

Injury severity and 3-month outcomes among Māori: results from a New Zealand prospective cohort study

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Abstract

Aims To examine the prevalence of health and social outcomes pre- and 3 months post-injury, and the association between New Injury Severity Scores (NISS) and 3-month outcomes, for the Māori cohort of the Prospective Outcomes of Injury Study.

Methods New Zealand residents were recruited from the Accident Compensation Corporation's entitlement claims register and participants interviewed at 3 months post-injury. Those who reported Māori ethnicity (n=566) were included in the Māori cohort.

Results States indicative of favourable health were less prevalent among the cohort post-injury than pre-injury for all measures examined. Approximately half the cohort were experiencing difficulties walking 3 months after their injury, over two-thirds a level of pain or discomfort, and more than half a level of psychological distress. The prevalence of disability was 49%. The prevalence of some adverse outcomes increased with increasing NISS but a high level of problems were still experienced by those classified as having a 'minor' injury. Nonetheless, a majority of the cohort were satisfied with life and they considered themselves to be of good to excellent overall health.

Conclusions Findings emphasise the importance of injury prevention and appropriate post-injury care to reduce the burden experienced by Māori due to injury.

Injury is a leading contributor to the burden of death and disability in several countries including New Zealand.¹ The 2006 New Zealand Household Disability Survey found that one in six residents aged 15 years and over was living with a disability. In nearly one-third of cases injury was the reported cause, and among those aged 15-64 years it was the leading cause of disability.²

Māori, New Zealand's indigenous population, comprise 15% of the country's total population³ and experience a disproportionate burden following injury. Those aged 15-64 years are at greater risk of mortality (RR: 2.29) and hospitalisation (RR: 1.62) from unintentional injury than non-Māori in this age group.⁴

Prevalence of disability due to injury is also higher among Māori (31.4%) than non-Māori (29.3%) aged 15 years and over.⁵ Kingi and Bray have previously qualitatively explored Māori perceptions of disability with 15 participants.⁶

Themes identified included the impact of colonial history on knowledge of Māori language and culture, difficulties of access to healthcare providers, traditional foods and resources, and the disabling effect of this impact on reaching and maintaining *hauora* (i.e., optimal health and well-being). Negative socioeconomic factors were also perceived as disabling, more so than functional impairment.⁶

Their study points to the impact of broader sociohistorical factors on perceptions of Māori disability, which reflect Māori models of overall health and wellbeing.⁷⁻⁹ One model, Te Whare Tapa Whā (literally, a four-sided house), for example, advocates that Māori health can be encapsulated through *taha wairua* (the spiritual dimension), *taha hinengaro* (the mental dimension), *taha tinana* (the physical dimension) and *taha whānau* (the social relationship dimension).⁷

Quantitative research on Māori injury outcomes has generally focused on particular types of injury or fatal and/or serious injuries only.¹⁰⁻¹⁴ There is limited research published that has examined a broad range of injury types and outcomes for Māori following injuries of low to moderate injury severity.

The Prospective Outcomes of Injury Study (POIS) is a New Zealand longitudinal cohort study following 2856 participants who experienced one or more injuries – the majority of which were of low severity as indicated by New Injury Severity Scores (NISS)¹⁵ - between June 2007 and May 2009.¹⁶

A particular focus of POIS is to provide robust and relevant evidence about injury outcomes for Māori.¹⁶⁻¹⁸ Such work is important to inform efforts aimed at reducing adverse injury outcomes for Māori.

The aims of this paper, therefore, are to examine the prevalence of a range of health and social outcomes pre-injury and 3 months post-injury, and to examine the prevalence of 3 month post-injury outcomes in relation to injury severity.

Methods

The POIS cohort was recruited from claimants on the entitlement claims' register at the Accident Compensation Corporation (ACC), New Zealand's comprehensive "no-fault" insurer for both residents and visitors to the country who sustain an injury. If an injury is serious enough to be likely to necessitate a week or more away from paid work, or if supports such as home help and transportation (e.g., to and from work or a medical appointment) are required, the injured person is placed on ACC's entitlement claimants register.¹⁷

Those on the register (excluding those whose injuries were the result of self-harm or sexual assault) were eligible to participate if they were New Zealand residents aged 18-64 years (inclusive), and living in one of five regions from throughout New Zealand.

