Migrants and disability following injury: findings from a prospective study in New Zealand

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Abstract

Objectives: To compare the prevalence of disability between migrants and non-migrants at three and 24 months post-injury, and to identify key predictors of post-injury disability among migrants.

Methods: Disability among 2,850 injured participants, including 677 migrants to New Zealand, was measured prospectively using the World Health Organization Disability Assessment Schedule.

Results: Migrants experienced higher risk of disability than non-migrants at three months post-injury (aRR=1.14, 95%CI 1.03–1.26). Both groups had similar disability prevalence, but higher than pre-injury, at 24 months. For migrants, strong predictors of disability at three months post-injury were: higher injury severity, pre-injury obesity, and perceiving the injury as a threat of disability. Having multiple chronic conditions was a predictor of disability at both time points.

Conclusions: Disability was persistent for migrants and non-migrants to 24 months post-injury. The disability risk at three months was higher for migrants. Certain predictors associated with disability were identified.

Implications for public health: Despite having accessed healthcare services for their injury, migrants (compared with non-migrants) had higher risks of disability at least in the first three months post-injury. Interventions should be focused during this critical period on identified key predictors to promote faster recovery and reduce disability.

Key words: migrants, injury, disability, outcomes

Injury has a substantial impact on population health and contributes to outcomes such as disability or premature death.[1] Studies of injury incidence and mortality among migrants have shown that migrants are more likely to have higher rates of these adverse outcomes than those born in host countries, especially following work-related injuries.[2-5]

Few studies have investigated the burden of post-injury disability among migrant populations. A study in the US analysed data from two national surveys asking respondents whether they had any health limitations affecting their work, and whether the condition was caused by injury.[6] Results showed that, compared with US-born Hispanic workers, overseas-born Hispanic workers had higher work-related injury rates but lower work-related disability. The authors noted that disabled workers among the overseas-born Hispanic migrants may have returned home, due to their inability to work. Another, cross-sectional study examined the disability among 177 Mexican migrant farmworkers in Texas using the Western Ontario and McMaster Universities Knee Osteoarthritis Index (WOMAC) and the Shoulder Pain and Disability Index (SPADI).[7] The study found that 68% of participants experienced pain from musculoskeletal injuries, with half experiencing pain in multiple sites. These symptoms affected abilities to perform self-care, work and other daily activities. Another study, using Canadian Community Health Survey data, asked 115 respondents if they had experienced an injury in the past 12 months serious enough to limit their normal activities, what they were doing when injured, and if they received any medical treatment within 48 hours of the injury event.[8] Compared with Canadian-born male workers, male migrants had 47 % higher odds of any work-related injury that limited their ability to perform normal activities, and 93% higher odds of work-related injury that limited their ability to perform normal activities and required medical treatments in their first five years of living in Canada.[8] Despite providing some useful information, disability outcomes of these studies were measured either through non-validated survey questions or tools that focused mainly on the physical functioning. Disability post-injury is affected by both physical and mental factors,[9] thus research using a validated tool to measure disability is required for developing a holistic understanding of post-injury outcomes.

In 2013, overseas-born migrants in New Zealand exceeded 1 million for the first time, representing 25.2% of the population; increasing from 19.5% in 2001.[10] The 2013 Disability Survey reported 34% of disability among adult New Zealanders was attributed to injury or accident.[11] New Zealand has a 'no-fault' injury insurance scheme operated

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Submitted: October 2018; Revision requested: November 2018; Accepted: June 2019
The authors have stated they have no conflict of interest.

