



## **Injuries to New Zealanders participating in adventure tourism and adventure sports: an analysis of Accident Compensation Corporation (ACC) claims**

Tim Bentley, Keith Macky, Jo Edwards

### **Abstract**

**Aims** The aim of this study was to examine the involvement of adventure tourism and adventure sports activity in injury claims made to the Accident Compensation Corporation (ACC).

**Methods** Epidemiological analysis of ACC claims for the period, July 2004 to June 2005, where adventure activities were involved in the injury.

**Results** 18,697 adventure tourism and adventure sports injury claims were identified from the data, representing 28 activity sectors. Injuries were most common during the summer months, and were most frequently located in the major population centres. The majority of injuries were incurred by claimants in the 20–50 years age groups, although claimants over 50 years of age had highest claims costs. Males incurred 60% of all claims. Four activities (horse riding, mountain biking, tramping/hiking, and surfing) were responsible for approximately 60% of all adventure tourism and adventure sports-related injuries. Slips, trips, and falls were the most common injury initiating events, and injuries were most often to the back/spine, shoulder, and knee.

**Conclusions** These findings suggest the need to investigate whether regulatory intervention in the form of codes of practice for high injury count activities such as horse riding and mountain biking may be necessary. Health promotion messages and education programs should focus on these and other high-injury risk areas. Improved risk management practices are required for commercial adventure tourism and adventure sports operators in New Zealand if safety is to be improved across this sector.

The risks associated with adventure tourism and adventure sport activity are increasingly highlighted in media reports of fatalities and serious injuries involving overseas and domestic recreationalists in New Zealand and elsewhere.<sup>1,2</sup>

No single organisation or body in New Zealand is responsible for safety across this broad sector,<sup>3</sup> thus making it difficult to get an objective picture of risk for the various adventure activities provided commercially and undertaken independently. However, researchers in New Zealand have recently begun to examine the problem of adventure tourism and adventure sports safety through epidemiological and survey research, with the aim of establishing an injury surveillance baseline for this sector.

Early research in this field found that certain New Zealand adventure activities (notably whitewater rafting, scenic flights, and mountain recreation) were responsible for a number of fatalities and serious injuries involving overseas visitors.<sup>4–8</sup> More recent research, involving surveys of New Zealand adventure tourism operators and analysis of a national hospitalisation database, has found that other activities—

including horse riding, mountain biking/cycle touring, snow sports (i.e. skiing and snowboarding), and tramping (i.e. hiking)—are associated with relatively large injury counts.<sup>9–11</sup>

The present study seeks to examine the involvement of adventure tourism and adventure sports activity in injury claims made to the *Accident Compensation Corporation* (ACC).

This analysis, together with findings from the hospitalisation study and operator survey research cited above, will provide important injury risk information for participants, operators, and industry bodies (amongst others) and will assist in the prioritisation of injury-control measures as well as the identification of high-risk areas that require improved risk management practice and other intervention.

## Method

Compensation claims data for adventure tourism and adventure sport-related injuries to adult (16 years and over) New Zealand residents occurring during the 12-month period July 2004 to June 2005 were extracted from ACC's database for injuries occurring at a place for sport or recreation.

The initial dataset of approximately 40,000 cases was contained in a single Microsoft Excel data file. The involvement of adventure tourism and adventure sport activity was identified by content analysis of the one-line narrative 'accident descriptions' provided for each case—with non-adventure cases removed from the dataset, and adventure activities coded under one of 28 categories of adventure tourism/sports.

Unfortunately, many cases contained insufficient information in the narrative to determine whether adventure tourism or adventure sport was involved in the injury, stating only, for example, that the claimant had 'slipped off a rock', was 'walking down a steep bank' or 'was riding my bike', meaning many incidents involving tramping, mountaineering, rock climbing, and mountain biking may have been erroneously omitted from the analysis.

Boating activities (apart from kayaking, jet boating, and rafting) were not included in the dataset in line with other related studies. The final dataset of cases, therefore, is likely to underestimate the total number of compensated adventure-related injuries during the period of the analysis.

