

Factors predicting work status 3 months after injury: results from the Prospective Outcomes of Injury Study

Rebecca Lilley,¹ Gabrielle Davie,¹ Shanthi Ameratunga,² Sarah Derrett¹

To cite: Lilley R, Davie G, Ameratunga S, *et al.* Factors predicting work status 3 months after injury: results from the Prospective Outcomes of Injury Study. *BMJ Open* 2012;**2**:e000400. doi:10.1136/bmjopen-2011-000400

► Prepublication history and additional materials for this paper are available online. To view these files please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2011-000400>).

Received 18 November 2011
Accepted 31 January 2012

This final article is available for use under the terms of the Creative Commons Attribution Non-Commercial 2.0 Licence; see <http://bmjopen.bmj.com>

¹Injury Prevention Research Unit, Department of Preventive and Social Medicine, Dunedin School of Medicine, University of Otago, Dunedin, New Zealand
²Section of Epidemiology and Biostatistics, School of Population Health, University of Auckland, Auckland, New Zealand

Correspondence to
Dr Rebecca Lilley; rebecca.lilley@ipru.otago.ac.nz

ABSTRACT

Objective: Few studies examine predictors of work status following injury beyond injuries presenting to a hospital or emergency department. This paper examines the combined influences of socio-demographic, occupational, injury and pre-existing health and lifestyle factors as predictors of work status 3 months after hospitalised and non-hospitalised injury in a cohort of injured New Zealand workers.

Design: Prospective cohort study.

Setting: The Prospective Outcomes of Injury Study, New Zealand.

Participants: 2626 workforce active participants were identified from the Prospective Outcomes of Injury Study; 11 participants with missing outcome responses were excluded.

Primary and secondary outcome measures: The primary outcome of interest was 'not working' at the time of interview.

Results: 720 (27%) reported 'not working' 3 months after injury. The most important pre-injury predictors of not working following injury found by multidimensional modelling were as follows: low or unknown income, financial insecurity, physical work tasks, temporary employment, long week schedules, obesity, perceived threat to life and hospital admission. Contrary to expectations, workers reporting less frequent exercise pre-injury had lower odds of work absence. Pre-injury psychosocial and health factors were not associated with not working.

Conclusion: Certain pre-injury socio-demographic, physical work, work organisation, lifestyle and injury-related factors were associated with not working 3 months after injury. If these findings are confirmed, intervention strategies aimed at improving return to work should address multiple dimensions of both the worker and the workplace.

BACKGROUND

A timely and sustainable return to work is a crucial rehabilitation outcome for workers following injury, as prolonged work absences result in significant personal and societal costs.^{1 2} Many studies investigating factors associated with work status following injury are restricted to particular injury types or

ARTICLE SUMMARY

Article focus

■ Previous examinations of predictors of work status following injury have focused primarily on hospitalised patients and a limited range of risk factors; this study examines multidimensional predictors of work status 3 months following hospitalised and non-hospitalised injuries.

Key messages

- While previous findings on socio-demographic and work factors were confirmed, a number of rarely examined variables were associated with increased odds of not working, including obesity, temporary employment, long day work schedules and financial insecurity.
- Contrary to expectations, workers who were infrequent exercisers prior to injury were more likely to be working after injury.
- This study identified a range of potential predictors of not working that, if causal, help identify workers at increased risk of not working 3 months after injury. If confirmed, intervention strategies should target these groups to reduce short-term work disability.

Strengths and limitations of this study

- The strengths of the study include the collection of pre-injury information, large sample size, inclusion of non-hospitalised and hospitalised injuries and the collection and combined multi-variable examination of a wide range of potential determinants of work status. Consequently, this study has generated new hypotheses for further examination.
- This study relies on self-reported survey data with baseline data collected retrospectively at the time of first interview: consequently, recall bias might occur. However, few of the pre-injury variables examined in this analysis are likely to be influenced by their status at the time of interview. The design of New Zealand's universal no-fault injury compensation system may limit the generalisability of study findings beyond similar systems. However, the universal nature of the New Zealand scheme allows the examination of predictors of work status in a broader population context of injury and work than previously examined.

body regions.^{3–6} Others have primarily focused on injuries resulting in a hospital emergency department visit or admission.^{3 4 7–13} Few studies have examined work status following injury outside a hospital recruitment setting.^{14 15} However, when considering the total burden of injury, many seemingly ‘minor’ injuries that do not result in hospitalisation, such as soft tissue injuries, can result in substantial time away from the workplace for rehabilitation and recovery.

Researchers investigating return to work following injury have used different times to follow-up and different risk factors, outcome measures and sample populations. However, despite these differences socio-demographic, clinical and occupational factors are commonly associated with work status following injury.^{16–18} The need for broader examination of potential determinants of work status using a biopsychosocial perspective in the trauma population was recently highlighted.¹⁸ For example, pre-injury health and lifestyle factors associated with return to work following lower back pain¹⁹ have rarely been examined, and there has been limited examination of potential psychosocial risk factors following injury.¹⁸ In New Zealand, research appears to have been limited to examining time on compensation in workers with chronic back pain.²⁰

New Zealand’s universal no-fault compensation scheme (administered by the Accident Compensation Corporation—ACC) provides the opportunity to examine determinants of work status for workers with compensated injuries sustained in a broader context. The aim of this paper was to examine the combined influences of socio-demographic, occupational, pre-existing health and lifestyle factors and injury, as predictors of work status 3 months following injury in a cohort of injured New Zealand workers.

