What is a ‘return to work’ following traumatic brain injury? Analysis of work outcomes 12 months post TBI. Connor Jay Watkin (University of Nottingham), Julie Phillips University of Nottingham), Kathryn Radford (University of Nottingham).

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Abstract

Background: Literature lacks a clear description of return to work following traumatic brain injury (TBI). Aim: to describe work metrics for people with mild and moderate/severe TBI at 3, 6, and 12 months post-injury.

Methods: A retrospective cross-sectional analysis of 172 TBI participants measuring work outcomes up to 12-months post-injury. Metrics described vocational status, accommodations, satisfaction, hours, time taken to return, financial status, and responsibilities. Logistic regression identified factors indicative of complete (80% of pre-injury hours) return to work.

Results: 59/86 moderate/severely injured (68.6%) and 68/81 mildly injured (84%) people returned to work following TBI. 28 (16.3%) achieved a complete return by 12 months. The regression model was statistically significant X^2 (4) = 51.980, p = <.0005, suggesting that those with high health related quality of life, anxiety and functional ability were more likely to achieve complete return to work. At 12 months, 41 participants (23.8%) had workplace accommodations. 115 (66.9%) were less content with their job and many reported reduced working hours.

Discussion: This study highlights the heterogeneity of work post-TBI. Even people with 'mild' TBI fail to make a complete return to work by 12 months.

Conclusions: Further longitudinal research is needed to explore the personal and economic legacy of TBI.

Key words: Return to work, RTW, Traumatic brain injury, TBI, Employment

Introduction

Traumatic brain injury (TBI) is defined as 'an alteration in brain function caused by an external force' [1]. TBI is a global health problem, with the World Health Organization suggesting that TBI will surpass most diseases as a leading cause of morbidity and mortality by 2020. In the United Kingdom (UK), the prevalence of TBI in emergency departments is approximately 453 per 100,000; with 40 per 100,000 being moderate to severe injuries. TBI sequelae such as physical, cognitive, psychological, behavioural and communication problems [2] can affect a person's ability to work. A systematic review of TBI survivors working prior to injury found that only 41% of TBI survivors (range 0-85%) were at work one and two years post injury [3]. People with TBI (pwTBI) who do not return to work (RTW) within two years are unlikely to work again [4].

Those not returning to work are more likely to be depressed, anxious, and report a poorer quality of life [5, 6]. TBI can also cause bankruptcy [7]. Factors influencing successful work outcomes include socioeconomic, political, and environmental factors. These include: pre-injury work status, employment type, enterprise size, **the relationship between the employee and employer, and the participants expectations of recovery [8-11].** Furthermore, factors including a larger employer, employment before TBI, and having a managerial role with high autonomy are all related to successful RTW.

Successful TBI rehabilitation is influenced by the support offered to an individual in their RTW [11]. Employment is associated with reduced stress, improved quality of life, and enhanced physical and mental well-being [12]. Encouraging those who can work to seek employment is a UK government priority, and a UK National Health Service (NHS) outcome

[13]. However, NHS and employment services rarely work together to aid those who suffer from TBI to find work. Of the working-age population in the UK, 6-7% claimed incapacity benefit between 2004 and 2012 [14]. As a consequence, research has been directed towards developing strategies to support RTW [15]. One strategy is vocational rehabilitation (VR). VR is described as "whatever helps someone with a health problem to stay at, return to, or remain in work" [16]. To measure the effectiveness of interventions, we need to understand what a RTW is.

The lack of consistent description for RTW in research has resulted in various problems. Cancelliere et al [17] suggested that few studies provide information on the specific nature of RTW following TBI. Work status is often reported as a binary variable, dividing participants into working or not working. This makes it difficult to determine how a RTW relates to pre-injury work status, and what the impact of this is on a personal, workplace, and economic level. Nor does it tell us about variation in work outcomes. Consequently, research is required to identify what is meant by a RTW following TBI.

