

Factors associated with graduated return to work following injury in a road traffic crash

**Shannon E. Gray^{1,5}, Behrooz Hassani-Mahmooei¹, Elizabeth Kendall^{2,5}, Ian D.
Cameron^{3,5}, Justin Kenardy^{4,5}, Alex Collie^{1,5}**

¹Insurance Work and Health Group, Faculty of Medicine Nursing and Health Sciences,
Monash University, Australia

²The Hopkins Centre, Menzies Health Institute Queensland, Griffith University, Australia

³John Walsh Centre for Rehabilitation Research, Kolling Institute, University of Sydney,
Australia

⁴School of Psychology, University of Queensland, Australia

⁵Centre of Research Excellence in Recovery Following Road Traffic Injuries

Abstract

Return-to-work (RTW) after road traffic crash is an important rehabilitation and recovery step. A possible RTW pathway is to gradually return-to-work (GRTW), or return in a partial capacity before reaching full RTW goals. This study sought to identify those most likely to follow a GRTW pathway, and identify factors associated with successful GRTW.

Administrative claims data from a state-based compulsory third party transport injury insurer were used. Individuals whose crash occurred between 2003 and 2012 were included if aged 15 to 70 years at time of crash, sustained a non-catastrophic injury, had complete data for all variables and attempted a RTW in the three years follow-up. A matrix was created using income payments data, which were used as a proxy for RTW, to map their RTW pattern for up to three years post-crash. Individuals were flagged as attempting GRTW if patterns were detected for receiving full income payments, followed by partial payments, then receiving none. Individuals who resumed full payments after a period of partial payments or resumed any payments after a period of no payments were flagged as having relapsed. In the three years follow-up, 9.6% of individuals followed a GRTW pathway. Of those that attempted GRTW for their first full RTW, 55.1% relapsed. Least likely to attempt GRTW were males, individuals with contusions, abrasions, sprains, strains, non-limb fractures and those from the most advantaged socioeconomic group. Conversely, those admitted to hospital were 88% more likely. Of those who followed a GRTW pathway, those aged 15 to 24 years were most likely to succeed. Those with whiplash, internal injuries and those admitted to hospital were least likely to succeed. This study may assist regulators, insurers, employers and healthcare professionals to identify opportunities for GRTW, and identifies groups that may require additional support to achieve successful employment outcomes.

Keywords

Injury; road traffic crash; return to work; graduated return to work; work hardening

Introduction

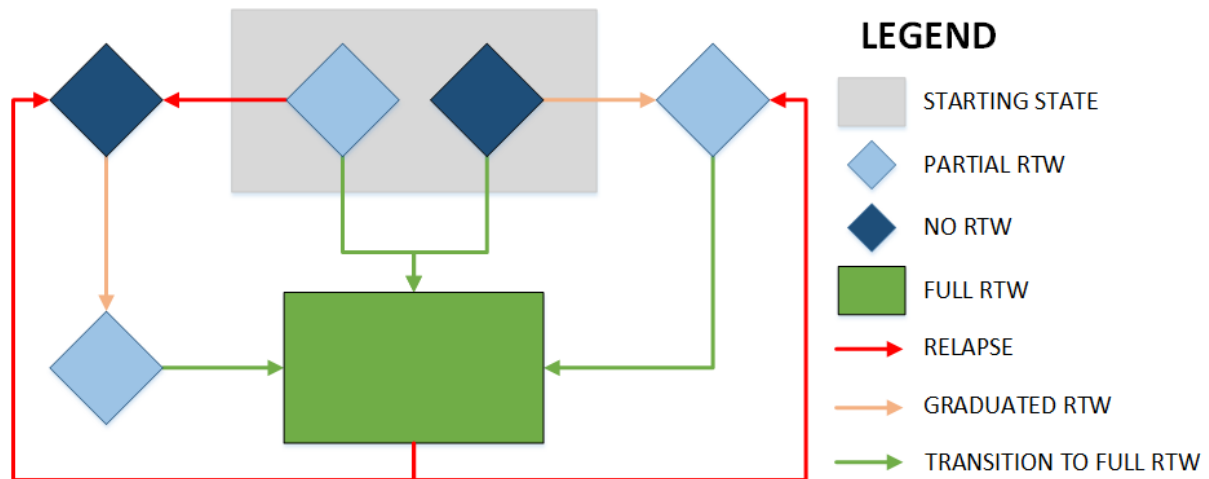
Road traffic crashes (RTC) result in more than 45 thousand hospitalisations in Australia every year, with the rate increasing 0.9% annually (Henley and Harrison, 2015). RTC injuries that do not require hospitalisation but can affect daily activities, including participation in paid work, are more common (Lilley et al., 2012). The most recent economic analysis in 2015 estimated that costs associated with road trauma were \$29.7 billion, with some of this attributable to workplace disruption (Potterton et al., 2017). Costs included lost output, temporary or permanent replacement of a worker, and recruitment and retraining costs, among others.

