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Vocational Outcomes after TBI; prevalence and risk factors after 1 year in a multivariable model

Dr Rajiv Singh [1,2] Prof Jeremy Dawson[3] Dr Subhashis Basu[4] Dr Thomas J Humphries[1,2], Prof Suzanne Mason[1] Prof Fiona Lecky[1]

1 School of Health and Related Research (ScHARR), Faculty of Medicine, Dentistry and Health, University of Sheffield S1 4DA

2 Osborn Neurorehabilitation Unit, Department of Rehabilitation Medicine, Sheffield Teaching Hospitals, Sheffield S5 7AU, UK

3 Institute of Work Psychology, Sheffield University Management School, Conduit Road, Sheffield S10 1FL

4 Occupational Health Department, Northern General Hospital, Sheffield Teaching Hospitals S5 7AU, UK

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Corresponding author; rajiv.singh@sheffield.ac.uk

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Abstract

Objective: To determine the prevalence of employment status(ES) or full time study after traumatic brain injury(TBI) in a representative population and its predictive factors

Design: Prospective cohort study

Setting: Regional Major Trauma Centre

Participants: 1734 consecutive individuals of working age, admitted with TBI to a Regional Trauma Centre were recruited and followed-up at 8 weeks and 1 year with face to face interview. Median age was 37.2yrs (17.5-58.2); 51% had Mild TBI and 36.8% had a normal CT scan

Main outcome measure: Complete or partial/modified return to employment or study as an ordinal variable

Results: At 1 year only 44.9% returned to full time work/study status, 28.7% had a partial or modified return and 26.4% had no return at all. In comparison to status at 6 weeks, 9.9% had lower or reduced work status. Lower ES was associated with greater injury severity, more CT scan abnormality, older age, mechanism of assault, and presence of depression, alcohol intoxication or a past psychiatric history. The multivariable model was highly significant ($p<0.001$) and had a Nagelkerke R^2 of 0.353 (35.3%)

Conclusions: Employment at 1 year is poor and changes in work status are frequent, occurring in both directions. While associations with certain features may allow targeting of vulnerable individuals in future, the majority of model variance remains unexplained and requires further investigation.

Introduction

Traumatic Brain Injury (TBI) causes a number of physical, cognitive and behavioural impairments, both in the short and long term; these have a huge impact on the individual, their family as well as the rest of society, given the huge incidence of TBI.[1]

While outcome of TBI can be measured in numerous ways, employment status (ES) is often considered a key outcome in recovery after injury. Work is an essential part of our daily lives and affects social integration, health status, self-worth and quality of life.[2-5] It should be considered a major goal of any rehabilitation programme. As TBI often affects young individuals, a disproportionate level of the burden of TBI falls on those in work or higher education. Hence TBI often strikes at a time in lives when paid employment or study is of paramount importance to future well-being.

The overall extent of ES after TBI is unclear and literature reports a wide range of prevalence (13-73%).[5-9] This wide range reflects on the huge variation in population selection, sample size, injury severity and time of follow-up. There are also national differences reflecting local benefits and payment systems and hence the pressure to return to work. As a result, the exact extent of the problem remains unknown.

Apart from the challenges in measuring prevalence, many studies have examined potential risk factors that may influence employment. A wide range of demographic and injury factors have been investigated in numerous papers. These include variables such as age, gender, ethnicity, marital or other support, occupational type, education level, employment at time of injury and TBI severity.[3,5,9-22] Others have examined particular aspects of cognitive and neuropsychological function or levels of social support and employer support.[23-5] However the findings are mixed and often contradictory with reviews failing to identify any consistent risk factors although individual papers often identify particular associations with employment.[10,13] Unfortunately there is also limited evidence that vocational programmes can influence outcome.[26] Reviewers noted that most studies are poorly designed and that converting return to work into a dichotomous outcome, i.e. “yes” or “no”, does not take into account that many individuals return to modified jobs or part time hours; binary outcome does not reflect the “real world situation”.[10]