This study will describe the 3, 6, and 12-month work outcomes in two cohorts of TBI survivors [6, 18] who were working at the time of their injury. Participants engaged in research offering vocational interventions (one was a cohort comparison and one a RCT). This study will be an important addition to literature because it will arguably reduce ambiguity in the term 'RTW'. By understanding RTW, clinicians and researchers may be better informed on the barriers that people face when they RTW post brain injury. This may facilitate comparisons between studies and be used to inform evidence-based assessments and guidelines for RTW following TBI.

Aims

1. To describe the work metrics of TBI participants in two datasets comparing participants with moderate/severe injuries to those with mild injuries.

2. To explore what factors were indicative of individuals making a 'complete' or 'incomplete' return to work (defined in method).

3. To explore whether receiving an early vocational rehabilitation intervention is associated with a more 'complete' return to work compared with those who are only given usual NHS care.

Method

Design

A retrospective cross-sectional analysis of work outcomes from 172 participants with a newly acquired TBI from two studies [6, 18]. Data was collected from four UK sites: London, Leeds, Preston, and Nottingham. Participants in both studies received either usual NHS rehabilitation with or without early VR to support job retention following TBI. Participants were followed up at 3, 6 and 12 months post recruitment.

The early VR was an occupational therapist (OT) led case management approach based on a set of best practice guidelines for VR following TBI. It involved assessing the impact of TBI on the participant, their family and their role as a worker. The OT encouraged independence skills, community re-integration, pre-work hardening and liaison with employers and tutors to facilitate a return to and maintaining work or education. The intervention was individually tailored according to need and could last from one appointment to 12 months. It took place in the person's home, in the community, or in the work place. Support and education were provided to patient, family and employer when required and all services involved were coordinated by the OT. The VR intervention is described in more depth elsewhere [19, 20]. Usual care involved whatever rehabilitation was available locally. It typically involved family support, Headway (a national self-help support group), community OT, physiotherapy, and routine GP follow-up.

Sampling

Data was available for participants in two studies using the same inclusion criteria, interventions and follow-up time points. The first was a single centre cohort comparison of 94 participants recruited over 22-months between 2007 and 2009 (Data set 1) [6]. Radford et al [20] conducted a randomised controlled trial and recruited 78 participants from three centres over 12 months between 2013 and 2015 (Data set 2).

Inclusion criteria

Adults (aged 16 years or older), admitted to hospital for >48 hours with a new TBI (all severities) and who were in paid or voluntary work or education at the time of injury.

Exclusion criteria

Those not intending to return to any form of work were excluded. In the first study, people with a documented medical history of mental health, drug or alcohol problems; living more than one-hour drive from the centre were also excluded.

Data collection and analysis

Data collection

Baseline data for both studies were collected at approximately four weeks post hospital discharge. Baseline measures in both data-sets were collected face to face. In data-set 1, this was by the VR OT. In data-set 2 baseline data was gathered by a research assistant. Baseline data was collected either in hospital or at the individual's home depending on whether they had been discharged at the time of recruitment.

Self-reported work, health, and wellbeing outcomes were then collected by postal questionnaire or over the telephone at three, six and twelve months from baseline or randomisation. The primary outcome in both studies was whether the individual had returned to work (defined as a minimum of 1 hour per week) or full-time education (defined as >5 hours per week). The brain injury community rehabilitation outcome scale (BICRO) [21], the Nottingham extended activities of daily living questionnaire (NEADL) [22], the Hospital and Anxiety Depression Scale (HADS) [23], the Work Productivity and Activity Impairment

questionnaire (WPAI) [24], and the EuroQOL five dimensions questionnaire (EQ-5D) [25] were all used to describe and value participant outcome.

