New Zealand Journal of Health and Safety Practice; Vol 2, edition 3, November 2025

Quad Bikes – a state-of-the-art rapid review

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DOI: https://doi.org/10.26686/nzjhsp.v2i3.10187

Abstract

Quad bike accidents remain a cause for concern with 697 serious harm incidents and 79 fatalities reported from 2006 to 2023. This rapid review aimed to collate research on injury mechanisms, environmental factors and harm reduction initiatives. A total of 32 papers were included in the review and identified that there are some common factors involved in accidents including rollover events, the presence of a slope, males are more likely to have an accident and younger and older riders are more at risk. In terms of prevention, rollover protection devices have shown a reduction in fatalities where the use of such devices is supported by both enforcement activity and education. While legislation is difficult to enforce, standards have been found to be successful in reducing fatalities in Australia. Training courses have been found to increase the self-report of the intention to change behaviours including wearing helmets. This has not been evaluated through actual behaviour change. There is still limited information around other intervention strategies including attitude and risk perception but understanding these factors is essential in any plan for change. The review proposes not just workplace hierarchy of controls but also societal level interventions.

Key Words: Quad Bikes, Farming, Accidents, Initiatives & Interventions, Legislation, Standards

1, Introduction

Quad bike accidents on farms remain a cause of concern and recent data recorded by WorkSafe NZ between 2010 and 2023 identified 697 serious harm incidents related to quad bikes and 79 fatalities between 2006 and 2023. The cost of this in New Zealand was estimated in 2012 at an average cost of $19,497 per incident (Wood et al., 2013). From Australian data where a human capital approach has been taken, between 2001 to 2010 the estimated costs were AU$288.1 million with an average cost per incident of AU$4.2 million (Lower et al., 2013).

With an estimated 80,000 quad bikes in New Zealand an import ban would do little to these numbers in the short-term. There are still opportunities to reduce risks from this mode of vehicle. The aim of this paper is to collate and synthesise international research on the mechanisms of quad bike accidents, the use of protective devices and to review interventions or initiatives that could have the potential to reduce quad bike accidents. This evidence collation highlights our current knowledge and gaps with a view to informing future initiatives and interventions.

2. Methods

A search strategy was developed including key search terms and inclusion and exclusion criteria for the review. The questions addressed were:

1. What are the injury mechanisms from quad bike accidents on farms?
    a. How does injury mechanism relate to seriousness of injury or fatality?
    b. What are the demographics of injury (age, gender, size)?
    c. Are there specific time of year or time of day events?
    d. Are there specific environmental conditions associated with incidents e.g., striking an object, driving on a slope?
    e. Are there specific behaviours that are linked to accidents, e.g., alcohol, drugs or excessive speeds?

2. Are safety devices reducing the impact of accidents?
    a. Roll cages
    b. Crash helmets
    c. Speed restrictors

3. Do crush protection devices have unintended effects or cause other injuries?

4. Are safety devices reducing the impact of accidents?
    a. Rollover Protection Systems (ROPS)
    b. Crash helmets
    c. Speed restrictors

5. Have initiatives from government, employers, farming organisations or research shown harm reduction in the use of quad bikes on farms?
    a. Legislation and Standards
    b. Training and behaviour change
    c. Attitude Measurement
    d. Risk perception

Inclusion criteria included publication dates after 2009 (search dates 2009-2024), English language and on-farm incidents. Searches were carried out using the Dimensions database. A total of 739 publications were identified. The titles and abstracts of the papers were downloaded and reviewed against the inclusion and exclusion criteria, and this resulted in the identification of 165 publications. These publications were obtained and full papers screened and 94 were removed as they did not fit with the inclusion criteria. After full reading of the papers, a further 31 were removed as not fitting with the inclusion criteria of being on-farm or not defining what type of all-terrain vehicle had been studied. This resulted in the inclusion of 32 papers in the review and this breakdown is presented in Figure 1. Data were extracted from those publications and synthesised to address the questions posed by the review.

3. Results

In total, 32 papers were identified that have been included in this review. The review is focused on quad bikes and their use on farms and many of those excluded papers did not clarify the vehicles being used or what the quad bike is used for.