Our aim in this study was to examine the influence of a range of injury and demographic features on ES; there was a particular focus on examining the role of employment type and of level of CT scan abnormality, both of which have been relatively underrepresented in

literature. Evidence for the role of work type on outcome is mixed with some studies showing an effect while others have noted none.[3,6,7] Our previous work has shown the importance of deprivation as a predictor for poor overall TBI outcome[27] and an examination of work type seemed a useful complement to this. As a new system of socioeconomic(SEC) or work type classification was introduced for national census and population categorisation,[28] this seemed an ideal time to examine this variable which is known to predict overall human mortality and morbidity.[29] In addition, we are unaware of any studies that have examined the extent of CT scan abnormality across the entire TBI severity spectrum; this may reflect the lack of appropriate methods of classifying CT scans after TBI as most systems focus on the very severe end of the TBI spectrum and the need for surgical intervention.[48] We therefore wished to examine this variable using a CT classification system that was suitable for a mixed TBI group.

The creation of a brain injury rehabilitation pathway in our region of the UK offered the opportunity to study a prospective, unselected TBI group, reflecting the "real life" outcomes of individuals which clinicians treat. By capturing all TBI admissions, coupled with a systematic follow-up pathway, a representative sample with minimal attrition has been achieved. Use of face to face, structured interviews also allows a measure of the *extent* of the return to work, i.e. full or partial. This study was designed to identify risk factors for poor ES following TBI. The ability to identify at-risk individuals would provide an opportunity for targeted interventions to reduce poor employment outcomes in the most vulnerable groups..

Methods

Individuals admitted with traumatic brain injury to a large Teaching Hospital between August 2011 and July 2017 were screened for inclusion in this study. Only individuals of working age (17-58) were entered so that 1 year follow-up would definitely occur before the usual retirement age of 60 yrs. All individuals had a CT(computerised tomography) of head and

spent at least 24 hours for observation as inpatients. Protocol for observations and decision on admission and discharge are determined by use of the National Institution for Health and Care Excellence Guidelines (2014).[30] Individuals with previous TBI requiring inpatient care, residence out of region, dementia or age less than 17, were excluded. Individuals under 17 are admitted to the Children's Hospital.

TBI diagnosis was determined by criteria of common data elements.[31] Systematic arrangement for follow-up at 8 to 10 weeks after injury was organised. All individuals were assessed by the same physician in Rehabilitation Medicine, while for those few who remained inpatients at this stage, assessment took place on their ward. All individuals received letters, phone calls and a text message to facilitate attendance and non-attenders were further contacted to book new appointments.

Demographic information and injury factors, such as aetiology and ethnicity were recorded at interview. A positive psychiatric history was operationally defined as a diagnosed psychiatric condition or treatment and a record of alcohol intoxication at injury was taken from admission records or direct history. A significant level of medical comorbidity was ascertained with the Cumulative Illness Rating Scale.[32]

Aetiology was classed by the UK Trauma Audit and Research Network system as into Falls, Assault, Road Traffic Collisions, Sporting Injury and "Other" mechanisms which predominantly consists of falls greater than two metres in height or workplace injuries.[33] Unfortunately, most CT classification systems focus on severe TBI and particularly the need for Neurosurgical intervention. This is unsuitable for the entire TBI population which largely constitutes mild TBI. Therefore the "overall appearance" classification system for CT scans was used.[34] This grades severity of CT abnormalities into Normal, Mild focal injury, Moderate focal injury and Diffuse or widespread injury.

Attendees also completed a HADS (Hospital Anxiety and Depression Scale).[35] This has been validated in TBI populations with a cut-off score>8, signifying significant depressive symptoms.[35-6]

Work history

A structured interview to ascertain work status was undertaken at each appointment. This included the exact type of work, hours, responsibilities and previous work history or higher education. This was used to determine if a return to work was complete or partial.Classification of individuals into employment type, was made by the National Statistics Socio-economic Classification (NS-SEC).[28] This is the classification system used by the National Census Office for categorising work type, consisting of nine levels. For students, return to the same course, including hours of study, was used to determine complete or partial recovery.

