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Work limitations four years following mild traumatic brain injury: A Cohort Study

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Title: Work limitations four years following mild traumatic brain injury: A Cohort Study
Running head: Mild TBI and long-term work

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DECLARATION OF COMPETING INTERESTS

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ETHICAL APPROVAL

Ethical approval was obtained from the Northern Y Health and Disability Ethics Committee of New Zealand (NTY/09/09/095) and the Auckland University of Technology Ethics Committee (09/265).

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1 **Work limitations four years following mild traumatic brain injury: A cohort study**

2

3 **Abstract**

4

5

6 *Objective*: To explore employment status, work limitations and productivity loss following
7 mild traumatic brain injury (TBI).

8 *Study Design:* Inception cohort study over four years.

9 *Setting:* General community.

10 *Participants:* 245 Adults (>16 years at the time of injury), who experienced a mild TBI and
11 who were employed prior to their injury.

12 *Interventions:* Not applicable

13 *Main Outcome Measures:* Details of the injury, demographic information and pre-injury
14 employment status were collected from medical records and self-report. Symptoms and
15 mood were assessed one-month post-injury using the Rivermead Post-Concussion Symptom
16 Questionnaire and the Hospital Anxiety and Depression Scale. Post-injury employment
17 status and work productivity were assessed four-years post-injury using the Work
18 Limitations Questionnaire.

19 *Results:* Four-years following mild TBI, 17.3% of participants had exited the workforce
20 (other than for reasons of retirement or to study) or had reduced their working hours
21 compared to pre-injury. A further 15.5% reported experiencing limitations at work as a
22 result of their injury. Average work productivity loss was 3.6% The symptom of ‘taking

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23 longer to think' one month post-injury significantly predicted work productivity loss four
24 years later (β = 0.47, t = 3.79, p = <0.001).
25

26 *Conclusions:* Whilst changes in employment status and difficulties at work are likely over
27 time, the results indicate increased unemployment rates, work limitations and productivity
28 loss in the longer-term following a mild TBI. Identification of cognitive difficulties one
29 month following TBI in working aged adults and subsequent interventions to address these
30 difficulties are required to facilitate work productivity.

31

32 Keywords: Mild Traumatic Brain Injury, Work, Employment, Longitudinal studies,
33 Productivity

34

35 Abbreviations:

36

37 TBI = Traumatic brain injury

38 WLQ-25 = Work limitations Questionnaire

39 HADS = Hospital Anxiety and Depression Scale

40 RPQ = Rivermead Post Concussion Symptom Questionnaire

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42

43

44 The majority of traumatic brain injuries (TBIs) are classified as being in the mild severity
45 range (70-95%), [1, 2] with 63% of mild TBIs occurring in adults of working age (between 16-
46 64years).[2] Following a mild TBI the most common symptoms include headaches, fatigue,
47 forgetfulness and poor concentration and taking longer to think[3], all of which can affect an
48 individual's ability to function in everyday life, including productivity at work. Whilst
49 symptoms may resolve quickly in many cases, estimates suggest between 22% and 48% of
50 those sustaining a mild TBI experience persistent symptoms (including headaches, fatigue
51 and difficulties processing information) and functional losses for at least one year following
52 injury.[3, 4] However, further work is needed to understand the longer-term consequences of
53 mild TBI on occupational functioning.[5]

54

55 Return to work is increasingly identified as a key outcome in TBI, being linked to improved
56 psychological well-being and quality of life.[6, 7] Most adults (90%) return to pre-injury
57 employment within two months of sustaining a mild TBI.[8] Delayed return to work after
58 injury results in considerable lost earnings and long-term treatment costs.[9] Thus, there is a
59 substantial economic incentive to facilitate return to work given the disproportionate risk of
60 TBI in younger adults.[2] Studies have revealed that poorer mood, reduced global functioning,
61 lower level of education, acute symptoms of nausea, vomiting and dizziness, extracranial
62 injuries, cognitive impairment, occupational factors such as limited independence, increased
63 age, multiple injuries and fatigue all predict delayed return to work following mild TBI.[8, 10,
64 11] However, studies have been limited by small sample sizes and short follow up periods.[10]
65 Consequently, it remains unknown if mild TBI has an impact on employment status in the
66 longer term. Additionally, the current focus of research on return to work rates following

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67 mild TBI has failed to identify the impact of mild TBI on work productivity or changes an
68 individual may have needed to make to remain in their employment, and/or whether mild
69 TBI increases absence from work. These are all key factors in a person's ability to sustain
70 employment in the longer term.[10, 12] Work productivity is defined as how efficiently people
71 perceived that they are performing in their employment including managing their time,
72 coping with physical demands, relationships with colleagues and clients as well as the
73 quality and quantity of their work).[13] It remains unclear if factors that are predictive of
74 return to work also predict work productivity.