Engagement in work after injury is now widely recognised as an important rehabilitation goal and has been shown to facilitate injury recovery (Waddell and Burton, 2006). Prolonged absence from the workforce can be detrimental to mental and physical health (Waddell and Burton, 2006), and is associated with reduced likelihood of sustained return-to-work (Canadian Medical Association, 2013; Pransky et al., 2005). Re-engagement in the workforce following injury can ensure preservation of pre-injury skills, increase sense of self-efficacy and confidence, and reduce the impact on social support networks and the community (Canadian Medical Association, 2013).

The return to work process has been described as having four stages: off work; re-entry; maintenance; and advancement (Young et al., 2005). Progression through these stages is highly variable and not necessarily linear, with possible RTW pathways summarised in Figure 1. In some cases, individuals are in a position to re-enter the workforce immediately with little or no time absent, however in other cases, the nature of the work and the severity of the injury means that a graduated return to work (GRTW) is required. A GRTW may involve different duties, restricted hours or modified tasks. At the same time, supports are provided to assist the individual to regain full capacity. It is possible that pre-injury capacity may never be attained, in which case employment may lapse, the tasks may be permanently modified or there may be a job change in hours or activity. In the return to work

conceptualisation proposed by Young et al (2005), within the re-entry phase the individual, their workplace, and often vocational rehabilitation providers continually assess and evaluate performance in order to achieve the goal return to work status and the desired outcome for all parties (Young et al., 2005).

Figure 1: Conceptual diagram indicating possible return to work pathways



A number of studies have shown that GRTW pathways can lead to sustainable full time employment (Grunert et al., 1992; Høgelund et al., 2010; Schneider et al., 2016; Streibelt et al., 2017). A Danish study of long-term sickness absence found a significant and positive effect of a GRTW program on the probability of returning to regular working hours (Høgelund et al., 2010). Those with work-related hand injuries benefited from GRTW, with 80% of injured workers retaining employment with their previous employer at 6-months follow-up (Grunert et al., 1992). Bethge (2016) found that younger people and females were more likely to attempt a GRTW in a German rehabilitation program (Bethge, 2016), and those who had followed a GRTW program received less welfare benefits and had a higher average income than those who did not.

Studies have also stressed the importance of engagement with the employer to facilitate the likelihood of retained employment with suitable accommodations and modifications and to focus on strengths of workers rather than injury-related limitations (Arnetz et al., 2003).

Ample evidence has confirmed the fact that employer accommodations, such as reduced

hours during injury recovery, modified equipment, and light workloads, can significantly reduce work absence and increase the likelihood of a successful return (Butler et al., 1995; Palmer et al., 2012). For instance, in a systematic review of return to work following musculoskeletal disorders, Palmer et al. (2012) found that interventions involving graded tasks had a positive impact on return to work and a reduction in the median days lost per month (Palmer et al., 2012). Interventions involving workplace adaptations and assessments or extra support services were even more beneficial in reducing days lost.

Information on the predictors of attempting and successfully achieving GRTW following RTC is important to aid in the development of interventions seeking to ensure sustained re-introduction to the workforce. Existing studies are in cohorts of people with work-related injury or ill health leading to sickness absence. The prevalence and outcomes of GRTW processes following RTC injury has received little attention.

The objectives of this study are to: 1) to identify RTC survivors most likely to follow a GRTW pathway; and 2) identify factors associated with successful GRTW in Victoria, Australia.