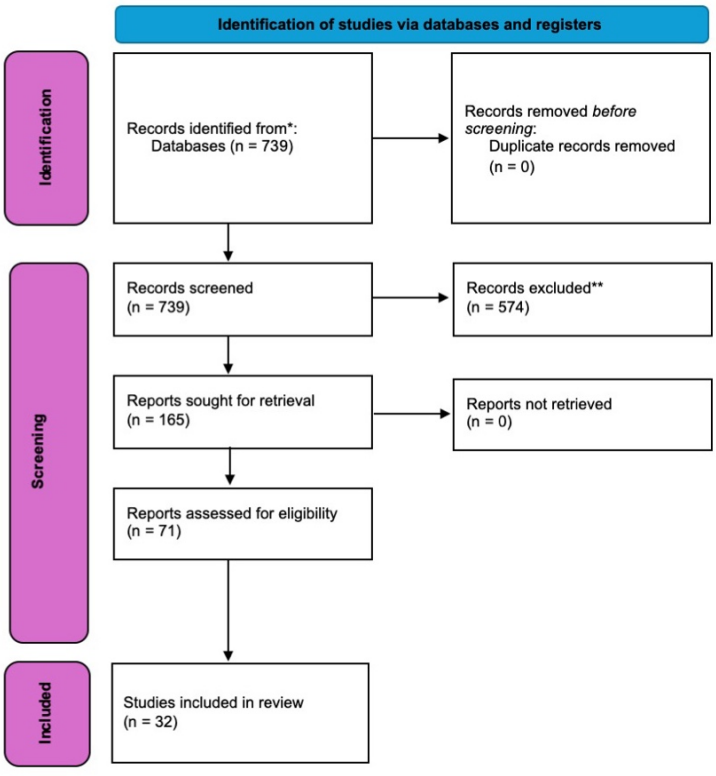

Figure 1 PRISMA Diagram (Moher et al., 2015)

3.1 What are the injury mechanisms from quad bike accidents on farms?

Research in the past 15 years has identified consistent injury and fatalities patterns. In Australia and New Zealand the most common mechanism is a rollover (Lilley et al., 2017; Lower et al., 2022) and loss of control events (Clay et al., 2014b; McIntosh et al., 2016). A different pattern is seen in the UK: ejection from the quad bike was the most frequent incident (Adil et al., 2017) but this is also likely to include a rollover or a loss of control event

Demographic analysis of fatalities and accidents has highlighted that males and older adults are at increased risk (Amey & Christey, 2019; Lilley et al., 2017; Lower et al., 2016; Menon et al., 2022; Monaghan et al., 2017) while young drivers were at higher risk of loss of control events (Menon et al., 2022).

For children, 70% of 27 patients were injured while driving and a further 22% were passengers in New Zealand (Pearce & Miles, 2015). Yet, evidence has shown that those that start riding quad bikes before the age of 12 years are four times more at risk of an accident (OR: 4.08, 95% CI: 2.43–6.86) (Burgus et al., 2009; Menon et al., 2022). Farm fatality data for children was examined between 2001 and 2019 using the National Coronial Information System (NCIS) in Australia (Peachey et al., 2020). A total of 222 (15% of all fatalities) fatalities involved children. In breaking this down further, in 32 cases, quad bikes were identified as the agent. The authors also add that those in the 0-4 years age group were more likely to be passengers and for children aged 10-14 years it was thought they were more likely to be operating the quad bike (Peachey et al., 2020)

Factors identified as contributing to incidents included the presence of a slope (Lilley et al., 2017; McIntosh et al., 2016), load carrying (Lilley et al., 2017), stock work or herding animals (Clay et al., 2017; Lower et al., 2016; Manolova et al., 2023) and weed control and spray tanks (Lilley et al., 2017; Lower et al., 2016). Clay et al., (2017) also identified mechanical failure, poor visibility, multitasking, personal misjudgement and reacting automatically as precursors to incidents on Canadian farms (Clay et al., 2017). A final factor identified was in incidents where there was a protracted time to find the worker when more than half of accidents took more than one hour to find (Lilley et al., 2017; Lower et al., 2016).

The presence of alcohol and drugs was assessed in the study by Lilley et al., (2017). From the 32 fatalities, 69% were negative for alcohol, 12% were positive for alcohol, 4% tested positive for alcohol and drugs and 15% tested positive for drugs only. In the study by Lower et al., (2016), of fatalities in Australian farmers, toxicology results were available in 34 out of 62 cases. These identified that in three cases there was evidence of prescription medications, and one individual had alcohol readings above 0.05 mg/L.

