Chapter Three

Epidemiological study of New Zealand compensation claims involving quadbikes

3.1 Introduction

The objective of the study reported in this chapter was to develop a more detailed overview of the problem in New Zealand, drawing on archival data, predominantly those collected by the state-run insurer the Accident Compensation Corporation (ACC). The study is therefore a descriptive epidemiological analysis of ACC Claims Data of 850 ACC claims positively identified as being related to quadbike use, in the period July 2000 – July 2001. This study addresses in part the first stated research aim, to establish the scale of the problem of loss of control events (LCE) involving quadbikes on New Zealand farms.

The specific aims of this epidemiological study were twofold:
a) Identify patterns and trends in quadbike-related escalated claims for the period July 2000- July 2001. Specifically, to determine the distribution of claims across:

- occupational groups
- locations/incident scene
- geographical region
- months/seasons
- demographic variables (sex, age, employment status)
- injury types/diagnosis and body areas injured.

b) Determine incident event/injury mechanism information, specifically:

- activity immediately preceding the incident
- first and subsequent events in the event sequence
- injury agencies

This analysis also informed the design of incident-independent enquiry and detailed quadbike LCE follow-up investigations by the researcher as reported in Chapters Four and Five. The findings were integral to the participative dialogue of the latter on-farm work, providing new insights to inform the discussions on risk factor interactivity and potential interventions.

3.2 Methodology

3.2.1 General approach

Cryer (1995) states that descriptive injury epidemiology has the goals of identifying injury causes, priority areas for preventive action and evaluation of countermeasures.

In the context of quadbike LCE leading to compensated injury, patterns and trends can be usefully identified and some indication of likely risk factors gained through epidemiological methods. The strengths of an epidemiological approach include low cost (Bentley & Haslam, 2006), and in the case of New Zealand a national perspective on the issues. However, as Bentley and Haslam warn, the use of descriptive injury epidemiology alone may fail to deliver effective countermeasures as high level desk-based studies do not yield a rich level of valid and reliable detail.

Archival sources alone are also poor at identifying distal factors at the organisational (Bentley & Haslam, 2006; Reason, 1990), social or regulatory levels. Triangulation of the archival injury data with data from other sources that gather information closer to the actual events is generally needed if the investigator is to provide appropriate recommendations for injury prevention.

The findings of the epidemiological study reported in this chapter also served to inform the researchers on certain matters of interest to the farming community - beyond the level of this population in general. Wilson, Haines and Morris (2005) highlight the importance in participatory studies for the facilitator to be unbiased and knowledgeable at an appropriate level for their role in the exercise (p. 995). Apart from having a demonstrable grasp of the bigger picture, an understanding of the problems at a population level enables the researcher to impart information which farmers find useful – informing the debate and immediately giving the participants something in return for their involvement.

A second source of archival claims data was identified that could be used alongside the ACC data. Farmers Mutual provides a private insurance scheme of a similar nature for farm owners and agreed to make it available for the study. It was not forthcoming however, despite continued promises that it would be, for reasons that the company would not make clear. This private sector reluctance to share data underlines the importance to New Zealand injury prevention research of having accessible and reasonably representative sources like ACC.

3.2.2 ACC data

ACC provided the researcher with a database containing 882 cases, representing all escalated quadbike-related claims for the period July 2000-July 2001. Escalated claims are those that ACC consider (at initial processing stage) to be amongst the one third that will be most costly. Only these third have narrative included at data capture stage and can therefore be retrieved by a keyword search.

These data were selected from the main ACC claims database using the following keywords: 'quad bike', 'farmbike', 'quad', 'four-wheeler', 'ATV', 'all-terrain vehicle'. The data were cleaned by the researcher, removing all non-four-wheel/quad bikes from the dataset through a manual inspection of the data fields. The narrative text in some cases gave clear indications of this despite not specifically stating 'quad' or 'two-wheeler'. For example 'burned leg on exhaust pipe' was assumed to be from a two-wheeler, given the frequency of this occurrence as the machine slides under the rider. It is unlikely that the leg would be brought into contact with the far more concealed exhaust system on a quadbike. This left 850 ATV-related claims, believed to involve quadbikes.

