



Australian Centre for Agricultural Health and Safety

FARMSAFE FARMS FOR KIDS

Evidence based solutions for child injury on Australian farms

**A report funded by the Financial Markets
Foundation for Children**

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Farmsafe Farms for kids: Evidence Based Interventions for Child Safety on Farms

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Foreword

The National Child Safety on Farms strategy was developed by Farmsafe Australia in response to the high rate of child death and injury on Australian farms.

Every year 30 children are killed on a farm in Australia. This statistic is made more tragic due to the preventable nature of many of these deaths.

This report into evidence based interventions is a timely investigation into the literature available regarding what works and what doesn't in preventing deaths of our children on Australian farms.

The work of Farmsafe Australia is now to take the findings of this report and to instigate further research and development to address child safety on farms.

David Brownhill
Chair
National Child Safety on Farms Reference Group

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Foreword

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- Ms Beth Fuller- Mid North Coast Farmsafe Action Group
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Executive Summary

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The issue of child safety on farms is a complex and sensitive area that requires careful consideration in the context of the Australian farming environment. This report will investigate key child safety hazards on farms within the context of a child's growth and development and relevant state child protection legislation.

The objectives of the project are to identify effective solutions and strategies to prevent injury to children aged 0-14 on Australian farms through identification of currently available evidence based solutions to defined hazards, definition of cognitive and physical skills of children to safely perform a range of activities within the context of farming life and to highlight further research needs.

The priority hazards of high risk that have been addressed are dams and other bodies of water, farm machinery, motorbikes, other vehicles and horses. Relevant literature was reviewed and a panel of child injury prevention experts was assembled to review the material and make recommendations. The hierarchy of effectiveness of control that forms the framework for OHS risk management in Australian OHS Acts and Regulations has been used for consideration and presentation of risk control options in this report.

Few research reports were found that provided evidence in support of interventions for any of the specific farm hazards of high risk to children in the farm setting. We addressed this paucity by extrapolating from studies addressing the same or similar risks in other settings.

1. Toddler drowning and toddler deaths from vehicle run-over, machinery and horses

Recommendations for intervention to reduce risk of serious injury and deaths to toddlers from drowning in dams and waterways, from vehicles on farms, from farm machinery and from horses are generally similar. The evidence supports the following interventions:

1. Elimination of the hazards where they are not in use eg unused water bodies.
2. Fence the house yard to separate the farm workplace from the place where children live and play, with self latching gates - create a safe place to play. Fencing should be "child resistant".
3. Establish and maintain family and workplace rules relating to:
 - The boundaries where children can be without parental supervision
 - Ensuring that the home yard gates are kept closed and maintained

- Ensuring adequate adult supervision of children in the vicinity of bodies of water, machinery, vehicles and of horses or other farm animals.
4. Adults and older children on farms should be trained to undertake cardio-pulmonary resuscitation.

These interventions should be established on all Australian farms where children are living, or where children visit.

2. Further recommendations relating to child injury associated with farm machinery

“No passengers on tractors” should be the focus for prevention of injuries to children associated with farm machinery. The evidence shows that the majority of child fatalities relating to tractors resulted from the child riding as a passenger, falling from the tractor and being hit/run over by the tractor or attached implement.

When older children begin to engage in farm work, they should be trained to undertake farm work in accordance with their developmental and physical capabilities, and under close supervision. Parents need knowledge of cognitive, physical and behavioural characteristics of child at each stage, AND an accurate perception of risk. Section 11 of this report is devoted to the issue of children’s physical and cognitive development related to farm work.

Protection of children as young trainees should include:

1. Where possible the elimination of hazards associated farm machinery.
2. Effective guarding of exposed moving parts, or isolation of operators from those hazards.
3. Safe tractor design features including ROPS and safe tractor access, outside of the path of the rear wheel.
4. Adequate induction, training and close supervision of working trainees.
5. Hearing protection when children are in the vicinity of hazardous machinery noise.
6. Respiratory protection when children are in the vicinity of hazardous dusts.

3. Child injury associated with farm motorcycles

The evidence supports the following interventions for children aged 5-14 years to reduce risk of serious injury and death to children associated with motorcycle riding:

1. Use safer forms of transport or leisure for young children.
If children are to accompany adults use safer vehicle option, for example utility with seat belts. Suggest alternative leisure pursuits for young children eg mountain biking.
2. “No extra rider” rule for ATVs.
Establish and maintain family and farm rules to ensure that children are not ever carried as passengers on ATVs.

3. Establish minimum age and conditions for riding farm motorcycles.

It is recommended on limited evidence from specific studies, that the minimum age for riding for ATVs is set at 16 years and that suitability to ride any motorcycle should then be determined by the demonstration of competency.

There is strong support for the recommendation of a minimum age for riding farm motorcycles by the manufacturers of these machines. Manufacturers clearly state that children under the age of 16 years should not ride adult sized ATVs. They identify that such vehicles have not been designed to be ridden safely by persons under 16 years of age who are considered to have physical and cognitive developmental limitations. On road motorcycle licensing requires the demonstration of a minimum level of skill and knowledge following a training period.

4. Ensure suitable helmet and other protective clothing is worn.

PPE including helmets should be worn when riding. The value of helmets in reducing head injury from motorcycle and bicycle injury incidents is clear and substantial evidence has been established as proof of the effectiveness of helmets in this instance.

Other PPE including that worn by professional riders – goggles, gloves, long pants and suitable sturdy footwear - should reduce the severity of injury if the rider is subject to a fall or runs into objects.

5. Training and supervision.

Training in the riding and operation of motorcycles on farms is a workplace OHS requirement in all states of Australia. It is not clear from the evidence at the moment how to develop and assess competencies that are relevant to injury prevention.

4. Further recommendations relating to child injury associated with other farm vehicles

The evidence supports the following interventions to reduce risk of serious injury and deaths related to other farm vehicles:

1. The most suitable and safe form of transport for moving children around the farm should be used.
2. Vehicles used to transport children should be fitted with child restraints and/or seat belts.
3. Establish and maintain family rules whereby children should not ride unrestrained in the front or back of vehicles, or in the tray of the utility or truck.
4. Establish and maintain rules to ensure seat belt use by all occupants of vehicles on farms – children and adults.
5. Establish and maintain rules that young children should not drive vehicles on farms. Once of an age to drive, children should receive training and demonstrate knowledge and competency to drive vehicles.

5. Further recommendations relating to injury associated with horse handling

The evidence supports the following interventions:

1. If horses are no longer in use, removal from the farm, or from the vicinity of small children.
2. Where children are learning to ride, and/or there are child riders:
 - Select a horse of suitable temperament and size for the child
 - Rider training should include equine behaviour, care, handling, pre-rise saddle check, safety checks, riding and maintenance of tack
 - Ensure suitable and safe tack – stirrup size is important
 - The rider should wear a correctly fitting helmet that meet the Standards Australia standard for equestrian activity. The helmet should be worn during all horse handling activities, not just while riding.
 - The rider should wear smooth soled, heeled, elastic sided riding boots.

These five key hazards are responsible for an estimated 85% of toddler deaths and 77% of deaths of children aged 5-14 years on Australian farms. Further, they are responsible for 40% of toddler admission to hospitals with on-farm injury, and 60% of admissions for children aged 5-14 years. Adoption of these recommendations on farms could result in an overall reduction of 82% of child deaths and 58% reduction of hospital admissions due to injury on farms.

Whilst this report identifies possible interventions for farm parents and health professions further research and development is required to effectively address child safety on Australian farms. A program of further research is recommended to address the research needs identified through this review.

A paper has been prepared that outlines priority research requirements to provide the necessary evidence base for optimal child safety on farms programs.

1.0 INTRODUCTION

1.1 The National Child Safety on Farms Strategy

Farmsafe Australia is an association that is incorporated in the Australian Capital Territory. Member agencies act as a coalition with a common mission to improve the well-being and productivity of Australian agriculture through enhanced health and safety awareness and practices. The following agencies are members of Farmsafe Australia:

- National Farmers Federation
- Country Women's Association of Australia
- Australian Workers Union
- Department of Transport and Regional Services
- Agriculture, Fisheries and Forestry -Australia
- National Occupational Health and Safety Commission
- Rural Industries Research and Development Corporation
- Rural Training Council of Australia
- Tractor and Machinery Association of Australia
- Motor Traders Association of Australia
- Women in Agriculture
- Australian Centre for Agricultural Health and Safety
- Farmsafe Western Australia Inc
- Farmsafe New South Wales
- Farmsafe Queensland
- Tasmanian Rural Industry Training Board
- Farmsafe Victoria
- Farmsafe South Australia.

Farmsafe Australia, in partnership with key stakeholders, has developed a strategy that addresses child injury and death on Australian farms (Farmsafe Australia, 1999). The Strategy comprises eight components, viz:

1. Establishment of a national framework for action
2. Identification of key hazards for children on farms
3. Identification of effective strategies to control key injury risks
4. Identification of educational needs and development of resources for children, parents and teachers
5. Identification and development of flexible child care options
6. Promotion of strategies to farm parents, farm managers, schools, service providers and others
7. Identification of further research needs
8. Evaluation of the national strategic plan.

Development and implementation of the Strategy is the responsibility of a National Reference Group of approximately 12 members from a range of sectors. Further consultation and input is obtained from a wider Advisory Group of approximately 100 people from key sectors at both state and federal level. This

wider group provides comment and suggestions to all strategic directions and initiatives before being referred to the Farmsafe Australia executive.

This report has been produced as a key output for Component 3 - *Identification of effective strategies to control key injury risks*, and the success of the Strategy to a great extent is contingent upon the findings of this component, as they directly influence the other components such as educational resources, promotional strategies, and future research needs. Identifying effective interventions defines the content for these activities.

The first and major section of this document reports findings relating to effectiveness of interventions associated with the priority hazards and risks to children on farms. These are drowning; farm machinery, including tractors; farm motorcycles; other vehicles; and horses.

The second section briefly examines child development stages and their relevance to child safety on Australian farms. Child growth and development impacts on the degree of risk that children face while in the farming environment. This section of the report includes a review of the North American Guidelines for Children to perform farm tasks.

The third section of the report lists state, federal and international standards for child protection, employment and safety. Each state's child protection legislation is outlined with key definitions included.

1.2 Project Personnel

This project was implemented on behalf of the Farmsafe Australia partnership by personnel from the Australian Centre for Agricultural Health and Safety as the key Australian research and development centre in agricultural health and safety, and as the organisation which provides executive services and resource development for Farmsafe Australia.

A research officer was appointed and a Working Group assembled comprising individuals with expertise in injury analysis, cognitive and behavioural approaches to injury, engineering approaches to injury, and agricultural processes.

The Working Group established for the project included leading injury prevention specialists from Australian academic, agriculture and government sectors. The Working Group considered the findings of the literature and data reviews and defined the levels of evidence for effectiveness of defined solutions, and for the recommendations for intervention and research need.

2.0 BACKGROUND

2.1 Dimensions of the Problem

Injuries and traumatic deaths to children on farms is an internationally acknowledged public health problem, with a number of countries adopting specific strategic approaches (National Committee for Childhood Agricultural Injury Prevention, 1996; Doyle and Conroy, 1989). Similarly, child farm safety in Australia has received increasing attention, and Farmsafe Australia has moved to define a national strategy for child injury prevention (Farmsafe Australia, 1999).

Agricultural enterprises in Australia are generally not only a place of work, but also incorporate the family home. The potential for injury is heightened as a result of this blurring of home and work domains and the rapid cognitive and motor skill development that children are passing through (Ozanne-Smith, 1992). Qualitative data from studies involving farming families indicates that parents believe the farm is an ideal environment in which to raise children, as it emphasises the “healthy outdoors” and allows for a wide variety of challenges (Hartigan and Clarke, 1994). Consequently, in developing intervention strategies it is imperative to ensure child safety is achieved in the context of a stimulating learning environment.

The diverse and changing nature of Australian farming increases the complexity of the nature of this issue and potential intervention measures. Economic, social, environmental, political and technological factors have impacted on the nature of farming and consequently changes over time have occurred. These changes will continue into the future as farming responds to the external pressures associated with the above factors. Notable changes include the increasing size of commercial enterprises, the corporatisation of some agricultural land holdings, the emergence and increase in number of ‘hobby farms’ and the decrease in the amount of labour used in production processes which has resulted from both the increasing use of technology in farming and the pressure to become increasingly efficient in production. Coupled with this the economic vagaries associated with farming has seen the farming unit increasingly struggle to be financially viable which has in turn had an effect on farming practices.

It is now widely accepted that action to reduce injury should be based on identification of the causal factors of the injury problem, the amenability of the problem to prevention/control; and the availability of effective countermeasures (Commonwealth Department of Human Services and Health, 1996). Farmsafe Australia, in partnership with key stakeholders, has developed a strategy which addresses child injury and death on Australian farms based on these principles. This strategy comprises a number of components addressing key areas such as problem definition, child safety solutions, education and training, promotion research needs, and evaluation.

There are numerous reports on child farm injuries that highlight the extent of the problem (for example, National Occupational Health and Safety Commission, 1998; Rivara, 1997). Despite this body of evidence, there is little published data on the efficacy of interventions to address the causal factors underpinning these injuries.

2.2 Population at Risk

An estimate of the farming population in 1994/95 found that there were around 39050 males and 33787 females aged between 0-19 years resident on farms (Garnaut J, Lim-Applegate H, 1998). The data are population estimates based on survey responses of a sample of farm establishments. Estimates were based on weighted data that took into account the numbers of farms in geographic regions and the particular commodity groups represented (Commonwealth Department of Human Services and Health, 1996). Information collected in the survey included demographic data relating to owner manager households and other farm households on farms (which include employees, relatives, etc). Both males and females of this age group accounted for approximately 12% and 10% respectively of the wider farming population. The estimates reported by Garnaut and Lim-Applegate for this age group are provided in Table 1.

Table 1: Estimated on-farm resident population of children and adolescents 1990/91 and 1994/95.

Age group	1990/91		1994/1995	
	Male	Female	Male	Female
0-4	12107	11076	10247	7500
5-14	17038	18569	18543	17046
15-19	8302	8562	10260	9241

However, the population of children at risk of injury on Australian farms is greater than those who are resident on farms. Child visitors to farms include children visiting and staying with relatives who run family farms - grandparents, aunts and uncles, as well as children who visit with their friends.

2.3 The Injury Problem

The key sources of comprehensive mortality data to define the nature and scale of traumatic fatalities of children on Australian farms are surveys based on coronial data for the period 1982-1984 (Erlich et al, 1993) and for the period 1989-1992 (Franklin et al, 2000).

Table 2 presents mortality data for farm deaths of children for the period 1989-1992. There were 115 child fatalities on farms between 1 January 1989 and 31 December 1992. Of these, 87 (75.7%) were male and 28 (24.3%) were female. Bodies of water were the most common agent of injury for children aged 0-4 years, for older children the most common agents were vehicles and tractors.

Overall, there were approximately 30 childhood fatalities per annum, with deaths being recorded in all states and the Northern Territory.