Methods

Setting

In the state of Victoria, Australia, the Transport Accident Commission (TAC) is a government authority that both promotes road safety and provides financial support for those injured in RTCs (including drivers, passengers, motorcyclists, pedestrians, and in some cases cyclists) (Transport Accident Commission, 2016). The TAC operates a predominantly no-fault injury compensation scheme, which means benefits are provided regardless of who was at fault in the RTC. These benefits can include payments for medical or rehabilitation services, and income support whilst unfit for work. To be provided with income support, individuals must have had at least five days' absence from work. Employment can be full-time or part-time, or on a casual basis. In this group return to work is an important goal, and people may be eligible to access income support payments through the TAC for up to 36 months post injury.

These loss of earning payments are made at 80% of pre-injury income up to a maximum of \$1,300 per week for the first 18 months, and then for a further 18 months if deemed eligible for loss of earning capacity payments.

Data sources

Data were extracted from the Compensation Research Database (CRD), a population based administrative dataset that includes detailed information on all claims, payments, services, hospital admissions, and medical certificates processed for all compensated transport and work-related injuries and illnesses in Victoria since 1985 (Prang et al., 2016).

This study utilises a modified version of the TAC Payments Dataset, where each entry is a record of payment for income replacement. Additionally, each record includes information on the crash, injured individual (e.g. sex, age, postcode of residence, injury), payment details (e.g. start and end date, type of payment), and information on hospital admissions.

Inclusion and Exclusion criteria

Records were included if the RTC occurred between January 2003 and December 2012 and payment records indicated there was at least one day of paid income replacement.

Additionally, cases were only included if the claim was accepted and the injured individual was aged between 15 and 70 years at the time of RTC. Fatalities and catastrophic injury, including quadriplegia and severe acquired brain injury according to the TAC-defined “catastrophic injury” flag, were excluded because they represent only a small percentage of claims (~1%) and are managed through a different process by the TAC. The inclusion criteria resulted in 980,401 payment records, from 33,263 individual cases. Individual cases were excluded if they were missing information from predictor variables (see Methods – Predictors). There were 293 individual cases with missing sex and decile information (n = 4 and n = 289 respectively), leaving 32,970 individual claims for analysis.

Predictors

Age at time of crash was grouped into ten-year brackets from 15 to 54 years, and another 55 to 70 years. Due to their highly interrelated clinical presentations (Marshall et al., 2015), injuries classified as concussion were included in the mild acquired brain injury (ABI) category. Injury types with greater than 1000 cases were retained, with all others combined into the 'other injuries' group. It is important to note that injury types appear exactly as they are coded in the TAC dataset. These injury codes are assigned by the TAC claim manager and hence are not directly based on medical records.

The Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) was used to determine the socioeconomic status of the injured individual using their postcode of residence (Australian Bureau of Statistics, 2013). These were grouped into most disadvantaged (IRSAD deciles 1-3), middle (4-7) and most advantaged (8-10). Injury severity was derived using service and hospitalisation indicators with cases categorised into three groups: those admitted to hospital after their RTC; those who received treatment at the scene of their RTC via an ambulance service or presented to an emergency department (but were not subsequently admitted); and those who did not receive any immediate ambulance or hospital treatment after their RTC.

Data Manipulation

In order to represent the daily income replacement pattern for each TAC injured individual, a matrix was created with each row representing the benefits pattern for each injured individual (N = 32,970) and each column representing a single day during the three-year follow-up period (N = 1,095). Income replacement was used as a proxy for RTW, for example receiving full benefits indicated no return to work and partial benefits indicated partial return to work. Matrix set up has been detailed elsewhere (Gray et al., 2018).

Creation of this matrix allows the analysis of income replacement on any given day at a case level. For example, it can be determined whether a particular injured individual received income replacement on any day after their initial income replacement payment, for example

35 days following their first payment, it could be determined if the injured individual was receiving full, partial or no benefit (denoted by an F, P or N in the matrix element) (Gray et al., 2018). Patterns of income replacement can be detected in sequential columns of each row of the matrix and can be used as a proxy for a return to work pattern (Berecki-Gisolf et al., 2012).

Outcomes

The first outcome of the present study is whether an injured individual followed a GRTW pathway for their first full return to work, or followed a different return to work pathway. In order to identify whether an individual had followed a GRTW pathway, patterns were detected if they transitioned from full to partial payments ('FPPPPPP') and if they returned to work from partial payments ('PNNNNNN'). Injured individuals who had a full return to work prior to attempting a GRTW were excluded from this group (e.g. those who relapsed then followed a GRTW pathway for any subsequent return to work). When the necessary combination of patterns was detected for each injured individual, they were flagged as having followed a GRTW pathway (dichotomous outcome variable 1, 1 = followed GRTW pathway, 0 = different return to work pathway).