Having removed all information associated with the claimant's identity and other confidential and non-useful information, variables available for analysis were:

- narrative text field (one-line description of the incident)
- date of birth
- sex
- work-related (yes or no)
- accident date
- scene (e.g. 'farm', 'road')
- employment status (e.g. self-employed, employee, non-earner)
- serious injury (yes/no)
- fatality (yes/no)
- diagnosis (eg. fracture, soft tissue)
- injury site (eg. hand, face)
- location (district)
- occupational group (eg. livestock producer, labourer)

These data were entered into Excel and data preparation was undertaken. This included:

- transforming incident date data to month codes
- collapsing location data into 19 district codes, using Statistics New Zealand regional boundaries
- collapsing occupational group data into a few relevant codes for purposes of clarification

The narrative text fields describing incident events were coded into four new variables: 'activity'; 'first event', 'subsequent event' and 'injury agency'.

Coding of the narrative text fields involved the following process:

- sample content analysis to determine the quality of information the narrative could provide in regard to these variables
- coding of a sample of 100 cases to produce category codes for each of the four variables using the narrative text and where available supporting information from other data fields
- calculation of percentage agreement (>95%) on sample coding of 100 cases between two experienced epidemiological researchers
- coding of entire dataset for the four new variables by the author and other experienced researcher
- review of coding by both researchers

Analysis methods used were restricted to basic frequency and cross-tabular distributions as the data were discrete and low order. The analysis was performed using SPSS for Windows version 10.

3.3 Findings

A total of 850 escalated claims to ACC during the 13 month period July 2000-July 2001 involved quadbikes. Of these, just four were classified by ACC as 'serious', and six others were fatalities.

3.3.1 Employment Status

Claimants were mostly either classified as self-employed (47%) or employed (45%). Some 5.5% of claimants were non-earners.

3.3.2 Occupational Group

Agricultural/Land-related occupations were by far the largest group, accounting for 518 (61%) incidents. Non-occupational/other occupations comprised 221 (26%) incidents, with students/pre-school children involved in 50 (6%) incidents.

3.3.3 Scene of Incident

The large majority of incidents occurred on a farm (43%) or industrial place (24%). A large number of incidents occurred in non-industrial settings, with some 11% classified as 'home' and 52 (6%) as 'road'. Based on indications from the narrative data, and the overlapping home and work nature of the agricultural sector, it is likely many incidents classified as occurring at home and on the road were work-related. A further 28 (3%) incidents occurred in a place for recreation and sport. It is likely that some of these events will have involved commercial adventure tourism clients.

3.3.4 **Region**

Figure 3.1 shows the number of quadbike-related claims by region (as defined by Statistics New Zealand for census purposes as at Sep 2001), together with claims incidence rate, using total regional population statistics as denominator (Source: Statistics New Zealand Census 1996).

Figure 3.1. Regional distribution of claims and claim incidence rates by region

The spread of percentage of claims broadly reflects the most active producer areas for dairy and beef farming in New Zealand; these being Waikato, Canterbury, Northland, Southland and the lower central and the West of the North Island. There is a strong pattern of low incidence in those regions dominated by large urban centres – notably Auckland and to a lesser degree, Christchurch (in Canterbury) and Wellington.

3.3.5 Month of incident

The pattern of quadbike-related incidents across the year July 1,2000 - June 30, 2001 are shown in figure 3.2. We can see that quadbike-related incidents are reported as occurring more commonly during the milder Southern Hemisphere months.