Table 2: Agent of Injury, child fatalities, 1989 - 1992

Agent	0-4 years	5-9 years	10-14 years	Total
Vehicle	12	7	12	31
Tractor	7	2	2	11
Other machinery	4	1	1	6
Body of water	43	5	1	49
Horse	1	3	1	5
Other animal	1	0	0	1
Other	4	7	1	12
Total	72	25	18	115

Table 3 indicates the causes of child injury resulting in admission to hospitals for the period July 1994 to June 1998

Table 3. Children injured on farms who were discharged from hospital between July 1994 and June 1998 by selected External Cause code groups and age group, Australia (excluding SA): numbers and percent of discharges

Description	0 to 4		5 to 9		10 to 14		Total	
	n	%	n	%	n	%	n	%
Motor Vehicle Non Traffic Accident & Other Road Vehicle Accidents								
Motorcycles	13	2.7	116	17.3	346	27.5	475	19.7
Other Vehicles	65	13.5	76	11.3	186	14.8	327	13.6
Animal ridden	20	4.2	109	16.3	237	18.9	366	15.2
Poisoning by Petroleum Products	*	*	*	*	*	*	5	0.2
Poisoning by Agricultural Chemicals	11	2.3	*	*	*	*	14	0.6
Poisoning by Corrosive & Caustics	*	*	*	*	*	*	*	*
Poisoning by Other Solids, Gases & Liquids	*	*	*	*	*	*	5	0.2
Fire and Flames	*	*	8	1.2	21	1.7	32	1.3
Venomous Animal Plants	18	3.7	19	2.8	26	2.1	63	2.6
Dog Bite	16	3.3	*	*	*	*	21	0.9
Injury by Other Animal	31	6.4	39	5.8	44	3.5	114	4.7
Agricultural Machinery	31	6.4	51	7.6	41	3.3	123	5.1
Other Machinery	15	3.1	5	0.7	6	0.5	26	1.1
Cutting and Piercing	16	3.3	33	4.9	32	2.5	81	3.4
Firearms	*	*	*	*	*	*	5	0.2
Subtotal	246	51.1	463	69.1	949	75.5	1658	68.9
Motor Vehicle Accidents	20	4.2	36	5.4	110	8.8	166	6.9
Poisoning	14	2.9	0	0.0	4	0.3	18	0.7
Falls	81	16.8	102	15.2	84	6.7	267	11.1
Natural & Environmental Factors	15	3.1	11	1.6	15	1.2	41	1.7
Drowning	26	5.4	*	*	*	*	27	1.1
Other E-codes ^{##}	79	16.4	57	8.5	95	7.6	231	9.6
Group Total	481	100.0	670	100.0	1257	100.0	2408	100.0

Case counts and rates are not shown where the cell count is less than 4

Source: Franklin RC, Harrison J (2002). Child Injury where the place of occurrence was recorded as farm: Hospital separations 1993/94 to 1997/98. (In draft)

3. OBJECTIVES

The objectives of the review were:

1. To identify evidence based interventions for adoption on Australian farms to reduce risk of serious injury and deaths on Australian farms related to the key hazards:
 - Drowning
 - Farm machinery
 - Farm motorcycles
 - Other vehicles
 - Horses.
2. To review development stages of children in relation to protection of their safety on farms.
3. To identify relevant Australian federal and state legislation relating to the safety of children on farms to provide context for the recommended interventions for child injury prevention on farms.

The report will provide the basis for development of programs and resources to guide farmers, farm parents and grandparents, educators and those involved in delivery of promotion and extension programs to reduce the incidence of death and serious injury of children on Australian farms.

4.0 METHODS

4.1 Physical Hazards

The key physical hazards to be addressed were defined with guidance from the national strategic framework for Child Safety on Farms prepared by Farmsafe Australia (Farmsafe Australia, 1999) and in association with the Expert Working Group established under that Strategic Framework to monitor child injury and deaths on farms, and to define the key causes of serious injury. That Working Group is led by the National Farm Injury Data Centre.

Literature searches and reviews were conducted to further clarify the nature of the child safety on farm issue. Literature was collected from the available reference material held in the library of the Australian Centre for Agricultural Health and Safety. Additional material was sought via internet searches including the Cochrane Collection and Harborview Reviews, and searches of the Medline database using key words including:

- *Drowning*: drowning, pool fencing, dams, swimming lessons, water safety, child injury, child trauma, farm injury, injury prevention.
- *Farm Machinery*: tractors, farm machinery, child injury, child trauma, farm injury, injury prevention, and machinery guarding.
- *Motorcycles*: including, child injury, child trauma, farm injury, injury prevention.
- *Other Vehicles*: child injury, child trauma, farm injury, injury prevention, vehicle rollover, vehicle accidents, pedestrian accidents, driveway rollover and riding in the back of pick-up trucks.
- *Horses*: horse riding, horse injury/accidents, helmets, child injury, child trauma, farm injury, injury prevention, sports injury, equestrian injury.

Literature was read and information extracted based on the retrieval chart that had been agreed on by the Working Group.

Information was primarily sought and included if it addressed drowning among the 0-4 years age group on farms and farm machinery injury/fatalities in children on farms. However, as there was limited availability of information that focuses specifically on these injuries in the farm context, the search was broadened to include drowning for children and all locations, farm machinery injury/fatalities all ages, vehicle injury/fatalities in children on farms, vehicle injury/fatalities all locations and injury/fatalities all ages.

The research for horses concentrated on horse related injury/fatalities in children on farms. The search also included studies that incorporated horse related injury/fatalities for all ages and locations due to the limited available information that specifically focused on children on farms.

The focus has been on the Australian situation although studies from other countries have been accessed, and the relevant Harborview and Cochrane Reviews have proved useful.

4.2 Reporting of Findings

Once findings had been summarised, they were collated into a summary grid. The interventions were organised using the *Hierarchy of Effectiveness of Control* approach to workplace OHS risk control ie:

1. Eliminate the hazard where possible

If elimination is not possible then the order of effectiveness is:

2. Substitute for a hazard of lesser risk
3. Engineer or design the process to reduce injury risk eg isolation of people from the hazard
4. Administrative control ie rules relating to safe work practice, and the organisation of work (in this instance, where children are legally considered to be visitors to the workplace, work practice has been expanded to include family rules)
5. Use of personal protective equipment.

The findings were presented to the Expert Working Group with a range of knowledge and experience in both agriculture and injury prevention.

4.3 Strength of Evidence

The evidence for the effectiveness of each proposed intervention was considered by the Working Group in accordance with the current approaches to review of evidence for public health interventions and presented using a template based on modification of the Public Health Partnership schema for evaluating evidence of public health interventions (Rychetnik and Frommer, 2002). Each intervention was assigned a score in relation to:

1. The level of evidence for the intervention
2. The strength of the recommendation
3. The need for further research.

The categories were defined by the Expert Working Group and are detailed in Table 4 which follows.

Table 4: Coding scheme for levels of evidence, strength of recommendation

Levels of evidence	
Level	Explanation
0	Self evident/ systems logic
I	Evidence obtained from a systematic review of all relevant randomised controlled trials
II	Evidence obtained from at least one properly designed randomised controlled trial
III	Evidence obtained from any of the following: <ul style="list-style-type: none"> ▪ Well designed pseudo-randomised controlled trials (alternate allocation or some other method) ▪ Comparative studies with concurrent controls and allocation not randomized (cohort studies) case-control studies, or interrupted time series with a control group ▪ Comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group
IV	Evidence obtained from case series, either post-test or pre-test and post-test
V	Opinions of respected authorities, based on public health and/or injury prevention experience, descriptive studies or reports of expert committees
X	No evidence. After thorough searching, no evidence was found, regarding recommendation
Strength of recommendation	
Level	Explanation
A	There is “enough” evidence to support adoption of the intervention. The Committee recommends its adoption.
B	There is some/fair evidence for support of the intervention and the Committee recommends its adoption.
C	There is no/ minimal/ equivocal evidence, but recommendation may be made on other grounds (eg consistent with legislative requirements that are generally considered effective)
D	There is no evidence one way or another, and no recommendation is made
E	There is evidence against the recommendation. The Committee recommends against its adoption.
Research recommended	
Level	Explanation
Y	The Committee believes that substantially stronger evidence can be obtained
N	The Committee believes that stronger evidence cannot be obtained because either: <ul style="list-style-type: none"> ▪ It is not necessary, or ▪ It is not feasible, or ▪ It is not ethical to do so

5.0. DROWNING OF CHILDREN ON FARMS

Dams on farms have a functional purpose, which may include providing water for stock, domestic and crop supply. Particularly in the case of stock water, animals require easy access to the water body, which often prohibits the ability to fence the water source. The physical location of water bodies on farms is often dictated by the biophysical environment and influenced by social/cultural and economic factors. Preventing drowning on farms is complicated by the difficulties in eliminating the body of water hazard to children by either fencing or removal.

Drowning is a significant issue for child safety on farms. It is the most common mechanism for death for children less than 5 years of age on farms (Franklin et al, 2000).

Drowning has been identified as a priority issue for action by Farmsafe Australia in its National Strategy for Child Farm Safety, 1999 (Farmsafe Australia, 1999).

Toddler drowning in dams have been the subject of a special investigation by the State Coroner's Office and the Department of Human services in Victoria. This study reported details of 27 toddler deaths by drowning in dams in Victoria between 1989 and 2001 (Owens, 2002).

Toddler drowning and drownings in rural settings and rural community drownings are recognised as key areas for attention by the Royal Life Saving Society of Australia (RLSSA) and Surf Lifesaving Australia (SLA) in the National Water Safety Strategy 1998, and in more recent promotion campaigns.

5.1 The Risk

Children in the 0-4 years age group are at greatest risk of drowning and the 2-year-old age group has a significantly higher number of drownings (Owens, 2002; Cass et al, 1996; Cass et al, 1991; NSW Child Deaths Review Team Annual Reports, 1996-1997 to present; Harborview Injury Prevention and Research Center, 1997).

Males in this age group are at greater risk (Cass et al, 1991; Owens, 2002).

Dams are the most common location for drowning on farms (Cass et al, 1996; NSW Child Deaths Review Team 1996-1997 Annual Report, 1997; Franklin et al, 2000; Giles, 1995).

The most common scenario reported is where the toddler has wandered from supervision (Owens, 2002; Cass et al, 1996; Giles, 1995).

Drownings predominantly occur on weekends (Cass et al, 1991; Franklin et al, 2000; Owens, 2002).

5.2 Identified Interventions

There is reasonable evidence on drowning in domestic settings, particularly the urban backyard pool and the recommendation of pool fencing as an effective intervention. There was no evidence found on the effectiveness of interventions for prevention of drowning in a rural setting.

1. Pool Fencing

Pool fencing that complies with the Australian Standard for fencing for swimming pools (Standards Australia AS 1926.1-1993) has been effective in reducing the rate of drowning in domestic pools (Thompson and Rivara, 2001; Harborview Injury Prevention and Research Center, 1997).

Pool fencing is most effective in these settings if it meets requirements of the Standard, has a self-latching gate and is maintained. Isolation fencing, where the pool is isolated from all access by the fence, including access from the house, is more effective for prevention of drowning in domestic pools. (Thompson and Rivara, 2001; Harborview Injury Prevention and Research Center, 1997).

Pool fencing is now acknowledged as a suitable intervention measure, the legislation introduced in Australia since 1993-4 requiring domestic pool fencing gives validation to this measure. Applying this successful intervention measure to the farm setting requires some variation. Isolation fencing is preferred over perimeter fencing as the most effective barrier. It would seem highly unlikely and impractical to expect isolation fencing to be erected around farm waterways. Cass et al state that it is “unrealistic to fence all dams or creeks, and fencing the house area to separate it from the rest of the property (and the hazards there) should be standard practice” (Cass, Ross and Lam, 1996).

The nature of the fence is most important in being an effective barrier. Many of the domestic pool drowning cases occurred where fencing was in place yet the fence did not comply to the recommended standard and/or was not fully functional as a safety barrier (eg gates left open, object available to enable child to climb over fence, toddler following others through the gate). The study carried out by Cass et al “highlights the need to emphasise proper maintenance of pool fencing” (Cass et al, 1996), this would need to be a most important consideration when proposing fencing as an effective intervention measure on farms. Further understanding of the practicalities of such a measure would need to be looked at to be confident that fences would be maintained and functional at all times in the farm setting (consider peak times, need for access including vehicle or machinery access, convenience). Similar consideration would need to be given to the anticipated expense in erection of suitable fencing (The limits in success of mesh/ring lock type fencing materials were noted – they may be easily climbed,

cited in Harborview review – Rabinivich, 1994). (Harborview Injury Prevention and Research Center, 1997).

The Harborview Injury Research and Prevention Centre identified and reviewed 7 pool fencing intervention studies. They found that early studies reveal significantly higher drowning incidence in those areas without pool fencing laws, but caution at making the preventative association between fencing and drowning due to the type of methodologies used (ecological studies or case series studies of pool fencing). Subsequent case-control studies show that pool fencing significantly reduces the risk of drowning and the most recent studies show that isolation fencing is superior to perimeter fencing. The Harborview reviews recommend, “Pool fencing should have a dynamic and secure gate and isolate (i.e. four-sided fencing) the pool from the house... Legislation should require isolation fencing with secure, self-latching gates”. The Harborview reviews make reference to studies that have examined whether the type of fencing surrounding a pool makes a difference and looked at children’s ability to climb certain types of fences, finding that chain-link fences, in particular, are the most easily scaled by children as young as 2 years old. They indicate that the height makes little difference if the child is able to climb it. For a fence that is not scalable, the most important element of fencing is a secure, self-closing gate (Harborview Injury Prevention and Research Center, 1997).

The Cochrane Review conducted by Thompson and Rivara (1997) on pool fencing for preventing drowning in children made similar conclusions. They found three studies to meet their selection criteria. Results of their review showed that the “case-control studies which evaluate pool fencing interventions indicate that pool fencing significantly reduces risk of drowning... Isolation fencing is superior to perimeter fencing” and they recommended, “Pool fences should have a dynamic and secure gate and isolate (i.e. four-sided fencing) the pool from the house. Legislation should require isolation fencing with secure, self-latching gates for all pools.” (Thompson and Rivara, 2001).

A report to the Health Department of Western Australia in 1991 by Harris et al, concluded that “the evidence very clearly suggests that a child is more likely to drown in a pool with no isolation fencing”. After reviewing data from Western Australia, Queensland, New Zealand and the United States they also stated that “not one study found indicated that the installation of isolation fences was associated with an increased risk of drowning” (Injury Issues, 1991).

2. A Safe Place to Play

The creation of a safe place to play is the most frequently mentioned intervention to prevent child injury on farms (Australian Centre for Agricultural Health and Safety Guidance Note 7, 1997), although there is no literature that provides evidence for the effectiveness of this solution for drowning prevention. This specific intervention was first described by an expert Working Group examining the evidence for effective solutions to child deaths on New South Wales farms for

Farmsafe New South Wales in 1993 (Child Safety on Farms Working Group, 1993).

