

A six-year review of patients admitted to hospital with injuries related to quad bike use

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ABSTRACT

AIM: To describe quad bike injury-related hospitalisations in the Midland region over a six-year period.

METHOD: A retrospective review of anonymised, prospectively-collected trauma registry data from 1 July 2012 to 30 June 2018 was undertaken. Cases include patients hospitalised with quad bike-related injuries. Non-major injuries are included to provide a clearer picture of the trauma burden.

RESULTS: Three hundred and forty-six injuries resulted in hospitalisation with 70.2% of events occurring on a farm. Males outnumbered females 3.7:1. Forty-six children (<16 years) were hospitalised, of which 23 were injured on-farm and seven on a road. Over six years there was an annual average increase of 7.3% for all events occurring on a farm, 2.6% for injuries occurring during a farming activity and 4.7% for off-farm recreational injuries.

CONCLUSION: Despite continued public debate and education on the safe use of quad bikes, injuries severe enough to require hospitalisation continue to occur. Children continue to be injured, both as riders and passengers. Ageing farmers are a developing area for concern. While workplace safety garners most of the safety attention, two other areas also deserve injury prevention consideration; injuries that occur on-farm but not during farming activities and those occurring off-farm to recreational riders.

Quad bikes have been embraced by the rural community. There are an estimated 80,000–100,000 vehicles in use across New Zealand, the majority being used on farms.^{1–3} Quad bikes are now the farm workhorse, used extensively for transport and small load carrying, having rapidly decreased the use of tractors.² Their popularity is based on their versatility, ability to perform multiple functions, perception of being able to go places other machinery cannot, and their relative cost-effectiveness.⁴ Some of these properties that make these bikes valued also make them dangerous, especially for inexperienced adults and children.^{5,6}

In New Zealand, as in other countries, quad bike injuries are an important cause of trauma admissions and carry a significant risk of morbidity and mortality.^{2,5,7–11} There has been persistent concern and discussion over many years around the safe use of

these vehicles, particularly on farms.^{10,12} The agricultural sector in New Zealand is recognised as a high-risk occupation and improving the safety of farmers is a priority prevention area for WorkSafe as the national regulator of workplace safety.¹³

In this paper we describe quad bike injuries severe enough to require hospitalisation over the period 2012–2018. Our hypotheses were that the number of quad bike injuries would have increased over time, including those occurring in relation to farming activities, those occurring on farms but not during farming activities and those due to recreational activities. Our interest in quad bike injuries is due to our role as the hospital-based regional trauma service provider. To this end we focus on three areas; farming-related injuries, injuries to children and the growing importance of injuries to older riders, particularly farmers.

Methods

A retrospective review of anonymised, prospectively-collected MTS trauma registry data for the period 1 July 2012–30 June 2018 was conducted. The study criteria included patients recorded in the Midland Trauma System (MTS) registry as admitted to hospital as a result of an injury sustained while operating or being a passenger on a quad bike. The MTS was established in 2010 to coordinate the management of trauma care for the region and support injury prevention in the Bay of Plenty, Lakes, Taranaki, Waikato and Tairāwhiti District Health Board areas (a regional population of approximately 950,000).

Consistent with trauma registries internationally, patients are excluded from the MTS trauma registry if they sustained insufficiency or periprosthetic fractures, exertional injuries, hanging/drowning/asphyxiation

without evidence of external force, poisoning or ingested foreign body (not causing anatomic injury), injury as a direct result of pre-existing medical conditions or late effects of injury, or the injury occurred more than seven days prior to admission.¹⁴

Severity and pattern of injury diagnoses were quantified using the Abbreviated Injury Scale (AIS), an anatomical scoring system that ranks injuries from '1' (minor) to '6' (nonsurvivable).¹⁵ The Injury Severity Score (ISS) is also an anatomical scoring system using a 0–75 scale. The highest AIS scores in each body region are the basis of the ISS, with injuries then categorised as non-major (ISS≤12) and major (ISS≥13).¹⁶