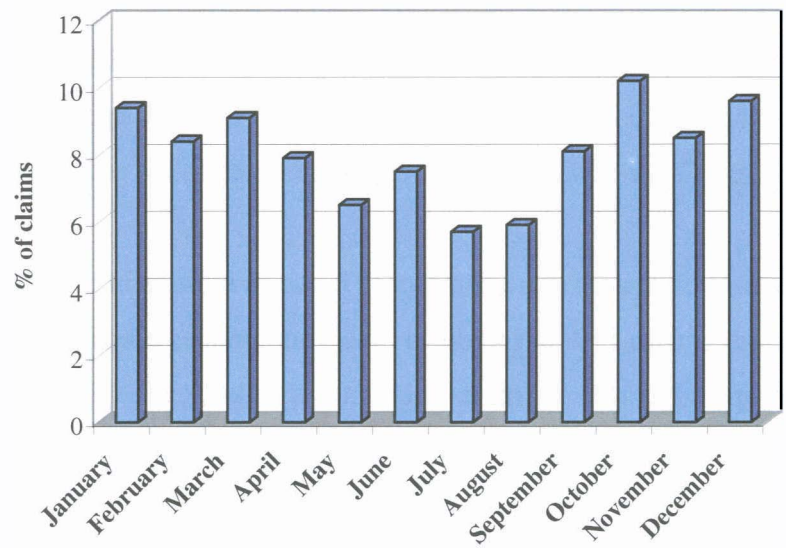

Figure 3.2 Distribution of quadbike-related claims by month

The pattern broadly reflects the seasonal fluctuations in workload on New Zealand farms. During the winter, milking stops on all farms apart from those contracted to provide 'town supply', and this is the easiest time for dairy farmers to take holidays, travel to trade shows and carry out maintenance work. Lambing, calving and the spring growth make September and October the busiest period of the year with little opportunity for time off.

3.3.6 Age and Gender Distribution

Males registered 83% of quadbike-related claims, and females 16%. Figure 3.3 shows the age and sex distribution of quadbike-related incidents. The majority of incidents involved people in the main working age groups: 21-60, with a total of 374 incidents (44%) involved persons in the 31-50 age group. Young adults and children (0-20 years) incurred some 98 (12%) injuries.

Females were over-represented in the 0-10 years and 11-20 years age groups, with 5% of female injuries involving children in the 0-10 age range compared to 0.4% for males. Older females were under-represented in the oldest two age groups.

Female claimants more commonly incurred injuries in non-occupational/industrial settings, with 17% of incidents involving females classified as occurring at 'home' compared to 10% for male claimants. Similarly, *6%* of incidents involving females occurred at a 'place for recreation and sport' compared to 3% for males.

Incidents involving children and young adults occurred at 'home[7]' more frequently than for other age groups, with some 20% of all home incidents involving claimants under the age of 21 years, while home claims made up just 11% of all claims.

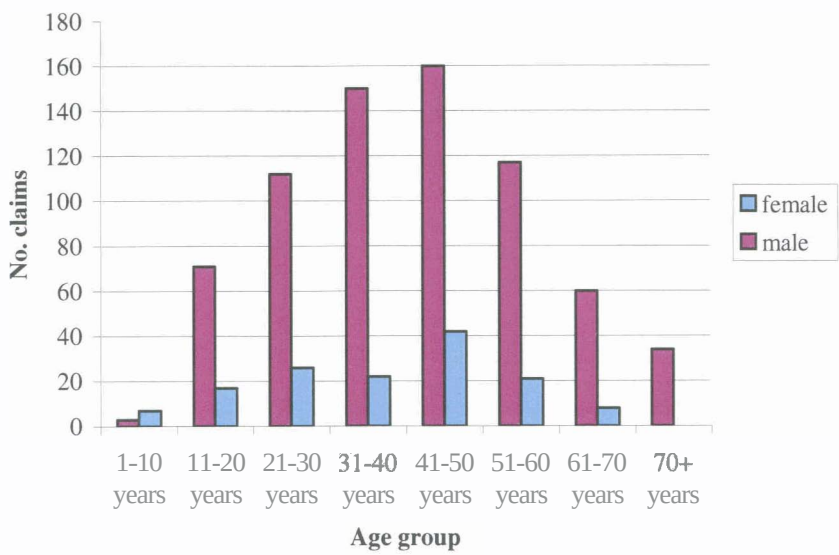

Figure 3.3 Age by sex distribution for quadbike-related claims

3.3.7 Diagnosis and body region injured

Claimants most often sustained soft tissue injuries (57%), fractures or dislocations (19%) or lacerations (12%). Injuries were most frequently located at the knee (10%) and lower back (9%), with some 89% of knee injuries and 75% of lower back injuries recorded as soft tissue injuries. Other high-frequency body part regions were to the shoulder (9%) and chest (8%), both of which involved a relatively high proportion of fractures or dislocations (shoulder = 34%; Chest = 39%).