In the case of drowning, it would need to be considered that a safe place to play is most likely to be adopted by residents with a special interest (eg parents with young children). The potential risk for visitors may still remain in many cases. During the 1989-92 period, 30.4% of all children fatally injured on farms were visitors, 37.3% of all drowning fatalities (all ages) were visitors to the farm (Franklin et al, 2000). Thus it would seem vital that education and awareness campaigns aimed at all rural people are conducted which is the intent of the RLSSA (Giles, 1995).

Similar recommendations in regard to fencing have been made by the RLSSA and SLA in their 1995 project *"Towards a National Water Safety Strategy"*. Based on the guidelines used in the pool fence legislation restricting access to outdoor private swimming pools, it is recommended that a child resistant fence to create a safe place to play should be 1.2 metres high with a self-closing, self-latching gate, structures such as horizontal supports that could provide footholds should be located on the 'outside' to prevent climbing the barrier, and the most suitable material would be a pool safety fence (Giles, 1995).

Other studies that could be considered as relevant relate to protection of children from non-traffic/ driveway vehicle run over, where fencing of the driveway from the area where children play or have access has been proposed. A case control study reported by Roberts et al found that the absence of a physical separation of the driveway from the children's play area was associated with a three and a half times increase in the risk of driveway related injury (Roberts et al, 1995; and also reviewed in Neeman et al, 2002).

3. Water Safety Lessons

As highlighted in the National Water Safety Plan - July 1998, "there are many Water Safety oriented programs being successfully carried out throughout Australia. There has been however, very little analysis of the effectiveness of these programs either individually or collectively" (Australian Water Safety Council, 1998).

Similarly, the Harborview reviews (1997) identify that "few studies have evaluated intervention programs for their effectiveness" (Harborview Injury Prevention and Research Center, 1997). It was found that no studies have been published that investigate general education programs on drowning prevention. The centre found no studies to have examined the question of whether swimming lessons and/or drown proofing courses actually prevent drowning and near-drowning. They found only two studies which evaluated the short term effect of swimming lessons in children and concluded that "there is strong evidence that swimming lessons improve swimming performance. Pre-school aged children in certified swimming programs show significant improvements in swimming

ability and pool deck behaviour compared to those who do not take lessons. The earliest age at which swimming lessons show improvement in swimming ability is 24 months. Children are highly sensitive to training, are able to retain most skills if lessons are continued, and can use those acquired skills in mastering more advanced swimming skills (eg diving)". The reviewers recommend that the generalisation of skills acquired from a certified instructor to real-world settings cannot be determined from the studies conducted so far. This is most significant for the rural child as the water bodies presenting risk are not the same as those in which early childhood water awareness are taught (Harborview Injury Prevention and Research Center, 1997). There is the unresolved concern that swimming lessons may increase toddler interest in water and possibly lead to increased risk of water exploration.

4. Enhanced Adult Supervision

A recent study undertaken as part of the Louisiana Farm Family Injury Prevention and Health Initiative used descriptive and categorical data analysis methods to examine the associations between farm-related injury and supervision type (Pryor and Carrie, 2002). While water and drowning were not found to be a key injury issue, and the age group studied included children aged 0-18 years, they found that children of all ages were more likely to sustain farm-related injury when they were supervised by a caregiver engaged in farm work versus supervised at home. It should be noted that this may not be related to the supervision per se, but to spending less time exposed to farm hazards.

The RLSSA and SLA clearly state, "The importance of careful supervision of children cannot be emphasised enough". They also acknowledge "round-the-clock supervision of a toddler is almost impossible for a parent or guardian". Because it is so often the case that a child just simply wanders off from adult supervision and it takes only a few minutes from the moment a child wanders from supervision to the time they have drowned, it is imperative that the need for improved parental supervision including education regarding injury risk for children be reinforced. The "Keep Watch" program developed by the RLSSA is directed at the prevention of toddler drowning and clearly emphasises that there is no substitution for constant adequate adult supervision (Giles, 1995; RLSSA, 2001).

The Harborview reviews (1997) identify that "few studies have evaluated intervention programs for their effectiveness" and found that no studies have been published that investigate programs to increase adult supervision of children in water (Harborview Injury Prevention and Research Center, 1997).

5. Awareness of Developmental Capabilities

The review report of Victorian toddlers drowning in dams recommends that 'any public awareness campaign should address carer's consciousness of how quickly

toddlers can get into danger, specially those most at risk in the one to three years age bracket” (Owens, 2002).

Cass et al identified 12 drowning deaths in dams in NSW between 1990-95, children aged between 0-8 years. They identified “The repetitive sequence was of the child wandering away from the house, noted to be missing and found drowned in the dam” (Cass et al, 1996). This demonstrates the need for an adequately fenced play area to be erected out from the back door, however, could it also be considered that this common sequence may also highlight a need for a more *realistic parental awareness of the developmental capabilities* of their child at various stages? It was found that parents often underestimated their child’s mobility and curiosity (Giles, 1995) and that verbal instructions are not effective for the toddler age group, despite their verbal acknowledgment of warnings and cautions they do not understand these (Giles, 1995).

6. Personal Floatation Devices (PFDs)

The Harborview reviews suggest that PFDs are often overlooked as an additional safety intervention. However, no studies have examined the ability of PFDs to prevent drowning.

7. Cardiopulmonary Resuscitation

There is compelling evidence from case series that cardiopulmonary resuscitation (CPR) has a good likelihood of achieving successful outcomes for paediatric submersion (Pearn, 2000). There are numerous other studies that are not reported here, none in the farm setting.

5.3 Levels of Evidence, Recommendations and Need for Research

Table 4 provides a summary of the Expert Committee’s determination of the level of evidence for effectiveness of interventions, the strength of the recommendation for its adoption on Australian farms and the need for/ value of further research.

Table 5: Interventions to reduce drowning of toddlers in bodies of water on farms – level of evidence for, strength of recommendation for and need for further research. (Refer to Page 9 for coding scheme)

Scope: Includes drowning of toddlers aged 0-4 years in dams, rivers, creeks, water troughs, stock dips, ponds and containers with water. Does not address domestic swimming pools, where these should meet local government standards and recommendations for water safety.

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference
1. Eliminate the hazard				
1. Remove unused body of water	For example unused sheep dips, dams no longer in use	0,A	N	9
2. Substitute for a hazard of lesser risk				
1. Substitute alternative stock watering systems	For example “nipple drippers”, others might include troughs, although toddlers have drowned in small bodies of water	0,A	Y Descriptions of systems that could be recommended as safe	9
3. Engineering/ design/isolation from the hazard				
1. “Child proof” fencing-off of bodies of water	For example effluent ponds, aquaculture ponds	V, A Arguing by analogy with evidence for effectiveness of pool fencing	N Although a researchable question relates to the practical implementation	44, 92,9
2. Covering lids on wells and tanks	Required for septic tanks	0, B	Y	9
3. Meshing under the water	NSW legal requirements for ornamental pools	0, C	Y Is NSW law supported as a safety response	
4. “Child proof” fence around the home – a Safe Play Place	Create equivalent of an urban “back yard” Separate the child from the farm worksite Not complete solution - needs associated administrative solutions – family rules (see below) Isolation of person from other hazards (eg plant) a requirement under OHS regulations	V,B Analogy with evidence for pool fencing	Y Cohort or case series studies to determine: - effectiveness and other components of solution Research acceptability and adoption - Link with driveway deaths research agenda	44,92, 77, 64, 23, 9
4. Administrative controls/ safe practice				
1. Designated responsibility for adult supervision	a. Where child IS exposed to water hazard – eg swimming pool or in company of responsible person around bodies of water	0, C	Y Develop specific package of instructions	73, 20, 67, 40

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference
	b. Not recommended as primary safety system to protect children from farm water hazards, <u>part</u> of overall prevention plan.	X,D/E	N Inadequate intervention	44
2. Establish and maintain family rules re boundaries	Integral <u>part</u> of overall prevention plan for family farms Not considered sufficient for prevention	V, C	Y Research into child and family behaviours	46, 20
3. Water awareness training of children		X,D	Y Research into effectiveness at different toddler ages is needed	44
5. Personal protective equipment				
1. Flotation devices for children	Not complete intervention, requires direct adult supervision when exposed to water hazard. Improperly designed devices can be hazardous	X,C	Y Research into effectiveness is needed.	44
6. First aid/ resuscitation				
1. Resuscitation skills for adults	Effective for resuscitation of near drowning in small time interval Not a complete solution for prevention of drowning	IV, A	N	69

5.4 Recommended Interventions

Recommendations for intervention to reduce risk of toddler drowning on farms are based on the available information that has defined the circumstances of toddler drowning on Australian farms, the developmental characteristics of children in this age group and the literature on available intervention measures. The evidence supports the following interventions:

1. Eliminate unused water bodies, and, where possible, cover water bodies with covering unable to be lifted/opened by children

Water bodies that are no longer used in the production process should be removed to prevent drowning.

Sheep dips, wells, tanks, troughs can collect water in them and provide a potential location for drowning to occur. It is strongly recommended that these

vessels are removed, closed in, securely covered or securely fenced off to prevent access by children.

2. Fence the house yard to separate the farm workplace from the place where children live and play, with self latching gates - create a safe place to play. Note that this is the recommendation to reduce serious injury to toddlers associated with other farm hazards – machinery, vehicles and horses.
3. Establish and maintain family and workplace rules relating to:
 1. The boundaries where children can be without parental supervision
 2. Ensuring that the home yard gates are kept closed and maintained
 3. Ensuring adequate adult supervision of children in the vicinity of bodies of water
4. Adults and older children on farms should be trained to undertake cardio-pulmonary resuscitation

These interventions should be established on all Australian farms where children are living, or where children visit.

5.5 Further Research

The following research would further inform farm families and farm businesses in their attempts to reduce risk of child drowning.

1. Descriptions of design options for safer watering systems aimed at reducing drowning risk to children, including the substitution of troughs for dams, meshing, 'nipple drippers'.
2. Research into the effectiveness of the key recommendation – maintenance of the “child proof” fence to create a safe play place for children. Research should include effectiveness of different farm fencing designs, and cohort or case studies. Links could be made with child driveway deaths studies.
3. Development of a specific package of instructions for those whose role is supervision of toddlers on farms with recommendations for the delivery of the package.
4. Research into child and family behaviours relevant to maintaining family rules re out of bounds areas.
5. Research into the effectiveness of water awareness training in reducing drowning risk
6. Research into effectiveness of personal flotation devices.

7. Research into the contribution that could be made by technologies such as electronic monitoring devices that trigger an alarm when a child is outside of the designated safe area.

6.0. INJURY ASSOCIATED WITH FARM MACHINERY

Farm machinery includes tractors, their linkage, tillage equipment, seeders, grain augers, slashers, other fixed and mobile farm machinery and plant. The range of machinery used on farms is relevant to the many different agricultural systems present in Australia. Farm machinery is used for a variety of purposes and during many different stages in the production process of each system. Many different brands, makes, and models of farm machinery exist. Some farm machinery is relatively old while other items will be the latest technology available.

Farm machinery death and injury is a significant issue in terms of child safety on farms and has been included as a priority issue by Farmsafe Australia in its National Strategy for Child Farm Safety 1999 (Farmsafe Australia, 1999). Mobile farm machinery and plant ranked as the third most common agent of fatal incident for children in farm-related fatalities in Australia for the period 1989-1992 (Franklin et al, 2000).

The issue can be separated into two groups with differing characteristics. The first being farm machinery injury and death of children aged 0-4 years and secondly farm machinery injury and death of children aged 5-14 years.

OHS legislation in each state provides for protection of all persons operating machinery, plant and equipment. In this legislative framework children are treated as visitors to the workplace.

6.1 The Risk

The 0-4 years age group has a greater number of farm machinery fatalities in Australia than the 5-14 years age group (Ashby and Day, 1995; Franklin et al, 2000; Langley et al, 1997).

The majority of serious and fatal injuries occur to bystanders and the most common activity at the time was using the tractor for transport or during recreation (Ashby and Day, 1995; Franklin et al, 2000). The most common scenario reported in Australia, and internationally, has been where a child was riding on the tractor as a passenger and fell under the tractor's wheels or attached implement and was crushed (Ashby and Day, 1995; Franklin et al, 2000; Southorn, 1997). Males appear to be at greatest risk and more likely to be injured/killed by farm machinery (Ashby and Day, 1995; Franklin et al, 2000; Hawk et al, 1994).

Injury rates were higher at peak farming activity times. Injuries to children were more likely to occur on weekends (Ashby and Day, 1995; Hawk et al, 1994).

The most common tractor injuries to children were to the head and face. The most common type of injury was a fracture. Children's injuries tended to be more

serious than adult tractor injuries (Ashby and Day 1995; Franklin et al, 2000; Langley et al, 1997).

Assumptions have been made as to the most likely context of injury event for children. These are based on limited available information, logical reasoning and anecdotal evidence. It is assumed that children in the 0-4 years age group are more likely to be accompanied by an adult into the workplace, be playing around the machinery or a passenger on a tractor and are unlikely to be actively involved in the work process. Children in the 5-14 years age group are likely to be involved in accompanying the parent into the workplace (although this is less likely to occur among school aged children able to 'look after themselves'), playing on or around machinery and as a passenger on a tractor as well as operating farm machinery in supervised, semi-supervised and unsupervised working situations.

A survey of farm families conducted by Hawk et al in Iowa, USA supports such an assumption. They found that the average ages at which children of either gender were reported to start operating tractors were 11 for tractors and 12 for cab tractors. They found that male children as young as four years of age were reported as operating a tractor. They note that an observed bimodal injury peak could be "partially explained by the fact that the peak age for children accompanying an adult on a tractor is in the younger age groups and the peak for operating machinery is in the oldest group", in this case the 15-18 years age group (Hawk et al, 1994).

This study also provided evidence for the ages at which children operated other agricultural machinery in the United States, stating "For children under the age of ten, percentages were low for operation of equipment using PTOs, grain augers and combines, for either sex. However, for boys age 10-14 years, 31% operate PTOs, 26% augers, and 6% combines. Very few girls in this age group operate these machines." (Hawk et al, 1994). Research conducted by Southorn (1997) surveying a sample of 117 tractor operators from throughout NSW supports the conclusions made for this project. Southorn's survey found that 62% of operators were under 12 years of age when they first drove a tractor. Ninety two percent were trained when they were 15 years old or younger, indicating the young age at which children are being exposed to farm machinery (Southorn, 1997).

Exposure to farm machinery needs to be considered. There is some evidence to indicate that children are commonly carried as passengers on a tractor (Southorn, 1997). The following assumptions are supported by the US study of Hawk et al. It can be assumed that males have greater exposure to farm machinery. It can also be considered that pre-school aged children are more likely to accompany a parent into the workplace where school aged children (5-9 years) are more likely to be left at home or at school and thus exposure is not as high for this age group. Teenagers become an important part of the labour force and thus have greater exposure to farm machinery (Hawk et al, 1994).