After data coding, the following variables were available for analysis for each case: age and gender; region where the incident occurred; month of incident; adventure activity; injury initiating event; body part injured; injury diagnosis; and cost of claim.

The majority of these variables were categorical—the exceptions being age and cost of claim, for which interval and ordinal (age and cost groups) variables were provided.

Once coded, the data were transferred from Excel to 'SPSS for Windows version 13'. Descriptive analyses were undertaken for each of the variables (including cross-tabulation). Non-parametric inferential statistics (including Chi-squared and Kruskal-Wallis tests) applied where differences and associations between categories and variables were examined.

Claim incidence rates were calculated for variables where suitable denominator data were available. Denominator data were 2005 population data provided by Statistics New Zealand and New Zealand adult participation in sport and active leisure, as derived by SPARC (Sport & Recreation New Zealand) from sample surveys conducted during 1997, 1998, and 2000.

It is noted, therefore, that participation data are only indicative of New Zealander participation in adventure tourism and adventure sports activities.

## Results

**Distribution and cost of claims by age and gender**—The content analysis and coding of the narrative data for compensated injuries (occurring in a place for recreation and sport) produced a total of 18,697 adventure tourism and adventure sports cases; 27 of these were fatalities.

These cases were coded into some 28 activity sectors. Table 1 shows the distribution of claimants by age group as well as median and total costs of claims (as best available proxy for injury severity) for each age range.

**Table 1. Distribution and cost of claims by age**

Age group (years)	n	%	Median cost of claim NZ\$*	Q1†	Q3‡
16–20	2435	13	91.8	38.5	233.7
21–30	4609	25	106.5	44.4	298.63
31–40	4481	24	122.3	52.88	306.1
41–50	3829	21	135.1	54.7	344.0
51–60	2153	12	152.0	58.3	391.2
61–70	800	4	138.7	56.9	358.9
>70	283	1	138.7	51.6	390.5
<b>Total</b>	<b>18590</b>	<b>100</b>	<b>118.6</b>	<b>50.7</b>	<b>316.7</b>

**Note:** These figures exclude the cost of cases (n=1296) for which no cost data was provided in the dataset;

\*New Zealand dollars; †First quartile; ‡Third quartile.

Age groups differed significantly in their number of claims for adventure tourism and adventure sport injuries ( $\chi^2(7)=10,355.6$ ,  $p=.000$ ). Claimants in the 21–50 years age range incurred the largest proportion of claims (approximately 70% of all claims). However, claims were most expensive, and therefore injuries potentially most severe, in the 51–60 years age group.

A Kruskal-Wallis test using the Monte Carlo method showed that the cost of claims for adventure tourism and sports injuries is related to the age of the claimant ( $H(6)=132.1$ ,  $p=.000$ ).

As indicated in Table 1, the median cost of claims increases through to the 51–60 age group, and then reduces slightly for the 61–70 and >70 age groups. Jonckheere's test supports this observed trend in the data of claims costs increasing with claimant age ( $Z=10.7$ ,  $p=.000$ ).

Males (60%) made significantly more claims than females (40%) ( $\chi^2(1)=749.6$ ,  $p=.000$ ), although gender of claimant distributions varied considerably across the various activities (see below).

The injury claim incidence rate for male claimants was 533.4 per 100,000 people, compared to a rate of 356.9 for females (based on 2005 population data provided by Statistics New Zealand). However, the median cost of claims was significantly lower for male (\$111.90) than for female (\$130.37) claimants ( $U=33,263,846$ ,  $p=.000$ ). The proportion of claims for each age group was very similar for male and female claimants, with the majority of claims for both genders in the 21–50 age range.

**Distribution and cost of claims by activity**—Table 2 shows the major activity categories for adventure tourism and adventure sports injuries in New Zealand for the

period of the analysis, along with an analysis of claims costs by activity—and, for activities where participation data is available, injury claim incidence rates.