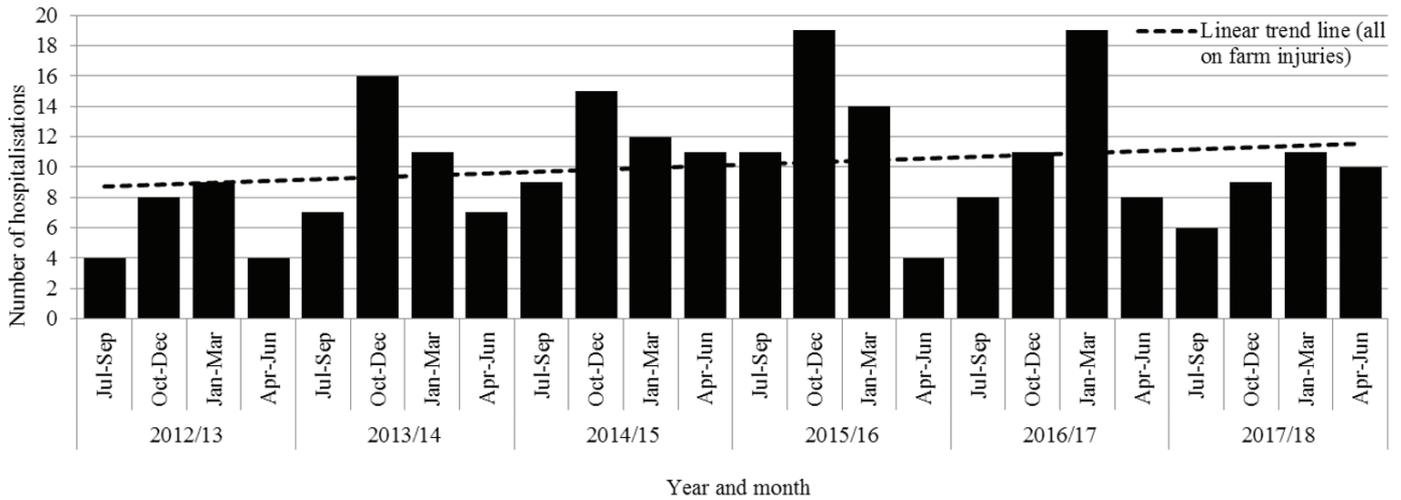
Results

A total of 346 hospitalisations met the study criteria with 70.2% of quad bike injuries occurring on a farm (Table 1). Less

Table 1: Demography of injury by place of injury, 1 July 2012–30 June 2018 (n=346).

	Farm	Road	Country/beach	Sports	Other	Total
Total	243 70.2%	30 8.7%	32 9.0%	16 4.6%	25 7.2%	346 100%
Injury severity (ISS)						
Major (ISS>12)	30 55.6%	11 20.4%	6 11.1%	2 3.7%	5 9.3%	54 100%
Non-major (ISS<13)	213 73.0%	19 6.5%	26 8.9%	14 4.8%	20 6.9%	292 100%
Gender						
Female	54 74.0%	7 10.0%	4 5.5%	2 2.7%	6 8.2%	73 100%
Male	189 69.2%	23 8.4%	28 10.3%	14 5.1%	19 7.0%	273 100%
Age group						
0–14 years	20 48.8%	6 14.6%	1 2.4%	3 7.3%	11 26.8%	41 100%
15–24 years	38 66.7%	8 14.0%	5 8.8%	4 7.0%	2 3.5%	57 100%
25–44 years	75 75.8%	5 5.1%	11 11.1%	3 3.0%	5 5.1%	99 100%
45–64 years	79 72.5%	10 9.2%	11 10.1%	3 2.8%	6 5.5%	109 100%
65–74 years	21 72.4%	1 3.5%	4 13.8%	2 6.9%	1 3.5%	29 100%
75+	10 90.9%	-	-	1 9.1%	-	11 100%

Figure 1: Hospitalisations resulting from quad bike events on a farm, during farming or non-farming activities (n=243).



than 10% of injuries occurred on a road, but this category contributed 20.4% of all major injuries. Of all quad bike injuries, 15.6% were considered major injuries (ISS \geq 13). This is in contrast to all injuries in the MTS trauma registry where eight percent are major injuries. Most patients admitted to hospital were male (78.9%). Children (0–14 years) made up 11.9% of patients with almost half (48.8%) of injuries occurring on a farm. For males aged 25+ years, over 70% of injuries occurred on a farm. Those over 75 years made up 3.2% of patients, and for those patients all but one were injured on a farm.

The median age of all admitted patients was 39 years (SD 20.2) with the median age for on-farm injuries being 41 years (SD 19.7), though these injuries were not necessarily

due to carrying out a farming activity. For injuries occurring on a farm while a farming activity was being undertaken the median age was 45 years (SD 17.4).

Hospital admission patterns over time—events by quarter

Given longstanding safety discussions and education around the use of quad bikes by both government and sector agencies, we were interested to see the pattern of hospital admission over the six-year period for all injuries occurring on a farm (Figure 1), those injuries occurring on farm during a farming activity (Figure 2) and for those injuries that did not occur on a farm (Figure 3). In each instance a linear trend line has been fitted to quarterly data to highlight any increase or decrease in admissions over time.