Exposure to damaging machinery noise is also a hazard to hearing for all ages, including children. Hearing screening results for young farm adults aged 15-24 years in New South Wales between 1994 and 2001 indicate that 21 percent of young people aged 15-16 already have a mild noise induced hearing loss in one (left ear), and more than 1 percent have a moderate to profound noise induced hearing loss. This hearing loss has presumably occurred during childhood exposure to damaging levels of noise (Franklin et al, 2002).

Many items of farm machinery on Australian farms are associated with damaging noise levels, and children need to be protected from noise injury (Depzcynski et al, 2002).

6.2 Identified Interventions

The majority of farm machinery fatalities in children are associated with tractors (Ashby and Day, 1995), thus a greater emphasis on the literature that focused on tractors. The majority of studies and reports that have been undertaken focus on farm machinery injury/death among adult farm workers, however, the nature of the issue is considered to be different for children.

1. Isolate Children from Machinery in the Farm Workplace

Evidence shows that children fatally injured on farms are commonly engaged in recreation or transport activities (Franklin et al, 2000). It is well known that the difficulties of preventing child injuries on farms result from the nature of the environment, ie, the farm workplace is also the setting for the home and leisure and play area.

Injuries to children are recorded where children have been playing in the vicinity of machinery and have been run over because the operator was not aware of their presence prior to moving the machinery or the child fell onto the machinery while playing on or near it (Ashby and Day, 1995). There are many reasons why children are taken into, or are playing in, the workplace. Often there is no clear distinction between the home, play space and workplace.

Without clearly defined boundaries children will often have access to the work place for recreation. Young children may be taken into the workplace by parents who are required to work on farm and who have no other option available for childcare. Farmsafe Australia is committed to investigating the availability of a range of flexible childcare options for parents of children on farms. Depending on the outcome of this research, the need for parents to take children into the workplace may be alleviated. The focus at this stage is therefore on the concept of separating the home from the workplace and creating a safe place to play. An adequately fenced and maintained play yard may provide a barrier to hazardous machinery and create a clear distinction between areas used for different functions (Australian Centre for Agricultural Health and Safety, 1997).

Other relevant studies for child injury associated with mobile plant and equipment come from driveway deaths studies. In a study of driveway motor vehicle injuries to children Holland et al indicate that access limitation was not maintained (i.e. gate/door left open) in 3 of the 3 cases where this information was documented (Holland et al, 2000).

The principle of isolation of persons exposed to plant and machinery hazards in the workplace is a key OHS risk management principle for other industries – eg separation of pedestrian workers from forklift pathways in large warehouses.

2. Reversing Alarms

The use of reversing alarms in passenger vehicles appears unlikely to be effective given that the group most at risk of injury, toddlers and preschool children, are too young to appreciate the significance of the alarm and act with appropriate speed (Holland et al, 2000).

3. Proximity Warning Devices

Proximity warning devices consisting of ultrasonic transceivers located in the vehicle's bumpers can be found in some prestige vehicles. These allow for the detection of objects within 50cm to 70cm of the bumper and above a height of 30cm. Holland et al note "Although the effectiveness of such devices has not been proven in this situation, their wider introduction in high-risk vehicles may help reduce the frequency of this injury" (Holland et al, 2000). Research is being carried out in the USA on the use of sensor systems to detect the presence of a person near a dangerous machine part in the farm setting. It appears that although this research is not directly targeted at child safety, it may produce promising results and potential for application as an effective intervention in the future (Shutske et al, 1998).

4. "No passenger" or "No extra rider" Rules

The evidence shows that the majority of child fatalities relating to tractors resulted from the child riding as a passenger, falling from the tractor and being hit/run over by the tractor or attached implement (Franklin et al, 2000). It is reasonable to assume that if "no passenger" rules were maintained on farms across Australia, then there would be a significant reduction in deaths and serious injury to children.

5. Passenger Seats in Tractors and Mobile Plant

Prevention of death of persons due to tractor rollover, requires that the tractor operator be seated (preferably with seat belt) within the safety zone afforded by an approved roll over protective structure (ROPS). No passengers should be on the tractor unless there is a second seat, with the passenger within the ROPS protected safety zone. It has been suggested that a passenger seat may also reduce risk of serious injury of children associated with falling from a moving tractor.

The evidence is inconclusive and somewhat controversial on the effectiveness of passenger seats on machinery, particularly tractors, in reducing serious injury. There are opposing schools of thought on this issue and both have some merit. Murphy et al, in the USA, suggest that providing a passenger seat on farm machinery responds to farmers who choose not to follow the recommended safety practice of permitting no one but the operator on the machine (Murphy et al, 2001).

Current ROPS designs do not provide for protection of a passenger on a tractor (WorkCover Authority of New South Wales, 1992). In addition, manufacturers have to date not been willing to install passenger seats on tractors and as such they are relatively unavailable to Australian farmers.

6. Guarding

Guarding of exposed moving parts of plant and machinery is an OHS regulatory requirement for protection of workers and visitors to workplaces in all industries, including the rural industries (Australian Centre for Agricultural Health and Safety, *Guidance Note 5: Farm machinery*, 1997). Literature on the effectiveness of guarding on farm machinery to prevent injury to children has not been found. It is not disputed that guarding is an effective intervention measure for adult workers, however, often the design of such barriers do not have children in mind, particularly small children, and they remain at risk if they are in the vicinity of working plant and equipment.

7. Hearing Protection

The Australian Centre for Agricultural Health and Safety provides advice regarding measures to reduce exposure to damaging noise (Australian Centre for Agricultural Health and Safety, *Guidance Note 4: Noise on farms*, 1997). This advice is based on measured noise levels in typical farm activities, and the noise attenuation levels that are afforded by currently available ear muffs and plugs. This project has not reviewed the evidence base for those recommendations.

6.3. Levels of Evidence, Recommendations and Need for Research

Tables 6 and 7 provide summaries of the Expert Committee's determination of the level of evidence for effectiveness of interventions, the strength of the recommendation for their adoption on Australian farms, and the needs for/ value of further research. Table 5 refers to interventions for toddlers and young children aged 0-9 years, and Table 6 provides additional assessments relevant to older children aged 10-14 years. This assessment recognises that older children may be considered as "young trainees" in some circumstances.

Table 6: Interventions to reduce injury associated with farm machinery for toddlers and young children (0-4, 5-9 years age group) – level of evidence for, strength of recommendation for, and need for further research. (Refer to Page 9 for coding scheme)

Scope: Includes injury associated with being in the vicinity of mobile plant eg tractors, and fixed plant and machinery, or a being a passenger in mobile plant and machinery

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference/ s
1. Eliminate the hazard				
1. Remove hazardous item of machinery	For example replace power generator with mains power	O,A	N	8,9
2. Relocate machinery area	It may rarely be an option to relocate machinery area away from the home eg to second property	O,A	N	8,9
2. Substitute for a hazard of lesser risk				
	Substitution solutions not relevant to this age group			
3. Engineering/ design/isolation from the hazard				
1. “Child proof” fence around the farm yard – a Safe Play Place	Create equivalent of an urban “back yard” Separate the child from the farm worksite Not complete solution - needs associated administrative solutions – family rules (see below) Isolation of person from hazards (including plant) a requirement under OHS regulations	V,B Analogy with evidence for pool fencing, and driveway vehicle run-over	Y Cohort or case series studies to determine: - effectiveness and other components of solution Research acceptability and adoption - Link with driveway deaths research agenda	44,92, 77, 64, 23, 9
2. Sensor device to detect human presence near a dangerous machine	The small size of a child makes it difficult to see from machine operators seat		Y Monitor the research being undertaken at the Marshfield Clinic	84,48
3. Passenger seats in tractors and mobile plant and enclosed cab tractors	No evidence for protection through passenger seat While parent’s perceptions are that child passengers in an enclosed cab tractor are safer, there have been deaths where door opened.	V, D	Y Further information could be derived from deaths data and studies	60
4. Administrative controls/ safe practice				
1. Establish and maintain family rules re boundaries and “out of bounds” areas of the farm	Integral <u>part</u> of overall prevention plan for family farms Not considered sufficient for prevention	V, C	Y Research into child and family behaviours	46, 20
2. Designated adult supervision	Access to childcare where parent labour is required	V, C	Y	

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference/ s
2. Work rules “No extra rider’ policy for tractors and mobile plant	Majority of tractor deaths of children result from child passenger falling from tractor, and being hit/run over by tractor.	V,C	N	37, 9
3. Remove keys from machinery when not in operation	Only considered a part of a solution for this age group	V,C	N	
5. Personal protective equipment				
	PPE solutions not relevant to this age group			
6. First aid/ resuscitation				
1. First aid skills for adults	Required for emergency response to machinery injury in the workplace. Not an effective solution for prevention of machinery injury.	V, C	N	

Table 7: Additional interventions to reduce injury associated with farm machinery for older children level of evidence for, strength of recommendation for, and need for further research. (Refer to Page 9 for coding scheme)

Scope: Includes mobile plant eg tractors, and fixed farm plant and machinery

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference/ s
1. Eliminate the hazard				
See Table 6	Solutions may be relevant for older children			
2. Substitute for a hazard of lesser risk				
1. Use less risky means of undertaking job where risk is high to young assistant	For example, use utility with seat belts to pull trailer to feed out stock, rather than tractor.	O,C		8,9
3. Engineering/ design/ isolation from the hazard				
1. Fence around the farm yard – a Safe Play Place/ recreation area for children	Create equivalent of an urban “back yard” Separate the older child’s recreation area from the farm worksite Also needs associated administrative solutions – family rules (see below) Isolation of person from hazards (including plant) a requirement under OHS regulations	V,B	Y Cohort or case series studies to determine: - effectiveness and other components of solution Research acceptability and adoption - Link with driveway deaths research agenda	44,92, 77, 64, 23, 9
2. Sensor device to detect human presence near a dangerous machine	See Table 5			
3. Effective guarding or isolation of all hazardous machinery	Required under OHS workplace regulations to protect workers and visitors to the workplace	O, C	Y Machinery safety research programs to consider young operators risks	8,9
4. Safe tractor design features for tractors being operated by young trainees	For example, ROPS, safety access platform, safety start devices. Passenger seat for supervisor of trainee operators required under OHS regulations for the protection of workers.	IV, B	Y Machinery safety research programs to consider young operators risks	60, 8
5. Enclosed cab tractors	See Table 5			
4. Administrative controls/ safe practice				
1. Establish and maintain family rules re boundaries and “out of bounds” areas of the farm	See Table 5 Relevant to older children’s recreational areas.			

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference/ s
2. Establish and maintain family rules re conditions under which children operate any machine in the farm workplace.	Children should be trained to undertake farm work in accordance with their developmental and physical capabilities, and under supervision. Parents need knowledge of cognitive, physical and behavioural characteristics of child at each stage, AND accurate perception of risk	X, C	Y Research into child and family behaviours	45, 86 See also Section 59
2. Work rules “No extra rider” policy for tractors and mobile plant	See Table 5			
3. Remove keys from machinery when not in operation	See Table 5			
5. Personal protective equipment				
1. Close fitting clothing in the vicinity of machine operation in the farm workplace	General prevention recommendation related to machinery operation, from observations of mechanism of injury for adults	V, C		37, 8
2. Eye protection	Suitable eye protection when in the vicinity of welding	V, C		
3. Hearing protection for hazardous machinery noise	Noise injury on farms begins in childhood	V, C		36, 28, 8
4. Mask when in vicinity of dusts	For example, during harvest and moving grain	V, C		
6. First aid/ resuscitation				
1. First aid skills for adults	Required for emergency response to machinery injury in the workplace. Not an effective solution for prevention of machinery injury.	X, C	N	

6.4 Recommended Interventions

Recommendations for intervention to reduce risk of serious injury and death associated with farm tractors and machinery are based on the available information that has defined the circumstances of machinery related deaths on Australian

farms, the developmental characteristics of children in this age group and the literature on available intervention measures. The evidence supports the following interventions for children aged 0-14 years:

1. Where possible eliminate farm machinery hazards from the children's environment. This will only rarely be an option.
2. Fence the house yard to separate the farm workplace from the place where children live, play and generally undertake their recreation, with self latching gates – create a safe place to play. Note that this is the recommended intervention to reduce toddler drowning deaths.
3. Establish and maintain family and workplace rules relating to:
 1. The boundaries within which children can be without parental supervision
 2. Ensuring that the home yard gates are kept closed and maintained.
4. Establish and maintain family and work rules relating to “No extra rider” on tractors and other mobile plant and machinery.

No passengers on tractors should be the focus for prevention of injuries associated with farm machinery to children on farms. The evidence shows that the majority of child fatalities relating to tractors resulted from the child riding as a passenger, falling from the tractor and being hit/run over by the tractor or attached implement (Franklin et al, 2000).

5. Adults and older children on farms should be trained to undertake cardio-pulmonary resuscitation

When older children begin to engage in farm work, they should be trained to undertake farm work in accordance with their developmental and physical capabilities, and under close supervision. Parents need knowledge of cognitive, physical and behavioural characteristics of child at each stage, AND an accurate perception of risk. Section 11 of this report is devoted to the issue of children's physical and cognitive development related to farm work.

Protection of children as young trainees should include:

6. Where possible the elimination of hazards associated farm machinery.
7. Effective guarding of exposed moving parts, or isolation of operators from those hazards.
8. Safe tractor design features including ROPS and safe tractor access, outside of the path of the rear wheel.
9. Adequate induction, training and close supervision of working trainees.

10. Hearing protection when children are in the vicinity of hazardous machinery noise.
11. Respiratory protection when children are in the vicinity of hazardous dusts.

6.5 Further Research

The following research would further inform farm families, farm businesses manufacturers and policy makers in their attempts to reduce risk of child injury associated with farm machinery:

1. Research into the effectiveness of a key recommendation – maintenance of the “child proof” fence to create a safe play place for children. Research should include effectiveness of different farm fencing designs, and cohort or case studies. Links could be made with child driveway deaths studies.
2. Development of a specific package of instructions for those whose role is supervision of toddlers on farms.
3. Research into child and family behaviours relevant to maintaining family rules re out of bounds areas and rules relating to “No extra rider.”
4. Current research in the United States of America by the University of Minnesota, funded in part through the Midwest Centre for Agricultural Research, Education, and Disease and Injury Prevention: A NIOSH/CDC Cooperative Agreement Program and supported by The National Farm Medicine Center (Marshfield Clinic) is being conducted into the development of a sensor system to detect the presence of a person near a dangerous machine component. Monitoring of the developments of this research is recommended to consider its relevance as an intervention for child farm injury.
5. Research into the effectiveness of enclosed cabins on tractors to protect passengers from runover injury and death. Further information could be derived from analysis of deaths data.
6. Particular attention should be given to the competencies required for children to perform tasks and thus to guide parents and farm managers in their training and assessment of their child’s ability to safely operate machinery.