Individuals who were unemployed for less than a year at the time of injury but actively seeking work, were not excluded; any change in their ability and attempts to seek work was considered at each appointment ie if the TBI had affected their employment prospect and efforts to seek it.

Appointments were repeated at one year. Those who failed to attend were contacted and further appointments encouraged and rearranged.

The study was approved by the Teaching Hospital Trust and the University of Sheffield Ethics Committees (STH16208).

Statistics

Descriptive data are presented as frequency and percentages. Data approximating a normal distribution is presented as mean and standard deviation or otherwise as median and range.

In univariable analysis, ES (an ordinal variable) was compared with other variables as follows; for binary independent variables (ethnicity, gender, comorbidity, alcohol intoxication, psychiatric history) a Mann-Whitney test was applied; for nominal independents with >2

categories (aetiology), a Kruskal-Wallis test was applied; for ordinal independent variables (severity, work type/SEC, CT scan abnormality) a Kendall-τ was applied as appropriate.

While a simply Y/N work outcome could have been easily analysed in a logistic regression model, in order to incorporate a partial return to work, an ordinal regression model was created with ES at the dependent variable.

Independent variables entered were injury severity, age, work type, CT scan abnormalities, gender, ethnicity, aetiology, alcohol intoxication, psychiatric history, medical comorbidity and pre-injury employment.

Features of interest were entered as continuous or categorical predictors. Further post-hoc tests were applied to variables that were significantly different but had more than two categories (NS-SEC, aetiology and CT scan). Statistical analysis was performed using SPSS version 23.

Results

Over the study period (2011 – 2017) there were 2642 individuals with TBI admitted to the hospital. Out of these, 46 met the exclusion criteria (out of area residence, previous treated TBI or dementia), 261 could not have TBI confirmed with the CDE criteria and 473 were aged over 58 years. The remaining 1803 individuals had follow-up appointments arranged for 8 to 10 weeks and 1734 attended their first appointment. After one year, appointments were repeated at which point there had been 29 deaths (1.7%) and 79 (4.6%) cases were lost to follow-up despite repeated attempts to re-appoint. The study group had “milder” TBI as judged by a higher GCS score and higher prevalence of medical comorbidities than the “lost” group. Otherwise there were no differences between the two groups (Table 1).

The final study population at one year therefore consisted of 1626 individuals with a work outcome recorded after one year. In terms of the original recruited group this equates to a one year follow-up of 93.7%.

The demographics of the group is shown in Table 1. Mean age of the cohort was 40.7 years (SD 15.1); the median age was 37.2 (a range 17.5 to 58.2 years). The majority of cases were male (1148, 69.2%), and of white ethnicity (1547, 93.1%), a further breakdown of the groups found that women with TBI were slightly older than men, reflecting a higher frequency of falls as aetiology but fewer RTC or assault cases. They also had a higher GCS suggesting less severe TBI.

The median length of stay in hospital was 3 days (range 1 – 211) with 84.1% of inpatient stays less than 10 days. This reflects the high proportion of mild TBIs, most of whom had an overnight stay in hospital.

Using GCS to classify injury severity (GCS 9-12 for moderate TBI) the group consisted largely of mild TBI (814, 50.1%), while moderate TBI consisted of 552 (33.9%) and STBI 260 (16.0%). This high proportion of mild TBI is a much closer representation of the real life distribution of TBI than many other studies.

Normal CT scan was found in 612 (36.8%) of individuals with only 5.7% demonstrating diffuse CT abnormalities affecting non-adjacent lobes.

In terms of aetiology, falls (36.3%) and road traffic collisions (27.2%) were the most frequent cause of injury, with assaults making up 18.4%. Based on the operational definition of past psychiatric history, there was a positive history in 287 (17.3%) as well as intoxication at injury of 391 (23.5%) of individuals and significant medical comorbidity in 422 (25.4%) individuals.