Aust NZ J Public Health. 2019; Online; doi: 10.1111/1753-6405.12927

by the government entity, the Accident Compensation Corporation (ACC),[12] which provides universal injury insurance cover for everyone including visitors to New Zealand, irrespective of injury cause or setting.[12] The ACC provides a range of supports (e.g. medical treatments, rehabilitation, attendant care, home alteration, travel and accommodation subsidies) with a vision of improving quality of life and promoting return to daily lives and work in realistic timeframes.[13-14] Those in paid employment may also receive earnings-related compensation (up to 80% of pre-injury income) if their injuries are serious (e.g. requiring at least seven days off work). In 2017, the ACC spent $3.7 billion supporting injured people.[14] This support was $1.7 billion for treatment costs (e.g. general practitioner/specialist visits, x-rays, surgery and associated travel), $0.6 billion for care and support costs (e.g. carers, home alterations), and $1.4 billion for financial compensation and vocational rehabilitation for people who cannot return to work.[14]

Few previous studies have examined post-injury disability among New Zealanders. A study using data from the Survey of Families, Income and Employment showed that the odds of injury that precluded respondents' ability to perform daily activities for at least seven days in the past 12 months were lower for Pacific People and Asians compared with New Zealand Europeans.[15] Previous analyses of the Prospective Outcome of Injury Study (POIS) – a New Zealand population-based prospective cohort study – found the risk of disability measured by the World Health Organization Disability Assessment Schedule (WHODAS) was 22% higher among Pacific compared to non-Pacific participants at three months post-injury.[16] A spinal cord injury study found that a greater percentage of participants (including New Zealand European, Māori, Pacific and Other ethnicities) reported moderate, severe or extreme difficulties to perform daily activities and participations (measured by the WHODAS) at six months post-injury.[17] Even people of the same ethnicity may have different patterns of pre-injury characteristics and use of healthcare services, depending on whether they were born in New Zealand or overseas. A qualitative study conducted among 113 Asians (including claimants and non-claimants of the ACC, community leaders, and healthcare providers) in Auckland found that barriers to accessing the ACC and injury-related healthcare services were personal or cultural factors (e.g. age, gender, English proficiency, health seeking behaviours, traditional treatment preferences), environmental factors (e.g. cost, transport, lack of translator), and institutional factors (e.g. discrimination, risk of employment, inadequate information about services).[18] Qualitative studies about overseas-born migrants found some migrants returned to their home countries for healthcare treatments because of unfamiliarity with the New Zealand healthcare system[19] and having problems associated with post-migration experiences, such as language difficulty or discrimination.[20]

Previous POIS analyses revealed having less severe injuries was also significantly associated with a wide range of adverse health outcomes post-injury (including disability);[21] 39% of non-hospitalised injured individuals experienced considerable disability three months post-injury.[22] To date, the injury studies have either been restricted to specific ethnic groups, focussed on those hospitalised, or did not compare overseas-born and New Zealand-born populations, especially into the long-term. POIS recruited participants with a wide range of injury types and severities from the ACC entitlement claims register,[23-24] examined disability outcomes following injury, and identified various significant predictors associated with both short- and long-term disability.[22,25] POIS provided an opportunity to prospectively examine disability for injured migrants in New Zealand, as 24% of participants were born overseas. Our study aims to compare disability between migrants and non-migrants at three and 24 months post-injury. We also sought to identify key pre-injury and injury-related predictors of disability among migrants.

Methods

Study sample

The study analysed data from POIS, a population-based prospective cohort study with participants from five regions of New Zealand (Auckland, Manukau City, Gisborne, Otago and Southland). The POIS protocol has been previously published.[23-24] In short, POIS recruited participants via ACC's entitlement claims register between December 2007 and June 2009. Participants were aged 18–64 years of age and included those who were and were not hospitalised. Those with self-harm or sensitive claims were excluded. Ethical approval was granted by the New Zealand Health and Disability Multi-region Ethics Committee (MEC/07/07/093). POIS data were collected through three sources: 1) interviews (mainly via telephone) with participants at three and 24 months following injury using structured questionnaires and with interpreters available in a range of languages if needed; 2) National Minimum Dataset (NMDS) of hospitalisations; and 3) ACC data (about the injury itself). The POIS participation rate was 59% and the follow-up rate was 79%.

The three- and 24-month POIS interview data were used in our analyses (Figure 1). Country of birth (COB) was used to classify migrant status. Of 2,856 POIS participants, six did not identify their COB, leaving 2,850 with complete data for analysis at three months post-injury, of which 677 were migrants (overseas-born) and 2,173 were non-migrants (New Zealand-born). At 24 months, of the 2,850 participants, complete data were available for 2,251 participants (512 migrants and 1,739 non-migrants). Complete disability data were available for analysis from: 651 migrants and 2,110 non-migrants at three months post-injury, and 499 migrants and 1,698 non-migrants at 24 months post-injury.