75

76 The potential impact of prior and recurrent brain injuries on work productivity has also not
77 been explored. This is particularly pertinent given 32% of people have experienced at least
78 one prior TBI before the age of 25 years[14] and 10% of people experience a recurrent injury
79 within a year of an initial injury, which can exacerbate symptoms and negatively impact
80 recovery.[15] This study aimed to explore employment status, work productivity and
81 productivity loss four years after mild TBI and to identify acute predictors of these
82 outcomes. It was hypothesised that lower age, acute symptoms and prior-recurrent injuries
83 would be predictive of longer-term work productivity.

84

85 **METHODS**

86

87

88 **Participants**

89

90 According to government statistics, in New Zealand (NZ), only one in ten people go on to
91 further study (including both degree and non-degree qualifications) and so many people

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92 enter the workforce at the age of 16 years.[16] Adults (aged >16 years) who experienced a
93 mild TBI during a 12 month period were identified through a longitudinal incidence and
94 outcome study (*Brain Injury Incidence and Outcomes New Zealand in the Community*,
95 BIONIC).[17] The BIONIC study identified 1369 cases (including all ages and severities) of
96 TBI between 1 March 2010 through 28 February 2011 in a mixed urban and rural region
97 (Hamilton and Waikato Districts) of the North Island of New Zealand (NZ). Multiple
98 overlapping sources of case ascertainment were employed including searches of sports club
99 accident records, general practitioners and allied health professional referrals and self-
100 referrals, in addition to searches of hospital admission and discharge records and national
101 health care databases. TBI was defined using the World Health Organisation criteria as: an
102 acute brain injury resulting from mechanical energy to the head from external physical
103 forces.[18] Information on all potential TBI cases based on self-report and information
104 obtained from medical records was reviewed weekly by a diagnostic adjudication group to
105 determine if they met the inclusion criteria for TBI. Mild TBI severity was defined using
106 Glasgow Coma Score (GCS; 13-15) and/or Post-traumatic amnesia (< 24 hours). All cases
107 meeting the TBI inclusion criteria that did not have a recorded GCS score were classified as
108 mild in severity.
109
110 **Procedure**
111
112 Participant demographic and clinical information about the person's TBI history (including
113 injuries sustained prior to the registering TBI identified as part of the incidence study and
114 recurrent injuries sustained over the subsequent four year period of follow up) were
115 obtained from medical records and self-report (for consenting participants) at baseline.
116

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117 All confirmed TBI cases were invited to participate in follow-up assessments that were
118 completed in person at the participant's place of residence or at another mutually convenient
119 location (e.g., private room at medical practice). Participants were also offered the option to
120 complete the assessment via the telephone if they preferred. Participants provided written
121 consent to participate all time-points. Assessments used in the current analysis were
122 completed at one month and four years post-injury. Participants were eligible for inclusion
123 in this analysis if they were: 1) aged >16 years at the time of injury; 2) had experienced a
124 mild TBI within the recruitment period; 3) were in full or part-time paid employment pre-
125 injury. The participant's occupation was classified into the 8 main job categories outlined by
126 the Australian and New Zealand Standard Classification of Occupations (2013 Version
127 1.2).[19] As the aim of this study was to identify the acute factors that may predict longer term
128 work status and productivity (to indicate targets for early intervention), potential predictors
129 (mood and symptoms) were assessed one month post-injury, with work productivity
130 assessed at four years post-injury.
131

132 **Assessments at one month post-injury**

133

134 The *Rivermead Post Concussion Symptoms Questionnaire*[20] (RPQ) was specifically
135 developed to assess the experience of symptoms after a brain injury in comparison to before
136 the injury. Participants are presented with a list of 16 cognitive, emotional and physical
137 symptoms commonly experienced after a brain injury including headaches, noise sensitivity
138 and balance difficulties. Participants were asked to rate on a 5-point scale, ranging from the
139 symptom is not experienced (0) to it being a severe problem (4). To explore the role of