Fawcett et al., (2016) in their review highlighted that in a Canadian study, 48% of adults and 12% of paediatric patients were positive for alcohol on entry to hospital (Fawcett, 2016). However, it is not clear whether these data included both recreational and occupational quad bike use. A further study within the review found that 76% of patients had blood alcohol levels above the legal Canadian driving limit.

No studies were identified that examined speed in the searches. This would be difficult to assess post-incident and would depend on recall and estimation.

3.2 Are safety devices reducing the impact of accidents?

An Australian study was identified that evaluated the on-farm impact of Roll Over Protection Systems (ROPS) (Lower & Trotter, 2014). This exploratory pre- and post- study involved 11 participants, and each participant had more than ten years' experience of using a quad bike. Post-intervention, little impact was found fitting and using the device apart from three participants who identified issues around towing and access to the dairy shed. In further focus groups, there was a perception that fitting such devices improved safety.

When examining the potential impact of protective devices on quad bikes, Lower & Temperley (2018) looked at whether control measures could have prevented 157 quad bike incidents. In their evaluation it was suggested that 70% (n=109) of potential fatalities could have been prevented through the use of crush protection devices and helmets (Lower & Temperley, 2018).

If individuals do not use helmets, they are at an increased risk of head injuries (Fawcett, 2016; Menon et al., 2022). While Rattan et al., (2018) identified moderate evidence that helmet use decreases the impact of traumatic brain injury but there is only low-quality evidence that legislation actually

increases helmet use (Rattan et al., 2018). For children not wearing helmets, there is an estimated five times increased risk of a severe head or neck injury. Interestingly, older boys are significantly more likely to wear Personal Protective Equipment (PPE) (Jinnah & Stoneman, 2016).

In a New Zealand study of children attending hospital, while seven out of 27 patients had received a head injury, only one was wearing a helmet. The injury rating for those not wearing a helmet was higher but not significantly so (Pearce & Miles, 2015).

No research papers were identified that carried out research into speed restrictors.

3.3 Do crush protection devices have unintended effects or cause other injuries?

This review was unable to identify on-farm research to this question. This was addressed in a small study by (Lower & Trotter, 2014) who found difficulties around towing and access to buildings but no mention of stability.

3.4 Have initiatives shown harm reduction in the use of quad bikes on farms?

This section presents international research where initiatives or interventions have been published. Thus, it covers legislations and standards, training and behaviour change, attitude measurement and risk perception.

3.4.1 Legislation and Standards

Two papers were identified that examined legislation as a means of reducing risks. Rattan et al., (2018) found in their systematic review that there is limited evidence to support legislation to ensure helmets are worn; this is in addition to the difficulty in enforcing such legislation on farms. Fawcett et al., (2016) concurs with this in that legislation is in place in a variety of countries but enforcement on private property is difficult. This review by Fawcett proposes that legislation without additional education and training will have less of an impact. One aspect that could be amenable to change is vehicle design including safety messages, warning labels and only selling adult sized vehicles to adults (Fawcett, 2016).

In 2019, Australia introduced the Consumer Goods (Quad Bikes) Safety Standard 2019 (Lower et al., 2025). This standard came into effect in 2020 and 2021 and required that quad bikes be fitted with existing standards, have an Operator Protective Device (OPD or ROPS) integrated or fitted to the vehicle and have additional safety signage and hang tags to the vehicles displaying stability test results. In their initial evaluation of the impact of the standard, Lower, et al. (2025) did find a non-statistically significant reduction in the number of fatalities. This varied by state in Australia and New South Wales found an increase in the number of fatalities, but Victoria found a statistically significant decrease from 9 fatalities to <5 ($p=0.045$). Further investigation in this interim report identified the importance of improvement or prohibition notices given and three prosecutions in Victoria by the regulator (Lower et al., 2025). The authors highlight the importance of an integrated approach to injury prevention including education, engineering controls, enforcement and economic incentives.

3.4.2 Training and Behaviour Change

Formal training as a means of increasing the skills of quad bike users is not mandated in any country. In a USA study, 9% of boys and 3% of girls had received training when working on farms (Jinnah & Stoneman, 2016). Jennissen et al., (2022) in their analysis found that of 4981 students, 8% had undertaken certified ATV training (Jennissen et al., 2022).