Outcome

Disability at three and 24 months post-injury was measured using the WHODAS 12-item,[26-27] a specific tool developed by the World Health Organization (WHO) based on the International Classification of Functioning, Disability and Health (ICF) framework to measure disability (covering physical, psychological and social dimensions). The WHODAS comprises questions within six domains of adult functioning: cognition, mobility, self-care, getting along, life activities and participation.[26-27] Participants were asked 12 questions about their level of difficulty performing activities and participating during the past 30 days: 1) standing for a long period; 2) taking care of household responsibilities; 3) learning a new task; 4) joining community activities; 5) being emotionally affected by health problems; 6) concentrating on doing something; 7) walking a long distance; 8) washing their whole body; 9) getting dressed; 10) maintaining a friendship; 11) dealing with people; and 12) performing day-to-day work. Each question had five levels of the difficulty

and a corresponding score: None=0, Mild=1, Moderate=2, Severe=3, and Extreme/Cannot do=4. The sum of the scores from the 12 questions ranges between '0' (no disability) and '48' (maximum disability).[26-27] Based on published criteria, scores of ≥10 were deemed consistent with having considerable disability while 0–9 refers to lesser or no disability.[25] If the participants did not respond to one WHODAS item, their score for that particular dimension was imputed by the average of remaining 11 items when calculating the sum score. However, if participants did not respond to more than one item, their disability data were not included in the analysis.

Explanatory variables

The variables included pre-injury socio-demographic, health and injury-related characteristics. A separate category 'Undisclosed' was used for variables with 100 or more missing responses to ensure those participants were included in analyses.

Pre-injury socio-demographic characteristics

Participants reported age, sex, highest educational qualification and living arrangements using questions from the 2006 New Zealand Census.[28] Age (at the time of injury) was grouped: 18–24, 25–34, 35–44, 45–54, or 55–64 years. Education was grouped as 'Post-secondary school', 'Secondary school', or 'No formal' qualifications. Living arrangements was grouped as 'With family', 'With non-family', or 'Alone'. Paid employment was grouped as 'Yes' if participants stated they worked either full-time or part-time pre-injury; and the remaining as 'No'.[29] Household income was classified as 'Adequate' if participants reported enough or more than enough for everyday needs; or as 'Inadequate' if they stated just enough or not enough.[29] Participants reported the extent to which family were involved in their lives before their injury;[29] responses were grouped as 'Very large/Large' or 'Small/Very small'. Participants rated how they felt about their comfort in faith or spiritual beliefs using a single question from the FACIT-Sp;[30] grouped as 'Very much/Quite a bit' or 'Somewhat/A little bit/Not at all'. Participants rated overall satisfaction of their social relationships; grouped as 'Satisfied' if responded with completely/mostly satisfied or 'Dissatisfied' if stated neither satisfied nor dissatisfied/mostly dissatisfied/completely dissatisfied.[22] Sense of community was assessed whether participants felt 'Strong', 'In-between', or 'Very little' towards their neighbourhood.[22]