- The BICRO is a TBI specific 39-item scale measuring six domains: personal care, mobility, self-organisation, socialising, productive employment, and psychological well-being [21]. This scale measures functional ability and quantifies the extent to which those with TBI can participate in personal, domestic and community activities.
- The HADS is a measure of mood and quantifies the extent to which an individual is experiencing anxiety and depression. It is a 14-item scale with seven questions on depression and seven on anxiety [23].
- The EQ-5D encompasses both positive aspects (well-being) and negative aspects (illness). The measure consists of a questionnaire and a visual analogue scale (EQ-VAS). The EQ-VAS records the individual's perceptions of their own current overall health. The self-reported questionnaire considers five key dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression [25].
- The NEADL is a 22-item questionnaire designed to quantify functional ability [22]. The 22 questions cover four sections including: mobility (six items), kitchen (five items), domestic (five items), and leisure (six items).
- The Glasgow Coma Scale (GCS) is a method to communicate the level of consciousness of patients with acute brain injury [26]. Patients are scored on responses from the following categories: eyes, verbal, and motor. Lower scores indicate a more severe brain injury.
- The Work Productivity and Activity Impairment Questionnaire (WPAI) is a questionnaire assessing participants competence at work [24]. The WPAI yields four types of score: absenteeism, presenteeism, work productivity, and activity impairment.

Table 1

Table 2

Data analyses

Frequencies were used to report group differences in workplace accommodations intended to facilitate a RTW and support people with brain injury to remain in work. These were: 'graded return to work', 'allowed more breaks', 'reduced responsibilities', 'additional supervision', 'allowed to work from home', and 'the use of outside help'. Outside help was primarily government led schemes helping people with brain injury return to and remain in employment. Percentages were used to describe participants' work status at 3, 6, and 12 months post-injury, job type, and any workplace adjustments implemented. Descriptive statistics reported income and number of working hours at 3, 6, and 12 month's follow-up. Binominal logistic regression analyses explored which factors were indicative of a complete RTW following TBI. The linearity of the continuous variable with respect to the logit of the dependent variable was satisfied using the Box-Tidwell procedure [27]. A Bonferroni correction was applied to the model to control for multiple comparisons. Further analyses were conducted to establish whether the factors indicative of a complete RTW changed based on injury severity. A chi-square test was conducted to ascertain whether those in the

intervention group (early VR) were more likely to achieve a complete RTW compared with those in the control group (usual NHS care). Data was identifiable through unique participant numbers, so no personal information was available to the author analysing the data. Specifically, the work outcomes that were included in the analysis were: work status, work hours, job roles/responsibilities etc. The factors indicative of a complete return to work include: quality of life, mood, and functional ability. Complete return to work was defined as any individual that returned to 80% of their pre-injury working hours and was doing the same job with the same employer. Analyses were conducted using SPSS version 24.0 and Microsoft Excel (2016). For the logistic regression, missing data was excluded from the analysis.

A post-hoc power analysis was conducted using the statistical software package GPower [28]. The sample size of the present study was used to calculate the power analysis (N= 172). The recommended effect sizes for this study are as follows: small (d = .20), medium (d = .50), and large (d=.80) [29]. The alpha level used for this analysis was p = .05. The post hoc analyses revealed that the statistical power for this study was .37 for a small effect, .95 for a medium effect, and .99 for a large effect. This statistical power was used for research questions 2 and 3 to establish the probability of a true effect.

Outcome measures; return to work metrics

The metrics used, and the questions asked to elicit the relevant information are outlined below in table 3.

Table 3

Results

Table 4

Available data

Several participants were lost to follow-up at different points throughout the study. Thirty-three participants were lost at 3 months, 43 at six months, and 59 at 12 months. Therefore, the data available for analysis across both groups at the three time points was; 3m 139, 80.8%; 6m 129, 75%; 12m 113, 65.7%.

Primary outcome and vocational status

Almost three quarters of participants (127/172; 73.8%) returned to work or education at some point in the twelve months following their TBI. 18/172 participants (10.5%) did not return to work at any time point. 27/172 participants (15.7%) were lost to follow up. All ten people who were studying at baseline returned to and remained in education at all three time points. Twenty-eight participants (16.3%) made a complete return by 12 months.

Missing data for mild participants at all three time points (3, 6, 12 months) was 8/81 (9.9%), 11/81 (13.6%), 18/81 (22.2%). Missing data for moderate/severe patients at all three time points (3, 6, 12 months) was 11/86 (12.8%), 15/86 (17.4%), 20/86 (23.3%). Those with mild injuries did not deem work status as "not applicable" at any time point. However, 3/86 (3.5%) with moderate/severe injuries at six months and 2/86 (2.3%) at 12 months nominated the "not applicable" option.