METHODS

Study setting

The Prospective Outcomes of Injury Study (POIS) cohort was recruited via New Zealand’s no-fault, non-tortious ACC scheme. People were not eligible to participate if their injury was the result of self-harm or if their injury resulted in their being placed on ACC’s sensitive claims register (eg, sexual assault). POIS participants include those who consulted with a primary or secondary healthcare professional for an injury and then consequently were placed on ACC’s entitlement claims register. Each year, there are approximately 1.75 million injuries claims in New Zealand.²¹ Of these, 7% are placed on an entitlement claimants register because they are likely to require more than simple medical treatment. For example, people likely to require a week or more off work or home support and/or rehabilitation are placed on this register. POIS participant’s injuries were variously sustained in recreational, road, home, public and workplace settings. Injured people living in one of five regions of New Zealand aged 18–65 years, who had sustained an injury between June 2007 and May

2009, identified via the ACC scheme entitlement claims register were eligible for inclusion. The recruitment process and resulting cohort has been described in detail elsewhere.^{22 23}

Data collection and explanatory variables

Between December 2007 and August 2009, 2856 participants were recruited.²³ Of these, 2626 (92%) responded that they were working for pay (‘workforce active’) prior to their injury, and they are the cohort presented in this paper. Of the 2626 POIS participants who were workforce-active pre-injury, 11 were missing responses to the work status question at the 3 month post-injury survey and were excluded from this investigation. Of the remaining 2615 workers, 720 (27%) reported not working at the time of interview (median time to interview was 3.4 months after injury; IQR: 2.5–4.1 months). Self-reported data, including pre-injury characteristics, were mainly collected by telephone interview (89%) and postal survey (11%), on average, 3 months following injury.

All explanatory variables are pre-injury measures retrospectively collected at the 3 month interview, with the exception of the injury-related variables, which relate to the injury event itself. Each explanatory variable was selected on the basis of an a priori hypothesis of a relationship with not working following injury and/or having been identified in previous studies.^{18 19} These measures, assessed at interview, have been grouped into seven dimensions:

1. Socio-demographic (age, gender, income, highest qualification, occupation, relationship status, living arrangements, material standard of living, adequacy of household income, financial security).
2. Physical work (repetitive hand movements, heavy lifting, physical exertion, standing or working in painful/tiring body positions).
3. Psychosocial (job strain, job support, job security, job satisfaction, optimism, self-efficacy, prior depressive episode).
4. Work organisational (hours of work, number of days worked per week, employment contract, multiple job holding).
5. Lifestyle (alcohol consumption, current smoking status, body mass index (BMI), exercise, sleep quantity).
6. Health (overall self-assessment for health, comorbidities, pain or discomfort, prior injury, prior disabling condition, work capacity).
7. Injury-related (work-related injury, intent of injury, hospital admission, injury a threat to life, injury a threat of serious disability, access to health services).

For more detailed information about the explanatory variables, see online appendix 1.

Outcome

Work status was assessed using a single item ‘Are you back at work following your injury?’ (yes, no). A participant was considered to be working at time of interview,

regardless of whether they were working with their pre-injury employer, a new employer or working under modified working conditions, such as reduced work hours. The majority (82%) of the cohort have had a week, or more, off work and received earnings-related compensation from the ACC scheme. The remainder may have had less time off work or been ineligible for earnings-related compensation. Not being in work at the time of interview is referred to in this paper as not working.

Data analysis

Frequency tables, summary statistics and binary logistic regression analyses were used to examine the relationship between not working and pre-injury characteristics and injury-related factors.

Initially, dimensional models were built using multivariable logistic regression analyses of all study variables within each of the seven dimensions simultaneously entered into individual models. Age, gender, hospital admission, body region injured and nature of injury were included in all models as potential confounders. Based on participants' descriptions body region injured (lower extremities, upper extremities, head and neck, spine and back, torso and multiple body regions) and nature of injury (fractures, sprains and strains, concussion, open wound/amputations, contusion/superficial, other single injury type and multiple injury types) were assigned using a modified version of the Barell Matrix.²⁴ Time since injury was included as a continuous variable into all analyses to account for the range in the timing of interviews after the injury event.

An overall multidimensional model was built by entering explanatory variables from each of the seven dimension models showing an association of $p < 0.20$ with not working as independent variables. Backward stepwise elimination (criteria $p < 0.10$) was used to select the final variables for inclusion. Post hoc testing of model using the Hosmer and Lemeshow goodness of fit test and area under the curve was undertaken to assess model fit. Analyses were performed using STATA statistical package V.11.1.

Ethics

Ethical approval for this study was obtained from the New Zealand Multi-Region Ethics Committee. Informed consent was obtained from all participants.