The aim of the POIS was to identify factors leading to disability following injury with a focus on outcomes among the usual working-age population.¹⁷ Disability among younger and older New Zealanders is also of concern. We limited the eligible age group as participation in paid employment is an important indicator of outcomes following injury, and selecting the working-age population allowed us to use consistent measures (rather than requiring versions for youth or older people) for all participants and because people in this working-age group report the greatest prevalence of disability.¹⁷

The regions, which include a mix of urban and rural areas, were: Auckland City, Manukau City, Gisborne and the provinces of Otago and Southland. They were selected to provide a broad range of communities in terms of sociodemographic characteristics and to ensure that sufficient Māori were recruited.^{16, 17}

Claimants in these areas were posted a letter by ACC inviting them to take part in the study. Members of the university research team were then provided with the details of those who did not opt out of being invited to participate in an interview.

A total of 2856 (59%) gave consent and participated in the 3 month post-injury interview phase conducted between December 2007 and August 2009.¹⁶ Ethical approval of POIS was granted by the New Zealand Health and Disability Multi-region Ethics Committee (MEC/07/07/093). Further details on the study protocol are provided elsewhere.¹⁶⁻¹⁸

Participants were interviewed up to four times post-injury. The focus of this paper is on the first interview conducted 3 months, on average, following injury. At this interview participants were asked an array of questions about their injury and personal characteristics (pre- and post-injury). This information was primarily collected via telephone although a small number of interviews were administered face-to-face or by post.¹⁶

Data on ethnicity was obtained using the ethnicity question from the 2006 New Zealand Census of Population and Dwellings which allows participants to report belonging to one or more ethnic groups.¹⁹ For the purpose of these analyses, those who reported Māori ethnicity, whether or not they reported additional ethnicities, were included in the Māori cohort (n=566).¹⁷

Injury severity was measured using Abbreviated Injury Scale (AIS) scores derived from ACC diagnosis data.¹⁵ The sum of the squares of each participant's three highest AIS scores was calculated to provide their NISS.²⁰ Participants were then grouped for analysis into NISS 1-3 (one or more minor injuries), NISS 4-6 (one moderate injury with or without other minor injuries) and NISS>6 (two or more moderate injuries *or* one or more serious injuries).

NISS were unable to be calculated for 23 Māori participants. Those admitted to hospital or treated at an Emergency Department for 3 hours or more within seven days of the injury event were identified from the National Minimum Dataset (a nationwide dataset of hospital discharge information) and were classified as having been 'hospitalised' as a result of their injury.¹⁵

A range of variables measuring psychological, physical and social well-being pre- and post-injury was examined. General health was assessed by asking participants to rate their overall health on a five-point scale (poor to excellent) and their health now compared to 1 year previous (much/somewhat better, same, much/somewhat worse).

The EQ-5D²¹ was used to assess health status in relation to mobility, problems with self-care, ability to perform usual activities, experience of pain or discomfort, and experience of anxiety or depression.

Information on psychosocial health was ascertained using the Kessler 6^{22, 23} to provide a measure of psychological distress in the previous 4 weeks (categorised as: low 1-3; moderate 4-12; high 13-24), and three items enquiring about overall happiness (very happy, fairly happy, not too happy), satisfaction with life (completely satisfied, mostly satisfied, neither satisfied nor dissatisfied, mostly dissatisfied, completely dissatisfied) and satisfaction with social relationships (completely satisfied, mostly satisfied, neither satisfied nor dissatisfied, mostly dissatisfied, completely dissatisfied).

The last two variables were categorised as 'satisfied' (the first two response options) and 'not satisfied' (last three response options) for analyses. Disability status was measured using the 12-item WHODAS II, those with a summed scoring ≥ 10 being defined as having a disability.^{15, 24} Participants were also asked how their recovery was meeting their expectations (much/somewhat better than expected, as expected, much/somewhat worse than expected).

Stata/SE v12.1 software was used to analyse the data.²⁵ Percentage estimates and 95% confidence intervals were produced to determine the pre- and post-injury (3 months) prevalence of a range of health and social outcomes. The prevalences of post-injury outcomes by injury severity were also estimated.

Results

The median time to interview for the group (n=566) was 3.1 months post-injury (IQR: 2.5-4.1 months). Females comprised just over one-third (34%) of the Māori cohort. The median age of participants at interview was 38 years (IQR: 28-48 years).

Approximately one in eight (12%) reported having 'not enough' household income pre-injury to meet their everyday needs (e.g. accommodation, food, clothing), just over one in four (28%) had 'just enough', and the remainder had 'enough' (40%) or 'more than enough' (20%). Further sociodemographic and health information on the Māori cohort is provided elsewhere.²⁶

The majority (85%) of injuries sustained by the cohort were of minor to moderate anatomical severity and less than 1.5% of participants had a 'severe' injury as defined

by a NISS of 16 or more (Table 1).²⁰ The median NISS was 4 (IQR = 1-5). Just over one-quarter (27%) were hospitalised as a result of their injury.