Table *5* demonstrates the number of participants in work or education at each time point.

Table 5

Sustainment of return to work

Of the 127 participants who returned to work or full-time education, 74/127 (58.3%) did so by 3 months and sustained this until 12-month follow-up. 9/127 (7.1%) returned by 6 months and remained in work/education by 12 months. 10/127 (7.9%) only returned to work/education by 12 months. 12/127 (9.4%) returned at 3 months but were no longer working or in education at 12-month follow-up. Moreover, sustainment of return to work could not be established for 22/127 (17.3%) participants who were lost to follow-up.

Time taken to return to work.

Meaningful time to return data was only available for dataset 2 (78 participants). Participants took a mean average of 98.5 days to return to work (SD: 80), 94 days for the mild participants (SD: 68.2), and 108 days for those with moderate/severe injuries (SD: 95.4) i.e. only 14 days difference.

Hours of work

At baseline, people with a moderate/severe injury worked a mean average of 4 hours less per week compared with those who had mild TBI (mTBI) (29 hours, range 2-45, SD: 23.5) v (33 hours range 18-48, SD: 10.9).

Many people who returned to work reported working fewer hours than before their brain injury. In the moderate/severe group, this applied to 10/45 (22.2%) participants at 3 months, 15/48 (31.25%) at 6 months, and 12/42 (28.6%) at 12 months. Those with mild TBI reported working fewer hours in 18/55 (32.7%) cases at 3 months, 21/56 (37.5%) at 6 months, and 11/51 (21.6%) at 12 months.

5/45 (11.1%) participants with moderate/severe injuries reported working the same hours as before their TBI at 3 months, 2/48 (4.2%) at 6 months, and 5/42 (11.9%) at 12 months. 5/55 (9.1%) mildly injured participants reported working the same hours as before their TBI at 3 months, 9/56 (16.1%) at six months, and 5/51 (9.8%) at 12 months.

3/42 (7.1%) with moderate/severe injuries and 4/51 (7.8%) with mild injuries reported working more hours compared with pre-injury at 12-month follow up.

Missing data for mild participants at all three time points (3,6, 2 months) was 16/81 (19.8%), 17/81 (21%), and 34/81 (42%). Missing data for moderate/severely injured participants at all three time points (3, 6, 12 months) was 23/86 (26.7%), 26/86 (30.2%), and 41/86 (47.7%)

Several mildly injured participants responded with "not applicable" to the hours of work option. This applied to 14/81 (17.3%) at 3 months, 8/81 (9.9%) at six months, and 5/81 (6.2%) at 12 months. This applied to 12/86 (14%) in the moderate/severe group, 11/86 (12.8%) at 6 months and 6/86 (7%) at 12 months.

Roles and responsibilities

Most participants returned to the same role with an existing (pre-TBI) employer. At 3 months, 30/45 (66.6%) of the moderate/severe group maintained the same job and employer, 24/48 (50%) at 6 months, and 22/42 (52.4%) at 12 months. By contrast, 32/55 (58.2%) people with mild TBI at 3 months, 33/56 (58.9%) at six months, and 32/51 (62.7%) at 12 months were working for the same employer and doing the same job.

Of those with moderate/severe TBI, 8/45 (17.8%) reported working for the same employer but doing a different job at 3 months, 5/48 (10.4%) at six months, and 2/42 (4.8%) at twelve months. For the mild participants, this was true for 3/55 (5.5%) at three months, 4/56 (7.1%) at six months, and 4/51 (7.8%) at twelve months.

Of those who were moderately/severely injured, 1/45 (2.2%) at 3 months was doing the same job with a new employer, 2/48 (4.2%) at 6 months and then 1/42 (2.4%) at 12 months.

Comparatively, in the mild group, 2/55 (3.6%) participants were doing the same job with a different employer at three months, 2/56 (3.6%) at 6 months, and 2/51 (3.9%) at 12 months.

In the moderate/severe group, 2/45 (4.4%) participants were doing a different job for a different employer at 3 months, 4/48 (8.3% at 6 months, and 8/42 (19%) at 12 months. In the mild group, 3/55 (5.5%) were doing a different job for a different employer at 3 months, 4/56 (7.1%) at 6 months, and 6/51 (11.8%) at 12 months.