7.0. INJURY ASSOCIATED WITH FARM MOTORCYCLES

A variety of motorcycle types can be found on Australian farms including 2-wheeled agbikes and trail bikes, 3-wheeled and 4-wheeled motorcycles or ATVs (Schalk and Fragar, 2000). Within these types are a plethora of makes, models and levels of age and maintenance.

Farm motorcycles are used for a variety of operations in a variety of situations. Activities include personal transport, mustering livestock, towing and/or carrying of goods and recreation the study conducted by Schalk and Fragar (2000) further describes these activities.

That study also provides an indication of the numbers of farm motorcycles used on Australian Farms. At the time of the study, the majority of Australian farms studies had at least one farm motorcycle in operation and there were more 2-wheeled motorcycles in use on Australian farms. However the numbers of ATVs were increasing substantially.

Farmsafe Australia has identified farm motorcycle injury and death for 5-14 year olds as a priority area for attention in their National Strategy for Child Safety on Farms, 1999 (Farmsafe Australia, 1999). Motorcycles are responsible for 10% of all child fatalities on farms in the period 1989-1992 and rank as the number one agent of fatality in the 5-14 years age group (Franklin et al, 2000). Agricultural fatalities associated with all-terrain vehicles on farms have emerged as a key problem for the industry (Worksafe Victoria, 2002).

7.1 The Risk

Males are more frequently injured or die as a result of motorcycle injury in Australia and New Zealand (Franklin et al, 2000; Langley et al, 1995; Schalk and Fragar, 2000; Begg, 1997).

Children and young people are at higher risk of injury (Schalk and Fragar, 2000).

Males were the majority of users (Franklin et al, 2000; Langley et al, 1995; Schalk and Fragar, 2000; Begg, 1997).

In New Zealand, greater numbers of injuries occurred during the warmer months with a peak in Dec/Jan (Langley et al, 1995).

Few riders in Australia reported having received formal training. Most were self taught or taught by their father (Schalk and Fragar, 2000).

Use of available and appropriate PPE appears to be low (Langley et al, 1995; Begg, 1997; Schalk and Fragar, 2000).

Fatalities in Australian children on farms have been associated with riding the motorcycle for transport for either work or recreation (Franklin et al, 2000).

Injury commonly occurred after the rider fell from the motorcycle, this was commonly the result of the rider losing control, frequently the result of hitting an environmental hazard (Franklin et al, 2000; Langley et al, 1995; Begg, 1997; Schalk and Fragar, 2000). Deaths associated with ATVs are often caused by the vehicle rolling over and pinning or crushing the rider and/or passenger.

Legs were the most commonly injured body part (Langley et al, 1995; Schalk and Fragar, 2000; Begg, 1997).

Head and face injuries were the major cause of fatal injury (Franklin et al, 2000; Schalk and Fragar, 2000).

Fractures are the most common type of injury requiring medical attention (Schalk and Fragar, 2000; Begg, 1997).

The location, nature and severity of injury were dependent on the type of machine (Schalk and Fragar, 2000).

7.2 Identified Interventions

1. Helmets

There is considerable literature to indicate that helmets are an effective intervention strategy to prevent/reduce head injury in bicycle and motorcycle incidents (Rivara et al, 1997).

There has been a long history of research on the effectiveness of crash helmets for motorcyclists. Supplementing this are the recent studies into the effectiveness of bicycle helmets. Parallels are valid because the principles for protection are the same (Henderson, 1995).

Henderson identifies a number of studies identifying the effectiveness of motorcycle helmets in reduction of risk of severe injury and death from head injury. These include Carins and Holbourn (1943), Jamieson and Kelly (1973), Watson et al, (1980), McSwain and Petrucelli (1984), Evans and Frick (1988) and Wilson (1989).

In 1997, the Harborview Injury Prevention and Research Centre of the University of Washington (child injury) reviewed 5 prevention interventions for bicycle injuries, one of which was the effectiveness of bicycle helmets. They reviewed six case-control studies and two population-based case-control studies including Thomas et al. (1994), McDermott et al (1993), Spaite et al (1991), Thompson et al (1990), and Thompson et al (1989). The review found consistent data "indicating

that wearing an industry-approved bicycle helmet significantly reduces the risk of head injury during crash or collision...". Overall, helmets decrease the risk of head and brain injury by 70 to 88 percent and facial injury to the upper and mid-face by 65 percent." (Harborview Injury Prevention and Research Centre, 1997).

Thompson et al in the Cochrane Review also examined the effectiveness of bicycle helmets and concluded "helmets reduce bicycle-related head and facial injuries for bicyclists of all ages involved in all types of crashes including those involving motor vehicles". This review identified five well conducted case-control studies that evaluated the effect of helmet use in a population of bicyclists who had experienced a crash. The conclusion was made that helmets provide a 63%-88% reduction in the risk of head, brain and severe brain injury for all ages of bicyclists. Helmets provide equal levels of protection for crashes involving motor vehicles (69%) and crashes from all other causes (68%). Injuries to the upper and mid-facial areas are reduced 65% (Thompson et al, 2001).

In 1987, Corner et al documented many aspects of head protection for pedal cyclists finding that bicycle helmets were reducing the severity of head injury, particularly when injury resulted from a collision with another vehicle. It was also found that there was a substantial variation in the protection offered by different types of helmets (Corner et al, 1987).

Corner et al (1987) conducted research into motorcycle protective helmets for the Australian Federal Office of Road Safety and found that helmet wearing does reduce the severity of head injury in motorcycle crash victims. They made significant recommendations for improving the testing and design of motorcycle helmets and recognised the limits of protection offered by helmets particularly to the jaw and base of the skull (Corner et al, 1987).

A report published by Monash University Accident Research Centre in 1993 aimed to evaluate the continuing influence of increased helmet wearing rates on bicyclist head injuries in the two years after the introduction of mandatory wearing. Mandatory bicycle helmet wearing in Australia was introduced gradually over the period July 1990 to late 1992. This "has reportedly coincided with a sizeable reduction in the number of bicyclists with head injuries in Victoria" (Finch et al, 1993).

2. Other Personal Protective Equipment (PPE)

Other PPE is worn by professional riders - motorcycle, motocross and BMX riders. PPE includes gloves, goggles, boots and long pants. Schalk and Fragar (2000) found that motorcycle injuries included injury to face and nose, and to the limbs.

No reports were found that had demonstrated the effectiveness of the PPE in reducing these injuries.

3. *Training*

Changes in legislation requiring the demonstration of a level of competency prior to receiving a motorcycle learner's permit has reduced learner motorcyclist casualties (Vulcan, date unknown).

"There is considerable argument on whether formal motorcycle training reduces the risk of rider injury. Studies by Nairn (1993) and Cooper and Rothe (1988) in the road safety industry concluded that there was no evidence to support formal motorcycle training to reduce injury. On the other hand, the court in Queensland has recently ruled that a worker seriously injured while working using an ATV had not been provided adequate induction and training for the work (*Beverley vs Hill-Douglas and Anor*, Supreme Court of Queensland), (Schalk and Fragar, 2000).

A control trial study is currently being undertaken in Western Australia to determine the effectiveness of ATV rider training in preventing injuries associated with riding these machines.

The Rural Injuries Training Council has developed training competencies for workers who use 2- and 4-wheeled motorcycles, aimed at ensuring the safety of operators of these machines. Competency based training requires assessment of competency in the environment in which the trainee operates.

4. *Age Restrictions in Riding Certain Classes of Motorcycles*

The study undertaken by Schalk and Fragar found that younger children are at higher risk of injury when riding motorcycles on farms.

In 1979 law was introduced to limit riders on learner's permit and first year probationary riders to riding a motorcycle of less than 260cc capacity, this restriction resulted in a decrease in the casualty rates for both groups (Vulcan, date unknown).

Persons less than 16 years are not permitted to drive motorcycles on public roads in Australia. Presumably the rationale for these regulations is that children are not considered psychologically or physically mature enough and do not have the skills to perform this task safely.

Manufacturers recommend that children under the age of 16 do not ride farm ATVs and there are sound ergonomic reasons for these restrictions in that these vehicles have not been designed for safe use by children (Langley, 1996).

5. *"No extra rider rule" for ATVs*

Manufacturers of ATVs advise that ATVs are not designed for passengers (Schalk and Fragar, 2000), and provide a rider safety video with ATV sales in Australia.

Cases of deaths of children riding as passengers on ATVs on farms continue to be reported in the press and by state work health authorities (WorkSafe Victoria, 2002).

6. ROPS to Prevent ATV Rollover Injury

While Roll Over Safety Protection frames have proved to be essential in protecting tractor operators from serious injury and death, there is no good evidence that such approaches are protective for currently designed ATVs (Schalk and Fragar, 2000).

7.3 Levels of Evidence, Recommendations and Need for Research

Table 8 provides a summary of the Expert Committee's determination of the level of evidence for effectiveness of interventions, the strength of the recommendation for its adoption on Australian farms and the need for/ value of further research.

Table 8. Injury associated with farm motorcycle safety, including All Terrain Vehicles (ATVs), of children 5-14 years (Refer to Page 9 for coding scheme)

Scope: Includes injury associated with farm 2- and 4- wheeled motorcycles designed for farm work. This does not address leisure bikes designed for children, about which there is no information regarding safety

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference/s
1. Eliminate the hazard				
1. No motorcycles on the farm	Not an option for most farms	0,A	N	
2. Substitute for a hazard of lesser risk				
1. Use the most suitable and safe form of transport or leisure pursuit.	If children are to accompany adults use safer option, for example utility with seat belts. Suggest alternative leisure pursuits for young children eg mountain biking	0,A	Y Action research with farm families to define safer options	
3. Engineering/ design/isolation from the hazard				
1. ROPS to prevent ATV rollover	Evidence does not support fitment of ROPS to existing ATV types	V,D	Y Research for improved design to reduce injury risk of ATV rollover	83
2. Safety features for 2-wheeled motorcycles of suitable size for child	Leisure type activity	X, D	Y Case series/ case control studies	11,9
4. Administrative controls/ safe practice				
1. Farm ATVs are not accessible/ available to children under 16 years of age	On-road rider age limit is 16+ years of age ATV manufacturers advise 16 year old limit	V, B	Y Further research to establish safe age/rider characteristics	83, 59
2. Establish and maintain rules re “no extra rider” on all ATVs	Manufacturers advise that ATVs are designed for one rider only	V, B	Y Continued surveillance to confirm early findings	83, 11, 9
3. Establish and maintain rules re “no extra rider” on 2-wheeled motorcycles driven by older children	As road traffic rules for new riders	V, C	Y Continued surveillance	
4. Establish and maintain family rules re conditions under which children ride any motorcycle on the farm	Children should be trained to ride farm motorcycles in accordance with their developmental and physical capabilities, and under supervision	V, B	Y Research into child and family behaviours Research into the	

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference/s
	Parents need knowledge of cognitive, physical and behavioural characteristics of child at each stage, AND accurate perception of risk		effectiveness of rider training in reducing injury risk	
5. Personal protective equipment				
1. Helmet for all motorcycle riders	Riders should wear helmets to reduce risk of serious head injury	III, A	Y Define relevant standards for farm use	47
2. Suitable footwear and sturdy trousers for all motorcycle riders	Riders should be suitably attired to reduce injury and /or severity of injury	V, A	Y Study to define optimal PPE for injury prevention	
6. First aid/ resuscitation				
1. First aid skills for adults	Required for emergency response to machinery injury in the workplace. Not an effective solution for <i>prevention</i> of machinery injury.	X, C	N	

7.4 Recommended Interventions

Recommendations for intervention to reduce risk of serious injury and death to children associated with motorcycle riding are based on available information that has defined the circumstances of motorcycle related injury and deaths on Australian farms, the developmental characteristics of children in this age group and the limited literature on available intervention measures. The evidence supports the following interventions for children aged 5-14 years:

1. Use safer forms of transport or leisure for young children.

If children are to accompany adults use safer vehicle option, for example utility with seat belts. Suggest alternative leisure pursuits for young children eg mountain biking.

2. "No extra rider" rule for ATVs.

Establish and maintain family and farm rules to ensure that children are not ever carried as passengers on ATVs.

3. Establish minimum age and conditions for riding farm motorcycles.

It is recommended on limited evidence from specific studies, that the minimum age for riding for ATVs is set at 16 years and that suitability to ride any motorcycle should then be determined by the demonstration of competency.

There is strong support for the recommendation of a minimum age for riding farm motorcycles by the manufacturers of these machines. Manufacturers clearly state that children under the age of 16 years should not ride adult sized ATVs. They identify that such vehicles have not been designed to be ridden safely by persons under 16 years of age who are considered to have physical and cognitive developmental limitations. On road motorcycle licensing requires the demonstration of a minimum level of skill and knowledge following a training period.

4. Ensure suitable helmet and other protective clothing is worn.

PPE including helmets should be worn when riding. The value of helmets in reducing head injury from motorcycle and bicycle injury incidents is clear and substantial evidence has been established as proof of the effectiveness of helmets in this instance.

Other PPE including that worn by professional riders – goggles, gloves, long pants and suitable sturdy footwear should reduce the severity of injury if the rider is subject to a fall or runs into objects.

5. Training and supervision.

Training in the riding and operation of motorcycles on farms is a workplace OHS requirement in all states of Australia. It is not clear from the evidence at the moment how to develop and assess competencies that are relevant to injury prevention.

6. Adults and older children on farms should be trained to undertake first aid and cardio-pulmonary resuscitation.

7.5 Further Research

The following research would further inform farm families, farm businesses, manufacturers and policy makers in their attempts to reduce risk of serious injury associated with farm motorcycles for children on Australian farms:

1. Action research with farm families to define safer options for transport and leisure

Alternative safer activities for young people in the farm setting should be undertaken in association with farm families and rural communities.

2. Research for improved design to reduce injury risk of ATV rollover

This research is needed for all operators of ATVs.

3. Further research to establish safe rider age/ development characteristics and effectiveness of competency based training to reduce injury.

Continued surveillance (using coding to distinguish between 2- and 4-wheeled motorcycles) of motorcycle injury should be maintained, and specific studies would be valuable.

Further research is required relating to the role that training plays in reducing injury. Results from a study in Western Australia are awaited (funded by the Rural Industries Research and Development Corporation)

4. Continued surveillance to confirm early findings of increased risk of injury to young children on ATVs and motorcycles
5. Research into child and family behaviours relevant to maintaining family rules re operation of farm motorcycles to ensure the safety of children.
6. Relevant standards for helmets for farm motorcycles

This is required for all operators of farm motorcycles. A New Zealand Standard has been introduced for helmets for use on farm motorcycles. This matter will be the subject of attention by Farmsafe Australia.

7. Study to define optimal PPE for injury prevention on farm motorcycles

This is required for all operators of farm motorcycles. Monitoring of research that may be conducted in similar fields such as motorcross, competition trail bike riding, professional motorcycle racing and BMX riding may assist in providing evidence as to the effectiveness of PPE such as the body armor and suits produced by the popular *Fox Team Racing* brand. The marketing of these products among such groups could be analysed in order to gain similar success in the adoption and use of such products for farm children.