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140 specific acute symptoms on work productivity, individual item (i.e., symptom) level scores
141 were used for this analysis.
142
143 As mood has been found to influence return to work following injury[11], the *Hospital Anxiety*
144 *and Depression Scale (HADS)*[21] was used to assess levels of depression and anxiety. The scale
145 was developed specifically to assess mood in people with physical health conditions and has
146 been found to be sensitive to changes in anxiety and depression following TBI.[22] High
147 scores (range 0-21) indicate poorer mood status.
148

149 **Outcome measures 4 years post-injury**

150
151 In addition to the measures collected up to one year as part of the BIONIC study,
152 participants employed four years post-injury were asked to complete the *Work Limitations*
153 *Questionnaire (WLQ-25).*[23, 24] This questionnaire was developed to assess the extent to
154 which a person experiences limitations at work and lost productivity due to their health.
155 Participants are asked to respond on a 5-point scale about the level of difficulty that they
156 have had in completing specific job tasks over the previous two weeks. Responses are
157 summed to yield four subscale scores for time management; physical demands; mental-
158 interpersonal demands; and an outputs demands scale assessing diminished work quality
159 and quantity. Higher scores indicate poorer work productivity. In accordance with the
160 scoring instructions of the measure, an algorithm was used to convert the four sub-scale
161 scores into an estimate of total percentage of productivity loss. Two additional time loss
162 questions were included which asked how many half and full days the person had taken off
163 work in the past two weeks. The questionnaire has well-established criterion and construct

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164 validity and reliability.[13, 24] Additionally, an open text question asked participants if they had
165 needed to make any changes within their employment as a result of their brain injury.
166
167 **Statistical analysis**
168
169 Descriptive statistics were used to examine the participant sample, changes in employment
170 status between pre-injury and four year follow up, changes required to remain in
171 employment and numbers of days taken off work in the past two weeks. Chi square or t-tests
172 were used to determine any differences between participants consenting to take part in the
173 four year follow up and those who did not. Spearman's correlation co-efficients were used
174 to explore demographic, injury related and symptom variables associated with work
175 productivity four years post-injury. The significance level was set at the more stringent level
176 of $p<0.01$ to account for multiple comparisons. Acute factors that were significantly
177 correlated with work productivity and which were not multi-collinear ($r = >0.8$), were
178 entered into a multiple linear regression to determine their unique contribution. Forward
179 conditional selection was used to develop the regression model. Predictors were retained in
180 each model if the p-value was ≤ 0.05.
181
182 **RESULTS**
183
184
185 There were 245 adults (>16 years) who met the inclusion criteria for this analysis. At four
186 year follow up two (0.8%) participants had died and 50 (20.4%) were unable to be
187 contacted. Of the remaining 193 participants, 110 (57.0%) consented to the four year follow
188 up assessment, 31 (12.7%) declined, 19 (7.8%) initially agreed but were then unable to be

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189 contacted and 33 (13.5%) had declined follow up at a previous assessment. Characteristics
190 of the sample are presented in Table 1 alongside a comparison with those who were eligible
191 for this analysis but who did not consent to follow up to explore risk of selection and
192 attrition bias. As can be seen in Table 1, there were no significant differences on most
193 clinical and demographic variables with the exception that participants in this analysis were
194 older than those who did not take part. The majority of assessments were completed face-to-
195 face with the person in their own home (96.6%), with only a few people preferring to
196 complete the assessment via telephone interview (3.4%). As there were minimal missing
197 data due to the majority of assessments being conducted by the researcher in person,
198 participants with missing data were excluded from the analysis. Prior to their injury, 11.8%
199 of the sample were in managerial roles, 15.5% professionals, 10.9% Technician/Trade
200 workers, 12.7% community workers, 10.9% clerical or administrative workers, 8.2% sales
201 workers, 10.0% machinery operators, 13.6% labourers and 6.4% who did not specify their
202 pre-injury occupation.