Missing data for mild participants at all three time points (3, 6, 12 months) was 11/81 (13.6%), 15/81 (18.5%), 19/81 (23.5%). Missing data for moderate/severe participants at all three time points (3, 6, 12 months) was 18/86 (20.9%), 21/86 (24.4%), 27/86 (31.4%).

Workplace accommodations

At three months post-TBI, 47/172 participants (27.3%) reported workplace accommodations; 48/172 (27.9%) reported these at 6 months and 41/172 (23.8%) at 12 months post-injury. The types of accommodations in place at each time point are illustrated below in *figure 1*.

Missing data for mild participants at all three time points (3,6, 12 months) was 14/81 (17.3%%), 15/81 (18.5%), 19/81 (23.5%). Missing data for moderate/severe participants at all three time points (3, 6, 12 months) was 20/86 (23.3%), 26/86 (30.2%), 29/86 (33.7%).

Figure 1

Financial factors

Meaningful financial data was only available for the second dataset (78 participants). Most participants experienced a drop in pre TBI earnings. Pre-injury, those with moderate/severe TBI had a mean annual income of £26,875 and those with mild TBI had a mean annual income of £24,625. At 3m, moderate/severe participants earned an average of £20,714 per annum and mild participants earnt £19,500 a year. This changed to £18,889 and £21,000 at 6 months and £24,285 and £19,600 at 12 months. At 12 months, on average people with a moderate/severe injury earnt 9.6% less than before their injury. Those with a mild injury earnt 20.4% less.

At 3 and 6-month follow-up, 11/81 (13.6%) participants with mild injuries had missing data. This applied to 16/81 (19.8%) at 12 months. In the moderate/severe group, 4/86 (4.7%) participants had data missing at 3 months, 5/86 (5.8%) at 6 months, and 11/86 (12.8%) at 12 months.

Work satisfaction

At 3 months, 60/172 participants (34.9%) self-reported that they enjoyed their job either the same as or more than before their injury. At 6 months, 64/172 participants (37.2%), and at 12 months 57/172 participants (33.1%) reported that they enjoyed their job. Table 6 shows work satisfaction by injury severity.

There was missing data for several participants. For those with mild injuries, this was 13/81 (16%) at 3 months, 16/81 (19.8%) at 6 months, and 22/81 (27.2%) at 12 months. For the

moderate/severe group, this applied at 20/86 (23.3%) at 3 months, 27/86 (31.4%) at 6 months, and 35/86 (40.7%) at 12 months.

Table 6

Factors indicative of complete return to work

A binominal logistic regression was performed to ascertain the effects of functional ability, anxiety, depression, and health-related quality of life on the likelihood that participants achieved a complete return to work. All continuous variables were found to be linearly related to the logit of the dependent variable. There were three studentized residuals with standard deviations of 3.531, 4.060, and 4.435, which were removed from the analysis. The model was statistically significant, X^2 (4) = 51.980, p = <.0005. It explained 63.8% (Nagelkerke R^2) of the variance in complete RTW and correctly classified 89.5% of cases. Sensitivity was 63.2%, specificity was 95.3%, positive predictive value was 75%, and negative predictive value was 92.1%. Of the five predictor variables, four were statistically significant (see table *7*). Those with high functional ability scores were 1.8 times more likely to achieve a complete return to work. Increased health-related quality of life and anxiety were associated with an increased likelihood of achieving complete RTW. Further analyses were conducted with the data split between participants with mild injuries and participants with moderate/severe injuries and similar results were obtained.

Table 7

A chi-square test was conducted between the types of rehabilitation received (vocational rehabilitation vs usual NHS care) and complete return to work. All expected cell frequencies were greater than five. There was no statistically significant difference between rehabilitation type and complete return to work, $X^2(1) = 0.002$, p = .962. (See figure 2). Fewer than 15 people in each group made a complete return to work.