A questionnaire survey was distributed at the Future Farmers of America convention, focusing on youths aged 12 to 20 years (Burgus et al., 2009). A total of 584 usable surveys were obtained and in relation to helmet wearing, 25.6% said they never wore a helmet, 56.9% allowed passengers on their bike sometimes and 66.9% said they would ride as a passenger. For participants that reported having a previous injury, injuries were more common in those who had had safety training (40% versus 26%, $p<0.001$), male respondents (37% versus 26%, $p<0.0001$) those who started riding before 12 years of age (38% versus 13%, $p<0.0001$). From a logistic regression model, the risk factors for injury included being male (OR: 1.62, 95% CI: 1.05– 2.50), the family owning a vehicle (OR: 4.04, 95% CI: 2.08–7.86) and starting to operate a vehicle before age 12 (OR: 4.08, 95% CI: 2.43–6.86) (Burgus et al., 2009). A univariate analysis of training and safety related outcomes found that those who had training were more likely to always wear a helmet (OR=1.72, 95%CI 1.12-2.63), would never take passengers (OR=2.31, 95%CI 1.36-3.91), would never ride as a passenger (OR=3.02, 95%CI 1.90-4.79). However, safety training was also associated with an increased risk of an accident (OR=1.96, 95%CI 1.31-2.94) (Burgus et al., 2009). It should be noted that the survey design did not allow for

identification if accidents happened before or after training, whether respondents used quad bikes for longer hours therefore at increased exposure rates or whether awareness has been raised through training on the importance of reporting accidents (Burgus et al., 2009).

An analysis of the Safety Tips for ATV Riders (STARs) programme was carried out in a survey of 4891 students between 2012 and 2019 (Jennissen et al., 2022). This programme was delivered in schools as part of the health and safety curriculum in a face-to-face session delivered by safety educators. The programme focuses on ten safety tips including helmet wearing and one person at a time. While most respondents used the vehicles for recreation (94%), 49% used them for work. The STARs programme is not certified and when asked, 8% of the sample had taken an ATV Certificate course. An analysis of the participants who had taken a certified training course found that they were more likely to always or almost always wear their helmet ($p<0.0001$), were less likely to ride with passengers ($p<0.0001$) and were less likely to ride on public roads ($p=0.0065$). This suggests the certificated training has an impact on safety behaviours, but this was a small number of people who had received certified training.

Gibbs et al., (2023) acknowledged that behaviour change after safety courses did not result in increased safety behaviours. Results reported that fewer than 20% of Canadian and US young adults in agriculture were aware of safety features including crash protection devices, wind shields and roll cages (for recreational use) (Gibbs et al., 2023). As a result of this research, quad bike education has been reorganised as part of the "Gear Up for Ag" programme. This has included using the hierarchy of controls approach where engineering controls are highlighted before other control measures including rules, behaviour and then PPE. The follow-up to this study identified that 35% of those on the programme were somewhat likely to buy crash protection devices for their quad bikes (Gibbs et al., 2023).

3.4.3 Attitude Measurement

A UK study evaluated attitudes to wearing helmets on quad bikes and 63.5% of 208 participants reported owning a helmet (Irwin et al., 2022). Those that had gone through training were more likely to wear a helmet ($p<0.001$). Furthermore, wearing a helmet was associated with perceived danger ($p<0.016$), the safety benefits ($p<0.001$) and prompts from guidelines ($p<0.001$). The negative correlations identified with helmet wearing were personal exemption from risk ($p<0.001$), cognitive barriers ($p<0.001$), usability barriers ($p<0.001$) and social norms ($p<0.001$) (Irwin et al., 2022). Surendran et al., (2024) also highlighted the perception that helmets were not always usable in their qualitative analysis. The study does suggest a number of interventions to these barriers including testing different helmet options in different conditions, prompting helmet use, stickers and storing the helmet and the bike together, showing key figures wearing helmets on quad bikes and increasing awareness of the potential consequences of not wearing a helmet through story telling.

A study with young farmers in the UK used qualitative methods to explore the attitudes of young farmers to safety (Manolova et al., 2023). Using a questionnaire survey, the study obtained 219 responses with 80% of the sample being aged under 30; and 56% of the sample were female. It was found that 27% of accidents occurred when animal handling and 14% of accidents were attributed to tools and vehicles including quad bikes. In further questions around injury and activity, those who had been injured had ridden often without a helmet. Other patterns of work identified within this study were working when feeling ill or tired. Perceived risks were also examined in this study where handling animals was seen as high risk as were slips trips and falls, and using a quad bike.