The second outcome of this study is whether a GRTW was successful, that is, the individual did not relapse back to full income replacement after a period back at part-time work ('PPPPPPF'), or the injured individual had fully returned to work yet relapsed to full or partial income replacement ('NNNNNNP', 'NNNNNNF'). Successful GRTW cases were those where the injured individual was flagged as having followed a GRTW pathway for their first full return to work, and were not flagged as relapsing (dichotomous outcome variable 2, 1 = successful GRTW, 2 = unsuccessful GRTW). Note that the term 'unsuccessful' was used in this study to describe those who relapsed, however long-term their RTW might actually be successful in that their job was retained at the right capacity for their abilities, however this was not measured in this study.

Analysis

To enable statistical analyses, the matrix of daily income replacement was combined with the aggregated dataset (32,970 cases) and matched by claim identifier. Therefore, the daily return to work patterns and pattern recognition flags were combined with the claim information. Once combined, cases were removed where the injured individual did not attempt a RTW in the three years ($n = 1,017$). This left 31,953 cases for analysis.

Counts and proportions were presented to describe the cohort that followed a GRTW pathway and those with a different return to work pathway. To ensure adequate sample size for quality regression results, cases with particular injury types were grouped together to create larger groups (contusions, abrasions grouped with sprains, strains). To determine the odds of GRTW, binomial regression was performed using dichotomous outcome variable 1 as the event.

Similarly, the characteristics of those with a successful GRTW versus an unsuccessful GRTW was described. Due to even lower numbers in these groups, three injury types were combined (contusions, abrasions; sprains, strains; and dislocations). To determine the odds of sustaining return to work after a GRTW, binomial regression was performed using dichotomous outcome variable 2 as the event. All regression output was presented as odds ratios by taking the exponent of the coefficient with the 95% confidence interval and p-value.

Inclusion criteria were applied using SPSS Version 23. All other analyses were conducted using RStudio Version 1.0.136.

Ethics was approved by the Monash University Human Research Ethics Committee (CF09/3150 – 2009001727).

Results

GRTW versus different return to work pathway

Of the 31,953 injured individuals included for analysis, 85.1% (N=27,190) received only full income replacement, 14.3% (N=4,582) received at least one day of both full and partial income replacement, and 181 (0.6%) injured individuals received partial payments only. It is important to note that some of those who received both full and partial payments could have recommenced partial payments after a period of no income replacement (failed return to work attempt), attempted a GRTW after a failed return to work attempt, or did not fit the required pattern of income replacement to be considered to have had a GRTW.

Of those who received both full and partial payments (4,582), 9.6% followed a GRTW pathway (e.g. 3,074 transitioned from full to partial payments at least once during the follow-up period).

There were 2,511 injured individuals whose first full return to work was following a GRTW (began on full payments then went back to work partially for a period of time before returning in full capacity). A GRTW was followed later in the follow-up period after initially returning to work through a different pathway for 563 individuals. Table 1 provides an overview of the characteristics of those who followed a GRTW pathway for their first full RTW compared with those who followed a different return to work pathway.

Table 1: Characteristics of injured people with a graduated or other return to work approach.

	GRTW approach (n = 2,511)		Other RTW approach (n = 29,442)	
	N	%	N	%
Sex				
Female	1195	47.6	10600	36.0
Male	1316	52.4	18842	64.0
Age Group				
15-24 years	532	21.2	6491	22.0
25-34 years	609	24.3	7395	25.1
35-44 years	559	22.3	6684	22.7
45-54 years	539	21.5	5637	19.1
55-70 years	272	10.8	3235	11.0
Injury Type				
Contusion, abrasions, sprains, strains	167	6.7	3737	12.7
Whiplash	462	18.4	6086	20.7
Dislocations	130	5.2	1385	4.7
Fracture - other	252	10	3005	10.2
Fracture - limb	781	31.1	8306	28.2
Internal Injury	278	11.1	2459	8.4
Mild Acquired Brain Injury	312	12.4	2834	9.6
Other injuries	129	5.1	1630	5.5
Socioeconomic Group				
Most disadvantaged (lowest 30%)	605	24.1	7348	25.0
Middle (40-70%)	1097	43.7	12256	41.6
Most advantaged (highest 30%)	809	32.2	9838	33.4
Severity Group				
Admitted to hospital with non-catastrophic injury	1966	78.3	18945	64.3
Emergency or ambulance services but not admitted or discharged on the same day	233	9.3	4940	16.8
Received no hospital, emergency or ambulance services	312	12.4	5557	18.9

Note: 'Other injuries' includes paraplegia, spinal, amputation, burns, loss of sight, degloving, nerve damage and other injuries.