RESULTS

The mean age of participants was 41 years (SD 13 years). The majority of the cohort are male (63%), had post-secondary qualifications (60%) and were employees (85%) (see online table 1). The median annual personal income was \$45 000. Annual personal income was not provided by 16% of participants. The predominant injury type was multiple injury types (39%), followed by sprains and strains (26%) and fractures (17%). The lower (37%) and upper extremities (28%) were the most

frequent body regions injured, followed by multiple injury regions (18%). Thirty per cent of the cohort reported hospital admission, while a further 36% reported attending an Emergency Department (without hospital admission).

Table 1 shows the dimension-specific multivariable analyses in relation to not working 3 months after injury. The following pre-injury variables had p values < 0.20 in the dimension-specific logistic regression modelling: socio-demographics (age, gender, highest qualification, income, occupation, relationship status, adequacy of household income, financial security); physical work (repetitive hand movements, heavy lifting, painful/tiring body positions, standing); psychosocial (job strain, job support, job security, prior depressive episode); work organisational (hours of work, number of days worked per week, employment contract); lifestyle (current smoking status, BMI, exercise, sleep quantity); health (comorbidities, prior injury, pain or discomfort); injury-related (work-related injury, injury a threat to life, intent of injury, hospital admission).

In order to identify the strongest predictors of not working across all dimensions, all these variables were entered in a multivariable logistic regression analysis.

Table 2 presents the overall multidimensional logistic regression model identifying the strongest (as defined by the variable p value < 0.10) predictors of not working 3 months after injury. Several socio-demographic factors were associated with greater odds of not working including: workers with a low personal income, those who gave no income, workers with a blue collar occupation and those reporting financial insecurity. While age was significantly associated with not working as a term, no individual age category was at significantly higher odds of not working compared to the reference of 18–24-year-olds. Physical work conditions associated with increased odds of not working included those working in painful/tiring or standing positions at work. Unlike the bivariate analysis, the association between not working and repetitive hand movements was not significant in the physical work factor model; however, it remains in the overall multidimensional model as it fits the backwards stepwise elimination criteria ($p < 0.10$). Several work organisational factors were associated with greater odds of not working: workers with temporary/casual employment contracts compared to those with permanent contracts and workers with long week work schedules compared to those working ≤ 5 days.

While the overall BMI term did not have a significant association with not working in the overall model, obesity was significantly associated with increased odds of not working compared to the reference of normal BMI. The lifestyle factors of lower pre-injury exercise frequency were associated with reduced odds of not working. The other lifestyle factor pre-injury sleep was not associated with working status but remains in the

Table 1 Dimension-level multivariable analyses for not working 3 months after injury

Dimension model variable	Adjusted* OR (95% CI)	p Value
Model 1: pre-injury socio-demographic factors (n=2368)		
Age, years		
18–24	Ref	0.05
25–34	0.72 (0.49 to 1.05)	
35–44	1.12 (0.77 to 1.63)	
45–54	1.07 (0.73 to 1.57)	
55–64	0.94 (0.62 to 1.42)	
Gender		
Male	Ref	0.2
Female	0.87 (0.69 to 1.11)	
Highest qualification		
Post-secondary qualifications	Ref	0.01
Secondary qualifications	0.98 (0.77 to 1.24)	
No formal qualifications	1.44 (1.09 to 1.89)	
Income		
≥\$50 001	Ref	<0.001
\$30 001–\$50 000	1.24 (0.95 to 1.61)	
≤\$30 000	1.81 (1.33 to 2.48)	
No income given	2.24 (1.63 to 3.07)	
Occupation		
White collar	Ref	<0.001
Pink collar	1.26 (0.94 to 1.68)	
Blue collar	2.15 (1.65 to 2.81)	
Unclassified	1.14 (0.59 to 2.17)	
Relationship status		
Married/de facto/civil union	Ref	0.1
Never married	1.17 (0.84 to 1.62)	
Separated/divorced	1.34 (0.92 to 1.94)	
Widowed	2.19 (0.94 to 5.12)	
Living arrangements		
Living alone	Ref	0.3
Living with familial other	1.31 (0.87 to 1.96)	
Living with non-familial other	1.37 (0.84 to 2.22)	
Adequacy of household income		
Sufficient	Ref	0.1
Insufficient	1.17 (0.94 to 1.47)	
Material standard of living		
High/fairly high	Ref	0.4
Medium	1.08 (0.87 to 1.35)	
Fairly low/low	0.82 (0.49 to 1.35)	
Financial security		
Secure/fairly secure	Ref	<0.001
Fairly insecure/insecure	1.55 (1.22 to 1.96)	
Model 2: pre-injury physical work factors (n=2509)		
Repetitive hand movements		
Never	Ref	0.09
Occasionally/sometimes	0.78 (0.55 to 1.13)	
¼ to ½ the time	0.77 (0.55 to 1.06)	
¾ of time or greater	1.03 (0.78 to 1.36)	
Heavy lifting		
Never	Ref	0.05
Occasionally/sometimes	1.29 (0.98 to 1.72)	
¼ to ½ the time	1.37 (0.99 to 1.89)	
¾ of time or greater	1.66 (1.15 to 2.38)	
Painful/tiring body positions		
Never	Ref	0.001
Occasionally/sometimes	1.17 (0.91 to 1.51)	
¼ to ½ the time	1.96 (1.44 to 2.65)	
¾ of time or greater	1.61 (1.16 to 2.24)	