For employment status prior to injury, the majority were in employment (85.9%) or study while 14.1% were unemployed. Employment type is also shown in Table 1. While there is an even distribution across all groups, this pattern reflects a slight difference to the Regional Census data of 2011 with a slightly lower proportion of individuals in professional and lower management groups. There was a substantial number of full time students and individuals who had never worked or been on long term sick leave.

The main outcome of the study, ES at one year is shown in Table 2.

At 6-8 weeks, 25.9% of the cohort had returned to full time work in the same role and capacity that they previously enjoyed. A further 34.5% were working part time or in a modified job and 39.6% had returned to no employment or study at all. By comparison, at 1 year,, the corresponding figures were 44.9%, 28.7% and 26.4%. The one year picture therefore represents a considerable improvement from the early weeks after injury. The breakdown of these figures divided by work type shows similar proportions of employed individuals within most of the categories. However, professional group and students had a higher proportion of full return than the other categories andthis was significant on a univariable test. Other significant univariable analyses are also shown in Table 3.

While most individuals had improved there was a considerable proportion of individuals (9.9%) whose ES had deteriorated between the initial appointment and 1 year. That is to say that their employment status had declined e.g. moved into the “no work” or “partial work” from a full time role or into “no work” from a “partial work”. In fact 2.5% dropped from full return at 8 weeks to no work after 1 year; 37.7% had improved their status and 52.5% had maintained the same level as the initial appointment.(Table 2)

A multi-ordinal regression model was calculated with return to work at 1 year as the dependent outcome (Table 4). The independent variables of age, gender, ethnicity, socioeconomic group, pre-injury employment, depression, medical comorbidity, GCS, aetiology, alcohol intoxication at time of injury, past psychiatric history, and CT scan abnormality were all entered. Post hoc tests were required for categorical variables greater than 2 groups (aetiology, work type, CT scan). The model was highly significant with a Nagelkerke R^2 of 0.353 ($p<0.001$). Features that were found to be significant for poorer ES than this model were older age, lower GCS (a more severe TBI), aetiology (assault versus falls or sport as mechanism), positive psychiatric history, presence of depression, alcohol intoxication and worse CT scan abnormality. These are therefore the independent predictors of work outcome.

Discussion

With the exception of the huge multicentre TBIMS studies,[5] this is one of the largest and most comprehensive studies of ES after TBI. We documented that a very high proportion of individuals at one year had a deterioration in employment status. Indeed only 44% had a full and complete recovery to work/study in a cohort in which over half of individuals had sustained MTBI. In fact, over a quarter of the group could not return to any form of work or study at all. Few studies have shown any improvement in job status beyond one year, suggesting that this is likely to be the best scenario that we will find in this cohort.[9,11,16,21] While the 1 year picture represented considerable improvement from the situation after 8 weeks, it is likely that the first appointment is far too early to make definitive statements about the likelihood of an individual's return to work.

While many individuals had improved, it was interesting that a considerable number of individuals had shown a deterioration in their work status between the earlier appointment and one year. This included several who had dropped two levels in the scale from Full return to No work. It is possible that some individuals optimistically integrate themselves back into the workplace early on but that the demands of work prove too difficult in subsequent weeks and months.[25] This only emphasises how difficult the return to work can be, as well as timing the moment of return.

The proportion of pseudovariance attributable in the model was fair and similar to others including Ponsford *et al* who identified a similar proportion of variance from only three variables.[11,37] Indeed these long-term models of outcome are comparable to predictive short-term models of acute prognosis.[38] Nevertheless it is clear that there is a complex interplay of many unmeasured environmental and personal factors, which makes the overall prediction of employment so difficult. The importance of personal coping styles and personality has

been identified as an important factor in determining brain injury outcomes[3,6,39] but we were unable to incorporate any such measures. This would be a useful project in future work.