Figure 2

Discussion

Whilst 73.8% returned to work in the 12 months post-injury, this figure masks that only 28 (16.3%) people with brain injury made a complete RTW. People with higher functional ability, anxiety, and health-related QoL were most likely to achieve a complete RTW. Most returned to the same job and employer, worked fewer hours than pre-injury, experienced substantial loss in income, were less satisfied, and still had workplace accommodations at 12-months post TBI. For the 172 TBI participants of all severities, the TBI appeared to impact their ability to return to their pre-injury work and financial status. **However, data on other factors influencing work return were not collected. This includes employee relationship to employer, patient expectations of recovery, job type and enterprise size [8-11]. These factors may have influenced why some of the mild patients in this cohort did not return to work after 12 months post-injury. Future studies examining work outcomes must collect this data.**

Participants took approximately 3 – 4 months to RTW regardless of injury severity, consistent with literature [17, 30]. This suggests factors other than injury severity influence the timing of return [31]. Individual patterns of RTW in this study were complex, with some individuals taking under a week and others taking over a year. The complexities contributing to differences in RTW have been investigated in the literature, and include both injury related e.g. age, multiple-bodily injuries, intracranial abnormalities at day of injury, fatigue [9, 32], employer related (**e.g relationship between the employee and employer)**, enterprise size, occupation, and workplace policy [9, 11]. Other factors may include environmental, socio-political and personal factors **including individual expectations of recovery [12, 33]**. This study demonstrates that time taken to return to work is heterogeneous, with differences across samples that cannot be explained by injury severity alone.

The factors indicative of complete RTW suggest that high functional ability and health-related QoL are associated with positive RTW outcomes [34, 35]. However, lower anxiety scores are usually related to better RTW [36]. Conceivably, the high levels of anxiety in this study were work-related, with qualitative evidence on TBI survivor perceptions suggesting concerns regarding negative employment reprisals such as being laid off, having hours cut, and poor shift assignments [37, 38]. It is possible that having insight into the impact of injury on work ability may influence anxiety levels [39].

Health related QoL is a new concept in TBI literature, with novel scales in their infancy [39]. Our findings indicate that higher health-related QoL is consistent with better work outcomes, **which is typical in people with other long-term neurological conditions [39, 40]**. Evidence suggests that the EQ5D is a measure of function as opposed to QoL [41].

Therefore, those with high functional ability are likely to score highly on the EQ5D. To specifically establish QoL, future research should utilise a more specific measure with better construct validity. These findings are valuable because they are modifiable, unlike demographic and injury related factors. Consequently, factors could be addressed by specific rehabilitation interventions and NHS policies to maximise vocational outcomes for those seeking and retaining employment post-TBI.

Participants had work-place accommodations in place at each time interval post-injury. Literature indicates that adjustments are "temporary" interventions to facilitate retention of RTW upon re-entry to employment [42], with research indicating that adjustments are varied [37]. Our findings indicate that support from employers may be necessary for longer periods following RTW post TBI. This could be explained by the nature of brain injury not being understood initially, with sequalae (poor concentration, slower reaction times and fatigue) impacting on productivity, meaning many adjustments are made several months after work re-entry [43]. It is plausible that adjustments implemented initially may not be reviewed, raising questions about the importance of accommodations for job retention. Future research must investigate the value of adjustments and establish how long these are reportedly used or if they are in situ indefinitely.

Furthermore, it is unclear whether participants and employers perceive accommodations as facilitators or barriers to ongoing employment. This study indicates that participants were less satisfied with their job at 12 months, compared with pre-injury. This is consistent with literature [44]. Longevity of work satisfaction could be compromised by participants realising the extent of their injury on their ability to perform their job role. Evidence suggests

that the presence of workplace accommodations often leads to lower status roles long-term as individuals are unable to manage their workload at pre-injury capacity [45].