Continued

Table 1 Continued

Dimension model variable	Adjusted* OR (95% CI)	p Value
Standing		
Never	Ref	>0.001
Occasionally/sometimes	1.65 (1.08 to 2.54)	
¼ to ½ the time	1.32 (0.87 to 1.99)	
¾ of time or greater	2.03 (1.38 to 2.96)	
Physical exertion		
Never	Ref	0.6
Occasionally/sometimes	1.18 (0.88 to 1.59)	
¼ to ½ the time	1.08 (0.78 to 1.49)	
¾ of time or greater	1.19 (0.86 to 1.65)	
Model 3: pre-injury psychosocial factors (n=2362)		
Job strain		
Low strain	Ref	>0.001
Active	0.88 (0.66 to 1.17)	
Passive	1.37 (1.02 to 1.83)	
High strain	1.52 (1.13 to 2.02)	
Job support		
Quartile 1—high	Ref	0.03
Quartile 2	0.65 (0.46 to 0.94)	
Quartile 3	0.73 (0.57 to 0.94)	
Quartile 4—low	0.80 (0.61 to 1.04)	
Job security		
Very secure	Ref	0.03
Secure	1.27 (1.02 to 1.59)	
Insecure/very insecure	1.46 (1.02 to 2.10)	
Job satisfaction		
Completely/mostly satisfied	Ref	0.4
Neither satisfied nor dissatisfied	0.85 (0.61 to 1.20)	
Mostly/completely dissatisfied	0.80 (0.51 to 1.26)	
Self-efficacy		
Good	Ref	0.2
Poor	0.80 (0.56 to 1.14)	
Optimism		
Yes	Ref	0.5
No	1.09 (0.81 to 1.47)	
Prior depressive episode		
No	Ref	0.03
Yes	1.27 (1.02 to 1.59)	
Model 4: pre-injury work organisational factors (n=2518)		
Hours of work		
≤30	Ref	0.004
31–45	0.84 (0.63 to 1.14)	
45–65	0.86 (0.61 to 1.22)	
≥66	1.32 (0.72 to 2.44)	
Number of days worked per week		
≤5	Ref	>0.001
6–7	1.68 (1.31 to 2.15)	
Employment contract		
Employee—permanent	Ref	>0.001
Employee—temporary/casual	2.25 (1.58 to 3.20)	
Employee—fixed term	1.51 (0.98 to 2.35)	
Employee—other contract types	1.50 (0.76 to 2.98)	
Self-employed	1.20 (0.87 to 1.66)	
Employer	0.70 (0.44 to 1.12)	
Multiple job holding		
Yes	Ref	0.8
No	1.04 (0.74 to 1.45)	

Continued

Table 1 Continued

Dimension model variable	Adjusted* OR (95% CI)	p Value
Model 5: pre-injury lifestyle factors (n=2445)		
Alcohol consumption		
Low	Ref	0.6
High	0.95 (0.77 to 1.18)	
Current smoking status		
No	Ref	0.009
Yes	0.76 (0.62 to 0.93)	
Body mass index		
≤24	Ref	>0.001
25–29	1.24 (0.99 to 1.56)	
≥30	1.61 (1.26 to 2.05)	
Exercise (days per week)		
5–7 days	Ref	>0.001
≤4 days	0.63 (0.52 to 0.76)	
Sleep quantity (per week)		
5–7 nights obtaining ≥7 h sleep	Ref	0.1
≤4 nights obtaining ≥7 h sleep	0.85 (0.68 to 1.07)	
Model 6: pre-injury health factors (n=2426)		
Overall self-assessment for health		
Excellent/very good	Ref	0.4
Good/fair/poor	0.91 (0.73 to 1.13)	
Comorbidities		
No comorbidities	Ref	0.06
1 comorbidities	0.82 (0.66 to 1.04)	
2 or more comorbidities	1.14 (0.87 to 1.48)	
Prior injury		
No	Ref	0.1
Yes	0.82 (0.63 to 1.06)	
Prior disabling condition		
No	Ref	0.7
Yes	1.04 (0.77 to 1.40)	
Pain or discomfort		
None	Ref	0.1
Moderate	1.00 (0.70 to 1.43)	
Extreme	3.46 (0.93 to 12.78)	
Work capacity		
High (≥7)	Ref	0.9
Low (<7)	1.01 (0.48 to 2.11)	
Model 7: injury-related factors (n=2509)		
Work-related injury		
No	Ref	>0.001
Yes	1.46 (1.21 to 1.78)	
Intent of injury event		
No	Ref	0.07
Yes—assaultive	1.55 (0.96 to 2.50)	
Injury a threat to life		
No	Ref	>0.001
Yes/may be	1.94 (1.45 to 2.58)	
Injury a threat of serious disability		
No	Ref	0.9
Yes/may be	1.00 (0.82 to 1.21)	
Hospital admission		
No	Ref	>0.001
Yes	1.74 (1.42 to 2.13)	
Access to health services		
No difficulties accessing	Ref	0.7
Difficulties accessing	0.95 (0.70 to 1.29)	

*All dimension-level models were adjusted for age, gender, hospital admission, body region injured, nature of injury and time since injury.