Interpreting the outcome of a multi-ordinal regression can be difficult, especially for categorical variables and it is certainly easier to dichotomise ES and analyse a logistic regression model. However, as has been noted in systematic reviews,[10] this does not allow for the considerable variation in the extent to which individuals can return to work including modifications to the job and responsibilities or the hours worked. We have tried to account for this in this study.

The systematic recruitment of prospective admissions from a large Teaching Hospital serving a region of over half a million and the distribution of TBI severity should ideally reflect the "real-life" picture as admitted to hospital. The categorisation of outcome was also aimed to reflect that many individuals manage a *partial* ES rather than a simple dichotomous outcome. Many other studies have focussed on small, selective groups, e.g. STBI and have much higher attrition rates to follow-up. Indeed, the loss of individuals in TBI outcome studies to follow-up is well documented.[40] Excluding deaths, this study included face to face assessments with >96% of cases. This was undoubtedly ameliorated by a team of specialists who phoned up and encouraged follow-up in individuals who missed appointments. Although any study population is subject to selection bias, we believe that this cohort with higher representation of MTBI, is characteristic of admissions with TBI and is of relevance to any clinicians who work within the field of Brain Injury.

As already noted, ES shows considerable variation between studies, largely reflecting differences in work definition, population selection and time of follow-up.[3,9,17,19,22,37,41] A large systematic review quoted a similar proportion of 40% return to work at 2 years.[7] Studies of moderate to severe TBI may be expected to show less successful return but in fact have a similar proportion including a study with ten years follow-up and 58% successful return of which a half were part-time work.[5,16,18,20]

Our finding of strong association with injury severity confirms what has been noted by others[3,5,8,11,14,18] although others find no effect of severity[12,15,22,42] or that it was the weakest of

predictor variables.[3] A systematic review found that overall evidence for severity was poor[10] while an earlier review noted an effect.[6] A review of mild TBI alone noted poor quality and heterogeneity of most studies.[8,12] It is clear that there is still room for debate but our results in a representative group of all TBI severities clearly points to a strong effect.

One of the main aims of the study was to assess employment type using a detailed classification of work type as used in the National Census.[28] We do not know of any other study that has used a similar system or with as many separate groups. Professional and student groups showed a higher return of ES than other groups which was significant in univariable analysis. However this was not confirmed in the regression model which is the important analysis and suggests that any effect is likely to be small and effectively overshadowed by other variables. It had been postulated that self-employed individuals may feel more pressured to return to work or that professional classes may enjoy more work support, benefits or job flexibility. The role of employment support was an important factor in a small study[25] and it has been noted that those in managerial positions had a threefold higher rate of return than those in a manual role.[22] Others have found no link.[3] While the negative association is disappointing, it is hoped to look at aspects of work support in a future study, trying to identify the elements of both social and employer support that can make a difference. Although we did not measure the educational level of individuals, this has been noted by others to determine employment after injury although not all.[12,24,42,43]

There is limited evidence for an association of CT findings and ES[18,23] with a review finding no effect.[47] However, most studies have used CT classifications that are heavily geared towards identification of very severe injuries requiring neurosurgical intervention[48] and which are not suited for large TBI groups including MTBI. The “overall appearance” system of CT classification is much better designed for this and has been successfully used in other TBI outcome studies.[49,50] There was a clear association with most severe scan abnormalities compared to normal scan or minor changes though not with a moderate abnormal scan. We are unaware of any other study that has shown this association.

While we noted a negative association with age, such that older age reduced the ES, others have found no association,[3] while other studies have confirmed the finding.[42] Indeed, it has been suggested that a cut off at 40 years distinguishes a turning point in likelihood of any return to employment.[37]

Pre-injury unemployment was a poor predictor as noted by others.[13,18,19,23] The clinc assessment ensured that unemployed individuals were actively seeking work rather than long-term unemployed and had been in paid employment or study within the last year. It is also known that TBI is more common in the unemployed[1] and therefore it is important not to exclude such individuals from analysis as is often the case.