Land-based activities comprised 61% of all cases, 38% involved water-borne activities, and just 1% cases were aviation-based. Approximately 60% of all adventure tourism-related injuries were incurred during participation in just four activities: horse riding, tramping, mountain biking, and surfing. Moreover, of these high-risk activities, horse riding had a significantly higher rate than the other three activities.

**Table 2. Distribution and cost of claims by activity**

Activity	Claim (n)	Claims (%)	Claims incidence rate per 1000 participants*	Fatalities (n)	Median cost per case (NZ\$)	Q1	Q3
Horse riding	3810	20.4	28.6	3	134.4	54.2	413.3
Mountain biking	2618	14.0	14.8	0	148.2	53.7	360.0
Tramping	2468	13.2	7.6	2	127.4	51.6	297.4
Surfing	2238	12.0	11.1	0	103.7	42.5	232.0
Waterskiing	1110	5.9		0	128.9	49.9	296.0
Fishing	980	5.2	1.5	6	74.3	46.2	184.9
Kayaking/canoeing	864	4.6		0	110.7	46.2	254.6
Wakeboarding/sea biscuit	650	3.5		0	92.4	37.3	233.1
Diving/snorkelling	491	2.6		3	72.7	33.2	223.1
Rock climbing	421	2.3		1	164.4	64.5	401.0
Hunting	392	2.1		1	106.3	38.5	283.9
ATV/quad bike	310	1.7		0	138.2	60.7	711.2
BMX biking	297	1.6		0	126.5	55.6	701.6
Wind surfing/kite surfing	287	1.5		1	109.1	56.3	309.4
Luge	239	1.3		0	108.7	59.1	337.1
Snowboarding	234	1.3		0	133.9	40.4	530.2
Jet skiing	229	1.2		0	106.0	56.8	296.9
Skiing	126	0.7	0.8	0	136.0	44.9	371.6
Mountaineering	206	1.1		6	148.7	56.8	366.1
Whitewater rafting	106	0.6		2	74.3	38.5	138.1
Skydiving	106	0.6		0	153.1	43.6	586.7
Jet boating	86	0.5		1	140.4	34.6	512.0
Paragliding/parasailing/hang gliding	56	0.3		1	335.7	90.2	1546.8
Bungee jumping	54	0.3		0	71.8	33.2	208.7
Other	213	1.1		0			
Total	18697	100		27	114.3	50.7	296.3

**Note:** Based on SPARC Aotearoa estimates of participation in sport and active leisure by New Zealand adults.

Specifically, the horse riding injury claim incidence rate was almost two-times greater than the rate for mountain biking and four times that for tramping. Moreover, horse riding was associated with three fatalities. Only fishing (n=6; 0.6% of all fishing injury claims) and mountaineering (n=6; 2.9%) had more fatalities than horse riding. A further three fatalities involved diving/snorkelling and two white water rafting.

Paragliding/parasailing/hang gliding participants incurred highest median costs, with injuries costing over two-times more than the next highest cost activity: rock climbing.

Of the high claims count activities, mountain biking had the highest cost per claim, while horse riding was also well above the overall median cost for all activities. Relatively low costs of claims were associated with diving, bungy jumping, fishing, and white water rafting, although these activities were associated with 11 fatalities combined.

Type of activity during which the injury occurred was found to differ significantly by gender ( $\chi^2(24)=4237.51, p=.000$ ). Specifically, male claimants had notably more claims for the majority of activities, the major exceptions being horse riding (78.5% of claimants were female), skiing (52.4% female), and tramping (54.6% female).

Indeed, women horse riders had an estimated client incidence rate of 34.5 per 1000 annual participants, which is two-times that of male participants (17.4), based on SPARC participation in sport data. A relatively even distribution of claims by gender was found for bungy jumping, abseiling, and jet boating. Male claimants dominated claims for hunting (91.6% of claims), fishing (84.0%), surfing (81.3%), mountain biking (77.2%), snowboarding (65.8%), and paragliding/parasailing/hang gliding (69.6%).