Reductions in working hours post-TBI explains the loss of income experienced in both groups. Our findings indicate that those in the mild group lost a greater proportion of their pre-injury earnings compared with those who were moderately/severely injured. This is consistent with research, suggesting that individuals typically declare financial loss following TBI [46]. To our knowledge, this is the first study specifically exploring salary loss between groups of injury severities. The definition of mTBI is ambiguous, with commissioners underestimating cognitive impairment [47]. This may lead to overestimation of vocational abilities. The findings in this study could be explained by the underestimation of the effect of mild TBI, causing financial loss as individuals take longer to adjust to work. Future research should consider income from all sources to reflect whether the loss of income from paid work is acquired elsewhere, perhaps increasing QoL by working less hours but maintaining a comfortable financial situation.

These findings suggest that injury severity alone does not explain the extent to which people successfully RTW. Psychosocial and employment related factors may be key determinants of work outcome, regardless of injury type or severity [11, 48, 49]. Most people with mTBI recover quickly [17] and may make a 100% recovery in RTW by 12 months [17, 50]. When this does not happen, non-injury factors are often the reason for failure to RTW. Unfortunately, data on other known predictors, including cognition and employment related factors were not collected as part of the primary studies in this analysis. At 12 months post-injury, most people with mild TBI in this sample failed to achieve complete RTW, still required workplace accommodations, were less satisfied

with their job than pre-injury, and experienced a loss in income, it suggests that a binary return to work outcome may mask recovery. Some may require more support, possibly with modifiable employment related and psychosocial factors, than is currently advised in contemporary guidelines. The exact nature of this support needs to be better understood as the availability of interventions to support those with mild brain injuries is often restricted in the UK [51].

The findings of this study differ from similar research [17, 52, 53]. This may be due to differences in the way people with TBI were recruited and injury severity classified. Just over half of the participants were classified as 'mild' TBI. However, all participants were admitted to a trauma unit in a UK hospital for at least 48 hours because of their head injury. Diagnosis of mTBI was not always based on a brain scan but relied on local diagnostic procedures. Injury severity was categorised using the GCS, which has been criticised for its lack of sensitivity and reliability [53]. Consequently, the mTBI sample in this study may have included people with injuries more significant than concussion or people not admitted to hospital included in other studies ([17, 52, 53], which may explain lower 12 month RTW rates in this sample. The data was also collected in the UK, which has different employment and health related policies compared to other parts of Europe and North America. In the UK, people with a brain injury without private medical insurance or whose injury did not result in a litigation claim may not receive support to RTW from the NHS.

Limitations

One hundred and thirteen participants' data was available at 12 months (65.7%). Studies with similar samples found that responders are often female, older at injury, and have more severe injuries [50]. To overcome this problem, future researchers could cross-reference data using participant's national insurance number (or other work-based identifier i.e. tax) to reduce missing data, preventing bias. Despite this, TBI participants are notoriously difficult to follow-up, making this large data-set a valuable addition to literature [54].

Furthermore, we did not ascertain the size and type of employer, the relationship between the employee and employer, and participant expectations of recovery [11, 12]. The differences in work-related variables in this research between those with mild and moderate/severe injuries may be a complex interaction between TBI related sequalae, environmental factors (including the employer and socioeconomics), and personal factors (such as re-appraising the meaning of work following a traumatic life event). This warrants further research on how non-injury factors impact upon RTW, particularly for those with milder injuries.

Despite this study having high statistical power to detect medium and large effects, this was based on the original sample size of 172 participants. Due to loss of follow up data in this study, it is possible that this research was under powered to find small effects that may have existed, albeit unlikely.

Conclusion

To our knowledge, this is the first study to comprehensively describe RTW following TBI. Establishing what is meant by 'return to work' following TBI is imperative to facilitate robust measurement of work outcomes that are currently lacking in TBI research. Categorisation of outcome into 'working' or 'unemployed' fails to provide a complete view of the heterogeneous nature of vocational status following TBI. Whilst most patients RTW post-TBI, many work fewer hours, are less satisfied, and fail to sustain work. As healthcare resources in the UK are limited and many people in this study still reported workplace accommodations 12 months after their injury, this paper raises questions over whether NHS resources should be directed towards vocational rehabilitation including working with employers to facilitate job retention. Moreover, it highlights the struggles associated with working after mild brain injury, a population who are typically offered little help returning to and remaining in employment post-injury.

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Declaration of interest statement

The authors report no conflicts of interest in this research.

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