In terms of aetiology, the negative association with violent injury mechanisms has been noted by others.[15] It is possible that emotional trauma and psychological reaction from a violent mechanism of injury may have a negative impact on the ability to perform in the workplace and studies to evaluate such emotions would be useful future work.

Depression is common after a TBI and is known to influence many outcomes including ES.[36,41,44-5] There was a very strong association in this study between the two although again, systematic review suggests poor overall evidence in studies.[10] It is, of course, impossible to determine causality in regression analysis and it is equally possible that inability to work causes depression. Our aim is to conduct a study of the treatment of depression and the effect on ES especially as the increased risk of depression is known to last for many years.[46] If this could be successfully identified as a successful treatment, then it would be a very useful intervention for clinicians.

We noted no association with gender or ethnicity, although others have found that women are less likely to return to work or become part-time and that ethnic minorities have a poorer ES.[3,5,13,19,20,51] Our study population had a relatively low proportion of ethnic minority compared to many other study populations particularly in north America and has limited scope for drawing any conclusions.

There are a number of strengths of this study, including size and systematic recruitment of a cohort that should closely reflect the picture of TBI as seen by clinicians. An attempt to incorporate partial return of work with modifications has also been made and there is minimal attrition. Even very large multicentre studies have a very high proportion of missing values and loss to follow-up of upto 75%.[11,40] Use of structured interviews by a single observer is another key strength and should minimise inter-observer bias. However, it also introduces the possibility of a systematic bias.

Other weaknesses should be noted. It was not possible to perform any cognitive evaluations and several studies have shown a link with specific cognitive domains.[23-4] As this was a single centre study, it may have limited ability to reflect the situation in other countries although we tried to reflect the true range of TBI. We also cannot account for the level of employer support that may be available to an individual. It is also important to note that there are significant differences in social security and benefits systems between countries with differing levels of compensation offered. This different compensation is likely to either promote or discourage return to work in some instances.

In future we would like to continue follow-up for employment and other brain injury outcomes in the long term. Reviews suggest that in contrast to functional outcome, e.g. GOSE, return to work does not improve beyond one year and some have shown increased unemployment with time.[52] It is known that work history can be unstable with individuals changing jobs or moving into alternative employmen[140] and therefore it would be useful to document the situation in this cohort at further time points. Indeed it has been shown that employment *stability* may be a more useful measure than simply employment at a single time point.[5] If we could gain a better understanding of certain predictive factors in ES, we may be able to provide more focussed interventions. This study has led to changes in the individuals that are prioritised in the community rehabilitation service and to further projects to examine treatment for depression and measurement of the extent of employer support that may make a difference.

It is known that people who are employed have a better sense of wellbeing, greater social inclusion, better overall health and less need of health facilities.[4] Overall quality of life is also much improved compared to the unemployed. By gaining a better understanding of the role of predictive factors in ES, rehabilitation programmes may provide more focussed interventions. This could improve the proportion of individuals who can attain a work status and hence benefit from the protection that work seems to offer.