Table 1. Description of injuries

Variables	n ¹	% of cohort ²
Injury region and nature		
Head and/or neck		
Intracranial	17	3.0
Superficial	18	3.2
Spine		
Sprain or dislocation	95	16.8
Upper extremity		
Fracture	81	14.3
Open wound	36	6.4
Sprain or dislocation	78	13.8
Superficial	36	6.4
Lower extremity		
Fracture	89	15.7
Open wound	33	5.8
Sprain or dislocation	146	25.8
Superficial	34	6.0
Other		
e.g. burn, crush injury	102	18.0
Injury severity (NISS)³	N	% of cohort⁴
1–3	241	44.4
4–6	220	40.5
>6	82	15.1

¹ Total exceeds 566 as some participants had multiple injury types

² Percentage among the 566 participants

³ NISS were unable to be calculated for 23 participants

⁴ Percentage among the 543 participants for whom a NISS could be derived

General health

More than two-thirds of the cohort described their overall health as being ‘very good’ or ‘excellent’ prior to their injury and only 8% felt it was ‘fair’ or ‘poor’ (Table 2). Three months post-injury, a greater proportion (26%) reported ‘fair’ or ‘poor’ overall health. More than 40% of the cohort felt their health at 3 months post-injury was worse than 12 months prior.

EQ-5D health status

Close to one-half of the cohort was experiencing problems with mobility and one-quarter problems with self-care at 3 months post-injury (Table 2). Over half reported trouble performing usual activities at 3 months, 70% were experiencing pain or discomfort, and more than one-quarter were experiencing anxiety or depression. For each of the five dimensions, a statistically significant increase was observed in the proportions reporting EQ-5D problems post-injury compared to pre-injury.

Table 2. Health status of Māori participants pre- and 3 months post-injury

Variables	Pre-injury		Post-injury (3 months)		χ^2 (p-value)
	n	% (95% CI)	n	% (95% CI)	
General health					
<i>Overall health</i>					
Excellent/very good	383	68 (64, 72)	229	41 (37, 45)	101.2 (<0.001)
Good	136	24 (21, 28)	185	33 (29, 37)	
Fair/poor	45	8 (6, 10)	148	26 (23, 30)	
<i>Health compared to 1 year ago</i>					
Better	–	–	114	21 (17, 24)	–
Same	–	–	210	38 (34, 42)	
Worse	–	–	226	41 (37, 45)	
EQ-5D health status					
<i>Mobility</i>					
No problems walking	529	93 (91, 96)	307	54 (50, 58)	225.5 (< 0.001)
Some problems walking	37	7 (4, 9)	254	46 (42, 50)	
Confined to bed	–	–	5	–	
<i>Self-care</i>					
No problems with self-care	554	98 (97, 99)	428	76 (72, 79)	122.0 (<0.001)
Some problems with self-care	12	2 (1, 3)	129	24 (21, 28)	
Unable to wash/dress self	–	–	9	–	
<i>Usual activities</i>					
No problems performing	532	94 (92, 96)	250	44 (40, 48)	328.9 (<0.001)
Some problems performing	33	6 (4, 8)	269	56 (52, 60)	
Unable to perform	1	–	47	–	
<i>Pain or discomfort</i>					
None	504	89 (87, 92)	172	30 (27, 34)	405.8 (<0.001)
Some	57	11 (8, 13)	351	70 (66, 73)	
Extreme	4	–	42	–	
<i>Anxiety or depression</i>					
None	523	93 (90, 95)	407	72 (68, 76)	81.7 (<0.001)
Moderate	37	7 (5, 10)	144	28 (24, 32)	
Extreme	5	–	14	–	
Psychosocial health					
<i>Psychological distress (Kessler 6)</i>					
Low (0–3)	–	–	250	45 (41, 49)	–
Moderate (4–12)	–	–	244	44 (40, 48)	
High (13–24)	–	–	60	11 (8, 13)	
<i>Overall happiness</i>					
Very happy	281	50 (46, 54)	162	29 (25, 32)	102.1 (<0.001)
Fairly happy	263	46 (42, 51)	282	50 (46, 54)	
Not too happy	22	4 (2, 5)	122	22 (18, 25)	
<i>Satisfaction with life</i>					
Satisfied	521	93 (90, 95)	402	71 (68, 75)	85.1 (<0.001)
Not satisfied	42	7 (5, 10)	161	29 (25, 32)	
<i>Satisfaction with global social relationships</i>					
Satisfied	529	94 (92, 96)	455	81 (78, 84)	42.8 (<0.001)
Not satisfied	35	6 (4, 8)	108	19 (16, 22)	
Disability (WHODAS)					
No (0–9)	519	92 (90, 94)	283	51 (47, 55)	234.8 (<0.001)
Yes (10+)	44	8 (6, 10)	273	49 (45, 53)	
Recovery course					
Better than expected	–	–	263	48 (44, 52)	–
As expected	–	–	141	26 (22, 29)	
Worse than expected	–	–	144	26 (23, 30)	