203

204 **INSERT TABLE 1**

205

206 As shown in Table 2, 19 (17.3%) of participants had exited their employment at four years
207 post-injury for reasons other than retirement or study. Rates of unemployment were slightly
208 higher (7.0%) in our mild TBI sample four years post-injury than reported in the New
209 Zealand general population in the same year of follow up (5.8% in 2015).[25] Additionally,
210 17 (15.5%) people reported needing to make changes to enable them to continue in their
211 employment role because of the impact of their brain injury. The most common changes
212 included becoming more reliant on note taking and allowing themselves more time to
213 process information, increasing their sleep/rest/breaks to assist in managing fatigue and

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214 reducing working hours. A greater proportion of labourers exited the workforce, than
215 remained in their employment, which neared statistical significance $X^2 = 3.31$, $p = 0.07$.
216 There were no observable differences in employment status at four years within the other
217 occupation categories. Of those who had left the workforce four years post-injury, 45.8%
218 were under the age of 35 years, with 63.6% of these participants becoming unemployed.

219

220 **INSERT TABLE 2**

221

222 There were N = 86 participants who completed the WLQ-25 four years post-injury. The four
223 sub-scales of the WLQ-25 demonstrated good internal consistency for this mild TBI sample,
224 with Cronbach alpha scores ranging between 0.84 and 0.92. To provide context for the
225 scores on the WLQ-25, NZ normative data matched for age, gender, education level and
226 ethnicity were supplied by the developers of the WLQ-25. As can be seen in figure 1, the
227 mild TBI sample experienced far greater difficulties at work four years post-injury than
228 reported in the NZ general population.

229

230 **INSERT FIGURE 1**

231

232 **Figure 1. Comparison of mean scores between the mild TBI sample four years post-**
233 **injury and NZ norms**

234

235

236 Participants who were employed lost on average half a day off work in the past two weeks
237 due to health or medical care (although this was not directly specified as due to their TBI),
238 with 15% of people having taken two days off work or more. Work productivity loss ranged
239 between 0 – 18%, with a mean productivity loss score (3.6%) that was higher than the NZ

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240 norm of 2.3%. (Figure 1). Adults who had experienced a mild TBI had particular difficulties
241 with losing their train of thought, concentration and sticking to a routine. One in six reported
242 having to makes changes to their working style to assist them in managing persistent
243 symptoms at work.

244

245 To explore the acute factors associated with longer-term work productivity, baseline socio-
246 demographic factors and injury characteristics, self-reported symptoms (RPQ items) and
247 mood assessed at one month, were correlated with the sub-scales of the work limitations
248 questionnaire assessed at four years. As shown in Table 3, the symptom of taking longer to
249 think at one month was significantly correlated with all work productivity subscale scores
250 and work productivity loss. Symptoms of fatigue, irritability and poor concentration were
251 also related to more than three of the five WLQ outcome domains. Demographic factors
252 were not correlated with the subscales of the WLQ, with prior and recurrent TBI being the
253 only injury characteristics associated with work limitations four years post-injury.

254

255 **INSERT TABLE 3**

256

257 Variables significantly correlated with each work productivity outcome were entered into a
258 regression model to explore their unique contribution to aspects of work productivity.
259 Taking longer to think at one month was independently predictive of work productivity loss,
260 physical demands and, output demands at four years. Poor concentration was significantly
261 associated with time management difficulties and mental and interpersonal concerns at four
262 years (Table 4).

263

264 **INSERT TABLE 4**

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265

266 **DISCUSSION**

267

268

269 This study highlights that whilst previous research has shown high return to work rates
270 following a mild TBI in the short term, nearly one in five people struggle to meet the
271 demands of their employment in the longer term and may go on to exit employment or
272 reduce their hours. Those working as labourers may be at particular risk of maintaining
273 employment post-injury. The findings highlight that cognitive impairments, particularly
274 taking longer to think and poor concentration observed one month following injury, may
275 help to predict those who will go on to experience difficulties in their employment and who
276 may benefit from early intervention to help reduce the likelihood and impact of mild TBI on
277 longer term work limitations and productivity loss.