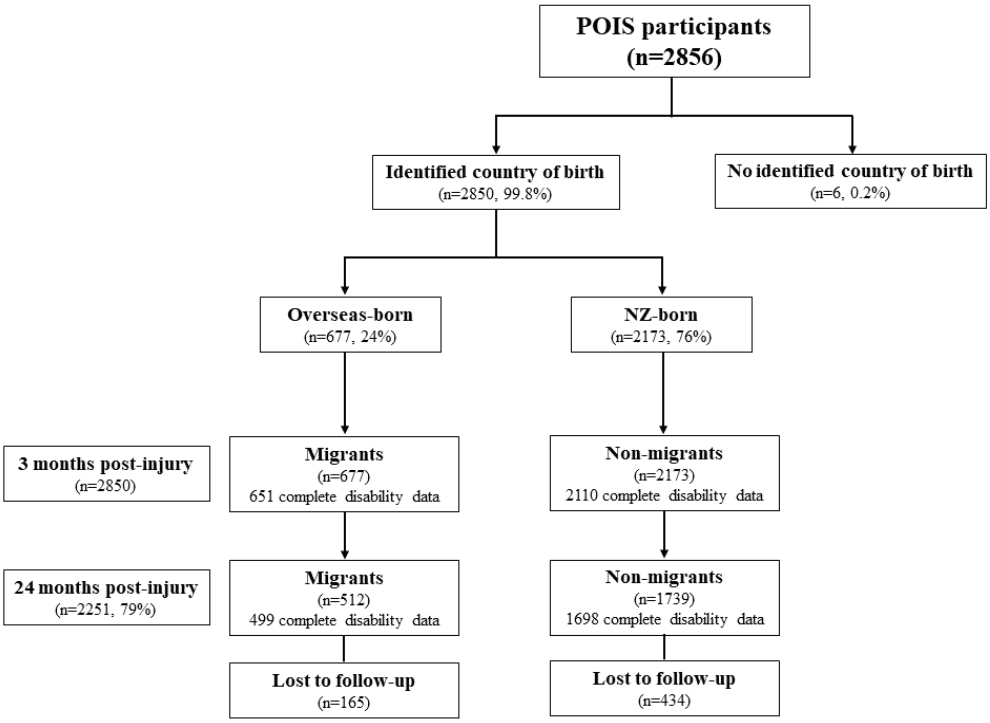
Pre-injury health characteristics

Participants were asked to rate their overall general health on a 5-point rating scale using a single question from the Short-Form 36;[31] dichotomised as 'Excellent/Very good/Good' or 'Fair/Poor'. Participants reported which chronic conditions they had at pre-injury by choosing from a list of 21 conditions;[32] their answers only being defined as 'Yes' if the condition had been diagnosed by a doctor and had continued for at least six months; these responses were then further grouped into '0', '1', and '≥2' conditions. WHODAS was also used to assess disability in the 30 days before the injury event; grouped as 'No/Lesser' or 'Yes' as mentioned previously. Participants were asked whether they smoked one or more cigarettes a day ('Yes' or 'No').[28] They were also asked their frequency of alcohol drinking, with a question from the Alcohol Use Disorders Identification Test Consumption (AUDIT-C),[33] and their frequency of recreational drug use in the past 12 months pre-injury;[22] grouped as 'Yes' if they responded to varying frequencies of use or as 'No' for those who stated 'never use'. Body Mass Index (BMI) was calculated from participants' self-reported weight and height; grouped as '<30' (non-obese) or '≥30' (obese).[34]

Injury-related characteristics

Participants were asked whether their injury was caused by an assault or violence; grouped as 'Assault' (if responded yes/maybe) or 'Unintentional' (if stated no). Information

Figure 1: Study participants recruited from POIS and numbers with complete disability data available for analyses.



about whether or not the injury was work-related was from ACC's claim data about the injury (Yes/No). New Injury Severity Score (NISS) was calculated using participants' ICD-10 codes, and then categorised into injury severity groups: 1–3 (least severe), 4–6 (middle severe), or >6 (most severe).[22,35] POIS data were probabilistically linked to the National Minimum Dataset (NMDS) of hospital discharges to identify those hospitalised or treated for three hours or more at an emergency department within seven days of their injury.[36] Participants reported whether they felt their injury was a threat to life and whether they felt it was a threat to severe long-term disability. Responses were 'Yes' (if they stated yes/maybe) or 'No'. Participants were asked whether they had trouble getting to or contacting healthcare services; grouped as 'Trouble/Mixed' or 'No trouble'.