8.0. OTHER FARM VEHICLES

“Other farm vehicles” include trucks, utilities, cars and trailers, but do not include farm motorcycles that have been considered in the previous section. “Other farm vehicles” are a significant issue for child safety on farms and have been included as a priority area by Farmsafe Australia in their National Strategy for Child Safety on Farms document in 1999 (5). “Other farm vehicles” ranked as the second most frequent agent of fatal injury for farm children (0-14 years) for the period 1989-1992 (Franklin et al, 2000).

The problem has been considered for two distinct age groups with differing characteristics; they are the 0-4 years age group and the 5-14 years age group.

Farm vehicles are present on all Australian farms, playing a vital role in the day-to-day operation of the farming process, which makes elimination of this hazard an impractical control measure.

8.1 The Risk

The farm fatalities study of Franklin et al (2000) found that the majority of other vehicle fatalities of children on Australian farms are attributed to utilities, followed by trucks and trailers.

The highest frequency of such fatalities was to the 0-4 years age group.

Risk taking behaviours included the child riding unrestrained in the back of utilities and trailers, and children as unrestrained passengers in vehicles (Franklin et al, 2000).

Being run over is a common cause of injury of Australian children in household driveways, and a study undertaken by Holland et al (2000) may be relevant to some farm injury to children on farms. Driveway deaths mostly occurred when a vehicle is reversing. Males were more likely to be fatally and non-fatally injured, and 4-wheel drives (4-WDs and light commercial vans (LCVs)) were associated with a 2.5 times greater risk of fatality compared with other motor vehicles. Fatal injuries were caused by a severe, crushing head injury. Non-fatal injuries were commonly associated with a head injury resulting from a fall to the ground or cerebral oedema from traumatic asphyxia secondary to compression of the torso.

Anecdotal evidence has suggested that the injury issue varies for the two age groups. Both age groups experience injury while as a passenger on a vehicle or while playing on or near a vehicle and being run over. The 0-4 years age group is considered to be at higher risk of vehicle run over while playing in close proximity to the vehicle. The 5-14 years age group is considered to be at

increasing risk of injury as a driver of a vehicle in addition to run over and falling out of a vehicle.

8.2 Identified Interventions

There is little literature relating to evidence-based solutions for vehicle injury interventions in the farm setting.

1. Isolate Children from Vehicles in the Farm Workplace

Barriers to limit access to vehicles and machinery is the most commonly recommended intervention to prevent children's access to moving vehicles (in particular driveways), noting that barriers must be maintained – i.e. fences unable to be climbed and with no exit spots, gates need to be kept closed and unable to be opened with ease by a child, no items around that can be moved/leant up against the fence to provide something to climb over the fence in order for this intervention to be effective (Roberts et al, 1995, Neeman et al, 2002).

Vehicle injury is commonly associated with vehicle runover. The majority of such incidents occur while the vehicle is reversing. Commonly the child is near the vehicle without the driver's knowledge and is unable to be seen prior to the driver moving the vehicle, particularly when reversing. For this injury event in urban settings it is recommended that "the optimal prevention would appear to be clear separation of the driveway and garage from the children's play area by a physical barrier such as a fence, wall or self-latching gate" (Holland et al, 2000). Holland et al found that the access limitation that was in place was not maintained (i.e. gate/door left open) in 3/3 of the cases where this information was documented for vehicle runover injury

2. Reversing Alarms

The use of reversing alarms in passenger vehicles appears unlikely to be effective given that the group most at risk of injury, toddlers and preschool children, are too young to appreciate the significance of the alarm and act with appropriate speed (Holland et al, 2000).

3. Proximity Warning Devices/ Sensors

Reference to the proximity warning devices consisting of ultrasonic transceivers located in the bumpers that are found in some prestige vehicles is made by Holland et al (2). These allow for the detection of objects within 50cm to 70cm of the bumper and above a height of 30cm. They note that "Although the effectiveness of such devices has not been proven in this situation, their wider introduction in high-risk vehicles may help reduce the frequency of this injury".

4. Vehicle Type

Holland et al (2000) indicate a link between fatal outcome, age of child and the size and weight of the vehicle involved. They noted a higher number of fatalities and greater risk of fatality associated with 4WDs and LCVs, particularly when reversing such vehicles in the driveway. These types of vehicles are commonly found on Australian farms.

“The increased ride height reduces visibility and makes identification of a young child much more difficult, even with the use of convex mirrors” (Vulcan, date unknown). This is significant when considering the perception of risk and the provision of information for awareness.

5. Use of Convex Mirrors

As indicated above, the increased ride height of vehicles reduces visibility of children around vehicles even with the use of convex mirrors (Vulcan, date unknown).

6. Seat belts/Child Restraints

Seat belt and child restraints are well recognised and accepted as effective intervention strategies for motor vehicle injury prevention (Vulcan, date unknown). Children frequently lose balance while riding in the back of vehicles when the vehicle hits an environmental obstacle such as a rock or pothole causing instability. Injury is commonly to the head as a result of the fall or can be a crush injury to the head, torso or extremities as these body parts are run over by the moving vehicle.

In addition to the increased risk associated with such practices, it is illegal to do so in most states on public roads. Anecdotally, seatbelt use on farms is not adhered to as rigorously as when driving on public roads, where seat belt use is a legislated requirement and compliance is enforced. It is assumed that it would be a common occurrence that the young infant would accompany parents in the work vehicle without the correct restraint.

Of particular note is the use of seat belts by adults, as this role modelling will have a significant influence on the behaviours of younger and other farm members. One would assume that the failure to use seat belts is the result of habitual behaviour and/or a perceived lack of risk in the situation. There is no supporting literature on these issues.

(Note: The recent attention given to the need for and legislation requiring the restraint of dogs riding on the back of utilities to ensure their safety adds strength to this recommendation.)

7. Age Appropriate Tasks

Legislation has established minimum age and skill and knowledge levels required to be achieved before being licensed to drive on public roads. These laws are socially acceptable and considered appropriate. The minimum requirements are based on the developmental capabilities considered necessary to competently drive a motor vehicle. Prior to being able to drive on public roads, the candidate must demonstrate competency in both knowledge and skill and undertake a probationary “training” period. The practice of children below minimum age and without assessment of skill and knowledge is an activity that increases risk.

8.3 Levels of Evidence, Recommendations and Need for Research

Table 9 provides a summary of the Expert Committee’s determination of the level of evidence for effectiveness of interventions, the strength of the recommendation for its adoption on Australian farms and the need for/ value of further research.

Table 9. Child injury associated with other farm vehicles (Refer to Page 9 for coding scheme)

Scope: Addresses injury to toddlers aged 0-4 years who are in the vicinity of moving vehicles and all children aged 0-4 and 5-14 years who are passengers rather than young drivers.

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference/ s
1. Eliminate the hazard				
Generally not an option				
2. Substitute for a hazard of lesser risk				
1. Use the most suitable and safe form of transport for the task	Do not carry children as passengers in vehicles not fitted with seat belts	O,A		9
3. Engineering/ design/isolation from the hazard				
1. Fence around the farm yard – a Safe Play Place/ recreation area for children	Create equivalent of an urban “back yard” Separate the child from the farm vehicle movement area. Not a complete solution - needs associated administrative solutions – family rules (see below) Isolation of person from hazards (including plant) is a requirement under OHS regulations	V,B Analogy with evidence for pool fencing	Y Cohort or case series studies to determine: - effectiveness and other components of solution Research acceptability and adoption - Link with driveway deaths research agenda	44,92, 77 64, 23, 9
2. Seat belts in all vehicles	Farm vehicles should be fitted with seat belts	IV, B	N	98
3. Easily transferable child seats/restraints	If child seats are readily transferable between vehicles, then they are more likely to be used	O, C	N	
4. Proximity warning devices	Visibility is limited in 4WD and other high vehicles Available on some vehicles	X, C	Y	48
5. Reversing alarms	Use unlikely to be effective for at-risk group for reversing injury of 0-4 age group	X, C	Y	48
4. Administrative controls/ safe practice				
1. Establish and maintain family rules re boundaries and “out of bounds” areas of the farm	Integral <u>part</u> of overall prevention plan for family farms Not considered sufficient for prevention	V, C	Y Research into child and family behaviours	46, 20
2. Establish and maintain rules to ensure seat belt use on farm vehicles	Adult role model also important	IV, B		

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference/ s
3. Establish and maintain rules to ensure no passengers on the tray of farm utilities and trucks	Children should only be carried as passengers in vehicles with restraints	V, B	N	
4. Training for riders	Need to establish the evidence for development and assessment of competencies to reduce injury risk	X, C	Y Need to establish the evidence for development and assessment of competencies to reduce injury risk	
5. Personal protective equipment				
Dress children in bright clothing	To assist visibility for drivers	X, C	Y Examine road safety and other literature	
6. First aid/ resuscitation				
1. First aid skills for adults	Required for emergency response to machinery injury in the workplace Not an effective solution for prevention of machinery injury	X, C	N	

8.4 Recommended Interventions

Recommendations for intervention to reduce risk of toddler serious injury and deaths related to other farm vehicles are based on the available information that has defined the circumstances of child deaths on Australian farms, the developmental characteristics of children in this age group and the limited literature on available intervention measures, mostly from the road safety literature. The evidence supports the following interventions:

1. Use the most suitable and safe form of transport for moving children around the farm.
2. Vehicles used to transport children should be fitted with child restraints and/or seat belts.
3. Fence the farm yard, and use self closing gates, to separate the farm workplace and vehicle movement from the place where small children live and play – create a safe place to play.
4. Establish and maintain family and workplace rules relating to:
 - The boundaries where children can be without parental supervision
 - Ensuring the home yard gates are kept closed and maintained.

5. Establish and maintain family rules whereby children should not ride unrestrained in the front or back of vehicles, or in the tray of the utility or truck.
6. Establish and maintain rules to ensure seat belt use by all occupants of vehicles on farms – children and adults.
7. Establish and maintain rules that young children should not drive vehicles on farms. Once of age to drive, children should receive training and demonstrate knowledge and competency to drive vehicles.
8. Adults and older children on farms should be trained to undertake first aid and cardio-pulmonary resuscitation.

8.5 Further Research

The following research would further inform farm families and farm businesses in their attempts to reduce risk of serious injury and death to children associated with being either a passenger in, or bystander to vehicles in operation on farms:

1. Research into the effectiveness of a key recommendation – maintenance of the “child proof” fence/ gates etc to create a safe play place for children. Research should include effectiveness of different farm fencing designs, and cohort or case studies. Links should be made with child driveway deaths studies.
2. Development of a specific package of instructions for those whose role is supervision of toddlers on farms.
3. Research into child and family behaviours relevant to maintaining family rules re out of bounds areas and rules relating to use of seat belts and child restraints in vehicles.
4. Current research in the United States of America by the University of Minnesota, funded in part through the Midwest Centre for Agricultural Research, Education, and Disease and Injury Prevention: A NIOSH/CDC Cooperative Agreement Program and supported by The National Farm Medicine Center (Marshfield Clinic) is being conducted into the development of a sensor system to detect the presence of a person near a dangerous machine component. Monitoring of the developments of this research, and research into the effectiveness of reversing signals and proximity warning devices in reducing injury risk is recommended.
5. Monitoring of research to determine the effectiveness of clothing to assist visibility of drivers is warranted.

9. HORSES

Horses are used in a variety of rural settings. The frequency and nature of use is different among production types, enterprise size and geographical location. Horses of many different breeds, ages and levels of training are used on farms.

Horse injury is a significant issue in terms of child safety on farms. High levels of injury are attributed to horse related incidents, resulting in admission to hospitals and some deaths of children in the farm setting (Fragar and Franklin, 2000).

The issue can be separated into two groups with differing characteristics. The first being horse injury/death in the 0-4 years age group and the second being horse injury/death in the 5-14 years age group.

Significant research has been conducted in the past that provides good evidence as to the nature of the issue and suitable recommendations as to safe practices. Of note is the work conducted by the Gloucester Farm Safety Action Group who conducted a horse injury prevention project and developed the promotional and educational package *Horse Play* (Gloucester Community Health, 1994). The Monash Accident Research Centre's Report No. 103, *Locking the Stable Door: Preventing Equestrian Injuries*, 1996) provides an extensive review of the literature available as to the available horse riding injury countermeasures.

There is an active network of doctors, the American Equestrian Medical Association, that shares information and reports of horse related injury worldwide. A number of relevant reports of horse handling injury are found on that association's website.

9.1 The Risk

Injuries were highest on weekends and peaks were noted during the school holiday periods and warmer months (Williams and Ashby, 1995; Wolfenden et al, 1994; North West Farmsafe, 1992).

Females aged 10-15 years are most frequently injured on Australian farms. Their injury incidents are highest, they also have the greatest exposure (Cripps, 2000; Williams and Ashby, 1995; Wolfenden et al, 1994; North West Farmsafe, 1992; Pounder, 1984). This is in keeping with horse related injury reports from the United States (Bixby-Hammett, 1997; Malavase, 1995; US Department of Health and Human Services/Public Health Services, 1987/88; Bixby-Hammett, 1992; US Consumer Product Safety Commission, 1998).

In the 0-4 years age group, males are at greatest risk of a non-riding horse related injury (North West Farmsafe, 1992; US Department of Health and Human Services/Public Health Services, 1987/88).

Injured riders are more likely to be repeat injury victims in equestrian settings in the United States and the Netherlands (American Equestrian Medical Association, 2000; Toet, 1999).

Equine knowledge, horse handling and riding skills, and knowledge of hazards was generally low for children with horse related injuries (Wolfenden et al, 1994).

Rider error and horse behaviour/temperament were cited as the most common cause of injury events among children (Williams and Ashby, 1995; North West Farmsafe, 1992; Pounder, 1984; Toet, 1999; Malavase, 1995; McAbee and Ciminera, 1988; Bixby-Hammett, 1999).

While the majority of injuries occurred while riding, horse related injury is not confined to this activity. A significant number of injuries occurred in the many varied activities associated with involvement with horses (feeding, grooming, leading, holding the horse loading onto the float, saddling, mounting/dismounting, patting the horse) (Williams & Ashby 1995; North West Farmsafe 1992, Pounder 1984; American Equestrian Medical Association 2000; Toet 1999; Bixby-Hammett 1997; Malavase 1995).

Injuries are frequently the result of the rider falling from the horse (Williams and Ashby, 1995).

Non-riding injuries/death are commonly associated with a kick, particularly to the head (Williams and Ashby, 1995; Lim et al, 1993; Pounder, 1984; Toet, 1999).

The most frequently injured body part is the upper limb and the most common type of injury is a fracture (Williams and Ashby, 1995; North West Farmsafe, 1992; Toet, 1999; US Department of Health and Human Services/Public Health Services, 1987/88; Bixby-Hammett, 1992; US Consumer Product Safety Commission, 1998; Bixby-Hammett, 1999).