278

279 Over the period of the study, unemployment in NZ remained relatively stable, declining by
280 0.7% between 2010 when TBI cases were identified and recruited and 2015 when the four
281 year follow up assessments were conducted. Given that the majority of people (91.7%)
282 return to work within two months following a mild TBI, reductions in the employment rate
283 were not expected.[8] Whilst nearly half of the sample did not experience any difficulties at
284 work following their injury, this study has clearly highlighted that more than half of adults
285 experiencing a mild TBI experience challenges in their workplace. These levels are higher
286 compared with findings from other clinical populations, such as colorectal cancer patients,
287 where only 22-39% of patients report experiencing work difficulties.[26]

288

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289 A work productivity loss of 3.6% as assessed by the work limitations questionnaire was
290 similar to the 3.0% long-term productivity loss costs based on health economic projections
291 for TBI.[27] This level of productivity loss is higher than has been reported for colorectal
292 cancer patients of 1.9%,[26]but lower than reported for psoriatic and rheumatoid arthritis[28], [29]
293 and systematic vasculitis[30] patients with reported productivity losses of 5.9%, 7.1% and
294 8.2% respectively. These findings provide more evidence of the possible persistent nature of
295 symptoms following mild TBI, and specifically the implications of symptoms on
296 employment and work productivity[3, 4]
297

298 One month symptoms of taking longer to think and poor concentration one month post-
299 injury were significantly correlated with sub-scale work limitations and productivity scores
300 at four years. As the reliability and validity of individual items of the post-concussion
301 symptoms scale have not been demonstrated, these findings should be interpreted with
302 caution, however the findings indicate an important trend in need of further investigation.
303 This study indicates that screening, to see if these particular symptoms remain present one
304 month after injury, may help to identify those at risk of developing longer term difficulties
305 at work. It was interesting to note that prior and recurrent TBIs were the only injury
306 characteristics that were significantly correlated with longer term work limitations and
307 productivity loss. This suggests that symptoms may be more informative in identifying
308 those who may be more at risk of longer term difficulties. Whilst a high proportion of those
309 exiting employment following injury were aged less than 35 years, age was not an
310 independent predictor of longer term work productivity. It may be the case that length of
311 time in the job or whether the role is part of a planned career path may have more of
312 influence on employment status and productivity. Further exploration of potential job and

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313 contextual factors may be useful to understand the links between mild TBI and work
314 productivity.
315
316 **Study Limitations**
317
318 This study was based on an incidence cohort of people who sustained an injury within a one
319 year period and took advantage of the multiple sources of cases ascertainment used to
320 identify those often missed in TBI research (e.g. those who do not go the hospital following
321 their injury). However, it is acknowledged that participants in this sample were older in age
322 than those with mild TBI in general, and only included those employed at the time of injury,
323 limiting generalizability of the findings. Whilst one in six participants did report making
324 direct changes to their working style as a result of their injury, it is not clear what changes to
325 employment status and work productivity were directly the result of TBI. For example,
326 some work difficulties may have been due to additional injuries sustained at the time of the
327 accident, comorbid medical conditions or changing life circumstances as a result of external
328 factors. Although data on employment status at time of injury were available, the impact of
329 recall bias meant the person's level of pre-work functioning was not able to be reliably
330 obtained. However the findings do suggest a link between symptoms following a mild TBI
331 and longer term work productivity.
332
333
334 **CONCLUSIONS**
335
336

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337 Whilst return to work rates following a mild TBI may be high in the short term, nearly one
338 in five people struggle to meet the demands of their employment in the longer term and may
339 go on to exit employment or reduce their hours. The findings highlight that cognitive
340 impairments, particularly taking longer to think and poor concentration observed one month
341 following injury, may help to predict those who will go on to experience difficulties in their
342 employment and who may benefit from early intervention to help reduce the impact of mild
343 TBI on longer term work limitations and productivity loss.

344

345

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347

348

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350 many doctors, nurses and rehabilitation professionals who assisted in the long-term follow
351 up of this sample.

352

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Table 1. Participant Characteristics of those employed pre-injury consenting to follow up and those who declined or could not be contacted