Results in Table 2 show that males were less likely to GRTW than females, but age had no association. Injured individuals with contusions, abrasions, sprains, strains, other fractures or other injuries (see table footnote) had lower odds of GRTW than those with limb fractures. Those from most advantaged deciles were slightly less likely than those in the middle deciles to GRTW. Injured individuals admitted to hospital were 86% more likely than those who received no ambulance or emergency treatment to GRTW, which is likely to reflect greater levels of injury severity.

Table 2: Odds of having initially attempted a graduated return to work

	Odds ratio	Lower bound (2.5%)	Upper bound (97.5%)	p-value
Sex				
Female	Ref			
Male	0.56	0.51	0.61	<0.01
Age Group				
15-24 years	0.90	0.79	1.02	0.11
25-34 years	0.96	0.86	1.09	0.56
35-44 years	Ref			
45-54 years	1.08	0.95	1.22	0.24
55-70 years	0.95	0.81	1.10	0.48
Injury Type				
Contusions, abrasions, sprains, strains	0.48	0.40	0.57	<0.01
Whiplash	0.90	0.78	1.02	0.11
Dislocations	0.92	0.76	1.12	0.43
Fracture - limb	Ref			
Fracture - other	0.84	0.72	0.98	0.03
Internal injury	1.07	0.92	1.23	0.38
Mild acquired brain injury	1.04	0.90	1.19	0.60
Other injuries	0.89	0.73	1.09	0.27
Socioeconomic Group				
Most disadvantaged (lowest 30%)	0.94	0.85	1.05	0.26
Middle (40-70%)	Ref			
Most advantaged (highest 30%)	0.90	0.81	0.99	0.02
Severity Group				
Admitted to hospital with non-catastrophic injury	1.88	1.65	2.16	<0.01
Emergency or ambulance services but not admitted or discharged on the same day	0.86	0.72	1.02	0.09
Received no hospital, emergency or ambulance services	Ref			

Note: 'Other injuries' includes paraplegia, spinal, amputation, burns, loss of sight, degloving, nerve damage and other injuries. An odds ratio greater than 1 indicates higher odds of having a failed RTW compared with the reference.

Successful versus unsuccessful GRTW

Of the 2,511 injured individuals who followed a GRTW pathway prior to their first full RTW, 1,128 (44.9%) successfully remained at work and off income replacement payments. This means that 1,383 injured individuals (55.1%) relapsed onto income replacement after full

return to work or relapsed to full income replacement after a period on partial payments.

Table 3 shows the characteristics of each group.

Table 3: Characteristics of injured people with successful and unsuccessful graduated return to work attempts

	Successful GRTW (n = 1,128)		Unsuccessful GRTW (n = 1,383)	
	N	%	N	%
Sex				
Female	523	46.4	672	48.6
Male	605	53.6	711	51.4
Age Group				
15-24 years	264	23.4	268	19.4
25-34 years	272	24.1	337	24.4
35-44 years	233	20.7	326	23.6
45-54 years	228	20.2	311	22.5
55-70 years	131	11.6	141	10.2
Injury Type				
Contusion, abrasions, sprains, strains, dislocations	146	12.9	151	10.9
Whiplash	198	17.6	264	19.1
Fracture - other	126	11.2	126	9.1
Fracture - limb	365	32.4	416	30.1
Internal Injury	107	9.5	171	12.4
Mild Acquired Brain Injury	126	11.2	186	13.4
Other injuries	60	5.3	69	5.0
Socioeconomic Group				
Most disadvantaged (lowest 30%)	254	22.5	351	25.4
Middle (40-70%)	496	44.0	601	43.5
Most advantaged (highest 30%)	378	33.5	431	31.2
Severity Group				
Admitted to hospital with non-catastrophic injury	831	73.7	1135	82.1
Emergency or ambulance services but not admitted or discharged on the same day	131	11.6	102	7.4
Received no hospital, emergency or ambulance services	166	14.7	146	10.6

Note: 'Other injuries' includes paraplegia, spinal, amputation, burns, loss of sight, degloving, nerve damage and other injuries.