Figure 2: Hospitalisations resulting from quad bike events on a farm, during a farming activity (n=158).

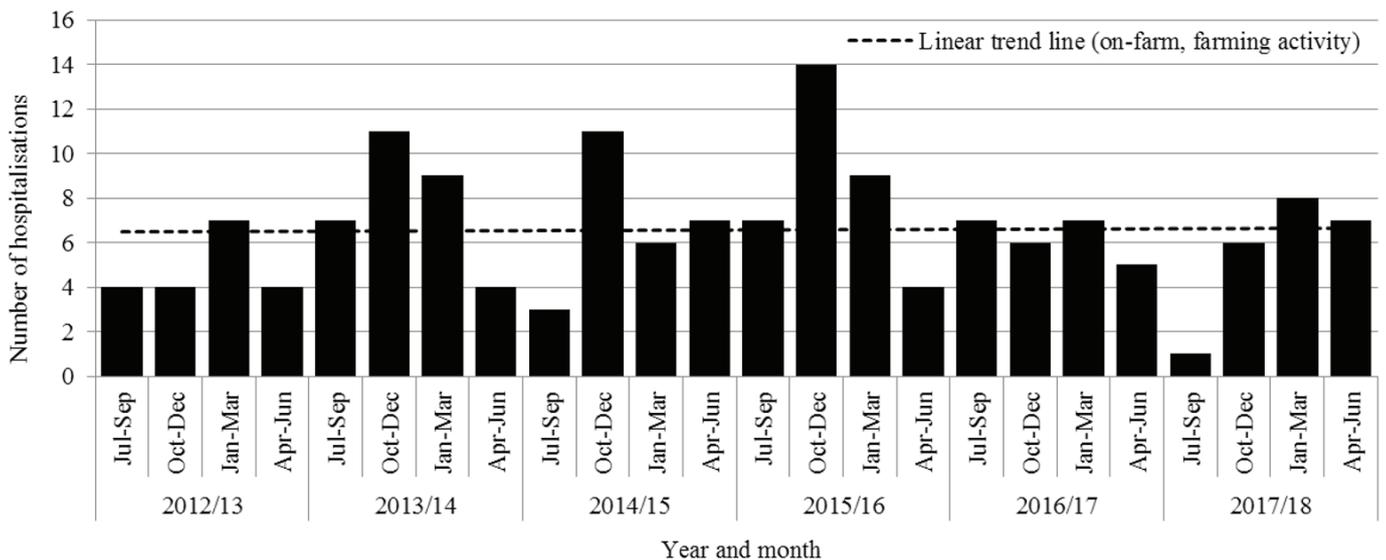
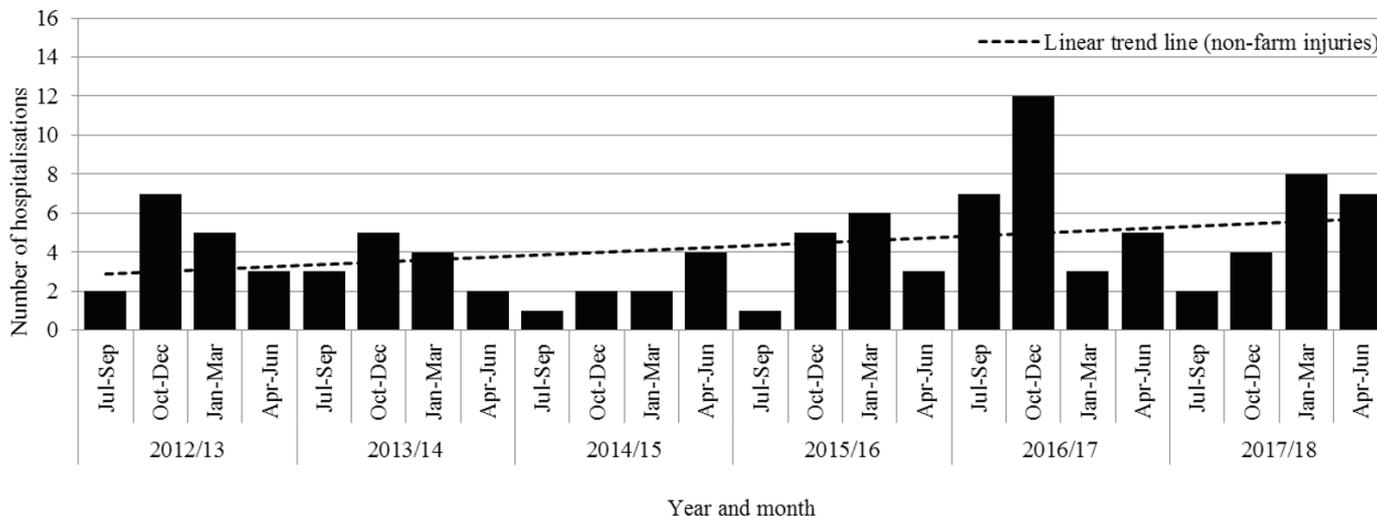


Figure 3: Hospitalisations resulting from quad bike events not occurring on a farm by year and month (n=103).