Statistical analysis

Chi-square tests were used to compare proportions between migrants and non-migrants according to each explanatory characteristic and disability at three and 24 months post-injury. In order to identify predictors of disability among these characteristics, Modified Poisson regression with robust standard errors was used to estimate relative risks (RRs) of disability[37] after adjusting for a range of confounders. A multivariate model was built to estimate the RR of disability for migrants relative to non-migrants at three months post-injury. All explanatory variables from the chi-squared analyses (where p-value<0.1), and from prior knowledge[22,25] were initially included as potential confounders in the multivariate model building. Backward stepwise procedure was performed to remove the explanatory variables from the model one by one for p-value≥0.1 (after reviewing the intuitiveness) at each step. Four variables (pre-injury disability, sex, age and NISS) were deliberately retained. A similar multivariate model was then built for disability at 24 months post-injury. Covariates retained in any one of these two final models were included so that both models had a consistent set of adjusting covariates. Complete case analysis was performed at the variable selection process in each model, but everyone with non-missing information in all variables included in these models was then included in the final two models at three and 24 months post-injury.

The procedure was repeated to build another two multivariable models for the migrants to identify predictors associated with the disability at three and 24 months post-injury. Number of years living in New Zealand was included into these two models of migrants as an additional covariate. Pearson-goodness-of-fit was used to assess model fit for the four final models. All analyses were done using Stata® version 15 software.[38]

Results

Compared with non-migrants, migrants were more likely to have post-secondary school qualifications (70% versus 57%) and a higher incidence of work-related injury (38% versus 33%), but were less likely to have chronic conditions (39% versus 51%), smoke cigarettes (22% versus 33%), drink alcoholic beverages (78% versus 91%), use recreational drugs (9% versus 22%) or have an adequate household income (58% versus 65%), see Table 1. Similar proportions of migrants and non-migrants reported difficulties accessing healthcare services (11% versus 10%) and small proportions from both groups reported pre-injury disability (4% versus 6%).

At three months post-injury, substantial proportions of migrants (45%) and non-migrants (42%) experienced disability (Table 1). These proportions declined to 13% among both groups 24 months post-injury; still higher than the pre-injury proportions (4% and 6%). Multivariate analysis showed that migrants had a 14% significantly higher risk of disability at three months post-injury than non-migrants after adjustment for potential confounders (p=0.008, data not presented). This difference did not remain statistically significant at 24 months post-injury.

Predictors of disability at three months post-injury for migrants were: NISS4-6 (aRR=1.27; 95%CI 1.05–1.55) or NISS>6 (aRR=1.62; 95%CI 1.25–2.10) compared with NISS1-3; BMI ≥30 (aRR=1.34; 95%CI 1.10–1.62) compared with BMI<30, and perceiving injury as a threat of disability (aRR=1.42; 95%CI 1.18–1.71) compared with those who did not (Table 2). Having ≥2 chronic conditions pre-injury was a predictor of disability at both three months (aRR=1.29; 95%CI 1.01–1.66) and 24 months (aRR=2.43; 95%CI 1.34–4.43) post-injury compared with having none. Numbers of years living in New Zealand was not associated with disability at either three months (aRR=1.00; 95%CI 0.99–1.01) or 24 months post-injury (aRR=0.99; 95%CI 0.97–1.01) among migrants (Table 2). Both these models had acceptable statistic model-fits (p-values 0.99–1.00).

For migrants, we found no differences in characteristics between the migrants followed to 24 months (75.6%) and those lost to follow-up (24.4%) according to household income (p=0.2). Those lost to follow-up were more likely to be male (p=0.02), smokers (p=0.003), to have had a work-related injury (p=0.03), and a small/very small degree of family involvement (p=0.004) compared with those followed to 24 months.

Discussion and conclusion

In this prospective study of injury survivors in New Zealand, the risk of disability was significantly higher among migrants compared with non-migrants, at least in the first three months post-injury. The association was not found longer-term (24 months post-injury). Our study indicates that having ≥2 chronic conditions pre-injury significantly increases risk of disability at both three months (1.29 times) and 24 months (2.43 times). Having higher injury severity, obesity and perceiving the injury as a threat of severe long-term disability was strongly associated with disability among migrants at three months post-injury, but not at 24 months.

Having chronic conditions may be impairing recovery post-injury. A study analysing data from the Victorian Orthopaedic Trauma Outcomes Registry among orthopaedic injured survivors discharged from hospital found pre-injury chronic conditions were a strong predictor for disability, measured by the Glasgow Outcome Scale-Extended (GOS-E) tool, at 12-months post-injury.[39] Similarly, previous POIS analysis for the whole cohort also found that having ≥2 chronic conditions pre-injury was associated with slower recovery from disability over the 24 months post-injury.[40] The presence of at least two pre-existing chronic conditions appears to merit attention as an indicator of the need for additional support or interventions to improve disability for injured migrants.