Injured individuals in the youngest age group (15-24 years) were almost 50% more likely to succeed at a GRTW than those aged 35-44 years (Table 4). Injured individuals with whiplash or internal injury or mild ABI had lower odds of having a successful GRTW.

Individuals with mild ABI were close to statistical significance for also having lower odds of having a successful GRTW. Those admitted to hospital with non-catastrophic injuries were

significantly more likely to fail or relapse following a GRTW than those who received no emergency or ambulance treatment. There appeared to be no statistically significant difference between sexes for successful GRTW. Socioeconomic group also had no significant impact.

Table 4: Odds of successfully returning to work from a graduated approach with no fail or relapse

	Odds ratio	Lower bound (2.5%)	Upper bound (97.5%)	p-value
Sex				
Female	Ref			
Male	1.14	0.96	1.35	0.12
Age Group				
15-24 years	1.45	1.13	1.85	<0.01
25-34 years	1.15	0.91	1.45	0.26
35-44 years	Ref			
45-54 years	1.02	0.80	1.31	0.84
55-70 years	1.29	0.96	1.73	0.09
Injury Type				
Contusions, abrasions, sprains, strains, dislocations	1.11	0.84	1.45	0.46
Whiplash	0.62	0.47	0.81	<0.01
Fracture - limb	Ref			
Fracture - other	1.11	0.83	1.49	0.47
Internal injury	0.73	0.55	0.96	0.03
Mild acquired brain injury	0.78	0.60	1.02	0.07
Other injuries	0.83	0.56	1.23	0.36
Socioeconomic Group				
Most disadvantaged (lowest 30%)	0.88	0.72	1.07	0.21
Middle (40-70%)	Ref			
Most advantaged (highest 30%)	1.10	0.91	1.33	0.31
Severity Group				
Admitted to hospital with non-catastrophic injury	0.48	0.36	0.64	0.00
Emergency or ambulance services but not admitted or discharged on the same day	1.02	0.72	1.45	0.89
Received no hospital, emergency or ambulance services	Ref			

Note: 'Other injuries' includes paraplegia, spinal, amputation, burns, loss of sight, degloving, nerve damage and other injuries. An odds ratio greater than 1 indicates higher odds of having a failed RTW compared with the reference.

Discussion

This study identified that nearly ten percent of injured individuals insured through a state-wide compulsory transport injury scheme transitioned back to full pre-injury work through a managed or unintended GRTW process. Return to work pathways following injury can take a number of different forms (Collie et al., 2018; Gray et al., 2018; McLeod et al., 2018). In a study by McLeod et al. (2018), there were 2,132 unique return to work trajectories taken by 81,062 injured people from workers' compensation in Canada (McLeod et al., 2018). These trajectories showed that injured workers often return to work in a modified capacity (e.g. reduced hours, alternative or modified duties, or both) prior to full return to work, and fail in return to work attempts, among others.

Return to work pathways and their success has been attributed to both injury type and severity (Collie et al., 2018; McLeod et al., 2018). Injury type in the present study was also significantly associated with different return to work pathways and success of GRTW, with lower odds of success observed among those with whiplash and internal injury. Whiplash is an overarching term to describe injury to the neck after sudden and vigorous movement to the head, and hence can range in symptoms and severity. Previous studies have found that due to variations in the individual's psychological state, symptoms, severity and occupation, there can be large differences in their RTW success (Adams et al., 2007; Gozzard et al., 2001). It is possible that any return to work, whether part or full time, could lead to fears of re-injury, supporting the finding that individuals with whiplash had lower odds of a successful GRTW (McClune et al., 2002). Whiplash-afflicted individuals have also been associated with having high levels of psychological distress, which can affect long-term outcomes including RTW (Sterling et al., 2005). Furthermore, any persistent clinical presentation of whiplash including neck pain, numbness, fatigue, dizziness and loss of balance may reduce an individual's capacity to perform their pre-injury role, and is true for both physical (e.g. tradesperson) and non-physical tasks (e.g. administration officer).