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530

531 Table 1: cohort demographics and comparison with individuals lost to follow-up at 1 year

532 *includes 29 deaths

	Followed up n= 1655*	lost n=79	χ^2 or t-test, df, p-value 533
Mean Age yrs (SD)	40.72 (15.07)	40.07 (16.46)	0.330 df1732 p=0.741 534
Gender			
Male N(%)	1148 (69.1%)	55(76.3)	1.738 df1 p=0.187
Ethnicity N(%)			
White	1547 (93.1)	65 (90.3)	0.829 df1 p=0.363
(Non-white)	115 (6.9)	7 (9.7)	
Work Class N(%)			
Professional	114 (6.9)	3 (4.2)	13.375 df8 p=0.100
Lower managerial	235 (14.1)	5 (6.9)	(Fisher Exact Test)
Intermediate	147 (8.8)	8 (11.1)	
Self-employed	142 (8.5)	8 (11.1)	
Lower supervisor	278 (16.7)	13 (18.1)	
Semi-routine	371 (22.3)	11 (15.3)	
Routine	220 (13.2)	18 (25)	
Never worked	80 (4.8)	4 (5.5)	
Students	75 (4.5)	2 (2.8)	
Unemployed N(%)			
Yes	235 (14.1)	14 (19.4)	1.579 df1 p=0.209
Social Isolation			
No	683 (41.1)	28 (38.9)	0.139 df1 p=0.709
Aetiology N(%)			
Fall	604 (36.3)	24 (33.3)	5.029 df4 p=0.284
RTC	452 (27.2)	24 (33.3)	
Assault	305 (18.4)	17 (23.6)	
Sport	101 (6.1)	3 (4.2)	
Other(work)	200 (12.0)	4 (5.6)	
On Warfarin N(%)	112 (6.7)	0 (0)	5.187 df1 p=0.023*
Med Comorbidity N (%)	422 (25.4)	9 (12.5)	6.14 df1 0.013*
Alcohol at injury N (%)	391 (23.5)	7 (9.7)	7.436 df1 p=0.006*
Previous Psych Hx N(%)	287 (17.3)	7 (9.7)	2.791, df1 p=0.095
Mean admission GCS	11.91 (3.10)	10.54 (3.06)	-3.667 df1732 p<0.001*
Severity of TBI N(%)			
Severe	266 (16.0)	17 (23.6)	10.37 df2 p=0.006*
Moderate	568 (34.2)	33 (45.8)	
Mild	828 (49.8)	22 (30.6)	
CT Scan Findings N(%)			
Nil	612 (36.8)	14 (19.4)	11.94 df3 p=0.008*
Mild	345 (20.8)	24 (33.3)	
Moderate	610 (36.7)	31 (43.1)	
Diffuse	95 (5.7)	3 (4.2)	

Table 2: Return to Work at 8 weeks and 1 yr with change in work status N(%)

Work status	**8 weeks**	**1 year**	**Wilcoxon Signed Rank Test**
No work	644(39.6)	429(26.4)	z=-13.35, p<0.001
Partial Work	561(34.5)	467(28.7)	
Full Return	421(25.9)	730(44.9)	
Change in status			
Full→None		40(2.5)	
1-step loss		120(7.4)	
No change		854(52.5)	
1-step gain		500(30.8)	
None→Full		112(6.9)	

Variable	Number at 1yr	Return to Work			Correlation with ES (Mann-Whitney, Kendall-τ, Kruskal Wallis), p-value
		Full	**Partial**	**None**	
Severity	Mild (814)	466(57.3)	206(25.3)	142(17.4)	-0.262, p<0.001*
	Moderate(552)	207(37.5)	182(33.0)	163(29.5)	
	Severe(260)	57(22.0)	79(30.4)	124(47.6)	
Gender	Male(1125)	497(44.2)	331(29.4)	297(26.4)	-0.604, p=0.546
	Female(501)	233(46.5)	136(27.1)	132(26.3)	
Ethnicity	White (1511)	685(45.3)	427(28.3)	399(26.4)	-0.844,p=0.399
	Non-white (115)	45(39.1)	40(34.8)	30(26.1)	
Aetiology	Fall(574)	281(49.0)	159(27.7)	134(23.3)	7.226, p=0.027*
	RTC(449)	199(44.3)	133(29.6)	117(26.1)	
	Assault(305)	108(35.4)	105(34.4)	92(30.2)	
	Sport(101)	65(69.3)	19(18.8)	17(16.8)	
	Other(197)	77(39.1)	51(25.9)	69(35.0)	
NS-SEC	Professional(113)	65(57.5)	27(23.9)	21(18.6)	0.060, p=0.003*
	Lower Manager(231)	112(48.5)	68(29.4)	51(22.1)	
	Intermediate(145)	66(45.5)	47(32.4)	32(22.1)	
	Small Employer(135)	56(41.5)	45(33.3)	34(25.2)	
	Lower Supervisor(272)	127(46.7)	73(26.8)	72(26.5)	
	Semi-routine(363)	149(41.0)	100(27.5)	114(31.4)	
	Routine(219)	86(39.3)	63(28.7)	70(32.0)	
	Never worked(73)	21(28.5)	21(28.5)	31(43)	
	Student(75)	48(64)	23(30.7)	4(5.3)	
Pre-injury Employment	Employed(1395)	668(47.9)	397(28.5)	330(23.6)	47.48, p<0.001*
	Unemployed(231)	62(26.8)	70(30.3)	99(42.9)	
Comorbidity	Yes (392)	168(42.9)	110(28.1)	114(29.0)	-1.262,p=0.207
	No (1234)	562(45.5)	357(28.9)	315(25.5)	
Psych Hx	Yes(277)	65(23.5)	87(31.4)	125(45.1)	-8.87,p<0.001*
	No(1349)	665(49.3)	380(28.2)	304(22.5)	
Alco Intox	Yes(385)	122(31.7)	134(34.8)	129(33.5)	-5.69,p<0.001*
	No (1241)	608(49.0)	333(26.8)	300(24.2)	
CT Scan	Normal(602)	345(57.3)	147(24.4)	110(18.3)	-0.255, p<0.001*
	Mild(341)	170(49.9)	103(30.2)	68(19.9)	
	Moderate(591)	199(33.7)	187(31.6)	205(34.7)	
	Severe(92)	16(17.4)	30(32.6)	46(50)	
Depression	Yes(502)	44(8.8)	205(40.8)	253(50.4)	407,p<0.001*
	No(1124)	686(61)	262(23.3)	176(15.7)	