3.3.8 Activity immediately preceding the incident

Activities immediately preceding the quadbike-related injury event as identified from the narrative text fields are shown in Table 3.1

Table 3.1 Activities immediately preceding the quadbike-related injury

Activity	n	%
Riding quadbike as driver	690	81
Passenger on quadbike	20	2
Passenger on trailer (pulled by quadbike)	6	1
Getting on/off quadbike	47	6
Lifting/carrying/pulling/pushing	63	7
Other/unknown	24	3
Total	*850*	*100*

The most common activity immediately preceding the incident was 'riding the quadbike as driver' (n=690; 81%). Approximately 16% of incidents involved activities other than riding/driving an quadbike. Children and young adults were found to be over-represented among claimants not riding/driving the quadbike, with 55% of injuries to quadbike passengers involving claimants in the 0-20 age group. Moreover, the claimant was either a student or from another non-occupational category in 80% of incidents where the claimant was a passenger.

3.3.9 Incident event sequences for major activity categories

The most common event sequence was found to be riding the quadbike as driver when the quadbike rolled or tipped and the rider was thrown from the machine, as shown in the taxonomy - Figure 3.4. This specific event sequence occurred in 433 or 51% of all incident cases.

Where the quadbike was being ridden and struck an object, half of the riders then fell from the machine (n=63). In 19% of cases where the ridden quadbike struck an object, the rider stayed onboard but incurred a strain/sprain injury.

In 89% of cases where the person was struck or against an object while riding, no further description is given. The objects, where identified, were predominantly insects, light debris etc and presumably were not substantial enough for them to loose control.

Where the machine was not being ridden at the time of the events, the most common activities were manual handling (7%) and getting on/off (6%) which are analysed further in the second taxonomy, Figure 3.5. Injuries incurred while climbing on or off the quadbike most commonly involved the claimant stepping in or onto an uneven surface, or slipping on the foot plate or muddy surface.

Manual handling injuries were mostly (84%) attributed to lifting/carrying or pushing/pulling. Common scenarios identified from content analysis of the narrative text included dragging the quadbike out of heavy ground, attaching or detaching the trailer, and handling loads in and out of the trailer or other trailed implement - such as a spreader or calf feeder.