This study observed that those with comparatively minor injuries, such as contusions, abrasions, sprains and strains, were half as likely to GRTW, which is not surprising as they presumably return to their pre-injury working hours. However, given that all individuals have had at least six days off work (absence of at least five days to access income benefits and provided with at least one day of income benefit), these injuries have substantially affected the individuals. Whilst not statistically significant, odds of success were higher among those with contusions, abrasions, sprains, strains and dislocations. These results are supported by McLeod et al.'s study that found workers with sprains and strains were more likely to have favourable return to work outcomes than other injury types (McLeod et al., 2018).

As expected, the most severely injured group, who were admitted to hospital, were found to be more likely to have a gradual re-introduction to work. This group had 86% higher odds of GRTW, yet had 50% lower odds of a successful return to full capacity. It is likely that this group were either identified to benefit from a GRTW program or GRTW was necessary given their injuries, yet their GRTW has not been sustainable due to a number of possible factors. It is important to determine the right RTW outcome for the person at the right time, and it is possible that the GRTW program for some of these individuals was not appropriately designed or managed, leading to a relapse. In order to gradually achieve a sustainable return to work, there must be ongoing conversations between the employer and the injured individual to ensure consistent expectations (Høgelund et al., 2010). It can be argued, however, that in these cases GRTW can be labelled a success if the individual was able to retain work, despite relapsing at one or more stages, as in the end they have sustained a RTW. We were unable to determine return to work status after the follow-up period, however.

Whilst only approaching statistical significance, individuals with mild ABI had lower odds of a successful GRTW. This may be associated with persistent cognitive deficits (e.g. compromised attention, memory and executive functioning) and symptomatology that is experienced by a proportion of people with mild ABI for periods of longer than three months

(Holtslag et al., 2007), where up to 15% of this population experience ongoing functional impairments (Cancelliere et al., 2014). Individuals with mild TBI also experience greater psychological deficits after injury (e.g. anxiety, depression, social isolation). Mild ABI can result in productivity loss that may not be well understood initially, and may be difficult for an employer to accommodate (e.g., taking longer to think, poor concentration and slow reaction times). These problems, which may not have been evident at the time of beginning GRTW, could potentially lead to an inability to perform the pre-injury role in the same capacity (Theadom et al., 2017). Additionally, poorer odds of successful GRTW could be associated with inadequate employer support or lack of suitable RTW management. It is possible that individuals with mild ABI were not provided adequate support for their cognitive difficulties or psychological issues in the early stages of their return to work process even with a GRTW program (Silverberg et al., 2017), and were possibly returning to any or full-time work prior to being ready.

As found previously (Bethge, 2016), males were significantly less likely to GRTW. The present study, however, did not find statistically significant differences between sexes of obtaining a sustainable work outcome, which is contrary to previous studies that have found females are significantly more likely to relapse after returning to work following injury or illness (Baldwin et al., 1996; Berecki-Gisolf et al., 2012). This could suggest that males require greater assistance returning to work. There were no significant differences between ages with respect to GRTW, however it was found that injured individuals in the youngest age group were more likely to sustain employment after gradually returning to full time work.

One unexpected finding was that individuals in the most advantaged deciles were ten percent less likely to attempt a GRTW than those in the middle deciles, given that socioeconomic status may reflect the nature of the work and the greater likelihood of GRTW being possible in white-collar occupations. A possible explanation is that the TAC only covers up to a maximum of \$1,300 per week, and those in the most advantaged deciles may be opting to return to work on a full-time basis in order to earn their pre-injury income. There

was, however, no significant difference in the likelihood of success of GRTW between socioeconomic groups.

Use of the term 'unsuccessful' for GRTW with a relapse may be misleading. Return to work success can be measured and evaluated in a number of ways (Pransky, 2013). It is important to take into account how well an individual is doing after return to work, what work activities can be performed, and what future work prospects look like. From a vocational rehabilitation point of view, return to work can be labelled a success if in the long-term the injured individual has been able to retain their job at the right capacity, despite possible setbacks along the way. For instance, in one study, 44% of individuals injured in RTCs were not capable of returning to their pre-injury role, but were able to return to the same workplace in a different capacity (Fitzharris et al., 2010). This suggests that the degree of return to work success can often depend on whether the employer is able and willing to provide alternate or modified duties.