The head is commonly injured (Cripps, 2000; Williams and Ashby, 1995; North West Farmsafe, 1992; Pounder, 1984; Bixby-Hammett, 1997; Malavase, 1995; Bixby-Hammett, 1992; US Consumer Product Safety Commission, 1998; McAbee GN and Ciminera, 1988; Bixby-Hammett, 1999). Severe head injury is the most common cause of death (Cripps, 2000; Pounder, 1984).

The fingers and feet are also commonly injured in non-riding related incidents (Williams and Ashby, 1995; Bixby-Hammett, 1997; US Consumer Product Safety Commission, 1998).

9.2 Identified Interventions

It should be noted that the evidence available relating to horse handling safety, except in the case of helmets, is generally based on informed/expert opinion and anecdotal evidence. Even with the compelling evidence in favour of wearing

protective headgear to reduce head injuries, there have been no case control or prospective studies done to provide definite proof of the effectiveness of helmets (Monash Accident Research Centre, 1996). The Australian Centre for Agricultural Health and Safety, in association with agriculture industry and equestrian interests produced *Guidance Note 8 – Horses on farms* (1997) that provides guidelines for horse handling safety on farms.

1. Selection of Horse suited to Child's Physical and Developmental Capabilities

Selecting a suitable horse is considered by equestrian organisations to be an appropriate injury control measure. Evidence shows that horse behaviour and temperament was a significant factor resulting in an injury incident. Informed/expert opinion has led to the recommendation that older horses are generally safer for beginners and that an experienced and trained horse person should be involved in the selection of horses for riding (Williams and Ashby, 1995). The Gloucester Community Health – Rural Child Accident Prevention Program identified horse selection as an important intervention measure and published guidelines for parents for choosing a suitable horse for their child to ride.

2. Equestrian Helmet

Wearing a correctly fitted and maintained helmet that meets the Standards Australia equestrian helmet standard (AS/NZS 3838:2003 Helmets for horse riding and horse-related activities) has been recommended to reduce the severity of head injury (Williams & Ashby, 1995; Wolfenden et al, 1994; North West Farmsafe, 1992; Pounder, 1984; Finch and Watt, 1996; American Equestrian Medical Association, 2000; Malavase, 1995).

The literature reviewed during this project supported that conducted by Monash University which found that “the use of equestrian helmets to prevent head and face injuries has not been formally evaluated by a good prospective or case control study... Taken together, the available evidence suggests that any helmet/hat is better than no helmet/hat in the event of a head injury.” The study conducted by the United States Pony Club comparing the results of injury frequency during the eight years of USPC helmet use with the two years of ASTM/SEI helmet use, found that injuries to the head and face and concussion and closed fractures decreased, providing a strong indication that helmets are likely to be effective in preventing many injuries (Monash Accident Research Centre, 1996).

3. Training

Formal training in horse handling was reported as common among injured riders. The most common form of instruction was Pony Clubs (Wolfenden, Clarke L and Lower, 1994).

Evidence shows that rider error, inexperience, poor levels of equine knowledge, inadequate horse handling knowledge, limited riding skills and techniques, poor

knowledge of riding hazards and engaging in activities beyond level of skill/training were all factors that were associated with injury incidents. Recommendations of the reports reviewed indicate that training should be multifaceted including equine behaviour, care, handling, riding, maintenance of tack, safety and hazard identification and should be directed at all persons who will have involvement with the horse and rider (i.e. including child and parent).

The importance of training of the horse has also noted as important and again conducted by an experienced handler. Pony Club instruction was found to be the most common source of formal rider training. The Monash University literature review found that there was no conclusive evidence that proved rider education and involvement in lessons to be a measure of injury prevention. However, anecdotal evidence and informed/expert opinion has lead to the conclusion that rider, horse, handler and supervisor training and equine education have great potential to reduce injuries associated with rider error and poor equine knowledge.

9.3 Levels of Evidence, Recommendations and Need for Research

Table 10 provides a summary of the Expert Committee's determination of the level of evidence for effectiveness of interventions for improved horse related child safety, the strength of the recommendation for its adoption on Australian farms and the need for/ value of further research.

Table 10. Child injury associated with horses on farms (Refer to Page 9 for coding scheme)

Scope: Includes injury prevention for toddlers aged 0-4 years who are in the vicinity of horse handling activity, ie not riders; and older children aged 5-14 who may be riding, handling horses at ground level or bystanders.

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference
1. Eliminate the hazard				
1. No horses on the farm	A consideration if horses not in use are in the vicinity of small children	O, A	N	10
2. Substitute for a hazard of lesser risk				
1. Horse of suitable temperament, size	Horse behaviour a significant causal factor for injury Horse should be selected to suit child's physical and developmental capabilities	V, C	Y Case control studies would be valuable	97, 10
2. Alternative leisure activity for children	Other leisure activity involving physical activity	O, C	N	
3. Engineering/ design/isolation from the hazard				
1. Fence around the farm yard – a Safe Play Place/ recreation area for children	Create equivalent of an urban “back yard” Separate the child from the area where horses being handled. Not complete solution - needs associated administrative solutions – family rules (see below) Isolation of person from hazards (including plant) a requirement under OHS regulations	V, B Analogy with evidence for pool fencing	Y Cohort or case series studies to determine: - effectiveness and other components of solution Research acceptability and adoption - Link with driveway deaths research agenda	44,92, 77, 64, 23, 9
2. Designated riding path	Allows for control of area where riding occurs – type of surface, ground conditions freedom from other obstacles eg overhanging branches	V, C	Y Studies in urban settings may be useful	
3. Tack – safety stirrups	Correct stirrup size important Safety stirrups may not release because light weight of child could be insufficient	X, C	Y Case series or control studies might resolve this issue	33, 10
4. Administrative controls/ safe practice				
1. Establish and maintain family rules re boundaries and “out of bounds” areas of the farm	Integral <u>part</u> of overall prevention plan for family farms Not considered sufficient for prevention	V, C	Y Research into child and family behaviours	46, 20

Intervention	Comment	Level of Evidence/ Strength of Recommendation	Further Research	Reference
2. Rider training	To include: Equine behaviour, care, handling, pre-ride saddle up and safety checks, riding, maintenance of tack.	V, C	Y Case series may be valuable	33
3. Establish and maintain rider rules	No “extra rider” No activities beyond skills eg jumping	V, C		
4. Training in fall techniques	Falls the most common mechanism of injury Falls may be from a height of 2 m	X, D	Y Research needed to determine whether this intervention has merit	
5. Personal protective equipment				
1. Helmet that meets Australian Standard for Equestrian Helmet	Head injury common and common cause of death associated with horses Helmet needs to be properly fitted and worn correctly	V, B	Y Continued surveillance – case series, case control	33, 56, 71, 97,99
2. Suitable footwear	Smooth soled, heeled, elastic sided riding boots provide best protection and prevent foot being caught in stirrup if the rider falls	V, B	Y Continued surveillance, case series, case control	33
3. Close fitting clothing	Flapping clothing may frighten the horse	V, C	Y But may be difficult	33
4. Protective vests	In use in some equestrian settings	X	Y Studies may be undertaken in harness racing and racing settings	
6. First aid/ resuscitation				
1. First aid skills for adults	Required for emergency response to injury in the farm workplace. Not an effective solution for prevention of horse related injury.	X, C	N	

9.4 Recommended Intervention

Recommendations for intervention to reduce risk of child injury and deaths related to horse handling are based on the available information that has defined the circumstances of child deaths on Australian farms, the developmental characteristics of children in this age group and the literature on available intervention measures. The evidence supports the following interventions:

1. If horses are no longer in use, removal from the farm, or from the vicinity of small children.
2. Fence the house yard to separate the farm workplace, including the horse handling area, from the place where children live, play and generally undertake their recreation, with self latching gates – create a safe place to play. Note that this is the recommended intervention to reduce toddler drowning deaths and injury associated with machinery and vehicles.
3. Establish and maintain family and workplace rules relating to:
 - The boundaries where children can be without parental supervision
 - Ensuring that the home yard gates are kept closed and maintained.
4. Where children are learning to ride, and/or there are child riders:
 - Select a horse of suitable temperament and size for the child
 - Rider training should include equine behaviour, care, handling, pre-rise saddle check, safety checks, riding and maintenance of tack
 - Ensure suitable and safe tack – stirrup size is important
 - The rider should wear a correctly fitting helmet that meet the Standards Australia standard for equestrian activity. The helmet should be worn during all horse handling activities, not just while riding
 - The rider should wear smooth soled, heeled, elastic sided riding boots.
5. Adults and older children on farms should be trained to undertake first aid and cardio-pulmonary resuscitation.

9.5 Further Research

The following research would further inform farm families and farm businesses in their attempts to reduce risk of serious injury and death to children associated with horses and horse handling and riding on farms:

1. Case series or case control studies into the role that horse characteristics (size, “temperament” etc) play as a factor in horse related injury
2. Studies into the effectiveness of designated riding paths may be undertaken. Studies in urban settings may be relevant
3. Studies to determine the effectiveness of safety stirrups is needed
4. Studies to examine the effectiveness of rider training would be useful

5. Studies to examine the effectiveness of training in falls techniques is required
6. Continued surveillance is required to monitor the effectiveness of helmets and footwear in injury prevention
7. Studies into the effectiveness of safety vests are needed and should be undertaken and are likely to be undertaken in harness racing and horse racing settings
8. Exploration of the factors influencing an individual's decision to wear a helmet would be beneficial
9. It is important that monitoring be undertaken of research that may be conducted in other equestrian contexts including professional horse racing, rodeo, barrel racing and camp drafting, trail riding and cross country eventing should be maintained to keep abreast of findings applicable to improving safety.

10.0. SUMMARY OF RECOMMENDED INTERVENTIONS

10.1 Recommended Interventions

This section of the report has identified and reviewed potential interventions aimed at protecting children from serious injury and death on Australian farms. The priority hazards of high risk that have been addressed are dams and other bodies of water, farm machinery, motorbikes, other vehicles and horses. Relevant literature was reviewed and an expert panel of child injury prevention experts was assembled to review the material and make recommendations.

Generally speaking, few research reports were found that provided evidence in support of interventions for any of the specific farm hazards of high risk to children in the farm setting. Thus it has been necessary to extrapolate from studies addressing the same or similar risks in other settings.

As the farm is a workplace under occupational health and safety law in Australian states, children's safety in the farm workplace must be protected. The hierarchy of effectiveness of control that forms the framework for OHS risk management in Australian OHS Acts and Regulations has formed the framework for consideration and presentation of risk control options in this report, with elimination of hazards to children being the most effective option if it is practicable.

There has been significant attention to improving the safety of children on farms in the United States of America. However, at this stage, this literature still lacks reports of studies that rigorously evaluate injury prevention interventions. Further, care is needed in the use of American literature as the Australian farming culture, environment and legislative responsibility is different to that in most states in America.

For toddler deaths and serious injury the interventions for each of the key hazards are generally similar. Similarly there is some commonality for protection of older children.

Table 11 summarises the key recommended interventions for reducing serious injury risk and death of children on Australian farms. These five key hazards are responsible for an estimated 85% of toddler deaths and 77% of deaths of children aged 5-14 years on Australian farms. Further, they are responsible for 40% of toddler admission to hospitals with on-farm injury, and 60% of admissions for children aged 5-14 years. Adoption of these recommendations on farms could result in an overall reduction of 82% of child deaths and 58% reduction of hospital admissions due to injury on farms.

Clearly further work is required to identify the most effective strategies and mechanisms to achieve adoption of these recommendations on farms.

Table 11: Summary of common recommended inventions

Intervention	Hazard									
	Drowning in bodies of water		Farm Machinery		Farm Motorcycles		Other farm vehicles		Horses	
	Toddler	Older child	Toddler	Older Child	Toddler	Older Child	Toddler	Older Child	Toddler	Older Child
1. Elimination of hazards where these are not in use	X	X	X	X	X	X	X	X	X	X
2. Fence the house yard, separating the farm workplace from the safe play place. - self latching gates - “child proof” fencing	X	X	X	X			X	X	X	X
3. Establish and maintain family and workplace rules relating to: - The boundaries where children can be without parental supervision - Ensuring that the home yard gates are kept closed and maintained - Ensuring adequate adult supervision	X	X	X	X			X	X	X	X
4. Establish specific family and workplace rules			“No passenger” rules on tractors and mobile plant and equipment		“No extra rider” on ATV rules.		Child restraints and seat belts to be used for all persons in vehicles on farms. No riding on the back of trucks or utes			
5. Training and skills development for older children				X		X		X		X
6. Use of specific PPE relevant to the hazard				Hearing protection		Helmet				Helmet Riding boots
7. First-aid training of adults/ older children	X	X	X	X	X	X	X	X	X	X

Toddler drowning and toddler deaths from vehicle run-over, machinery and horses

Recommendations for intervention to reduce risk of serious injury and deaths to toddlers from drowning in dams and waterways, from vehicles on farms, from farm machinery and from horses are generally similar. The evidence supports the following interventions:

1. Elimination of the hazards where they are not in use eg unused water bodies.
2. Fence the house yard to separate the farm workplace from the place where children live and play, with self latching gates - create a safe place to play. Fencing should be "child resistant"
3. Establish and maintain family and workplace rules relating to:
 - The boundaries where children can be without parental supervision
 - Ensuring that the home yard gates are kept closed and maintained
 - Ensuring adequate adult supervision of children in the vicinity of bodies of water, machinery, vehicles and of horses or other farm animals
4. Adults and older children on farms should be trained to undertake cardio-pulmonary resuscitation

These interventions should be established on all Australian farms where children are living, or where children visit.

Further Recommendations relating to Child Injury associated with Farm Machinery

"No passengers on tractors" should be the focus for prevention of injuries to children associated with farm machinery. The evidence shows that the majority of child fatalities relating to tractors resulted from the child riding as a passenger, falling from the tractor and being hit/run over by the tractor or attached implement.

When older children begin to engage in farm work, they should be trained to undertake farm work in accordance with their developmental and physical capabilities, and under close supervision. Parents need knowledge of cognitive, physical and behavioural characteristics of child at each stage, AND an accurate perception of risk. Section 11 of this report is devoted to the issue of children's physical and cognitive development related to farm work.

Protection of children as young trainees should include:

1. Where possible the elimination of hazards associated farm machinery
2. Effective guarding of exposed moving parts, or isolation of operators from those hazards
3. Safe tractor design features including ROPS and safe tractor access, outside of the path of the rear wheel
4. Adequate induction, training and close supervision of working trainees

5. Hearing protection when children are in the vicinity of hazardous machinery noise
6. Respiratory protection when children are in the vicinity of hazardous dusts.