**Geographical distribution of claims**—Adventure tourism and adventure sports injuries clustered around the main population centres and adventure tourism regions. Thus, 16.0% of claims were for adventure tourism-related injuries occurring in the Auckland area, 14.3% in Canterbury, 13.0% in Waikato, and 9.4% in the Bay of Plenty. A further 9.7% of cases were from Otago, which is the region where Queenstown, the ‘world capital for adventure tourism’, is situated.

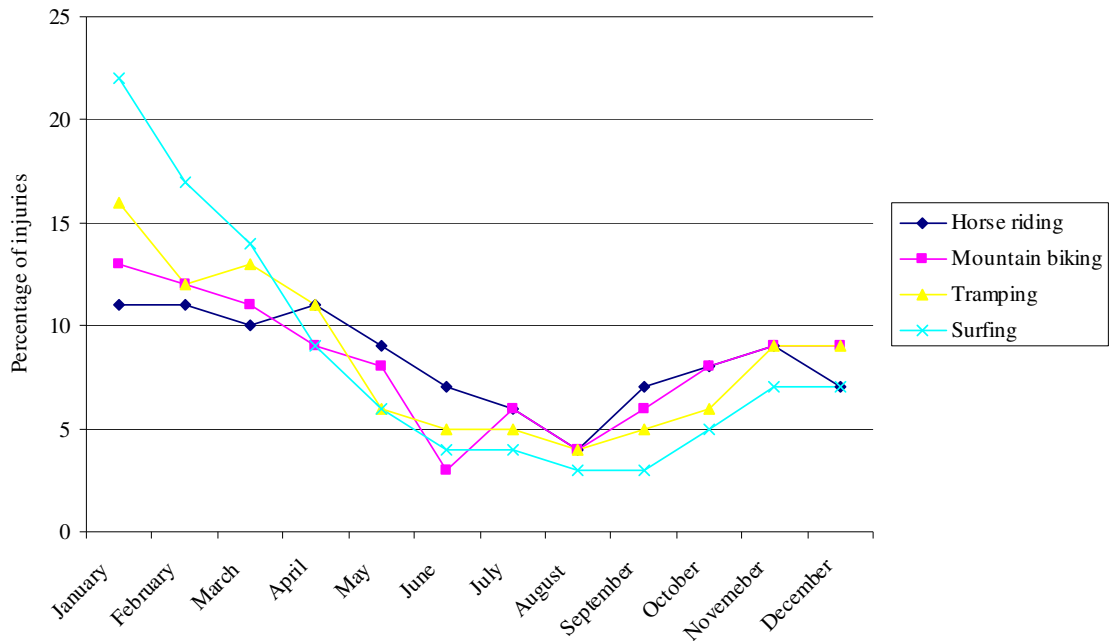
Mountain biking injuries were most frequently incurred in the Central North Island town of Rotorua and in Queenstown, while snow sports injuries were predominantly based around the Southern Alps and Central North Island regions.

**Month of claim**—52.4% of cases occurred during the period, January to April, thus reflecting the seasonal (summer) nature of New Zealand adventure tourism and adventure sports. Figure 1 shows the distribution of the top four injury claims count activities by month of injury occurrence. The distribution of activities across the New Zealand summer season is highlighted, while surfing injuries occur in significant quantities during the mid-summer January holiday period.

**Injury-initiating events**—The vast majority of adventure tourism and adventure sports injuries resulted from falls, including overbalancing, slipping, and tripping (68.6%). The activities contributing most commonly to fall counts included horse riding, mountain biking, snowboarding, and tramping. Other event categories included lifting and/or carrying (8%) and colliding with something (10%). Lifting and carrying injuries most frequently occurred during kayaking, tramping, surfing, and waterskiing.

A large number of cases involved the claimant being injured while lifting or carrying a pack or piece of equipment such as a kayak.