The major strength of this study is the use of a well-defined, population-based dataset. This study uses a novel approach to analysing the various return to work pathways that injured individuals may take by identifying patterns of return to work on a daily level. Analysis examined the impact of multiple predictors on the likelihood of GRTW and its success, providing insights and opportunities for future employment strategies.

There are limitations associated with this study, particularly the reliance of using income replacement data as a proxy for return to work. There were no variables in the dataset to definitely state that GRTW was followed, hence we were reliant on income replacement patterns to deduce RTW pathways. Further, in order to meet the criteria for a GRTW, a particular pattern had to be observed, and it is possible that this pattern does not apply to all individuals who attempted this. This study assumed that a resumption of full income replacement after a period on partial payments indicated a relapse, where in fact it could have been part of a pre-arranged agreement to gradually return an individual to work duties (e.g. one week back at work partially then off completely for a week), or a period of planned

treatment where work was not possible (e.g. surgery) (Berecki-Gisolf et al., 2012). Moreover, this cohort does not capture those who may have reached an agreement with their employer to initiate a GRTW without accessing compensation system income benefits. Additionally, there is a chance that injured individuals may not have been aware that they are able to access partial income payments during the GRTW process.

Specific bodily location (e.g. information on whether a fracture was to an arm or a leg) or injury severity information could not be factored into the regression models as this information is not recorded in the dataset, therefore it is unknown whether this would have an impact on GRTW outcomes. Likewise, this dataset did not have information on an individual's general health, which could give a more holistic picture of both the injuries sustained and the treatment that they are accessing (Cornes, 1992; Holtslag et al., 2007), and should be the focus of future research. Future research into those who failed to RTW at all in the follow-up period may also be beneficial.

Return to work or duration of work disability has long been measured using administrative data, which is considered a reasonable proxy for time spent away from work across a population (Krause et al., 1999). Common methods of estimating duration of work disability using administrative data include reporting the time on benefits during first episode of absence, the cumulative number of days on benefits, and estimated future benefits (Dasinger et al., 1999). Using the present study's novel approach of breaking down a injured individual's benefits by day represents an advance on previous studies that have used administrative data, by allowing greater detail into the varying patterns of return to work to be defined. Attaining more detailed information on work patterns post-injury may enable more appropriate service planning and response by healthcare providers, employers, insurers and the injured individual. Simply becoming aware that injured individuals follow different return to work pathways may be valuable, and may present greater opportunities to explore the use of GRTW as a means of supporting return to work.

Exploring alternative pathways to return to work and their success allows for compensation schemes, practitioners, policy makers, and injured people to understand how different approaches may be beneficial to different subgroups. This might involve introducing programs or incentives to encourage part-time return to work earlier in the recovery process, thereby reducing the period for which full income replacement benefits are paid, and increasing both the rehabilitation of the injured individual, and the sustainability of employment outcomes. The recommended key to success of GRTW programs is positive interactions between the injured individual, the employer, and sometimes the insurance scheme (Palmer et al., 2012; Young et al., 2005). These conversations should include when the GRTW is due to start, what tasks will be performed, the hours the individual will work, where the individual will work (e.g. at home or in the office) and what, if any, modifications can be made to the working environment (Anstis, 2014). Accommodations made by the employer to offset the functional limitations of the injured individual, which might include education and skill development or changing the worker's role, can help ensure a sustainable re-entry into the workforce (Butler et al., 1995). Further, it is important to put a plan in place regarding who will monitor the individual's progress, who they will report to should an issue arise, and how work tasks and working hours might change over time (Anstis, 2014).

Based on the results from this study there were some characteristics significantly associated with having undertaken GRTW, presenting opportunities to perhaps utilise this practice more widely.

Conclusion

This study of individuals injured in RTC and insured through a state-wide compulsory compensation scheme identified factors associated with the likelihood of both attempting a GRTW and succeeding. It found that females and those admitted to hospital were more likely to follow a GRTW pathway. The youngest were more likely to sustain return to work,

however those with whiplash, internal injury, mild ABI and those most severely injured (admitted to hospital) were most likely to relapse to full income replacement after a period back at work part time, or have a failed full return to work. This information may allow the identification of factors at the time of injury that may assist system regulators, insurers, employers and healthcare professionals to provide more specific support in order to achieve successful employment outcomes.

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