Table 2 Significant independent predictors of not working 3 months following injury (n=2250)

Explanatory variable	Work absent (n=609), N	Adjusted* OR (95% CI)	p Value
Socio-demographic			
Age			
18–24	95	Ref	0.004
25–34	96	0.73 (0.50 to 1.07)	
35–44	146	1.23 (0.85 to 1.78)	
45–54	172	1.33 (0.92 to 1.91)	
55–64	100	1.28 (0.86 to 1.91)	
Gender			
Male	424	Ref	0.5
Female	185	0.93 (0.72 to 1.20)	
Income			
≥\$50 000	140	Ref	<0.001
\$30 001–\$50 000	208	1.16 (0.88 to 1.53)	
≤\$30 000	149	1.52 (1.09 to 2.12)	
Refused to give income	112	2.11 (1.49 to 2.98)	
Financial security			
Secure/fairly secure	436	Ref	0.006
Fairly insecure/insecure	173	1.41 (1.10 to 1.80)	
Occupation			
White collar	146	Ref	0.01
Pink collar	120	1.04 (0.76 to 1.42)	
Blue collar	331	1.52 (1.14 to 2.02)	
Unclassified	12	0.96 (0.46 to 2.01)	
Physical work			
Painful/tiring body positions			
Never	216	Ref	<0.001
Occasionally/sometimes	168	1.33 (1.01 to 1.74)	
¼–½ the time	116	2.12 (1.54 to 2.92)	
¾ of time or greater	109	1.93 (1.38 to 2.72)	
Standing			
Never	42	Ref	<0.001
Occasionally/sometimes	66	1.92 (1.20 to 3.07)	
¼–½ the time	91	1.60 (1.03 to 2.49)	
¾ of time or greater	410	2.25 (1.51 to 3.34)	
Repetitive hand movements			
Never	104	Ref	0.03
Occasionally/sometimes	71	0.69 (0.46 to 1.02)	
¼–½ the time	107	0.76 (0.53 to 1.09)	
¾ of time or greater	327	1.04 (0.76 to 1.42)	
Work organisation			
Employment contract			
Permanent	410	Ref	0.02
Temporary	64	1.89 (1.27 to 2.81)	
Fixed term	32	1.43 (0.87 to 2.33)	
Other or no formal contract	12	1.62 (0.73 to 3.59)	
Self-employed	62	1.10 (0.76 to 1.59)	
Employer	29	0.82 (0.49 to 1.36)	
Number of days worked per week			
≤5 days per week	419	Ref	<0.001
6–7 days per week	190	1.54 (1.21 to 1.96)	
Lifestyle			
Body mass index			
Under/normal weight (≤24)	193	Ref	0.01
Over weight (25–29)	238	1.18 (0.92 to 1.51)	
Obese (≥30)	178	1.48 (1.13 to 1.94)	
Sleep quantity (nights ≥7 h sleep)			
5–7 nights	475	Ref	0.06
≤4 nights	134	0.79 (0.61 to 1.01)	

Continued

Table 2 Continued

Explanatory variable	Work absent (n=609), N	Adjusted* OR (95% CI)	p Value
Exercise (days per week)			
5–7 days	392	Ref	<0.001
≤4 days	217	0.67 (0.54 to 0.83)	
Injury			
Hospital admission			
No	369	Ref	<0.001
Yes	240	2.10 (1.66 to 2.64)	
Self-perceived threat to life			
No	505	Ref	<0.001
Yes/may be	104	1.90 (1.38 to 2.62)	

*Adjusted for body region injured, nature of injury and time since injury.

model as it fits the model criteria. Injury-related factors associated with increased odds of not working that remained in the overall multidimensional model were: those workers who perceived their injury was a threat to their life and those who were admitted to hospital following their injury. None of the psychosocial or health factor variables examined in this study remained in the overall multidimensional model. Diagnostic testing of the overall model indicated that goodness of fit was acceptable ($\chi^2=2279$, $p=0.13$), and the model had good accuracy in correctly discriminating if a worker was absent from work (area under curve=0.76).²⁵ The pseudo R^2 was 0.1533.

DISCUSSION

This paper presents evidence regarding pre-injury predictors of not working 3 months after injury. The injuries sustained by this cohort were sufficient enough to potentially warrant at least 1 week of entitlement compensation. The multivariable multidimensional model confirmed a set of important pre-injury predictors of not working 3 months following injury. Specifically, our analysis confirmed previous findings that certain socio-demographic, work and injury factors predict work status. This study also broadened the focus to examine dimensions rarely examined previously and found work organisation and lifestyle factors were also important predictors of work status. Psychosocial factors were suggested in prior studies to be an important predictor of working after injury^{17 18}; however, of the pre-injury psychosocial variables examined in this study, none were found to be important in predicting work status. Our study simultaneously controlled for a broader range of determinants than have previously been investigated by researchers examining the association between psychosocial variables and work status, and this may offer one explanation why there was a lack of association between psychosocial factors and work status in our study. Health-related factors, rarely examined previously, were not found to be important predictors of work status. Our findings further confirm the need for future studies to examine a broader range of determinants and assess the relative importance of these for work disability.¹⁸

Our findings are consistent with many studies that demonstrate a relationship between work status and economic security,^{16–18} with low-income workers most likely to be absent from work compared with high-income workers. Additionally, those who did not provide income for the income variable were more likely to be absent from work. Further descriptive analysis, not presented here, found that these workers were most likely to be on employment contracts that result in fluctuating work patterns, suggesting that these workers may find it difficult to provide an estimate of their annual personal income. Financial insecurity, a marker of future economic security, was associated with not working. While financial insecurity is a predictor of health outcomes,²⁶ there has been little examination of financial insecurity in relation to work status following injury. Financial insecurity is thought to influence mental health outcomes through anxiety generated by feelings of future economic insecurity.²⁶ This potential pathway needs further examination with regard to work status.