The present study also found higher injury severity among migrants was associated with disability at three months post-injury. This is in line with previous POIS analyses for the whole cohort that found prevalence of disability at three months post-injury was increased by injury severity (NISS1-3=34%, NISS4-6=43% and NISS>6=57%),[21] and there was significant gradient association between

Table 1: Descriptive results of explanatory characteristics and post-injury disability for migrants relative to non-migrants.

Characteristics	Migrants n (%)	Non-migrants n (%)	Chi-square tests (p-value)
Pre-injury socio-demographic characteristics			
Sex			
Male	422 (62.3)	1,328 (61.1)	0.57
Female	255 (37.7)	845 (38.9)	
Age (years)			
Mean ± SD	41.7 ± 12.3	40.9 ± 13.2	0.003
18–24	68 (10.0)	342 (15.7)	
25–34	160 (23.6)	433 (20.0)	
35–44	162 (24.0)	478 (22.0)	
45–54	165 (24.4)	535 (24.6)	
55–64	122 (18.0)	385 (17.7)	
Highest educational qualification			
Post-secondary school	460 (69.6)	1,211 (56.5)	<0.001
Secondary school	159 (24.1)	534 (24.9)	
No formal	42 (6.3)	400 (18.6)	
Paid employment			
Yes	623 (92.2)	1,997 (91.9)	0.83
No	53 (7.8)	176 (8.1)	
Household income			
Adequate	388 (58.3)	1,399 (65.0)	<0.001
Inadequate	277 (41.7)	753 (35.0)	
Living arrangements			
With family	563 (83.8)	1,742 (80.6)	0.16
With non-family	56 (8.3)	204 (9.4)	
Alone	53 (7.9)	216 (10.0)	
Social relationships			
Satisfied	630 (94.3)	2,025 (93.6)	0.49
Dissatisfied	38 (5.7)	139 (6.4)	
Sense of community			
Strong	193 (28.5)	652 (30.0)	<0.001
In-between	258 (38.1)	903 (41.6)	
Very little	164 (24.2)	526 (24.2)	
Undisclosed	62 (9.2)	92 (4.2)	
Comfort in faith or spiritual beliefs			
Very much/Quite a bit	323 (47.7)	643 (29.6)	<0.001
Somewhat/A little bit/Not at all	323 (47.7)	1,435 (66.0)	
Undisclosed	31 (4.6)	95 (4.4)	
Family involvement			
Very large/Large	601 (89.6)	1,902 (88.2)	0.32
Small/Very small	70 (10.4)	255 (11.8)	
Pre-injury health characteristics			
General health			
Excellent/Very good/Good	645 (95.4)	2,038 (94.1)	0.18
Fair/Poor	31 (4.6)	129 (5.9)	
Chronic conditions			
0	398 (60.9)	1,032 (49.2)	<0.001
1	161 (24.6)	596 (28.4)	
≥2	95 (14.5)	471 (22.4)	
Disability (WHODAS)			
No/lesser (0–9)	644 (96.4)	2,027 (94.4)	0.04
Yes (≥10)	24 (3.6)	121 (5.6)	
Smoking			
No	526 (78.3)	1,460 (67.3)	<0.001
Yes	146 (21.7)	708 (32.7)	
Alcohol use			
No	148 (22.1)	192 (8.9)	<0.001
Yes	523 (77.9)	1,974 (91.1)	
Recreational drug use			
No	614 (91.2)	1,683 (77.7)	<0.001
Yes	59 (8.8)	484 (22.3)	
Body Mass Index (BMI)			
<30	530 (78.3)	1,512 (69.6)	<0.001
>30	118 (17.4)	565 (26.0)	
Undisclosed	29 (4.3)	96 (4.4)	
Injury-related characteristics			
Injury cause			
Unintentional	646 (96.1)	2,078 (96.0)	0.90
Assault	26 (3.9)	86 (4.0)	
Work-related injury			
No	416 (61.6)	1,451 (67.0)	0.01
Yes	259 (38.4)	715 (33.0)	
Injury severity (NISS)			
1–3	310 (46.6)	879 (41.9)	0.08
4–6	285 (42.9)	1,001 (47.8)	
>6	70 (10.5)	216 (10.3)	
Hospitalisation			
No	501 (74.0)	1,640 (75.5)	0.44
Yes	176 (26.0)	533 (24.5)	
Threat to life			
No	567 (84.7)	1,897 (88.9)	0.004
Yes	102 (15.3)	237 (11.1)	
Threat of severe long-term disability			
No	368 (55.2)	1,259 (59.3)	0.06
Yes	299 (44.8)	865 (40.7)	
Access to healthcare services			
No trouble	595 (89.2)	1,940 (90.0)	0.54
Trouble/Mixed	72 (10.8)	215 (10.0)	
Disability Outcomes (WHODAS)			
3 months post-injury			
No/Lesser (0–9)	356 (54.7)	1,224 (58.0)	0.13
Yes (≥10)	295 (45.3)	886 (42.0)	
24 months post-injury			
No/Lesser (0–9)	433 (86.8)	1,475 (86.9)	0.96
Yes (≥10)	66 (13.2)	223 (13.1)	