Table 3. Prevalence of 3-month outcomes by injury severity

Variables	Injury Severity						
	n	NISS* 1–3 (n = 241)		NISS 4–6 (n = 220)		NISS > 6 (n = 82)	
		n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
General health							
Poor overall health	65	21	9 (5, 12)	19	9 (5, 12)	20	24 (15, 34)
Health worse than 1 year ago	226	84	36 (30, 42)	92	43 (36, 49)	39	49 (38, 60)
Any problems with mobility	259	90	37 (31, 43)	106	48 (42, 55)	53	65 (54, 75)
Any problems with self-care	138	47	20 (14, 25)	59	27 (21, 33)	24	29 (19, 39)
Any problems performing usual activities	316	109	45 (39, 52)	136	62 (55, 68)	58	71 (61, 81)
Any pain or discomfort	393	151	63 (57, 69)	158	72 (66, 78)	69	84 (76, 92)
Any anxiety or depression	158	61	25 (20, 31)	56	25 (20, 31)	34	41 (31, 52)
Psychosocial health							
High psychological distress	60	25	11 (7, 15)	20	9 (5, 13)	12	15 (7, 23)
Not too happy	122	45	19 (14, 24)	43	20 (14, 25)	28	34 (24, 44)
Not satisfied with life	161	58	24 (19, 30)	66	30 (24, 36)	30	37 (26, 47)
Not satisfied with social relationships	108	46	19 (14, 24)	45	21 (15, 26)	14	17 (9, 25)
Disability							
Yes	273	99	42 (35, 48)	108	50 (44, 57)	52	63 (53, 74)
Recovery							
Worse than expected	144	55	24 (18, 29)	59	27 (21, 33)	26	33 (23, 44)

* NISS (New Injury Severity Score) could not be calculated for 23 participants; NB: The total number (n) in each NISS group varies by injury outcome.

Psychosocial health

A moderate level of psychological distress was being experienced by nearly half the cohort 3 months post-injury and one in 10 were experiencing a high level of psychological distress (Table 2). Pre-injury information on general psychological well-being was not collected using the Kessler 6. Half the cohort reported that they were 'very happy' pre-injury and 46% reported being 'fairly happy', however, fewer participants were 'very happy' post-injury and more were 'not too happy'.

Nonetheless, 71% were satisfied with life and 81% satisfied with global social relationships at 3 months, although these percentages were lower than pre-injury prevalence rates of 93% and 94%, respectively.

Disability

Prior to injury the prevalence of disability (WHODAS \geq 10) was 8% (Table 2). This had increased to 49% at 3 months post-injury.

Recovery

In terms of self-perceived recovery from the sentinel injury, about half believed they were recovering 'better than expected' 3 months post-injury, however, one-quarter reported their recovery as being 'worse than expected' (Table 2).

Prevalence of outcomes by injury severity (NISS)

General health—The proportion considering their health to be worse than 12 months prior increased with increasing injury severity. A quarter (24%) of those in the highest injury severity group considered their health to be 'poor' at 3 months post-injury compared to 9% in the lower severity groups (Table 3).

EQ-5D health status—The tendency to report mobility problems at 3 months increased with increasing injury severity (Table 3). There was no discernible difference between the three injury severity groups for self-care difficulties. Like mobility problems, problems performing usual activities, pain or discomfort, and anxiety or depression also tended to increase with increasing injury severity (although with overlapping 95% confidence intervals in some cases). The prevalence of these problems in the low severity group was still considerable, ranging from 20% to 63% across the five EQ-5D items.

Psychosocial health—A third (34%) of participants in the high injury severity group were 'not too happy' 3 months post-injury compared to a fifth in the lower severity groups (Table 3). A higher proportion (37%) in this group was also not satisfied with life at 3 months compared to the lowest group (20%) although differences between the groups were not statistically significant. Psychological distress and satisfaction with relationships did not vary substantially by injury severity.

Disability and recovery progress—Disability prevalence at 3 months post-injury ranged from 42% in the lowest injury severity group to 63% in the highest (Table 3). Participants' views on recovery progress did not vary substantially by injury severity.