Occupational factors were important predictors of not working in our study. Previous studies using various occupational classification schemes or categorisations across have reported mixed findings regarding occupation.^{17 18} In our study, a blue collar occupation had a higher likelihood of not working. Our findings are consistent with previous cohort studies reporting blue collar workers as less likely to have returned to work following injury adding further strength to the evidence for a causal relationship.^{17 18} Physical work tasks involving painful/tiring body positions or standing were at increased likelihood of not working. Exposure to physical work tasks or blue collar work in general are commonly associated with an increased risk of not working following injury.^{17 18} However, specific ergonomic hazards are rarely examined with regard to work status and our study identifies potentially modifiable workplace ergonomic hazard exposures that are associated with not working.

Aspects of work organisation are rarely examined in injury populations, and our study found two important groups of workers at increased likelihood of not working:

temporary and long week workers. Temporary employees have the poorest social and employment protections, working conditions and higher risk of unemployment when compared with the permanent workforce.²⁷ Our finding that workers with temporary employment were more likely to be not working compared to those in other types of employment possibly reflects difficulties for employees in: retaining their jobs following injury, negotiating a modified return to work or in obtaining new employment in a tight labour market. Studies examining long-term sickness absence report lower rates of absence for temporary employees, suggesting that poor social protections are a key determinant of sickness absence-taking behaviour.^{28–29} Further examination of potential social and material pathways through which temporary employment can impinge upon the return to work process is warranted. Long week work schedules also predicted not working. While long week work schedules have not specifically been found to be associated with not working that we are aware of, other non-standard work schedules, such as long day work schedules, have been reported to disrupt a full return to work following workplace injury.³⁰

Our study found that obese workers were more likely to not be working 3 months following injury. Increasingly, studies are showing relationships between obesity and illness-related work disability.^{31–33} However, few studies have investigated the impact of pre-injury obesity on work status following injury.³¹ Obesity is often associated with a long list of chronic health conditions, and while this multivariable analysis examined the presence of comorbidities, more specific examination is needed to explain our findings.

Contradictory to expectations those who had higher levels of exercise prior to injury were less likely to have returned to work in our study. Our findings differ to those of a study demonstrating those with moderate fitness prior to injury are more likely to have returned to work 3 months following a whiplash injury.³⁴ Those workers used to getting regular exercise prior to their injury may have experienced a substantial change in their exercise patterns as a consequence of their injury. Conceivably, they may have to cope with fewer exercise opportunities—with possible impacts on their ability to work. This may not be occurring to the same extent among workers already used to irregular exercise before injury.

Two injury-related factors were strongly associated with increased odds of not working: workers who perceived that their injury was a threat to their life and those whose injury resulted in hospital admission. While it might be reasonable to explain these observations by considering injury severity, examination of hospital admission and threat to life within our cohort found the two variables were measuring independent effects. Perceived threat to life is strongly associated with post-traumatic stress disorder,³⁵ and post-traumatic stress disorder has been found to be strongly associated with failure to work

following injury.^{36–37} Further work to examine potential pathways of effect is required. Our finding that hospital admission predicts not working 3 months following injury corroborates previous findings in the few studies to include non-hospitalised injuries that report that intensive care admission and length of hospital stay predicts work status.⁹

The findings from our multidimensional analysis of a wide spectrum of injuries indicate interventions to improve opportunities for working in the short-term following injury need to target a broad range factors. As we have found some previously unreported findings, these will need to be confirmed with additional research. However, our findings indicate some self-reported pre-injury measures of socio-demographic, workplace and lifestyle-related factors could be used to identify individuals with increased odds of not working 3 months after injury. This paper identifies a number of pre-injury factors, which are potentially amenable to primary intervention, such as workplace hazard exposures, obesity and physical exercise. For example, workplace physical activity interventions have been shown to improve worksite outcomes, such as sick leave.³⁸ If confirmed, our findings would suggest that primary workforce interventions focusing on lifestyle-related factors may contribute to a reduction in rates of not working 3 months following injury, as well as contributing to maintaining a healthy and productive workforce.