**Figure 1. Distribution of claims for high claims count activities by month**

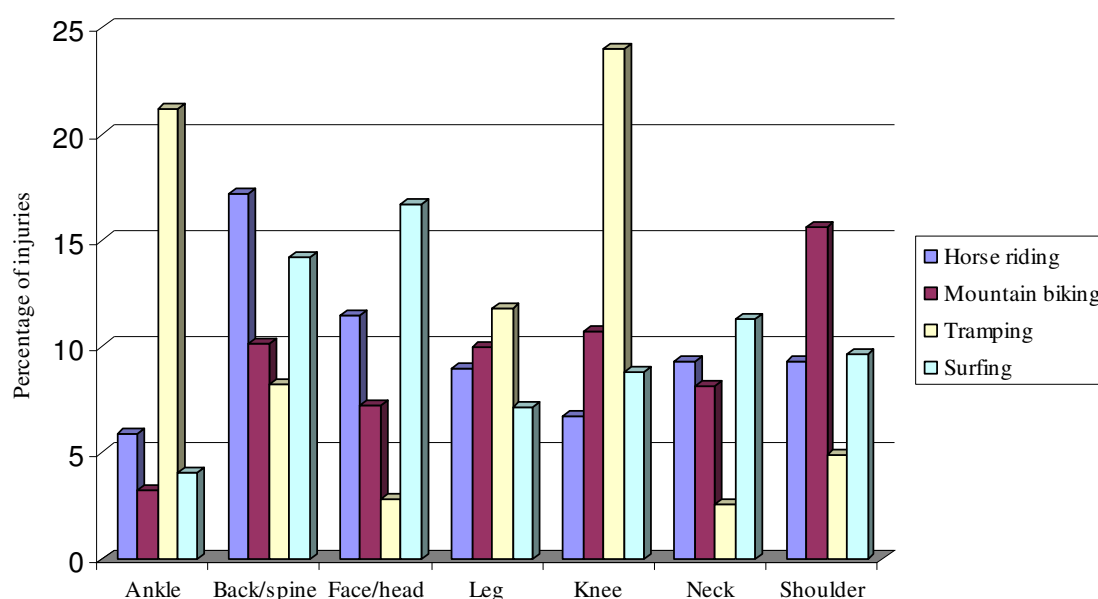


**Body part injured and injury diagnosis**—The most frequently injured body parts for adventure tourism and adventure sports claims were the lower back/spine (13.0%), shoulder (10.2%), knee (10.5%), neck (7.8%), and ankle (7.1%). Major body part injury areas for the four highest claims frequency activities are shown in Figure 2.

From Figure 2 it can be seen that each of the four highest injury claims count activities have distinct injury patterns, with horse riders commonly suffering injuries to the back/spine and head/face, while ankle and knee injuries are most prevalent for trampers. Mountain biking injuries were most commonly to the shoulder. Surfing injuries were most commonly to the back/spine and head/face, presumably through being struck by surf boards.

Soft tissue (sprains and strains) injuries were most frequent for adventure tourism and adventure sports, with nearly two-thirds (63.0%) of all injuries having this diagnosis. Puncture/stings (12.6%) and fractures/dislocations (11.6%) were the other major diagnosis categories.

**Figure 2. Distribution of claims for high claims count activities by body part injured**



## Discussion

This study suggests a significant adventure tourism and adventure sport injury problem, although further research is required to better understand the extent of the problem and to identify key areas for preventive action.

More than 18,500 domestic adventure injury cases were compensated by ACC; this figure underestimates the true scale of the problem as many cases will not have been captured by ACC's database, and many that were included on the database had insufficient information from which to code them as involving adventure activities.

It is also noted that the study omitted injuries to overseas visitors, although international tourists have been found to incur large numbers of hospitalised injuries due to adventure activity in previous studies by Bentley et al.<sup>9</sup> Adventure sport-related claims by New Zealand residents comprised a total financial burden of over NZ\$12 million over the one-year period of the analysis.

As found previously by Bentley et al.,<sup>9</sup> activities that are often undertaken independently (but which are also available commercially) were associated with the greatest number of incidents.

Adventure activities that are not currently covered by regulatory bodies and approved codes of practice, including mountain biking and horse riding, had highest injury counts and high claims incidence rates. These activities also had relatively high severity as measured by cost of claims.