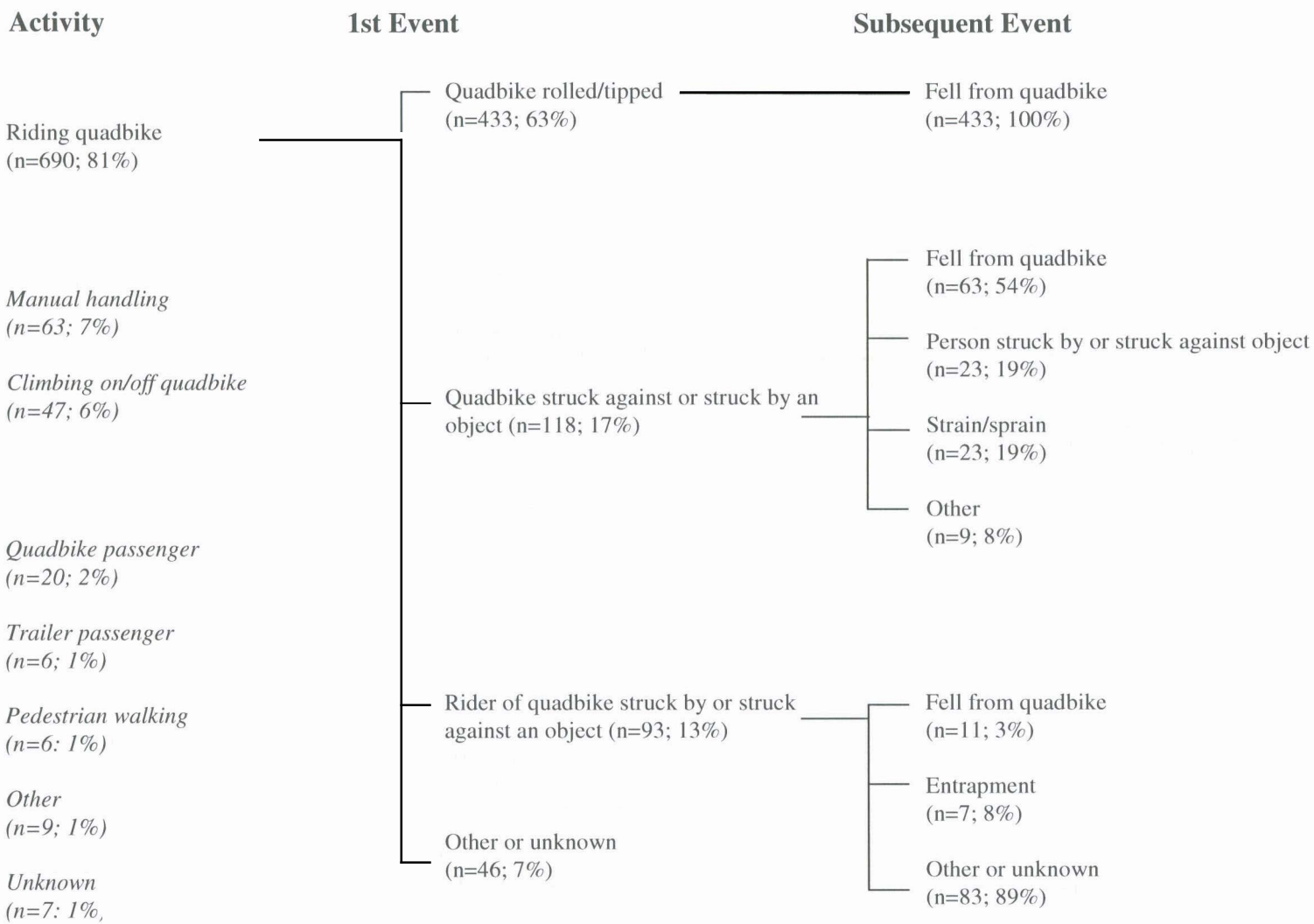

Figure 3.4 Taxonomy of incident event sequences

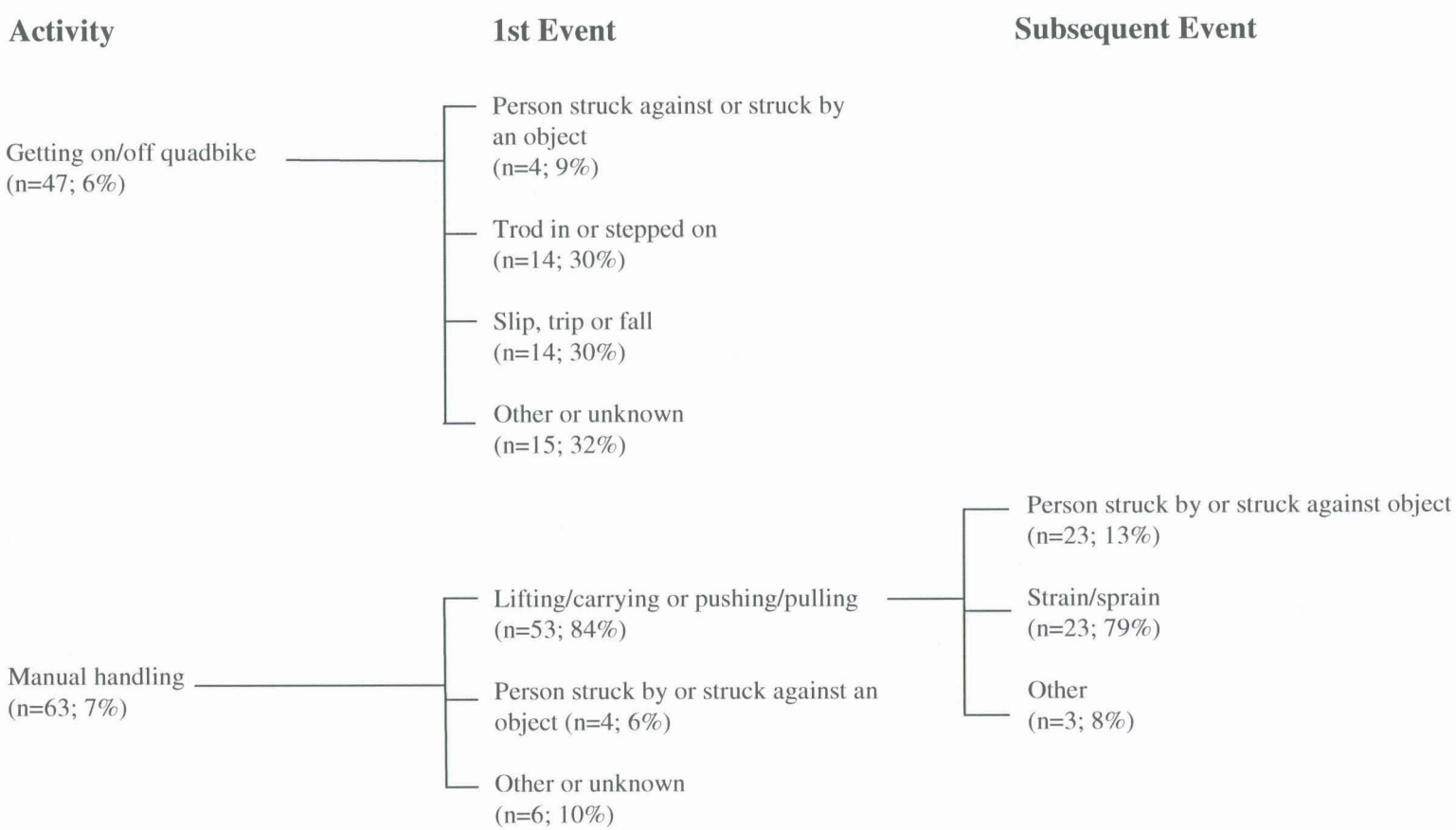

Figure 3.5 Taxonomies of getting on/off and manual handling injury events

3.3.10 Injury agency

The most common injury agencies identified from the narrative text include the ground surface (49%), the quadbike (37%) and airborne debris (5%). The roll bar was mentioned as having struck the claimant following a fall from the quadbike in just five cases. It is possible that in some cases where the narrative indicated the person was struck by the quadbike after a fall the person may have been struck by the roll bar. Where the quadbike rolled, the injury agency was most often the ground surface (65%) or the quadbike (31%). Where an object struck the rider, the injury agency was airborne debris (eg. mud, insect) in 23% of cases. The injured body area was the eye in the majority of struck by airborne debris cases. The wearing of eye PPE is not mentioned as a potential intervention in the literature – surprising given how often this type of incident appears to happen.