	Participant sample at 4 years (N=110)	Non-consenters to 4 year follow up (n = 135)	Test of Difference
Age, mean (SD)	39.63 (13.47)	34.50 (13.93)	T = 2.92 p = 0.04
Gender			
Male	63 (57.3)	92 68.1)	X^2 = 2.6 P = 0.10
Female	47 (42.7)	43 (31.9)	
Ethnicity			
European	79 (71.8)	82 (60.7)	X^2= 4.47 p = 0.11
Maori	24 (21.8)	46 (34.1)	
Other	7 (6.4)	7 (5.2)	
Mechanism of injury			
Falls	40 (36.4)	38 (28.1)	X^2 = 5.75 P =0.22
Motor vehicle accident	29 (26.4)	35 (25.9)	
Exposure to mechanical force	20 (18.2)	27 (20.0)	
Assault	21 (19.1)	30 (22.2)	
Other/unknown	0 (0.0)	5 (3.7)	
Additional injuries			
Yes	80 (72.7)	103 (76.3)	X^2= 4.67 p= 0.09
No	21 (19.1)	29 (21.5)	
Not recorded	9 (8.2)	3 (2.2)	
Prior TBI			
None	48 (43.6)	66 (48.9)	X^2= 2.15 p =0.54
One	24 (21.8)	23 (17.0)	
Two or more	33 (30.1)	43 (31.9)	
Unknown	5 (4.5)	3 (2.2)	
Recurrent TBI (over 4 year study duration)	25 (22.7)	22 (16.3)	X^2 = 1.23
Yes	85 (77.3)	113 (83.7)	p = 0.27
No			
Marital Status			
Married/Civil Union/De facto	60 (54.5)	69 (51.1)	X^2 = 2.49 P = 0.29
Never Married/Single	35 (31.8)	54 (40.0)	
Divorced/Separated/Widowed	15 (13.6)	12 (8.9)	
Area of residence			
Urban	85 (77.3)	91 (67.4)	X^2 = 2.45 p = 0.12
Rural	25 (22.7)	44 (32.6)	

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Table 2. Change in Employment Status from Pre-injury to Four Years post-injury

	N = 110
Exited employment	**24 (21.8)**
Employed – student	4 (16.2)
Employed – retired	7 (29.2)
Employed – unemployed/beneficiary	12 (50.0)
Employed - homemaker	1 (4.2)
Remained Employed	**86 (78.2)**
Reduced hours	6 (7.0)
Increased Hours	6 (7.0)
No Change	74 (86.0)

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Table 3. Correlations between demographic/injury factors, symptoms and mood at one month post-injury and work productivity at four years, N = 86

	WLQ Time Management	WLQ Physical Demands	WLQ Mental /Interpersonal	WLQ Output Demands	WLQ Productivity Loss
Age	-.04	.19	-.02	.09	.10
Gender	-.03	-.16	-.02	-.17	.13
Ethnicity	.04	-.09	-.12	-.07	-.09
Mechanism	.21	.11	.11	.08	.15
Education Level	-.16	-.22	-.12	-.02	-.06
Marital status	.07	.03	.02	.10	.08
Residence area	.03	.20	-.05	-.02	.01
Additional Injury	-.15	-.09	-.04	.04	-.07
Prior TBI	.26	.19	**.36**	.11	**.29**
Recurrent TBI	.17	.04	**.37**	.27	**-.37**
Symptoms (RPQ)					
Headaches	.15	.06	.27	.24	.24
Dizziness	.21	**.36**	**.38**	.25	**.37**
Nausea	-.22	.02	.11	.04	-.04
Noise sensitivity	.17	.11	.29	.35	**.37**
Sleep disturbance	.12	.09	-.02	-.19	.04
Fatigue	.25	.25	**.41**	**.36**	**.39**
Irritable	.19	.22	**.52**	**.36**	**.43**
Depressed	.11	.15	.27	.19	.22
Frustration	.14	.15	**.41**	.27	.30
Forgetful	.26	.31	**.41**	.30	**.49**
Poor concentration	.33	**.36**	**.53**	**.39**	**.55**
Longer to think	**.39**	**.38**	**.62**	**.49**	**.52**
Blurred vision	-.02	.09	-.10	-.06	.05
Light sensitivity	.06	.24	.20	.24	.29
Double vision	.02	.07	.13	.00	.10
Restlessness	.28	.20	.31	.20	.31
Mood (HADS)					
Anxiety	.34	.32	**.51**	.30	**0.44**
Depression	.18	.04	**.35**	**.40**	0.30