There was considerable variation in the number of hospital admissions occurring each quarter over the six years across the three categories of interest. For all events occurring on-farm (Figure 1) there were two injury peaks; in October–December 2015 and January–March 2017, each quarter with 19 hospital admissions. Over the period there was an annual average increase of 7.3% in the number of hospitalisations.

For events occurring during a farming activity (Figure 2) there was an annual average increase of 2.6% in the number of hospitalisations over the period. The third category of interest is for those injuries that did not occur on a farm (Figure 3). Hospital

admissions were variable over time, with the number of events ranging from 1–12 hospitalisations per quarter. Overall there was an annual average increase of 4.7%.

The youngest quad bike riders

There were 46 children hospitalised under the age of 16 years. From the injury description gathered at the time of hospital admission (Table 2), five children (<10 years) were driving child sized bikes. At least seven of the 13 hospitalised children aged 5–9 years were driving an adult-sized quad bike at the time of injury, as were 16 of the 20 children aged 10–14 years. In total, seven children were injured in events happening on a road.

Table 2: Riders aged <16 years, selected aspects of injury by age group (n=46).

Selected circumstances of injury	0–4 years (n=8)	5–9 years (n=13)	10–14 years (n=20)	15 years (n=5)	Total (n=46,%)
Passenger on quad bike	5	2	4	1	12 (26.1%)
Driver (child sized bike)	3	2	0	1	5 (10.9%)
Driver (adult sized bike)	0	7*	16	3	26 (56.5%)
Injured on a farm	2	6	12	3	23 (50.0%)
Injured on a road	0	1	5	1	7 (15.2%)
Quad bike rollover noted	4	2	7	3	16 (34.8%)
Hit a stationary object	1	5	4	0	10 (21.7%)
Major injuries (ISS>12)	1	1	1	1	4 (8.7%)
Average length of hospital stay (days)	1.5	2.4	2.7	4.0	2.5 days
Length of stay (range)	1–3 days	1–10 days	1–8 days	1–10 days	

*In two cases driver status could not be determined.

Table 3: Quad bike riders aged 65+ years, activity type when injured by selected characteristics (n=40).

	Farming activity	Non farming activity	Total
Total	24 (60.0%)	16 (40.0%)	40 (100%)
Injury severity (ISS)			
Major (ISS>12)	5 (62.5%)	3 (37.5%)	8 (100%)
Non-Major (ISS<13)	19 (59.4%)	13 (40.6%)	32 (100%)
Gender			
Female	4 (57.2%)	3 (42.8%)	7 (100%)
Male	20 (60.6%)	13 (39.4%)	33 (100%)
Ethnicity			
Non-Māori	24 (61.5%)	15 (38.5%)	39 (100%)
Māori	-	1 (100.0%)	1 (100%)
Place of injury			
Farm	24 (77.4%)	7 (22.6%)	31 (100%)
Road, street, highway	-	1 (100.0%)	1 (100%)
Beach, countryside	-	4 (100.0%)	4 (100%)
Other	-	4 (100.0%)	4 (100%)

Percentages may not sum to 100% due to rounding.

Older quad bike riders

Older riders are of interest for two particular reasons. Firstly, due to the physiological changes associated with ageing;¹² and secondly, due to the ageing farming population within the Midland region. There were 40 hospital admissions for riders or passengers aged 65+ years (Table 3), with five riders aged 80+ years (four being injured during farming activities). In total, 31 events happened on a farm for this age group (77.5% of all events). Of the seven injury events that occurred on a farm but not during a farming activity, four took place on a slope (three were rollover events) and two occurred when encountering an unexpected hole or uneven ground.