3.3.11 Use of implements

Some 3% (27) of the 882 identifiable ACC claims that involved quadbikes, also identified trailers specifically as factors in the incidents. Of note is that over half of the injuries came about via manual handling of the trailer or its contents. In particular, the 36% from attaching or detaching the trailer warrant further study.

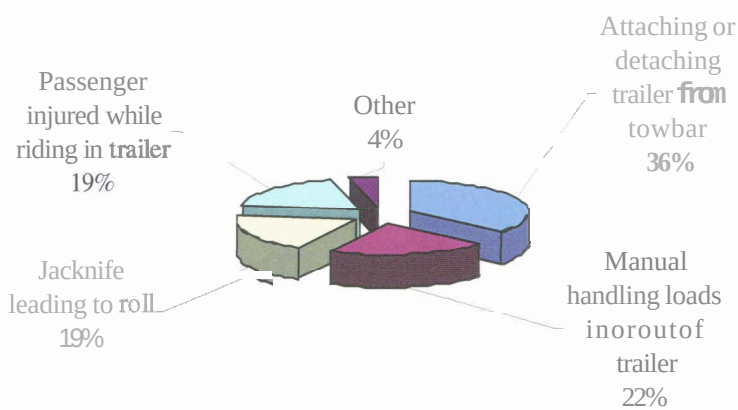

Figure 3.6 Cases involving trailers

3.4 Discussion

Loss of control while riding the machine emerged as the predominant injury scenario grouping. In 81% of all the 850 claims analysed, the injured party was riding the machine at the time - as opposed to another activity such as climbing on/off or engaging in manual handling tasks around the quadbike or trailer. In 63% of these cases the machine then rolled or tipped, throwing the rider to the ground. This sequence of events is reported seven times more frequently than the next most common scenario in which the machine strikes an object while being ridden, also throwing the rider off.