Table 3: return to work and univariable association with variables of interest; Correlation with Kendall-τ for ordinal data, Kruskal-Wallis for nominal variables (>2 categories) and Mann-Whitney for binary variables, *significance for $p<0.05$

Table 4: Ordinal Regression Model of 1 year ES. Categories described in text. OR odds ratio, *significant for p<0.05

				95% CI for OR	
	B	**p-value**	**OR**	**Lower**	**Upper**
Non-white Ethnicity	-0.046	0.819	0.955	0.642	1.420
Female Gender	-0.171	0.147	0.843	0.669	1.062
Age at injury	-0.008	**0.011***	0.992	0.988	0.998
Socioeconomic Class					
Professional-baseline	-	-			
Lower Manager	-0.244	0.321	0.783	0.484	1.268
Intermediate	-0.284	0.285	0.752	0.447	1.268
Small Employer	-0.475	0.075	0.622	0.369	1.050
Lower Supervisory	-0.298	0.213	0.743	0.465	1.186
Semi-routine	-0.411	0.077	0.663	0.421	1.045
Routine	-0.319	0.199	0.727	0.447	1.183
Never Worked	-0.357	0.294	0.700	0.359	1.363
Student	0.174	0.604	1.191	0.616	2.303
Unemployed	-0.390	0.018	0.677	0.490	0.936
Social Isolation					
Yes	-0.156	0.164	0.856	0.686	1.066
Aetiology					
Assault - baseline	-	-			
Falls	0.481	**0.002***	1.618	1.193	2.194
RTC	0.168	**0.282**	1.183	0.871	1.606
Sports	0.521	**0.038***	1.683	1.029	2.753
Other	0.011	0.954	1.011	0.702	1.456
GCS	0.170	**<0.001***	1.186	1.138	1.235
Psychiatric Hx	-0.415	**0.004***	0.660	0.499	0.874
Warfarin	0.119	0.590	1.434	0.542	3.795
Comorbidity	-0.169	0.206	0.844	0.650	1.097
Intoxicated	-0.278	**0.036***	0.757	0.584	0.982
Depression	-1.811	**<0.001***	0.164	0.129	0.207
CT Scan					

Diffuse-baseline	-	-			
Moderate	0.178	0.437	1.195	0.763	1.870
Mild	0.710	**0.003***	2.034	1.265	3.271
NAD	0.489	**0.049***	1.631	1.002	2.651
Constant	2.284	0.069	9.814		