Discussion

High levels of adverse outcomes were observed 3 months post-injury among the POIS Māori cohort. Almost half were experiencing problems with mobility, a majority were having difficulties performing their usual activities, and most were suffering some or extreme pain or discomfort. Over half were experiencing a level of psychological distress.

For all the measures for which we could make pre- and post-injury comparisons, there was a statistically significant increase in the prevalence of adverse outcomes at 3 months. The prevalence of some of these problems increased with injury severity but those classified as having sustained a minor injury were not immune to adverse outcomes.

A substantial proportion in each injury severity group reported their health was worse 3 months after their injury compared to 1 year ago. Nonetheless, a majority of the cohort considered themselves to be at least 'fairly happy', satisfied with their social relationships and life in general, and of 'good' if not 'very good' or 'excellent' overall health.

Previous research into injury outcomes, among both Māori and non-Māori, has tended to focus on particular injury types or people sustaining 'severe' injuries that have resulted in hospitalisation.¹⁷ Fatal and serious non-fatal injuries are only a small part of the "injury iceberg".^{27, 28} These injuries are far outnumbered by those of minor to moderate severity and many of these less severe injuries result in disability.^{27, 28}

Recruiting participants from the ACC entitlement claimants' register in POIS has allowed examination of longitudinal outcomes among those incurring injuries of 'minor' or 'moderate' NISS severity, most of which did not result in a hospital visit. It is a strength of the study that recruitment of Māori with lower NISS-severity injuries via ACC was possible. Inclusion of Māori with such injuries in the POIS reveals that the burden in terms of adverse outcomes is not restricted to those with higher NISS severity alone.

It is important to note that following letters of invitation being sent to potential participants on our behalf by ACC, the study was conducted independently of ACC (the insurer) thereby reducing any incentive for participants to exaggerate adverse outcomes in order to maximise compensation entitlements.

The POIS cohort was not designed to be a representative sample of all ACC claimants or the general or Māori populations and the results may not be generalisable to these larger groups. However, this does not diminish our finding that a significant proportion of the POIS Māori cohort, many of whom sustained injuries of low-to-moderate severity, was experiencing adverse injury outcomes at 3 months.

A potential source of recall bias was that pre-injury health information was collected retrospectively at the 3 month interview. Participants may have overestimated their pre-injury health status unaware that they were comparing it to their post-injury health status. This would lead to changes pre- to post-injury being inflated, however, comparisons of reported health status as measured by the EQ-5D revealed only small differences between pre-injury health and health at 5 and 12 months for those POIS

participants who had recovered from their injury.²⁹ This suggests that bias from using recalled pre-injury health information is likely to be minor.

Our finding that three-quarters of the Māori cohort considered their health at 3 months to be 'good' to 'excellent' suggests that many had adapted to life with injury. This is consistent with Kingi and Bray's⁶ finding that external factors were considered more disabling than any functional impairment. It is possible that for our participants, happiness and satisfaction with life in the face of marked adverse outcomes (e.g., pain or discomfort) was aided by positive social relationships (e.g., support from whānau and social networks).

These positive relationships, combined with other factors (e.g., self-efficacy), may have been promoting favourable health and well-being overall. This premise resonates with Māori models of health which are based on a number of aspects collectively contributing to total well-being (e.g.,^{7,9}) and which will be the focus of future research.

The purpose of this study was to describe a range of pre-injury and 3 month post-injury outcomes, by injury severity, in the POIS Māori cohort. It addresses a dearth of research examining injury outcomes for Māori across a range of injury types and severities. We intentionally did not compare findings between Māori and non-Māori nor take into account potential confounders. Focussing specifically on outcomes for Māori provides greater insight into areas that require further attention for this particular group and helps avoid a 'deficit model' approach.

The findings from this research will inform future regression analyses that control for pre-injury characteristics (e.g., existing comorbidities) and potential confounders in order to identify potentially modifiable factors that can be addressed to improve post-injury outcomes for Māori. Analysis of data at 12 and 24 months post-injury will also permit examination of whether, and how, injury outcomes for Māori differ from the 3 month post-injury period.

To the best of our knowledge, this study is the first to have examined the prevalence of various health and social outcomes following injury among an indigenous population. It reveals that injuries among Māori, including those of minor severity, can lead to adverse physical and psychological outcomes 3 months later. This may be due to the fact that injuries defined by NISS (a threat-to-life measure) as minor-to-moderate can still result in a high level of disability.^{15, 30}

The findings in this paper highlight the importance of identifying improved strategies to prevent injury, including 'minor' injuries, and for appropriate rehabilitation for injured Māori, irrespective of injury severity.

Competing interests: None identified.

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