NISS and disability, irrespective of whether participants were hospitalised.[22]

Obesity could also be related to recovery after injury. The present study found that obesity was associated with disability, particularly three months post-injury. A study among trauma patients aged ≥18 years from the Iowa Trauma Centre measured disability and rehabilitation outcomes using the Functional Independence Measurement (FIM).[41] Results showed the recovery rate was decreased by 37% for obese patients (BMI between 30 and <35), and by 48% for those with BMI≥35; and the functional recovery rate was significantly reduced by 4% in every unit increase of BMI.[41] However, as our migrants are recruited from a range of ethnicities, interpretation of BMI cut-off points to determine obesity among migrants should be done with caution. For example, a study among healthy men in New Zealand (aged 17–30 years, n=113) found percentage body fat was significantly different among Europeans, Pacific Peoples and Asian-Indians, even if BMI was the same.[42]

Our study has a number of strengths. We have investigated disability post-injury using data directly from migrants with a range of types and severities of injuries including participants who were and were not hospitalised. The study included a wide range of pre-injury and injury-related characteristics used to identify predictors of post-injury disability. Additionally, we have investigated disability for up to 24 months post-injury among migrants using the validated WHODAS that was specially developed to measure disability.

However, the study has some limitations. Recall bias could theoretically affect the estimation of pre-injury and injury-related characteristics as POIS participants reported this information 3.4 months (on average) post-injury. A study investigating recall bias in the POIS cohort (including migrants and non-migrants) by comparing pre-injury data to population norms reported bias as likely to be minor.[43] Men, smokers, those with work-related injury and those reporting a small/very small degree of family involvement were more likely to not participate at 24 months. Nevertheless, none of these characteristics were found to be predictors of disability. The study was restricted to people who had accessed the ACC as entitlement claimants after having received injury-related healthcare. While this was pragmatic, findings may under-represent the experiences of people who experience difficulties in accessing services, which includes migrants in the New Zealand context.[18] Both migrant and non-migrant groups are highly heterogeneous. Migrants include people from western countries, who are English-speaking, and in high-income professions with more flexibility and opportunities for work; and also people from less advantaged, culturally and linguistically diverse populations, who are in occupations that may provide less flexibility in accommodating disabilities. It is possible that participants in our study were more likely than non-participants to speak English. The 'non-migrant' group also includes a diverse range of ethnicities, including Māori and Pacific People who experience higher levels of disability relative to New Zealand Europeans,[16,44] and second-generation migrants who may have some experiences that are similar to first-generation migrants.

As this analysis did not consider disability estimates between three and 24 months post-injury, it is not possible to know when the excess risk observed was attenuated. There is a need for more nuanced stratified analyses in future research. There is also a need for future research that could: reduce selection biases; consider variations in disability experiences based on the types of migrants involved; and investigate the extent to which post-injury disability is associated with occupations and returning to work among migrant workers, relative to non-migrants, and quality of life among migrants compared with other groups in New Zealand.