Significant correlations p<0.01 in bold

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1 **Table 4. Predictors of work productivity four years post mild TBI (N = 86)**
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Outcome variable	Parameter	β	t	P Value	Lower CI	Upper CI	R sq	F	P value
Time Management	Poor concentration	0.32	2.32	0.025	0.53	7.64			
						Overall Model	0.10	5.36	0.025
Physical Demands≠	Taking longer to think	0.39	2.86	0.006	1.28	7.34			
						Overall Model	0.15	8.18	0.006
Mental/ Interpersonal∞	Poor concentration	0.52	4.12	<0.001	3.44	10.01			
						Overall Model	0.27	16.94	<0.001
Output Demands§	Taking longer to think	0.32	2.30	0.026	0.62	9.21			
						Overall Model	0.10	5.30	0.026
Productivity Loss†	Taking longer to think	0.47	3.79	<0.001	<0.001	0.02			
	Recurrent TBI	0.32	2.59	0.013	-0.06	-0.01			
						Overall Model	0.32	10.24	<0.001

3 ≠ Excluded variables = dizziness and poor concentration

4 ∞ Excluded variables = prior TBI, recurrent TBI, dizziness, fatigue, irritability, frustration, forgetfulness,

5 taking longer to think, anxiety and depression

6 § Excluded variables = fatigue, irritability, poor concentration and depression

7 † Excluded variables = prior TBI, dizziness, noise sensitivity, fatigue, irritability, forgetfulness, poor

8 concentration and anxiety.

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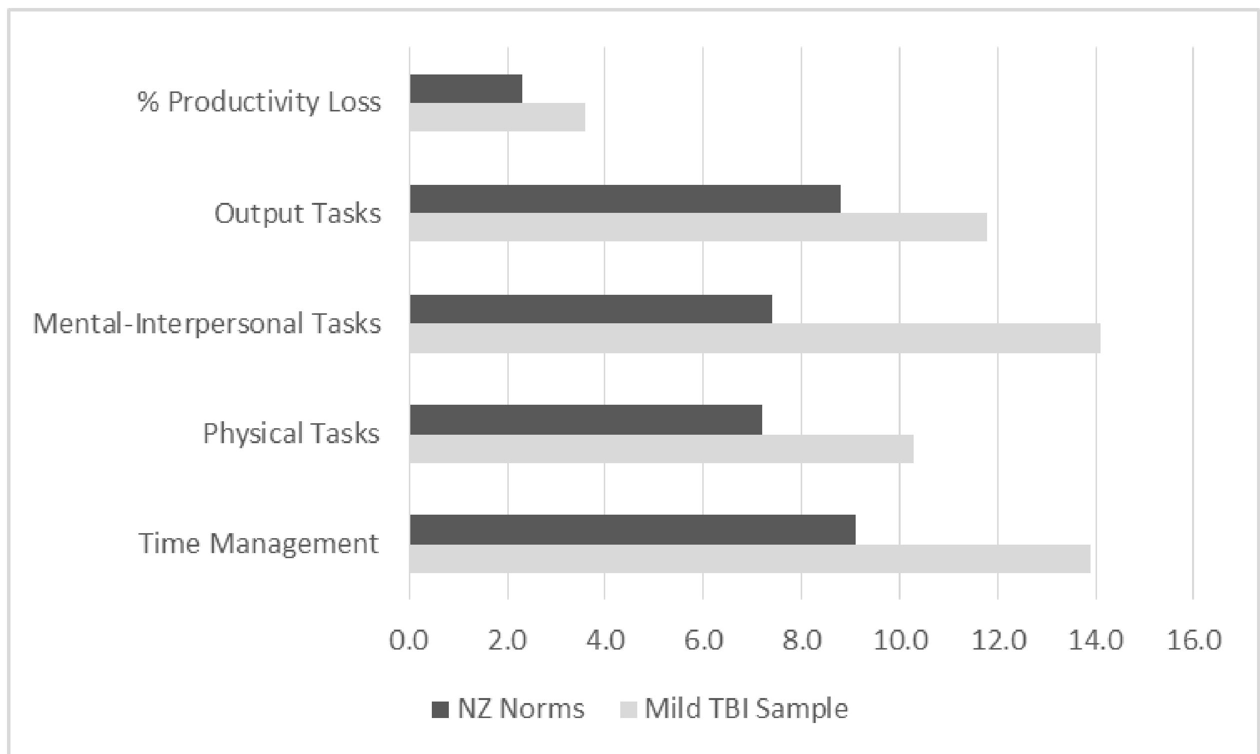

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