There were 47 injuries sustained while getting on or off. In those cases where the rider was getting off the machine when the injury occurred, it cannot be assumed that the machine was immobile at the time. Jumping off a moving quadbike to catch animals at lambing time is reported to be a necessary and common practice. Intimations of this were present in the narrative analysis, but it was not stated in any cases. The rider would have no reason to admit to ACC that they had acted in a way that could be construed by an insurer as horseplay. In the context study in Chapter Four, the ways in which quadbikes are used for mustering is discussed in more detail.

The self-employed group made up 47% of claimants in this study. They were quite possibly under-represented however as comments made by several farmers during the course of this research suggests that self employed people find the ACC system a laborious and unhelpful one when negotiating income-related benefits. This is primarily because the system is simpler for those who are employed and pay their tax at source on Pay As You Earn (PAYE). It is more complex for a self employed person who is part of a family-owned business. This is partly because profits from the business which all end up in family purse may be distributed through two or more people, and also because the self employed have a strong incentive to claim all that they legally can as work expenses as a way to minimise their personal taxable income for the year. On a farm, the line between home expenses and work expenses can be a very blurry one; road vehicle running costs being a good example. An

expensive trip into town for people on remote farms will of course take in a variety of both work and non-work related purposes. When injured, the actual financial loss to the family may be greater than just the declared taxable income of that particular individual. Unless the injury is a very serious one the farmer or contractor may therefore decide it is not worth making an ACC claim and just absorb the costs themselves. Others have private insurance to cover such losses.

Establishing the scene of the incident is difficult in this industry as the workplace is also home. Although the 850 locations were described variously as: a farm (43%), industrial place (24%), home (11%) and road (6%), all 84% of these could have been in the same place, for example, on a well formed race on a family-owned dairy unit.

What is clear, however, is that these findings support the contention that there is significantly less recreational use of quadbikes in New Zealand than there is in North America. Delisle (1988) reported that 76% of ATV-related hospitalisations in his Quebec study of over 600 admissions were from incidents on formal trails and roads. Just 6% of those in this New Zealand study took place on roads – or rather surfaces described as roads, which in some cases would not have been publicly maintained. The Motorcycle Distributors Association (NZMDA, 2001) estimate that nine out of ten of the five million US riders are recreational, whereas just 3% of those recorded in this study stated to ACC when making their claim that they were using their quadbike at the time for sport or recreation.

The regional distribution of claims and claim incidence rates by region broadly reflects the distribution of dairy and beef farming in New Zealand. Quadbikes are especially popular in Dairying for moving stock on races, resetting electric fences and moving feed. Dairy also employs more people per hectare than sheep or beef operations, and so will use more quadbikes per property. The incidence figures again reflect higher usage of quadbikes amongst some populations than others. Auckland demographics are dominated by the 1.5 million city dwellers. Southland has a rapidly growing dairy industry within a relatively small total population. The West Coast has a very small population and low total number of claims, and so the high

incidence rating may be misleading. This further supports the assertion that recreational riding of quadbikes represents a far smaller proportion of all use in New Zealand than in North America. In their study on the use of quadbikes by young people in Manitoba, Canada for example, Warda et al (1998) found no difference between those living in rural areas and those from towns.

The findings show quadbike-related incident reports to be more common during the milder months than in the wetter, colder weather months of May through August. These wintry months may have been expected to yield a larger proportion of injuries due to the dark, frosty or icy conditions. However, the spring and summer peaks mirror the greater workload/exposure to risk during busy periods such as lambing when it is common for people to be working seven day weeks for two or three months (Moore, 2005).

Middle-aged men appear most frequently in the ACC claims for quadbike injuries. A study by Langley et al. (1995a) drawing on hospitalisation data in New Zealand between 1978-1989 noted that, the 15-19 year old age group had the highest incidence per 100,000 of the rural population. 25% of all the injuries reported involved those under the age of 15 years. This contrasts with the greater prevalence of injuries amongst older riders noted in this study. A significant factor is that ACC Escalated Claims Database from which this current study is drawn is reportedly skewed towards earners as opposed to non-earners (including children), which confounds direct comparisons with the earlier work. The issue of injuries to young people clearly remains an important one in New Zealand with around one quarter of all fatalities, but is beyond the scope of this occupationally-based piece of research. No contemporary comparison can be easily made as the hospitalisation data ceased to carry descriptive narrative text from which quadbike-related cases could be positively identified during the 1990s (Langley, 1998, p. 296).