In conclusion, disability was persistent for both migrants and non-migrants to 24 months following injury. The risk of post-injury disability was higher for migrants

Table 2: Multivariate analyses of disability and predictors associated with disability at 3 and 24 months post-injury for migrants.

Variables	3 months		24 months	
	aRR (95%CI)	*p*-value	aRR (95%CI)	*p*-value
Sex				
Male	Ref	0.08	Ref	0.41
Female	1.18 (0.98-1.41)		1.22 (0.76-1.96)	
Age (years)				
18-24	Ref	0.11	Ref	0.32
25-34	1.04 (0.74-1.46)		1.25 (0.38-4.08)	
35-44	1.07 (0.76-1.52)		1.80 (0.56-5.74)	
45-54	1.13 (0.80-1.60)		2.22 (0.70-7.05)	
55-64	0.74 (0.49-1.12)		1.27 (0.36-4.55)	
Pre-injury disability (WHODAS)				
No/Lesser (0-9)	Ref	0.09	Ref	0.29
Yes (≥10)	1.34 (0.95-1.90)		1.59 (0.67-3.78)	
Chronic conditions				
0	Ref	0.05	Ref	0.009
1	0.91 (0.72-1.16)		0.98 (0.50-1.86)	
≥2	1.29 (1.01-1.66)		2.43 (1.34-4.43)	
BMI				
<30	Ref	0.003	Ref	0.09
≥30	1.34 (1.10-1.62)		1.57 (0.93-2.63)	
Injury cause				
Unintentional	Ref	0.13	Ref	0.15
Assault	1.30 (0.93-1.83)		1.97 (0.79-4.90)	
Injury severity				
NISS 1-3	Ref	<0.001	Ref	0.62
NISS 4-6	1.27 (1.05-1.55)		0.81 (0.49-1.34)	
NISS >6	1.62 (1.25-2.10)		0.68 (0.24-1.90)	
Threat of severe long-term disability				
No	Ref	<0.001	Ref	0.17
Yes	1.42 (1.18-1.71)		1.44 (0.85-2.43)	
Years living in NZ*	1.00 (0.99-1.01)	0.94	0.99 (0.97-1.01)	0.19

Notes:

Ref = reference (1.00)

aRR (adjusted relative risk): Adjusting for age, sex, pre-injury disability, chronic conditions, BMI, injury cause, NISS, perceiving as a threat of severe long-term disability, and years living in NZ.

**Continuous data*

relative to non-migrants at three months, but not at 24 months. Certain pre-injury and injury-related predictors were associated with disability among migrants.

Implications for public health

Injuries are known to have a significant impact on individuals, families and populations, and migrants are more likely to have a higher risk of injury while experiencing poorer outcomes compared to non-migrants. Our study highlights that migrants are at increased risk of disability in the first three months following injury. Interventions focused on this time period, and addressing identified predictors, will help to foster recovery process and are expected to reduce the post-injury disability burden among migrants.

Our study analysed data from migrants who received at least some injury-related healthcare services and ACC support in order to be ACC entitlement claimants. Findings could be different for migrants who had not accessed such services. Previous research has identified a range of factors associated with low injury-related healthcare service use among migrants in New Zealand.[18] An ethnographic study has found that migrants obtained healthcare information through social networks in their communities (e.g. by word of mouth, local newspapers).[19] Thus, promoting an awareness of the ACC and injury-related healthcare services could be done through migrant community groups and their local media sources. These may help increase migrants' access to information about New Zealand's system and the injury and rehabilitation services available to them, including improved awareness of the ACC and injury-related healthcare services. In the time since participants were recruited to POIS, there has been a small increase in the proportion of the population born in countries other than New Zealand, from 23% in 2006 to 25% in 2013.[10] This means the findings from this study (e.g. that additional supports may be required for migrants with ≥2 chronic conditions who also experience an injury) and from future studies investigating interventions to improve outcomes are likely to be of even greater importance to help ensure the best possible outcomes for injured migrants.

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