Discussion

Quad bike-related injuries continue to be a cause of trauma in the Midland region, despite ongoing public attention and education by farming groups and government agencies to improve safety and prevent injury. There have also been significant changes in workplace legislation and WorkSafe New Zealand now has a

tripartite function to safeguard health and safety through education, engagement and enforcement under The Health and Safety at Work Act (HSWA) 2015.¹³ The agricultural sector is recognised as having relatively ‘uncontained workplaces’, including uncontrolled variables such as the weather.⁴ In this sense the sector provides particular challenges for the successful implementation of health and safety measures.^{4,13}

Three recent coronial reports into quad bike fatalities in New Zealand refer to both the complexity of issues surrounding the use of these vehicles, particularly on farms, and the ongoing safety debate that in many respects remains unresolved despite universal acceptance that safety must be better addressed.^{1,4,17} Coroners have called on the government and the wider agricultural sector to do more to ameliorate this persistent concern,^{1,4} with the most recent inquest findings including the call for a cross-sector working party to consider mandatory quad bike safety improvements (the same Coroner made a similar recommendation in 2017).¹⁷ This call has met with general agreement, although some farming

groups have noted that the complex nature of farms and farming activities means that “a one size fits all safety option might not be a viable option”,^{18,19} with regular training and education preferred over mandatory rollover protection devices.²⁰ In light of ongoing safety concerns some government entities, including Pāmu Farms have moved away from having employees and contractors using quad bikes on its more than 50 farms—instead moving workers to side-by-side or two-wheeled bikes.²¹ The quad bikes remaining in use have rollover protection devices and GPS systems that send an alert if the vehicle tips over.¹⁹

Some of those working in agriculture see that fatalities and injuries will not decline without a common understanding of all the factors inhibiting the implementation of safety measures, including attitudinal and behavioural factors.²² Surveying by WorkSafe in 2016 found that those working in agriculture placed the lowest emphasis on health and safety of any sector. Just 26% of workers and 59% of employers ranked staying safe in their top three priorities.²³ The same survey showed a high level of scepticism about health and safety, where it can be seen as overly bureaucratic.²³

The ageing farmer workforce is a growing area of concern, and more research in our region is warranted. Lower et al¹² point to the risk of injury for those aged >50 years in terms of normal age-related physiological and cognitive changes that may work to both increase risk and negate education around rider training, due to reducing strength, flexibility and balance needed for active riding (alongside other issues). In New Zealand the average age of farmers has risen from 41.9 years in 1981 to 47.7 years in 2013, this ageing farmer situation also occurring in Australia, Canada and the US.^{10,12,24,25}

The recent coronial reminder of the work yet to do in agriculture sits alongside calls that no children ride (or be passengers on) adult-sized quad bikes, with some advocating that all quad bikes are dangerous for children given their immature motor and cognitive development.⁵ Over half of the children hospitalised in our region were riding an adult-sized vehicle at the time of injury. In terms of injuries, the Royal Australasian College of Surgeons (RACS) advocate that public awareness be raised

on the head, spine, chest and pelvis injuries associated with the use of quad bikes (and safety measures that could prevent such injuries).²⁶ We note here that our study does not include quad bike riders who died at the injury scene or while on the way to hospital. Workplace fatalities related to quad bike use numbered 12 in our region over the calendar years 2012–2018, being 18.8% of all fatalities.²⁷ These 12 fatalities are not included in our study. WorkSafe reporting in the first five months of 2019 show there has been one workplace fatality and three serious harm notifications in our region.²⁷

In mid-2018 the Motor Industry Association of New Zealand called on the Minister of Workplace Safety to develop a mandatory set of rules regarding quad bike use (and all other small utility vehicles).²⁸ WorkSafe and the New Zealand Transport Agency have current guidelines recommending all quad bike riders wear helmets, and they advise against carrying passengers or letting children use adult-sized bikes. The Association would like to see these guidelines move into regulations,²⁸ aligning with the RACS recommendation that children under the age of 16 be banned from using quad bikes.²⁶ In our region children continue to be injured while driving adult-sized quad bikes, and of particular concern is that almost 15% of injuries to children happened on a road.

Study limitations

Some limitations of this study include that quad bike casualties who attended an emergency department but were not admitted to an inpatient bed, or died at the scene, are not captured in the trauma registry. Our study does not include quad bike injuries treated in primary care.

Conclusion

For the Midland region this is the first time quad bike injuries have been analysed using trauma registry data, with the inclusion of non-major trauma allowing a clearer picture of the trauma burden. We found that children continue to be hospitalised from injuries received as riders and passengers of quad bikes, including events that occur on roads. We recognise that the discussion, policy and injury prevention initiatives around quad bike safety continue to evolve, with ACC recently announcing it will subsidise farmers to purchase WorkSafe

recommended crush protection devices⁹ For the MTS, older quad bike riders are a growing concern given the ageing farming population in our geographical region. However, while agriculture and workplace safety garners the majority of the attention

when it comes to quad bike safety, our study shows that there are two other areas also deserving of injury prevention attention; injuries that occur on the farm but not during farming activities and the increase over time in injuries off-farm to recreational riders.

Competing interests:

Nil.

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