon each day as a bonus	3.95 (1.66)	3.33 (1.71)	3.83 (1.69)
7. I'm a more understanding and tolerant person now *	4.0 (1.39)	2.96 (1.76)	3.44 (1.59)
8. I have a greater faith in human nature now *	3.37 (1.57)	2.37 (1.56)	2.99 (1.41)
9. I no longer take people or things for granted	4.53 (1.29)	3.75 (1.92)	4.39 (1.38)
10. I value other people more now *	4.58 (1.29)	3.58 (1.59)	4.25 (1.45)
11. I am more determined to succeed in life now *	4.18 (1.56)	3.17 (1.71)	4.06 (1.53)
Total Scale *	47.32 (9.65)	38.46 (11.63)	44.45 (11.0)

Note: Items are scored 1 (strongly disagree) – 6 (strongly agree)

* denotes significant differences between severity groups at the <0.05 level.
SD = standard deviation.

Table 6 Correlations between CiOP and injury and early outcome variables

Injury and Outcome Variables	CiOP
	Correlation coefficient
Injury variables	
Age at injury	+0.13
Gender	-0.06
Injury severity	-0.03
Abnormal CT scan	-0.02
Cause of injury	-0.06
Other injuries	+0.10
Time since injury to CiOP	-0.01
Outcomes at 6 months	
GOSE	+0.08
FIM	-0.02
FAM	+0.04
COS	-0.09
HADS Anxiety	-0.03
HADS Depression	-0.08
No. of Problems	+0.01
Post-traumatic epilepsy	-0.12
Early referral to rehabilitation	-0.14
Outcomes at 10 years	
Anxiety	-0.18*
Depression	-0.31**
General health	+0.14

* denotes significant correlation at the <0.05 level (2-tailed).
** denotes significant correlation at the <0.01 level (2-tailed).