What this study suggests is that those who had received a major injury were aware of risk, but their behaviours did not always reflect risk mitigation (Manolova et al., 2023). Whether that is understood to be due to a perceived lack of time, being a part of the job or being a social norm, needs to be investigated by further research. The study recommends implementing a community-based approach to improving safety practices on farm involving everyone on the farm.

3.4.4 Risk Perception

In a New Zealand study, 219 participants were interviewed including 183 male and 33 females (Clay et al., 2014a). The study aimed to examine whether farmers with greater levels of unrealistic optimism, fatalistic beliefs or a propensity for risk taking are more likely to have a loss of control event. In total, 690 loss of control events were reported by the sample. The analysis identified that 51% of participants had scores that suggested unrealistic optimism with risks to peers rated as significantly higher than individual risks. This group did not have a propensity for risk taking or fatalism. When calculating the Incident Rate Ratio, it was identified that loss of control events are associated with

being young ($p<0.001$) and being male ($p<0.001$). However, one point of note is that farmers think future quad bike accidents are less likely to happen to them.

In a later study, Clay et al., (2016) examined how personal risk of quad bike accidents was perceived by farmers in New Zealand (Clay et al., 2016). Interviews were carried out with eight individuals from the previous study. The qualitative analysis identified that the influences on risk perception were the impact of previous serious incidents which were seen as bad luck by individuals, but less serious incidents could result in behaviour change if the farmer reflected on the event. Learning from others also increased the perception of risk. Personal attributes were also evaluated with age being assumed to give experience and a better understanding of risk. In addition, the pressure of getting work done pushed people to the limits of their ability. This was highlighted by the results of the preceding study where workers who found their jobs were psychologically demanding were more likely to have had a loss of control event (IRR 1.14, 95%CI 1.05-1.23) (Clay et al., 2014b).

Factors thought to influence risk perception included confidence in own riding ability, being able to cope under pressure and safety beliefs. It was perceived being overconfident increased risks but also that being brought up on a farm contributed to some individuals accepting more risk (Clay et al., 2016). Having responsibility for others, e.g., workers, was a powerful driver in managing risks but this had to be balanced with getting the job done.

In an exploratory study of risk perception in Australia, five directors of nursing and 11 pastoralists and farmers were interviewed (McBain-Rigg et al., 2014). This study set out to explore the attitudes and perceptions of occupational quad bike users, healthcare providers and regulators. Through the course of the study a number of issues were highlighted in that wearing helmets is important, but people don't always use them, sometimes due to heat. Discussions around crush protection devices identified that attitudes vary as there are different perceptions as to whether they are safe or unsafe and retrofitting might cause problems. Those that use crush protection devices did so at purchase as a way of mitigating the risk of crush injuries. Suggestions from this research include to ensure an understanding of attitudes towards safety before starting campaigns for education or awareness building.

Surendran et al., (2024) carried out focus groups with 19 participants in Ireland. This study reports on part of the development of safety interventions for farmers in relation to machinery including tractors and quad bikes (Surendran et al., 2024). As a qualitative study, the paper highlights the interplay between capability, opportunity and motivation in their decision-making processes in behaviour on farms. There was disagreement on whether accidents were due to carelessness or accidents were inevitable, therefore nothing could be done (Surendran et al., 2024). While agreement was found in that planning and organising work tasks was essential, this was often put aside when the benefits of an unsafe action were thought to outweigh any risks. This paper drawn from an intervention development project used the Step Approach to Message Design and Testing framework (Lewis et al., 2016). This is a tool that can help with intervention design and behaviour change.

Vuong et al., (2023) examined critical beliefs in parents in their intentions to allow their children to ride quad bikes. This Australian study used a Theory of Planned Behaviour framework which is the starting point of the Step approach to Message Design and Testing (SatMDT) framework (Vuong et al., 2023). Seventy-one parents responded to the survey who had children aged 3-16 years. Four significantly critical beliefs were identified in the study. The first was a behavioural belief of the importance of getting tasks done and was strongly related to the behavioural intention of allowing children on quad bikes. Two normative beliefs were identified in that your parents and your partner would approve. Finally, a significant control belief was that of the increasing societal concerns around quad bikes was associated with a decrease in parental intentions to allow children to use the quad bikes. This paper proposed three safety message concepts including one on behavioural beliefs with children in adult clothes showing things don't always fit: a message concept around normative beliefs and perceived approval by other adults and a message highlighting control beliefs around swapping out quad bikes for other vehicles. These messages are yet to be tested.