Child Injury associated with Farm Motorcycles

The evidence supports the following interventions for children aged 5-14 years to reduce risk of serious injury and death to children associated with motorcycle riding:

1. Use safer forms of transport or leisure for young children
If children are to accompany adults use safer vehicle option, for example utility with seat belts. Suggest alternative leisure pursuits for young children eg mountain biking.
2. “No extra rider” rule for ATVs
Establish and maintain family and farm rules to ensure that children are not ever carried as passengers on ATVs.
3. Establish minimum age and conditions for riding farm motorcycles
It is recommended on limited evidence from specific studies, that the minimum age for riding for ATVs is set at 16 years and that suitability to ride any motorcycle should then be determined by the demonstration of competency.
There is strong support for the recommendation of a minimum age for riding farm motorcycles by the manufacturers of these machines. Manufacturers clearly state that children under the age of 16 years should not ride adult sized ATVs. They identify that such vehicles have not been designed to be ridden safely by persons under 16 years of age who are considered to have physical and cognitive developmental limitations. On road motorcycle licensing requires the demonstration of a minimum level of skill and knowledge following a training period.
4. Ensure suitable helmet and other protective clothing is worn
PPE including helmets should be worn when riding. The value of helmets in reducing head injury from motorcycle and bicycle injury incidents is clear and substantial evidence has been established as proof of the effectiveness of helmets in this instance.
Other PPE including that worn by professional riders – goggles, gloves, long pants and suitable sturdy footwear should reduce the severity of injury if the rider is subject to a fall or runs into objects.
5. Training and supervision
Training in the riding and operation of motorcycles on farms is a workplace OHS requirement in all states of Australia. It is not clear from the evidence at the moment how to develop and assess competencies that are relevant to injury prevention.

Further Recommendations relating to Child Injury associated with Other Farm Vehicles

The evidence supports the following interventions to reduce risk of serious injury and deaths related to other farm vehicles:

1. The most suitable and safe form of transport for moving children around the farm should be used
2. Vehicles used to transport children should be fitted with child restraints and/or seat belts
3. Establish and maintain family rules whereby children should not ride unrestrained in the front or back of vehicles, or in the tray of the utility or truck
4. Establish and maintain rules to ensure seat belt use by all occupants of vehicles on farms – children and adults
5. Establish and maintain rules that young children should not drive vehicles on farms. Once of age to drive children should receive training and demonstrate knowledge and competency to drive vehicles.

Further Recommendations relating to Injury associated with Horse Handling

The evidence supports the following interventions:

1. If horses are no longer in use, removal from the farm, or from the vicinity of small children
2. Where children are learning to ride, and/or there are child riders:
 - Select a horse of suitable temperament and size for the child
 - Rider training should include equine behaviour, care, handling, pre-rise saddle check, safety checks, riding and maintenance of tack
 - Ensure suitable and safe tack – stirrup size is important
 - The rider should wear a correctly fitting helmet that meet the Standards Australia standard for equestrian activity. The helmet should be worn during all horse handling activities, not just while riding
 - The rider should wear smooth soled, heeled, elastic sided riding boots.

10.2 Further Research

A program of further research is recommended to address the research needs identified through this review.

A separate paper has been prepared that outlines priority the research requirements to provide the necessary evidence base for an optimal child safety on farms programs.

11.0. PHYSICAL AND COGNITIVE DEVELOPMENT

11.1 Introduction

Information about child growth and development is seen to be an important consideration for development of child safety guidelines for parents of children who grow up on farms in Australia. Such information can help to understand why children are at risk to specific hazards at different stages of development, and to suggest effective interventions.

Most children on farms will participate in work on farms as they get older, although to varying extents, depending on the nature and business structure of the farm enterprise. Of the 115 deaths of children under 15 years on Australian farms for the period 1989-1992, 8 (6.9%) occurred in the context of the child undertaking farm work (Franklin et al, 2000). A study of child injury presentations to Emergency Departments of hospitals in two rural zones of NSW during the period 1990-1992 found 21 percent of injured children had been injured in the context of work activity (Fragar and Franklin, 2000).

Developmental growth is not age specific and children develop at different stages. It is this development uncertainty that makes a farm particularly dangerous for children. Physical, cognitive and emotional growth through the stages of a child's life span can have a significant impact on the risk of injury and illness on farms. Children do not have the physical, cognitive or emotional skills to be able to undertake many tasks on a farm which places them at risk.

This section of the report briefly reviews key child developmental stages that children experience and how these physical, cognitive and emotional characteristics may impact on risk of injury on farms.

11.2 Developmental Stages

Children develop at different ages and rates, however the following guide indicates some of the stages of development that can impact on health and safety of children in the farm environment. The following are derived from the US Children and Safety on the Farm, College of Agricultural Sciences, 1997.

Toddlers aged birth to 4 years:

- Are in a phase of rapid growth, beginning motor skills development
- Have balance problems and slow reaction times
- Are curious, exploring
- Are fascinated by movement
- Have illogical or "magic" thinking
- Are very energetic, releasing tension by playing, even when exhausted
- Are self-centred but interested in group activity.

Injury risk for this age group is high for falls from heights and play equipment, ingesting poisons, being run over by tractors and vehicles and drowning in dams and waterways.

Children aged 5-9 years

- Are learning to use small and large muscles – slow steady growth stage
- Have poor hand-eye coordination
- Try to master more complex skills
- Operate with concrete facts, not capable of abstract ideas/thinking
- Wish to appear competent; seeks parental approval
- Wish to take on tasks without parental supervision
- Are discovering that patents make mistakes, are human
- Rarely follow through on a task – not yet ready for responsibility.

Injury risk for this group is high for slipping and falling from playground equipment, from bicycles and from heights, tractors and vehicles.

Children aged 10-13

- Growing at a steady rate – approaching puberty; boys grow more quickly than girls
- Small muscles are developing rapidly
- Same coordination as adults, but lapses or awkwardness are common
- Greater physical and mental skills
- Desire peer and social acceptance
- Wish to try new skills without constant adult supervision
- Signs of independence emerging
- Success important for self-concept.

Injury risk for this group is high for falls from bicycles and motorcycles, sporting injury, and for machinery injury associated with farm work. For girls, horse handling injury is a risk.

Young teenagers aged 13-16 years

- Growing rapidly and changing physically; can be an uneasy time
- Girls growing faster than boys
- Have moved from concrete thinking to abstract; enjoy mental activity
- Can find solutions to own problems but still need adult guidance
- Feel the need to be accepted by peers
- Resist adult authority
- Feel immortal.

Injury risk for this group is high for motor vehicles including motorcycle injury, and for machinery injury associated with farm work. For girls, horse handling injury is a risk.

11.3 North American Guidelines

There have been attempts at providing child safety material for parents using development guidelines. The key organisation that has developed these guidelines is The National Children's Centre for Rural and Agricultural Health and Safety in Marshfield WI America. The guidelines are aimed to assist adults match up a child's physical and mental abilities with the tasks involved in completing different agricultural jobs. The objective is that children and adolescence will gain meaningful work experience with minimal risk of agricultural disease and injury.

The guidelines cover common agricultural tasks on farms including animal care, manual labour, haying operations, implement operation, tractor fundamentals, speciality production and general activities. The guidelines firstly identify adult responsibilities, main hazards and personal protective equipment. The guidelines then cover ability of the child with a series of questions about the child's physical, cognitive and emotional stage of development in relation to the task requirements. The guidelines also have training and supervision time recommendations. If one question about the child developmental stage is answered no or unsure, the guidelines recommend that the child should not do the task at all or caution should be taken.

Farmsafe Australia and The Australian Centre for Agricultural Health and Safety do not promote without reservation the North American guidelines for use in Australian farming systems, in light of:

- *Differing legal frameworks in Australian states*

Occupational health and safety law, child labour law and road traffic safety law in Australian states effectively place restriction on the use of children for similar labour and production purposes than appears to be the case in some American states.

- *Differing cultural expectations*

Australian agricultural industries may share some cultural expectations to American farm families in relation to use of child labour on farms, and most children growing up on Australian farms are expected to participate in farm work. The degree to which this occurs varies depending on the nature of the farm family enterprise type.

- *Australian Farming Systems and Environment*

There are hazards to children that are more specific to some Australian farming environments - eg hazards associated with sheep.

There is potential for development of Australian guidelines that take into account training and skills requirements for workers and visitors to Australian farm workplaces.

11.4 Summary and Recommendations

Child growth and development is important to consider in the context of the Australian farm. Physical and cognitive skills vary between children depending on age and developmental stage. Reaction time, strength, maturity and other developmental aspects can place children at heightened danger of farm hazards.

Most farm work is intended to be undertaken by physically and developmentally mature adults. In considering child safety on farms parents need to understand the basic principles of child growth and development and how they apply to children on their farm. No two children are the same just as no two farms are the same. However parents, with the assistance of hazard identification process and child development analysis can provide their children with a safe environment in which to grow up.

1. Development of guidelines associating developmental stages of children and relationship with risk of injury on Australian farms

The knowledge of developmental growth and development needs to be used to reinforce the danger of the farm environment to children. Whilst the American guidelines used developmental tasks in order to provide guidance to farm parents for children to perform work tasks safely, it is recommended that the developmental stages of children should be used to highlight the added danger that children are placed due to these developmental stages, and to suggest more effective interventions to reduce injury risk to children.

2. Development of safe ways to enrich a child's development on farm

Parents need to be able to recognise safe activities on the farm that can enrich and enhance their children's physical, social and emotional growth. Growing up on a farm offers a huge array of life experiences that are lacking in the city, and being involved in a farm can assist in the development of children sense of responsibility, work ethic and knowledge of life and people's place in the environment.

12.0. LEGISLATIVE REQUIREMENTS RELATING TO THE PROTECTION OF CHILDREN'S SAFETY ON FARMS

12.1 Introduction

Protection of the health, safety and wellbeing of children is the objective of several legislative provisions in each state of Australia. These have some potential bearing on the safety of children in the farm setting. This section of the report will identify relevant legislation and organisations with responsibility for its enforcement. It includes state child protection legislation, occupational health and safety legislation, child labour and relevant International Labor Organisation attention.

12.2 Methodology

An Internet search for Australian state legislation relating to child protection was undertaken. Government departments responsible for child protection were revealed through each state search and the relevant information was included in the results. Definitions of a child, parent, risk of harm/neglect and other protection issues are highlighted to address the application of this terminology to the issue of child safety on farms.

Occupational Health and Safety legislation was also investigated for relevant information concerning guarding of machinery and reducing exposure to risk on farms.

The International Labor Organisation web site was searched to identify any relevant child labour ratification's.

12.3 State Child Protection Legislation

Australian state legislation addresses the protection of children's physical and mental health and wellbeing in varying degrees. As part of this project, greater understanding of the interpretation of the legislation as it relates to children's health and safety on Australian farms is required. This report highlights relevant sections of each state legislation.

Child protection efforts within the context of the farm environment present unique problems as the concept of neglect can become confused and distorted. The sensitivity of this issue will require full consideration and endorsement from farm women's associations and farmer organisations to ensure that the issue is appropriately addressed. An example of the importance of the issue is occurring in the context of child custody applications. A number of calls have been received at the Australian Centre for Agricultural Health and Safety concerning separated partners concerned for their children spending time and/or living with their ex-partner on a farm. The concern of danger and neglect on farms has also been

suggested to be used in custody disputes for children where guidance material has been sought for use in cases at court.

Table 12 lists the child protection legislation for each Australian state.

Table 12: State Child Protection Legislation

State	Government Agency	Legislation	Definition of child
New South Wales	Department of Community Services (Also Child Deaths Review Team)	Children and Young Persons (Care and Protection) Act 1998 No 157	<16 years
Queensland	Department of Family and Community Services	Child Protection Act 1999	<18 years
Western Australia	Department of Family and Children's Services	Child Welfare Act 1947	<18 years
South Australia	Department of Family and Community Services, Department of Education and Children Services	Child Protection Act 1993	<18 years
Victoria	Department of Health and Community Services	Children and Young Persons Act 1989	<17 years
Northern Territory	Territory Health Services	Community Welfare Act: 2000	<18 years
Tasmania	Department of Community Services and Health	Children, Young Persons and Their families Act 1997	<18 years
Australian Capital Territory	Department of Health and Family Services	Children and Young People Act 1999	< 12 years

There is a high degree of variability between states in the definition of "harm" for the purposes of the legislation. The objects of the Act and the definition of harm in the New South Wales legislation is provided here in order to describe the scope of the legislation in one state. Other states are more or less prescriptive.

NSW Children and Young Persons (Care and Protection) Act 1998

Objects of the Act:

The objects of this Act are to provide:

(a) *that children and young persons receive such care and protection as is necessary for their safety, welfare and well-being, taking into account the rights, powers and duties of their parents or other persons responsible for them.*

Harm

Child or young person at risk of harm

For the purposes of this Part and Part 3, *a child or young person as at risk of harm if current concerns exist for the safety, welfare or well-being of the child or young person because of the presence of any one or more of the following circumstances*

- (a) the child's or young person's basic physical or psychological needs are not being met or are at risk of not being met,*
- (b) the parents of other caregivers have not arranged and are unable or unwilling to arrange for the child or young person to receive necessary medical care,
- (c) the child or young person has been, or is at risk of being physically or sexually abused or ill-treated,
- (d) the child or young person is living in a household where there have been incidents of domestic violence and, as a consequence, the child or young person is at risk of serious physical or psychological harm,
- (e) a parent of other care-giver has behaved in such a way towards the child or young person that the child or young person has suffered or is at risk of suffering serious psychological harm

12.4 Occupational Health and Safety Legislation

Occupational health and safety law in all states require that employers and those in control of workplaces maintain a safe workplace for employees and all who enter the workplace. This includes visitors (and children) in the workplace.

Accompanying regulations provide more specific guidance for specific hazards such as hazardous substances, plant and machinery and noise, and require that risks are controlled by elimination of hazards, or where elimination is not possible by using higher order control measures in the hierarchy of control – ie engineering or design controls before those control measures that depend on human behaviour.

Workers in the workplace are required to be adequately inducted and trained to operate safely.

12.5 Child Employment Legislation

States have legislation relating to limitation of employment of children. Legislation varies considerably between states, and may cover age of employment, limitation of employment of children during night hours, and restriction of employment of children in dangerous occupations.

12.6 Other Legislation

Other legislation that applies to the protection of children from risks associated with farm hazards include:

- Legislation relating to the ownership, storage and use of firearms
- Legislation relating to application and storage of chemicals.

12.7 International Labor Organisation

The International Labor Organisation Child Labor Agreement covers the use of children in a situation that threatens their health and safety. Australia has not ratified the Child Labor Policy of the International Labor Organisation.

12.8 Summary

The issues of child safety on farms may involve legislation of child welfare and protection, occupational health and safety laws concerning guarding of machinery and firearms legislation concerning safe storage of firearms. The International Labor Organisation also contains issues dealing with the employment of children in a workplace. The usefulness of employment legislation may be limited in Australia however as most deaths to children on Australian farms involve children who are not involved in production but are present in the production environment.

Child protection within the context of farm environments presents unique problems as the concept of neglect can become confused and distorted. No specific reference to child safety on farms was located in any of the legislation. The report recommends that the application of state child protection legislation to child safety on farms be investigated by relevant legal representation. The sensitivity of this issue will require full consultation and endorsement from farm women's associations and farmer organisations to ensure that the issue is appropriately addressed.

The implications of the legislation as it related to child safety on farms needs careful consultation with appropriate legal representation to ensure accuracy.

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