Unrelated directly to loss of control events, but warranting further study, is the high incidence of manual handling injuries related to hitching or unhitching the trailer from the quadbike. The positioning of the towbar is low and awkwardly placed,

being tucked away close to the rear axle, which makes it impossible in many cases for the user to get their feet under the load. An added factor is that the engine also needs to be switched off before connecting or disconnecting the trailer as most exhaust pipes emit at face level otherwise during the process.

The analysis of diagnoses and body region injured showed a wide spread of injury locations but a notable clustering of the more severe outcomes around the chest and shoulders. Less than five percent of injury claims in this study involved the head, neck or face, which is markedly different to findings from the USA. In the exercise to develop and promote a helmet for quadbike use, Standards New Zealand (2002) used North American data as justification for focussing on this injury type ahead of crushing injuries to the torso and limbs, stating that one in five claims related to head injury.

Incidence of fatality in New Zealand (2000-2) and the USA (Medford & Ahmed, 1999) in 1998 was identical at 10 deaths a year per 100,000 machines, and more recently, Scutchfield (2003) reported 2453 injuries per 100,000 machines in 1999 for the USA as a whole, which is probably again very similar to New Zealand (allowing for ACC coding practices and suspected under-reporting by self-employed New Zealand farmers). These similarities in incidence may have led some bodies in New Zealand to prematurely assume that other similarities in the detailed nature of quadbike incidents and resulting injury diagnoses also exist.

3.4.1 Limitations

The primary limitation of this study is that it draws on a single data source, and one that has been found through other studies (Moore et al., 2006b) to have certain weaknesses. However, it is the only one available of its kind in New Zealand, and these centrally collected records are used extensively by the injury prevention community, government and the industry

One limitation relevant to this study relates to the degree of detail in the narrative entries for each case. Identifying four-wheeler incidents from the pool of two, three, four and now six-wheeler incidents occurring on farms was not always possible as the narrative in some cases simply stated 'farmbike'. Establishing historical trends – 'is four-wheeler incidence increasing?' is further complicated by changes in available data sources in the last 15 years in New Zealand, and also inconsistencies in popular terminology.

The quality and reliability of the data are also influenced by the biases introduced by the various motivations for non-reporting or misreporting. For example, acute injuries are thought to be more likely to be accepted by ACC without further question than more gradually developed MSD (Musculoskeletal Disorders). This has been reported (Moore et al., 2006b) to affect account accuracy in reporting.

Employees are also judged by claimants to be able to gain realistic earnings-related benefits more easily than the self-employed. This is considered within the industry to deter farm owners from claiming with ACC, as the time and effort may not be justified by the return. This section of the farming community may therefore be under-represented in the claimant data, but the comparative incidence rates cannot be calculated due to an absence of denominator data.

3.5 Conclusions

The study aims of identifying meaningful patterns in quadbike-related escalated claims by: occupational group, locations/incident scene, geographical region, months/seasons, demographic variables (sex, age, employment status) and injury type were achieved. Incident event/injury mechanism, and the activity immediately preceding the incident, first and subsequent events in the event sequence and injury agencies were also analysed.

It should be noted that the ACC reporting process and database design does not lend itself to the recording of the multiple factors surrounding an injury event, and so while valuable, this level of analysis alone is not sufficient for generating evidence-based interventions. The description of the incident is rarely more than a sentence, and potential reporting biases include the fact that acceptance of an individual claim for payment by ACC may well hinge upon subtleties within the wording. Accurate interpretation and data entry may also be impeded by a lack of ACC data capture staff familiarity with the nuances of farming terminology.

The key contribution of epidemiology is its population focus (Pearce, 1996), and as pointed out by Bentley (submitted), epidemiological technique at the level of injury data analysis "can at best only provide information on active failures and proximal risk factors". Other methods are required in order to gain an understanding of the underlying factors and overall context of the incidents.

This analysis therefore also informed the detailed design of the next stages of the research - the context study and detailed quadbike incident follow-up investigations.