4. Discussion

4.1 Limitations

This review is a rapid review which has included systematic searching based on a search strategy, inclusion of studies based on comparison with set criteria and data extraction and synthesis into a narrative review. The quality of the included studies varied at times due to low numbers, but it

represents the current state of knowledge and gaps in relation to quad bike protective devices and intervention research.

One of the challenges in this area is that quad bike use varies across the world in relation to recreational use or on-farm use, as does farm size and landscape. This review aimed to collate the evidence in relation to injury mechanisms, impacts and the evidence around initiatives or interventions, to give of a state-of-the-art picture of what could come next in reducing harm. Taking relevant initiatives and trialling in Aotearoa New Zealand could have the potential to reduce further harm.

4.2 Safety Devices and the impact of Accidents

There has been some discussion about the usability of safety devices and quad bikes but little on farm measurement. The interim study by Lower et al., (2025) did show a non-significant reduction in fatalities in Australia after the introduction of a national standard. However, a significant reduction was found in the state of Victoria where around the use of ROPS, enforcement and education were implemented. An Australian study found that there was minimal impact on riding after having ROPS fitted while using the quad bike (Lower & Trotter, 2014). There still seems to be a reluctance to use ROPS and that is around questions of their impact on stability and retrofitting causing problems (McBain-Rigg et al., 2014). This emphasises the importance of getting clear messages about the use of ROPS to on-farm quad bike owners to reduce the risk of fatality from a rollover. The use of a standard in Australia has ensured that messaging is clear at a national level about the safety requirements when riding quad bikes. While economic incentives have been used in New Zealand to encourage farmers to fit protection devices, this initiative has not been evaluated although uptake was high[1]

An estimated two-thirds of those involved in accidents are not wearing helmets yet, they have the potential to reduce traumatic head injuries. The research studies do tell us that those who have received training report they are more likely to wear a helmet. The barriers to wearing a helmet include time, forgetting, not finding it comfortable, wearing not being a social norm and perceptions of being immune to damage (Irwin et al., 2022). This is a potential area of intervention in including reminders on the quad bike and making helmet wearing the accepted norm. Behaviour change should also be assessed.

4.3 Training and Behaviour Change

In the USA, less than 10% of those sampled had taken part in certificated training but interestingly those that had received training were at an increased risk of an accident. There has been little investigation into whether that is attributed to knowing you need to report an accident or other reasons and this is a gap. Any training programme is likely to increase awareness in the short term but in the context of quad bike riding, it is difficult to evaluate if there has been an impact on behaviour. The body of research suggests that those that have received training are less likely to take passengers, less likely to be a passenger and more likely to wear a helmet. However, there has been no long-term evaluation of whether training actually does result in behaviour change. To improve uptake making training mandatory may be one option but also focusing on the use of theories of change and frameworks to increase the likelihood of behaviour change. Many of these programmes fail to evaluate if behaviour has actually changed. Evaluation of the impact of the “Gear up for Ag” programme could help in the design of interventions within New Zealand.

4.4 Attitudes and Risk Perception

Research on farmers’ attitudes to safety and perception of risk covered a number of topics. The UK study by Manolova et al., (2023) found that for those who had had a major injury, their behaviours did not show any mitigation of that risk (Manolova et al., 2023). This was highlighted by the fact that it was seen as part of the job as a social norm. Whereas research in New Zealand highlighted the perception that quad bike accidents were less likely to happen to individuals, rather it was down to bad luck. When we think about accident reduction strategies, there is a clear need to understand the beliefs of the people and communities we are trying to influence. Using theories of change frameworks to build knowledge of what quad bike users’ and owners’ beliefs and knowledge are and through those developing initiatives and interventions to reduce harm.

[1] https://www.pggwrightson.co.nz/news/safer-rides-save-lives#:~:text=Alongside%20Farm%20Without%20Harm%20by,on%20the%20model%20of%20CPD.