The strengths of the study include the collection of pre-injury information, large sample size, inclusion of traditionally conceived 'less severe' non-hospitalised injuries and the collection and combined multivariable examination of a wide range of potential determinants of work status. Consequently, we have found a number of important and previously unreported associations generating new hypotheses for further examination. There are a few limitations to our study. This study relies on self-reported survey data with baseline data collected retrospectively at the time of first interview: consequently, recall bias might occur. However, workers were specifically directed to consider their pre-injury exposures, and few of the pre-injury variables examined in this analysis are likely to be influenced by their status at the time of interview. The exception to this are the psychosocial factors that may be subject to recall bias. If so, this could have contributed to a lack of relationship between psychosocial factors and not working following injury. Recall of the baseline pre-injury work status at the 3 month interview may be subject to recall bias. However, verification of employment status with ACC claims records indicates the likelihood of this is low with 1% of participants having a non-concordant employment status between the self-reported and claims record data. The use of single-item measures for psychological constructs, such as job satisfaction and optimism, is a potential limitation to this study. However, parsimonious measures have been found to demonstrate good reliability and validity. Furthermore, we were concerned to minimise

participant interview burden (the interview took 60 min to complete). A further limitation is the design of New Zealand's no-fault ACC compensation system meaning that the findings of this study are potentially not generalisable beyond no-fault compensation systems. However, the no-fault nature of ACC is also a strength of our study. In other injury-compensation systems, where people are required to litigate to gain access to compensation following injury, incentives may exist such that people would be ill-advised to return to work prior to their legal case for compensation coming before the court. Recruiting participants, via the universal no-fault ACC scheme does not allow us to examine work status outcome in relation to whether or not people were granted access to ACC. There may be injured New Zealanders, not included in our study, who did not access medical support from a health professional for their injury (a necessary requirement to become registered with ACC), or, who were not referred to ACC by a health professional. There is moderate evidence that the receipt and extent of compensation has a negative effect upon returning to work following injury in healthcare systems where only certain causes of injury receive compensation, such as those caused by a motor vehicle traffic crash or while at work.^{4 39} However, it is a strength of the study that the universal nature of this scheme allows us to examine predictors of work status in the short-term in a broader population context of injury and work than previously examined.

In conclusion, this study indicates a number of pre-injury socio-demographic, occupational and lifestyle factors, as well as injury factors, were associated with not working 3 months after injury in a sample of New Zealand workers. This study confirms that the predictors of work status following injury are multidimensional and that future studies need to examine a broader range of determinants for work disability. If these findings are confirmed, intervention strategies aimed at identifying workers at increased risk of not working and improving work status in the short-term following injury should address multiple dimensions of the worker and workplace.

Acknowledgements We are most grateful to the study participants for sharing their information with us. We thank Professor John Langley, Associate Professor Colin Cryer and Natalie Hardaker for their helpful comments on an earlier draft of this paper.

Contributors RL was the lead author and is guarantor of this paper. RL and GD analysed the data. All authors contributed to the study design, interpretation of the results and the review and editing of the manuscript. All authors approved the submitted manuscript.

Funding This study is funded by the Health Research Council of New Zealand (2007–2013) and was co-funded by the Accident Compensation Corporation, New Zealand (2007–2010) (ID 10/052). RL was supported by an Accident Compensation Corporation Early Career Post Doctoral Award (2007–2010) (ID 07/049). The views and conclusions in this paper are of the authors' and may not reflect those of the funders. The funders of this project provided funding for salary and working expenses and had no input in the study design, data collection, data analysis or interpretation with the sole exception of the Accident Compensation Corporation who provided the initial sampling list.

Competing interests None declared.

Ethics approval The ethics approval was provided by New Zealand Multiregional Ethics Committee.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement We have a data sharing policy and would consider requests on a case by case basis.