These findings indicate a need to explore whether some form of regulation may be necessary to improve safety and risk management for these sectors, and to determine the extent to which such intervention might be effective in reducing injury to participants of these activities.<sup>3,10</sup> Injury prevention should also focus on the risk to younger male participants, with the exception being horse riding, where attention should be directed towards females of all age groups.<sup>10</sup>

Other preventive activity should focus on risk factors for slips, trips, and falls as these events were the most common mechanism of injury.<sup>3,9,11</sup> For example, tramping, mountaineering, and hunting operators; guides; and individual recreationalists should consider carefully the underfoot conditions on their walking tracks and the footwear used by their clients.

Secondary safety issues such as the design of personal protective equipment that may reduce injuries at the most vulnerable body areas should also be considered, including the hand and wrist for mountain biking and surfing, the head for surfing, and the lower back for horse riding. Indeed, further research is required to identify appropriate protective equipment and its likely effectiveness in reducing injuries to these body areas.

Limitations of the findings of the data analysis for adventure sport-related claims include the inability to identify a large number of cases that may have been adventure-related from the available data. Moreover, the potential for bias in the reporting of injuries that result in claims to ACC must be acknowledged.

A further problem was the absence of reliable participation (denominator) data from which to determine incidence rates for many of the activities, thus making a full comparison of risk among activities impossible. Indeed, the participation data that was available was not up-to-date and should be considered as indicative only of the extent of participation by New Zealanders in these activities.

Despite these shortcomings, the current study's findings support those of the authors' previous studies in providing a useful baseline picture of the adventure tourism and adventure sports injury situation in New Zealand.

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**Author information:** Tim Bentley, Senior Lecturer; Keith Macky, Senior Lecturer; Jo Edwards, Researcher; Department of Management and International Business, Massey University, Auckland

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**Correspondence:** Dr Tim Bentley, Department of Management and International Business Massey University, Auckland. Fax: (09) 441 8109; email: [T.A.Bentley@massey.ac.nz](mailto:T.A.Bentley@massey.ac.nz)

## References:

1. Wilks J, Atherton T. Health and safety in marine tourism: a social, medical and legal appraisal. *Journal of Tourism Studies*. 1994;5:2–16.



2. Rowan J. Coroner wants safety belts installed in luge fun carts. Auckland: New Zealand Herald; 28 July 2005. URL: [http://subs.nzherald.co.nz/organisation/story.cfm?o\\_id=315&ObjectID=10337881](http://subs.nzherald.co.nz/organisation/story.cfm?o_id=315&ObjectID=10337881)
3. Bentley TA, Page SJ. Tourist injury. In: Wilks J, Pendergast D, Leggat P (eds). *Tourism in Turbulent Times. Towards Safe Experiences for Visitors* Amsterdam: Elsevier; 2006, p155–70.
4. Hall C, McArthur S. Commercial white water rafting in Australia. *Australian Journal of Leisure and Recreation*. 1991;1:25–30.
5. Johnson, M. Accidents in mountain recreation: The experiences of international and domestic visitors in New Zealand. *GeoJournal*. 1989;19:323–8.
6. Malcolm M. Mountaineering fatalities in Mt Cook National Park. *N Z Med J*. 2001;114:78–80. URL: <http://www.nzma.org.nz/journal/114-1127/2205/content.pdf>
7. McLaughlan M. White water death: Why is the Shotover New Zealand's most lethal river? North and South; 1995 December, p70–81.
8. Greenaway R. Thrilling not killing: managing the risk tourism business. *Management*. 1996;May:46–9.
9. Bentley TA, Meyer D, Page SJ, Chalmers D. Recreational tourism injuries among visitors to New Zealand: an exploratory analysis using hospital discharge data. *Tourism Management*. 2001;22:373–81.
10. Northey G. Equestrian injuries in New Zealand, 1993-2001: knowledge and experience. *N Z Med J*. 2003;116(1182). URL: <http://www.nzma.org.nz/journal/116-1182/601>
11. Bentley TA, Page SJ, Laird I. Accidents in the New Zealand adventure tourism industry, *Safety Science*. 2001;38:31–48.