Changing parental risk perception will also be a challenge in reducing children's access to quad bikes. The paper by Vuong et al., (2023) using the theory of planned behaviour identified those beliefs that were closely linked to encouraging and discouraging quad bike use by children. This in part has designed a campaign to improve risk perception, although this campaign has not been completed and evaluated yet.

4.5 The future

How can we increase prevention measures in the use of quad bikes? In considering the hierarchy of controls there is unlikely to be a ban on quad bikes implemented within New Zealand. While elimination or substitution are at the top of the hierarchy, the sheer number of quad bikes in New Zealand (estimated 80,000) will take time to be removed from use, while safer alternatives are introduced on farms.

However, Australia has taken a lead in this by the development of the standard the Consumer Goods (Quad Bikes) Safety Standard 2019[2]. This includes the fitting of ROPS to new or second-hand quad bikes as an engineering control can allow some protection from rollover events and preventing asphyxiation. The use of helmets is also an opportunity to reduce risks. While this is seen at the level of PPE within the hierarchy of controls, in the context of quad bikes, helmets need to be easily accessible and fit for purpose. so that no one needs to search around for equipment when under time pressure. Additionally, the use of social marketing and making helmet wearing the norm could help.

Administrative controls, those policies and procedures developed to support safe work have to include rules around children and preventing them from using adult sized quad bikes. The accident and incident data are clear and as is likely for any other farm equipment, children are kept well away. Administrative controls can also be developed to help decision making around vehicle use and which vehicle is more appropriate to use, in a given context. That is, when and where a quad bike should or should not be used, for example not on steep slopes nor having passengers on the quad bike.

There also appear to be some conflicting attitudes and perceptions around quad bikes and perception of risk. Factors such as 'it will not happen to me' or 'it's down to carelessness' for other people are challenging. However, it was noted in one paper (Clay et al., 2016), that having responsibility for others was a positive driver for risk management. Thus, understanding risk perception and what attitudes exist in relation to quad bike safety is an important part of making change in this context. The importance of working with the community to understand the current situation is essential in the process of making future change. There is also need to evaluate if initiatives or interventions do actually increase safety behaviours.

Farm work is at times done at high speed. While advice may be to try and slow things down, this might not be a realistic aim. However, taking the time to take make decisions based on education and knowledge of the risks around quad bikes still has the potential to reduce the current high levels of harm.

Table 1 shows potential suggestions to develop controls and to reduce the harm occurring.

Table 1 Proposed controls to reduce the harm from quad bikes

Controls	Workplace	Societal
Elimination	Remove quad bikes from the workplace	Import ban unless ROPS fitted Incentives to return quad bikes
Substitution	Use different vehicles	Tax incentives for safer vehicles
Engineering	Roll Over Protection Systems Technology including trackers, speed and slope warnings	Use of standards i.e. Rollover protection, helmets Highlighting tax incentives to buy safety equipment
Administrative	Rules around when quad bikes to be used and when not No children on adult quad	Require certified training Marketing tools to shift social norms and risk perception
PPE	Helmets Leg and arm/hand protection	Show those with influence wearing helmets on quad bikes

[2] https://www.legislation.gov.au/F2019L01321/latest/text

5. Conclusions

To date there has been limited research on the impact of ROPS, but they have been seen to reduce fatalities in Australia. Training courses and education programmes have been limited by the lack of evaluation of any impact on actual behaviour change. Risk perception and attitudes to risk concerningly include statements of “it won’t happen to me” or “it’s all part of the job”.

There are several areas where future research could focus including the following:

- Societal drivers including legislation and standards;
- Widespread use and evaluation of ROPS and clear messaging from this;
- Ensuring children do not have access to adult quad bikes or ride as passengers;
- Understanding the attitudes and risk perceptions of those in the farming community;
- Moving our knowledge of attitudes and risk perceptions into the development of interventions using intervention design tools that take account of context and culture;
- Using storytelling and role-modelling;
- Testing of GPS signals to enable easier finding after incidents.

Funding

This work was funded by Victoria University of Wellington

Ethics

As this was a review, no ethical clearance was required

Conflicts

There are no conflicts to be reported with this work

Submission declaration

This paper has not been published elsewhere and will not be published elsewhere in the same or any other form in English or any other language without the written consent of the NZJHSP.

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