REFERENCES

- Dembe AE. The social consequences of occupational injuries and illnesses. *Am J Ind Med* 2001;40:403–17.
- Crichton S, Stillman S, Hyslop D. Returning to Work from Injury: longitudinal evidence on employment and earnings (update). Wellington, NZ: Statistics New Zealand, 2005:12.
- MacKenzie EJ, Bosse MJ, Kellam JF, *et al.* Early predictors of long-term work disability after major limb trauma. *J Trauma Inj Infect Critic Care* 2006;61:688–94.
- MacKenzie EJ, Morris JA Jr, Jurkovich GJ, *et al.* Return to work following injury: the role of economic, social and job-related factors. *Am J Public Health* 1998;88:1630–7.
- Krause JS, Kewman E, DeVivo MJ, *et al.* Employment after spinal cord injury: an analysis of cases from the Model Spinal Cord Systems. *Arch Phys Med Rehabil* 1999;80:1492–1500.
- Yasuda S, Wehman P, Targett P, *et al.* Return to work for persons with traumatic brain injury. *Am J Phys Med Rehabil* 2001;80:852–64.
- Vles W, Steyerberg EW, Essink-Bot ML, *et al.* Prevalence and determinants of disabilities and return to work after major trauma. *J Trauma Inj Infect Critic Care* 2005;58:126–35.
- Clay FJ, Newstead SV, Watson WL, *et al.* Determinants of return to work following non-life-threatening acute orthopaedic trauma: a prospective cohort study. *J Rehabil Med* 2010;42:162–9.
- Meerding WJ, Looman CW, Essink-Bot ML, *et al.* Distribution and determinants of health and work status in a comprehensive population of injury patients. *J Trauma Inj Infect Critic Care* 2004;56:150–61.
- Mason S, Wardrope J, Turpin G, *et al.* Outcomes after injury: a comparison of workplace and nonworkplace injury. *J Trauma Inj Infect Critic Care* 2002;53:98–103.
- Holtslag HR, Post MW, van der Werken C, *et al.* Return to work after major trauma. *Clin Rehabil* 2007;21:373–83.
- Lundgaard Soberg H, Finset A, Bautz-Holter E, *et al.* Return to work after severe multiple injuries: a multidimensional approach on status 1 and 2 years postinjury. *J Trauma Inj Infect Critic Care* 2007;62:471–81.
- Fitzharris M, Bowman D, Ludlow K. Factors associated with return-to-work and health outcomes among survivors of road crashes in Victoria. *Aus NZ J Public Health* 2010;34:153–9.
- Kenny DT. Returning to work after workplace injury: impact of worker and workplace factors. *J App Rehabil Couns* 1998;29:13–19.
- He Y, Hu J, Yu IT, *et al.* Determinants of return to work after occupational injury. *J Occup Rehabil* 2010;20:378–86.
- Burger H, Marincek C. Return to work after lower limb amputation. *Disabil Rehabil* 2007;29:1323–9.
- Turner JA, Franklin G, Turk DC. Predictors of chronic disability in injured workers: a systematic literature synthesis. *Am J Ind Med* 2000;38:707–22.
- Clay FJ, Newstead SV, McClure RJ. A systematic review of early prognostic factors for return to work following acute traumatic trauma. *Injury, Int J Care Injured* 2010;41:787–803.
- Krause N, Frank JW, Dasinger LK, *et al.* Determinants of duration of disability and return-to-work after work-related injury and illness: challenges for future research. *Am J Ind Med* 2001;40:464–84.
- Fransen M, Woodward M, Norton R, *et al.* Risk factors associated with the transition from acute to chronic occupational back pain. *Spine (Phila Pa 1976)* 2002;27:92–8.
- Accident Compensation Corporation. *Annual Report 2009*. Wellington, NZ: Accident Compensation Corporation, 2009.
- Derrett S, Langley J, Hokowhitu B, *et al.* Prospective outcomes of injury study. *Inj Prev* 2009;15:e3.
- Derrett S, Langley J, Hokowhitu B, *et al.* Prospective Outcomes of Injury Study: changes to design and characteristics of the cohort. *Inj Prev* 2011;17:415–18.
- Barell VL, Aharonson-Daniel L, Fingerhut LA, *et al.* An introduction to the Barell body region by nature of injury diagnosis matrix. *Inj Prev* 2002;8:91–6.
- Tape G. *Interpreting Diagnostic Tests*, 2010. 2010. <http://gim.unmc.edu/dxtests/roc3.htm>
- Ferrie JE, Shipley MJ, Stansfeld SA, *et al.* Future uncertainty and socioeconomic inequalities in health: the Whitehall II study. *Soc Sci Med* 2003;57:637–46.

27. Benach J, Muntaner C. Precarious employment and health: developing a research agenda. *J Epidemiol Community Health* 2007;61:276–7.
28. Ferrie JE, Westerlund H, Virtanen M, *et al.* Flexible labor markets and employee health. *Scand J Work Environ Health* 2008;(Supp 6):98–110.
29. Tompa E, Scott-Marshall H, Fang M. Social protection and the employment contract: the impact on work absence. *Work* 2010;37:251–60.
30. Dembe AE, Delbos R, Erickson JB, *et al.* Associations between employees' work schedules and the vocational consequences of workplace injuries. *J Occ Rehabil* 2007;17:641–51.
31. Schulte PA, Wagner GR, Downes A, *et al.* A framework for the concurrent consideration of occupational hazards and obesity. *Ann Occup Hyg* 2008;52:555–66.
32. Neovius K, Johansson K, Kark M, *et al.* Obesity status and sick leave: a systematic review. *Obes Rev* 2008;10:17–27.
33. Robroek AJ, van den Berg TI, Plat JF, *et al.* The role of obesity and lifestyle behaviours in a productive workforce. *Occ Environ Med* 2011;68:134–9.
34. Geldman M, Moore A, Cheek L. The effect of pre-injury physical fitness on the initial severity and recovery from whiplash injury, at six-month follow-up. *Clin Rehabil* 2008;22:364–76.
35. Holbrook TL, Hoyt DB, Stein MB, *et al.* Perceived threat to life predicts posttraumatic stress disorder after major trauma: risk factors and functional outcome. *J Trauma Inj Infect Crit Care* 2001;51:287–92.
36. Zatzick D, Jurkovich GJ, Rivara FP, *et al.* A national US study of posttraumatic stress disorder, depression, and work and functional outcomes after hospitalization for traumatic injury. *Ann Surg* 2008;248:429–35.
37. Opsteegh L, Reinders-Messelink HA, Schollier D, *et al.* Determinants of return to work in patients with hand disorders and hand injuries. *J Occ Rehabil* 2009;19:245–55.
38. Conn VS, Hafdahl AR, Cooper PS, *et al.* Meta-analysis of workplace physical activity interventions. *Am J Prev Med* 2009;37:330–9.
39. Gabbe BJ, Cameron PA, Williamson OD, *et al.* The relationship between compensable status and long-term patient outcomes following orthopaedic trauma. *Med J Aust* 2007;187:14–17.